

**WORLDWIDE EMERGING ENVIRONMENTAL ISSUES AFFECTING THE U.S. MILITARY**  
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Note to Readers: Pages 1-12 comprise the summary and analysis of this report. Expanded details for some items that might not be available via the Internet at a later date are in the Appendix beginning on page 13.

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## Item 1. UN Creates Secretariat of the Global Bioenergy Partnership at FAO

The recently inaugurated Secretariat of the Global Bioenergy Partnership (GBEP) will help UN efforts to promote “green” fuels by facilitating a global political forum to support bioenergy production, marketing and use, and assisting international exchanges of know-how and technology. The focus will be mainly on helping developing countries’ governments and institutions formulate sustainable bio-energy policies and strategies to help reduce dependency on fossil fuel, as well as encouraging investments in multilateral projects for bio-energy development. It will also assist in formulating guidelines for measuring greenhouse gas emission reductions due to the use of bio-fuels. The GBEP Secretariat is located at the UN Food and Agriculture Organization headquarters in Rome and is supported by the Italian Ministry for the Environment, Land and Sea. [See also *UN Commission on Sustainable Development Fosters Energy Security* in May 2006 environmental security report.]

### **Military Implications:**

Military personnel involved in biofuel R&D should seek appropriate liaison with the GBEP Secretariat to explore potentials for mutual collaboration, new equipment, and exchanging views and regulations regarding biofuels.

### **Sources:**

UN Efforts to Promote New “Green” Fuels Move Ahead

<http://www.un.org/apps/news/story.asp?NewsID=20002&Cr=FAO&Cr1=>

Global Bioenergy Partnership Secretariat up, running

<http://www.fao.org/newsroom/en/news/2006/1000405/index.html>

Redesigning Crops to Harvest Fuel

<http://www.nytimes.com/2006/09/08/business/08crop.html?ex=1159416000&en=b4b46ba4cfda7706&ei=5070> (by subscription only; full text in the [Appendix](#))

Global meltdown feared: UN report

<http://www.canada.com/vancouver/features/energy/story.html?id=62464470-b75f-4b26-8360-f17b9a8e5249>

Energy review ignores climate change 'tipping point'

<http://www.guardian.co.uk/science/story/0,,1864802,00.html>

## Item 2. UN General Assembly 61st Session Pinpoints Global Warming as a Central Issue for Security

Tackling climate change and environmental degradation were mentioned in parallel with terrorism, fair trade, HIV/AIDS, and human rights as essential issues to be addressed by global action by world leaders at the UN General Assembly, September 19-29. Since the small island developing states are particularly vulnerable to the impacts of global warming and sea level rise, they reiterated the call for renewable energy, a global fund to support these efforts, recognition of the “polluter pays” principle, and the placement of climate change in the center of development considerations. Some declared that the impacts of climate change are the most serious threat to global security.

**Military Implications:**

In addition to the military implications of the increasing scientific evidence of climate change listed in previous Millennium Project monthly reports, the military should consider the opportunities created for collaboration on preparedness strategies; as well as, the increased political attention to the polluter pays principle.

**Source:**

UN General Assembly 61<sup>st</sup> Session, General Debate (19-29 September 2006)  
webcasts and texts of statements <http://www.un.org/ga/61/>

**Item 3. North America's Commission for Environmental Cooperation to Increase Enforcement of Environmental Regulations and Public Participation**

The Joint Public Advisory Committee (JPAC) of the Commission for Environmental Cooperation (CEC) of Canada, the United States, and Mexico held its third Regular Session for 2006 on 15 September in Montreal, Quebec, to discuss the proposed 2007-2009 Operational Plan. Participants assessed progress on cooperative projects the CEC is implementing to meet the goals and objectives of *Looking to the Future: Strategic Plan of the Commission for Environmental Cooperation 2005–2010*. The focus was on the implementation of the three program priorities as established by the CEC Council: information for decision-making; capacity building; and trade and environment, mutually reinforcing each other. Proposals called for increased comparability and reliability of environmental data and networks among the U.S., Canada, and Mexico; improved submission and enforcement procedures—to speed the process and increase citizen participation and responsibilities; and creating a North-American comprehensive atlas of all resources, ecosystems, and pollution matters. The Operational Plan will be updated annually, with a rolling three-year horizon, to reflect shifts in programming and associated budget reallocations.

**Military Implications:**

CEC projects are a relatively untapped source of information for relevant military personnel dealing with environment and health issues and potential future regulations affecting the military in North America. [Note: a staff member of the Millennium Project participated in the Montreal discussions of the Operational Plan.]

**Source:**

Operational Plan of the Commission for Environmental Cooperation 2006-2008  
[http://www.cec.org/files/PDF/PUBLICATIONS/OpPlan2006-Summary\\_en.pdf](http://www.cec.org/files/PDF/PUBLICATIONS/OpPlan2006-Summary_en.pdf)

**Item 4. OECD Meeting on Manufactured Nanomaterials**

The OECD will hold a meeting of the recently established Working Party on Manufactured Nanomaterials in London on 26-27 October 2006 to finalize recommendations for the 2006-2008 Programme of Work regarding human health and environmental safety aspects of manufactured nanomaterials in the chemical sector, to be forwarded to the Chemicals Committee of OECD. The meeting will discuss reports on recent developments in nanotechnologies and nanomaterials, their safety, and related activities in other International Organizations. For example, there will be

discussions of taking over the Woodrow Wilson Center's database and cooperating with other databases, such as the International Council for Nanotechnology (ICON)'s.

**Military Implications:**

If not already in process, military personnel concerned with nanotechnology safety might liaise through appropriate channels to keep abreast of developments in this meeting and contribute to its agenda. [Note: there is an EPA representative attending the meeting. At the website below, one can see the U.S. government participation in the December 2005 workshop and identify potential contacts by clicking on the report title.]

**Source:**

Safety of Manufactured Nanomaterials

[http://www.oecd.org/departement/0,2688,en\\_2649\\_37015404\\_1\\_1\\_1\\_1\\_1,00.html](http://www.oecd.org/departement/0,2688,en_2649_37015404_1_1_1_1_1,00.html)

## **Item 5. Technological Breakthroughs with Environmental Security Implications**

### **5.1 New Spectroscopy Sensor for Environmental Monitoring**

University of Wyoming researchers have developed and patented a sensor that can be used with surface plasmon resonance (SPR) spectroscopy to produce a low-cost system for rapid detection of biological signatures, explosives, and other volatile chemical targets in the environment. The sensor element comprises a specially designed surface optically coupled to an SPR spectrometer. Molecules such as antibodies are held close to the SPR surface, with no intervening liquid/hydrogel layer, maximizing sensitivity.

**Military Implications:**

The military should investigate the incorporation of this new technology into environmental surveillance and scanning systems.

**Source:**

UW Invention Targets Terrorist Weapons

<http://www.physorg.com/news75561848.html>

### **5.2 Nanocantilevers for Ultra-small Sensors**

Researchers at Purdue University are investigating the use of nanocantilevers in designing a new class of ultra-small sensors for quick detection of viruses, bacteria and other contaminants in air and fluids by coating the cantilevers with proteins, including antibodies that attract the contaminants. Nanocantilevers vibrate at different frequencies when contaminants stick to them, revealing the presence of dangerous substances. The work is funded by the National Institutes of Health.

**Military Implications:**

There are a wide range of applications of such sensors from protecting against food poisoning to detecting viruses, bacteria and other pathogens in the environment.

**Sources:**

'Nanocantilevers' yield surprises critical for designing new detectors

<http://www.purdue.edu/UNS/html4ever/2006/060828.Bashir.nanocant.html>

Anomalous resonance in a nanomechanical biosensor

<http://www.pnas.org/cgi/content/abstract/0602022103v1>

### **5.3 Deep Cooling Improves Uranium Detection**

Zheming Wang, at the Department of Energy's Pacific Northwest National Laboratory in Richland, Wash., has applied cryogenic fluorescence spectroscopy to detect uranium in contaminated soil at a former nuclear fuel manufacturing site. Use of an ultraviolet laser on the sample cooled to  $-267^{\circ}\text{C}$  produced fluorescence intensity of more than five times that at room temperature, and brought out additional spectral features enabling different forms of uranium, including uranium carbonate, to be distinguished.

#### **Military Implications:**

This technique should be studied for its feasibility for locating post-conflict areas needing cleanup of uranium contamination and managing the cleanup and disposal processes.

#### **Source:**

Cold Shot

<http://www.physorg.com/news77290661.html>

### **5.4 Biodetecting Wipes**

Scientists at Cornell University have started development of an inexpensive and easy-to-use biodegradable absorbent wipe containing polymer nanofibers attached to antibodies for biohazards and chemicals. By changing color, or through another effect, the wipes signal when the antibodies bond to their targets. The 100 nm fibers provide very large surface areas for sensing, and increased absorbency compared to conventional fibers.

#### **Military Implications:**

The military should follow this development as it progresses toward practical application and, when it is available, consider its application to detection and cleanup of contaminated environments.

#### **Source:**

Biodegradable napkin could quickly detect biohazards

<http://www.physorg.com/news77201571.htm>

### **5.5 Fish Provide Early Warning of Toxic Chemicals**

Bluegills, a small, hardy fish species, are highly sensitive to chemical disturbances in their environment, and react to toxins by convulsively flexing their gills to expel contaminating material. They can be used to monitor the chemical purity of a water supply by keeping them in a continuously re-supplied tank equipped with sensors to watch for changes in their breathing, heartbeat, and swimming patterns. The fish have successfully detected 30 alien chemicals, and have the advantage of requiring no "programming" for specific hazards. Their sensitivity was demonstrated on one occasion when they detected a diesel spill two hours before other sensors. The fish have been incorporated into an operational system by Intelligent Automation Corp. of Poway, CA.

**Military Implications:**

The military should investigate this development for its applicability to environmental water supply monitoring, especially in a post-conflict areas, where chemical pollution might be taking place.

**Source:**

Fish Used to Detect Terror Attacks

<http://www.enn.com/today.html?id=11282>

**Item 6 UNEP and Google Earth to Pinpoint Environmental Hotspots**

The United Nations Environment Programme has joined together with Google Earth to highlight environmentally plagued regions of the world and to compare them to previous maps of the same regions. This technology grants millions of people around the world access to accurate, easily comprehensible, and timely visuals of rapidly changing environments. This information could help increase public awareness, as well as alerting authorities to prevent eventual security issues due to environmental changes. Additionally, dissemination of this type of information will be beneficial for capacity building, teaching, and stimulating action against environmental degradation. Presently, the “UNEP: Atlas of our Changing Environment,” offers satellite images of 100 environmental hotspots from around the world. Google Earth images are not real-time images but have all been taken in the last three years. The continual improvement and widespread use of the “Atlas of our Changing Environment” could provide unique opportunities to help prevent environmentally related conflicts.

**Military implications:**

The military should create procedures to review what parts of its more advanced means and images of earth observation and ground-truthing can be shared on an ongoing basis to continually improve the *Atlas of our Changing Environment*. It should also seek ways in which this new tool could help prevent environment-related conflicts. As precision improves, environmental damages caused by conflicts could be made more defined and available, increasing accountability and responsibility for military actions.

**Sources:**

Flying Around the Globe on a Time Machine

<http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=487&ArticleID=5350&l=en>

**Item 7. Updates on Previously Identified Issues****7.1 Toxic Waste Disposal of Global Growing Concern**

The scandal around the dumping of toxic waste at Abidjan, Ivory Coast has intensified the global debate concerning trade in waste and the adequacy of the Basel Convention. Some African and Asian countries became dumping grounds for hazardous waste, such as radioactive uranium waste, lead, cadmium, mercury, industrial and hospital chemicals, and the rising volume of electronic waste. Although the Basel Convention and its 1995 amendment ban dumping of toxic waste in countries without proper facilities for handling it, the process continues illegally in countries that are not party to the Convention. In addition to environmental and health consequences, a

Senegalese ecologist points out the security aspect associated with illegal dumping since "the waste is often accepted by corrupt people or factions who want money to buy weapons". As a consequence of the Ivory Coast scandal, the Prime Minister dissolved his cabinet and elections are jeopardized in a country already tormented by conflicts. [See also *New Measures for Regulating E-waste* in August 2006, as well as *Basel Convention on Hazardous Wastes to be Made More Effective* in July 2005 and other related items in previous environmental security scanning reports.]

### **Military Implications:**

Considering the increasing attention to waste disposal processes and regulation enforcement, as well as their link to security, it is likely that the Basel Convention will be strengthened and/or special regulations will be set for toxic waste treatment. The military should carefully follow these new developments and be prepared to comply with eventual new directives. Furthermore, it should eventually incorporate observing hazardous waste disposal procedures and trade as part of its security actions in countries where it has peacekeeping forces. This would also be consistent with the stewardship goal in the Army's Environmental Strategy.

### **Sources:**

Deadly toxic waste dumping in Côte d'Ivoire clearly a crime – UN environmental agency  
<http://www.un.org/apps/news/story.asp?NewsID=20083&Cr=ivoire&Cr1=>

Africa: The world's 'septic tank'

[http://www.mg.co.za/articlePage.aspx?articleid=284851&area=/insight/insight\\_africa/](http://www.mg.co.za/articlePage.aspx?articleid=284851&area=/insight/insight_africa/)

Poisonous days

[http://www.electronicconomist.com/world/africa/displaystory.cfm?story\\_id=7923227](http://www.electronicconomist.com/world/africa/displaystory.cfm?story_id=7923227) (by subscription only; full text in the [Appendix](#))

Ivory Coast Tragedy Prompts Call for Stricter Toxic Waste Treaty

<http://www.ens-newswire.com/ens/sep2006/2006-09-11-03.asp>

Toxic waste mystery in Ivory Coast deepens

<http://www.newscientist.com/article/dn10097-toxic-waste-mystery-in-ivory-coast-deepens.html>

## **7.2 Call for Reinforcements to Chemical Safety**

At the Fifth Session of the Intergovernmental Forum on Chemical Safety, held 25-29 September 2006 at Budapest, Hungary, policymakers and experts reinforced the need for applying the precautionary principle in the context of chemical safety; extending globally the regulations on heavy metals; and tackling the widening gaps among countries in following chemical safety policies. Prior to the Session, a side event was held on health and environmental concerns associated with heavy metals and global needs for further action. [See also *Stockholm Convention Updates* in November 2005, *First Conference of the Parties to Rotterdam Convention* in September 2004, *New Strategy for International Chemicals Management Launched* in November 2003, and other related items in previous environmental security scanning reports.]

### **Military Implications:**

The military should follow the work of the Intergovernmental Forum on Chemical Safety and eventually provide input to new safety policies. Although these might not result in legally binding agreements, the discussions will most probably assess the effectiveness of existing chemical safety-related legislation and eventually generate new enforcement and/or safety issues for resolution.

**Sources:**

Forum V; Chemical Safety for Sustainable Development

<http://www.who.int/ifcs/forums/five/en/index.html>

Health and environmental concerns associated with heavy metals; global needs for further action?

[http://www.who.int/ifcs/documents/forums/forum5/side\\_events/en/index.html](http://www.who.int/ifcs/documents/forums/forum5/side_events/en/index.html)

## 7.3 Climate Change

### 7.3.1 New Scientific Evidence of Correlation between Global Warming and Severe Storms

A new study, *Global temperature change*, by a group of scientists, reveals that global surface temperature has increased approx. 0.2°C per decade in the past 30 years, and the world is the warmest it has been in the last 12,000 years. Scientists estimate that pollution from human activity, combined with the loss of snow and ice cover, will accelerate future temperature increase. Also, since warming is not uniform around the globe, the likelihood of strong El Niños and other harsh weather phenomena increases. A global temperature rise of approx. 1°C might represent a threshold with “dangerous” consequences, as sea levels rise and species become extinct.

Strong correlation between global warming and severe storms is also revealed by a study based on more than 80 simulations using 22 sophisticated computer models of the climate system. The simulations show with 84% probability that for the period 1906-2005, human activity—mainly greenhouse gas emissions—are responsible for about two-thirds of the temperature increases in hurricane formation regions of the Atlantic and Pacific Oceans. The research team that produced the study includes 19 hurricane and climate scientists from ten research centers.

### 7.3.2 Ice Melting Faster than Expected Around the World

Ice is melting at an increasing rate around the globe, and scientists warn that this might indicate that the effects of global warming are showing up faster than previously expected. Based on the latest calculations, Greenland ice loss increased by 250% between May 2004 and April 2006 compared with the two years between April 2002 and April 2004, which translates to an equivalent global sea level rise of about 0.5mm (0.02 inches) per year. Likewise, 95% of the glaciers in southeast Alaska (stretching from Yakutat Bay to the Stikine Icefield in British Columbia) are thinning at twice the rate that was previously estimated, according to a new study.

The National Snow and Ice Data Center reported that the North Pole ice melted again at a record rate this summer, meaning that the Arctic could be ice-free in summer far sooner than predicted a year ago. Similarly, based on data from Envisat’s Advanced Synthetic Aperture Radar (ASAR), European scientists determined that around 5%-10% of the Arctic’s perennial sea ice has been fragmented by late summer storms and the ice had retreated to the point of opening a navigation passage from northern Siberia or the Norwegian island of Spitzbergen to the North Pole. "If this anomaly trend continues, the North-East Passage or ‘Northern Sea Route’ between Europe and Asia will be open over longer intervals of time, and it is conceivable we might see attempts at sailing around the world directly across the summer Arctic Ocean within the next 10-20 years" says Mark Drinkwater of ESA’s Oceans/Ice Unit. New evidence also suggests that Antarctica has warmed about 1.4° per century—a fact that was masked at the end of the 20th century by large temperature variations.

### 7.3.3 Greenhouse Gas on the Rise

At the same time, methane—22 times more powerful than CO<sub>2</sub> for global warming—is emitted as result of melting permafrost at a rate five times faster than thought, and could become a significant

factor in global warming, representing a “a climate time bomb,” warn scientists. Most of the methane-releasing permafrost is in Siberia. Another study reveals that carbon trapped in this type of permafrost could be 100 times the amount of carbon released into the air each year by the burning of fossil fuels.

Deep ice drilled out of Antarctica confirms that carbon dioxide levels are substantially higher now than at any time in the last 800,000 years.

#### 7.3.4 Developing Countries Most Affected by Global Warming

Consequences of global warming are increasingly felt, mostly by developing nations. Rising sea levels force inhabitants of some South Pacific islands to relocate. The World Bank warns that development programs are jeopardized by climate change in many regions around the world and urges the international community to integrate climate risk concerns in development strategies. [See above ‘Item 2. UN General Assembly 61st Session Pinpoints Global Warming as a Center Issue for Security’]

#### **Military Implications:**

[Similar to previous on the same issue] Coastal early warning and impact forecasting systems and evaluation procedures should be developed in cooperation with local military and civilian first responders. There is compelling evidence of the consequences of anthropogenic climate change, and a growing world demand for action. The military should continue to accelerate efforts to reduce their own greenhouse gas emissions. New international environmental security-related policies and cooperation to avoid potentially large-scale disasters and conflicts seem inevitable.

**Sources:** [more sources available in the [Appendix](#)]

Global temperature change

<http://www.pnas.org/cgi/content/full/103/39/14288>

Human Activities Are Boosting Ocean Temperatures in Areas Where Hurricanes Form

<http://www.ucar.edu/news/releases/2006/oceantemps.shtml>

Deep ice tells long climate story

<http://news.bbc.co.uk/2/hi/science/nature/5314592.stm>

Overview of current sea ice conditions

[http://nsidc.org/news/press/2006\\_seaiceminimum/20060816\\_arcticseaicenews.html](http://nsidc.org/news/press/2006_seaiceminimum/20060816_arcticseaicenews.html)

Arctic summer ice anomaly shocks scientists

[http://www.esa.int/esaEO/SEM7ZF8LURE\\_index\\_0.html](http://www.esa.int/esaEO/SEM7ZF8LURE_index_0.html)

Climate ‘time bomb’ forecast

[http://www.boston.com/news/nation/articles/2006/09/07/climate\\_time\\_bomb\\_forecast/](http://www.boston.com/news/nation/articles/2006/09/07/climate_time_bomb_forecast/)

Rising sea forces islanders to relocate

<http://www.earthsky.org/shows/show.php?date=20060814>

Development Under Climate Threat

<http://web.worldbank.org/WBSITE/EXTERNAL/NEWS/0,,contentMDK:21035991~pagePK:34370~piPK:34424~theSitePK:4607,00.html>

#### **7.4 China to Invest \$175 Billion in Environmental Protection over Five Years**

China plans to invest \$175 billion (about 1.5% of GDP) in environmental protection in the next five years, to curb severe water and air pollution, which is causing riots and health problems. The money is to be spent on such measures as control of water pollution, improving air quality in cities, and halting soil erosion. China has 20 of the world's 30 most smog-affected cities, and 2.5% of its

grain is estimated to be contaminated by heavy metals. [See also *China Creates 11 Independent Environmental "Watchdog" Centers* in the July 2006, *China's President Hu Ordered Environmental Regulations for Military Activities* in April 2006, *Chinese Research Priorities for the Next Fifteen Years* in March 2006, and other related items in previous environmental security reports.]

### **Military Implications:**

This decision may also result in China becoming a more active and positive influence in international environmental protection efforts. Military liaisons in Beijing might consider contacting the State Environmental Protection Administration to offer advice and assistance, especially on the military's role in environmental security.

### **Sources:**

China to Invest US\$175 Billion in Environment Clean-Up

<http://www.planetark.com/dailynewsstory.cfm/newsid/37328/story.htm>

China's growing air pollution reaches American skies

<http://www.statesman.com/news/content/news/stories/nation/08/5chinapollution.html>

## **7.5 Nanotech Risk Assessment**

### 7.5.1 Data Base for Nano Environmental Health and Safety

The International Council on Nanotechnology (ICON), managed by Rice University's Center for Biological and Environmental Nanotechnology, has established the ICON Environmental, Health and Safety (EHS) database, containing summaries (abstracts) and citations for research papers related to the EHS implications of nanoscale materials. The database allows search by keywords and by aspects of the research reported, such as "exposure pathway = inhalation".

### 7.5.2 Major German Study on Nanotech in Food Industry

The German Federal Institute for Risk Assessment (Bundesinstitut für Risikobewertung (BfR)) is undertaking a major assessment of the potential dangers of nanotechnology in the food industry. The study will involve 100 experts from research, industry, public agencies, consumer associations, and NGOs in a multi-phase interviewing and mutual commenting process. According to Food Production Daily, "the objective is to identify ... nanomaterials, assign them to concrete applications, and then draw conclusions on consumer exposure. ... The applications will then be classified according to the level of probable risk and risk reduction strategies developed." The project is expected to be finished by the end of the year.

### 7.5.3 Nanotube Toxicity Tests Unreliable

Researchers from the Institute of Toxicology and Genetics at the Karlsruhe Research Center in Germany may have discovered why carbon nanotubes toxicity tests are not consistent. Their investigation revealed that a reaction between the nanotubes and two non-soluble toxicity test reagents, formazan and methylthiazol tetrazolium (MTT), was causing a "false positive" outcome. Three other tests on the same nanomaterial had yielded negative results.

### 7.5.4 Cleanup and Other Nanomaterials May Re-release Pollutants

Research by Prof. Baoshan Xing, of the Department of Plant, Soil & Insect Sciences at the University of Massachusetts has indicated that fullerenes and carbon nanotubes may exhibit reversible adsorption of polycyclic aromatic hydrocarbons, releasing into their environments toxic substances previously adsorbed by them.

**Military Implications:**

Relevant military personnel should follow the progress of these new discoveries in order to improve their own nanotech risk assessment processes, analytical procedures and materiel development programs.

**Sources:**

ICON database: <http://icon.rice.edu/research.cfm>

Experts and consumers convene on nano risks

<http://www.foodproductiondaily.com/news/ng.asp?n=70058-nanotechnology-bfr-toxicity>

Carbon-Nanotube Toxicity Test Tricks Scientists

<http://www.physorg.com/news76672397.html>

The Flip Side of Using Carbon Nanotubes for Environmental Pollutants Removal

<http://www.nanowerk.com/spotlight/spotid=780.php>

**Item 8. Reports Suggested for Review****8.1 Population Trends and Environmental Impact****8.1.1 U.S. National Report on Population and the Environment**

*U.S. National Report on Population and the Environment* by the Center for Environment and Population (CEP) is the first comprehensive assessment of the impact of U.S. national and regional population trends on the environment. The report addresses the main “America’s Population-Environment Challenges”: land use; water; forests; biodiversity; fisheries and aquatic resources; agriculture; energy; climate change; and solid and toxic waste. It highlights that from 1995 to 2005, the U.S. population increased by 10.6% (29 million people)—the highest rate of industrialized countries—and raises concerns over environmental consequences, since the U.S. already has the largest per-capita environmental impact in the world. It warns that in the future the situation might become more critical due to uneven distribution of the population, climate change, rising sea levels, and pollution.

**8.1.2 World Population in 2025**

*Mapping Future Population Growth* by the Earth Institute at Columbia University is mapping projected population change for the year 2025. It notes that most population growth will continue to be in already densely populated developing countries like India and China, and coastal population will increase by 35%, to 2.75 billion people living within 60 miles of the ocean; therefore, there will be increasing vulnerability to disasters resulting from climate-change and rising sea level.

**Military Implications:**

Relevant military personnel should review these reports for population projections that are important for developing adequate early warning and preparedness systems, as well as for developing strategies for preventing eventual conflicts due to scarcities and increasingly probable disasters—mostly in coastal areas.

**Sources:**

*U.S. National Report on Population and the Environment*

[http://www.cepnet.org/documents/USNatlReptFinal\\_000.pdf](http://www.cepnet.org/documents/USNatlReptFinal_000.pdf)

Press Release <http://www.cepnet.org/documents/USNatlReptPressReleaseFINAL8-30-06.doc>

Mapping Future Population Growth

<http://www.signonsandiego.com/news/science/20060817-9999-lz1c17popula.html>

Where will people live in the year 2025? (PDF) map

<http://www.signonsandiego.com/uniontrib/20060817/images/world.pdf>

## **8.2. New Reports on Nanotechnology Risk Assessment**

### 8.2.1 Increased Research Needed to Address Environmental, Health, and Security Issues

#### Related to Nanotechnology

The *Environmental, Health, and Safety Research Needs for Engineered Nanoscale Materials* report by the Nanoscale Science, Engineering, and Technology (NSET) Subcommittee of the U.S. National Science and Technology Council's Committee on Technology identifies environmental, health, and safety (EHS) research and information needs related to understanding and management of potential risks of engineered nanoscale materials.

*A Matter of Size: Triennial Review of the National Nanotechnology Initiative*, a new report from the National Research Council's Committee to Review the National Nanotechnology Initiative, although generally positive on the initiative's work in overseeing the U.S. government's role in developing nanotechnologies, suggests that improvements are needed mostly in the areas of measuring economic return, and addressing potential safety risks associated with nanomaterials. "The body of published research addressing the toxicological and environmental effects of engineered nanomaterials is still relatively small," states the report. Accepting the report's recommendations, in an interview with *The Scientist*, E. Clayton Teague, director of the federal National Nanotechnology Coordination Office, pointed out that the federal budget for environment, health, and safety research regarding nanotechnology will expand from \$38 million in 2005 to \$44 million in 2007, trying to fulfill the research needs suggested by the NSET report in addressing EHS issues related to nanotechnology.

#### 8.2.2 Nanotechnology and the Food and Agriculture Sector

*Nanotechnology in Agriculture and Food Production: Anticipated Applications*, by Jennifer Kuzma and Peter VerHage from the University of Minnesota's Center for Science, Technology, and Public Policy, discusses possible future nanotech-based food and agriculture applications, their potential benefits and risks, and requirements for environmental, health and safety oversight. Their investigation also resulted in creation of a searchable, online database covering more than 160 research projects.

#### 8.2.3 Reaction to Voluntary Nanomaterial Reporting Scheme

According to Meridian Nanotech News, "The U.K. Department for Environment, Food, and Rural Affairs (Defra) has released a document summarizing and responding to the results of a consultation it published in March seeking opinions on a 'Voluntary Reporting Scheme' for [the properties of] engineered nanomaterials." The scheme met with general support, as did its underlying evidence-based approach for determining the need for risk controls.

### **Military Implications:**

Relevant military personnel should study these reports for inputs in improving understanding of risk assessment and management of nanomaterials, as well as to prepare for eventual new safety regulations.

**Sources:**

Nanotechnology report urges better safety standards

<http://www.the-scientist.com/news/daily/24910/> (by subscription only; full text in the [Appendix](#))

*A Matter of Size: Triennial Review of the National Nanotechnology Initiative*

<http://www.nap.edu/catalog/11752.html>

*Environmental, Health, and Safety Research Needs for Engineered Nanoscale Materials* report

[http://www.nano.gov/NNI\\_EHS\\_research\\_needs.pdf](http://www.nano.gov/NNI_EHS_research_needs.pdf)

Report and data base: <http://www.nanotechproject.org/50>

<http://biz.yahoo.com/prnews/060907/dcw073a.html?.v=1>

Defra Consultation on a Voluntary Reporting Scheme for Engineered Nanoscale Materials: Summary of Findings and Government's Response, August 2006

<http://www.defra.gov.uk/corporate/consult/nanotech-vrs/nanotechvrs-consultfindings.pdf>

**8.3 UK Defence Ministry Highlights the Link between Environment and Security**

UK Ministry of Defence published its second annual Sustainable Development Report. The 2005 report identified potential risks from nanotechnology, chemical weapons from the WWII, risks from military sonar, and tungsten and its alloys as emerging sustainability issues related to military activities; and most importantly, acknowledged the link between conflict, security and sustainable development. 'We must also be ready to act, anywhere in the world, where environmental, social or economic stresses may contribute to the destabilization of society... we have a significant role to play in helping to address these concerns and exploring links between security, conflict and SD with Foreign and Commonwealth Office and Department for International Development,' the report said (DFID). [For the first Annual report, 2004, See the item *UK Defense Ministry released its first Sustainable Development Report* in the August 2005 environmental security monthly report]

**Military Implications:**

Relevant military personnel should study the report for useful insights to improve U.S. military environmental strategy and assess how the military could coordinate with USAID and other potential partners on sustainability issues.

**Sources:**

Ministry of Defense Sustainable Development Annual Report 2005

<http://www.mod.uk/DefenceInternet/AboutDefence/WhatWeDo/HealthandSafety/DSC/SustainableDevelopmentAnnualReport2005.htm>

See also the map on Oversea Deployment and Environmental Change in the [Appendix](#)

## APPENDIX

### Reference Details

This Appendix contains expanded background information on some items, and the full text for the articles that are not available on the Internet or are usually stored for a limited time on the respective Web sites.

#### Item 1. UN Creates Secretariat of the Global Bioenergy Partnership at FAO

##### Redesigning Crops to Harvest Fuel

By Andrew Pollack. New York Times, September 8, 2006

<http://www.nytimes.com/2006/09/08/business/08crop.html?ex=1159416000&en=b4b46ba4cfa7706&ei=5070> (by subscription only)

More miles to the bushel.

That is the new mission of crop scientists. In an era of \$3-a-gallon gasoline and growing concern about global warming from fossil fuels, seed and biotechnology companies see a big new opportunity in developing corn and other crops tailored for use in ethanol and other biofuels.

Syngenta, for instance, hopes in 2008 to begin selling a genetically engineered corn designed to help convert itself into ethanol. Each kernel of this self-processing corn contains an enzyme that must otherwise be added separately at the ethanol factory.

Just last week, DuPont and Bunge announced that their existing joint venture to improve soybeans for food would also start designing beans for biodiesel fuel and other industrial uses.

And Ceres, a plant genetics company in California, is at work on turning switch grass, a Prairie States native, into an energy crop.

“You could turn Oklahoma into an OPEC member by converting all its farmland to switch grass,” said Richard W. Hamilton, the Ceres chief executive.

Developing energy crops could mean new applications of genetic engineering, which for years has been aimed at making plants resistant to insects and herbicides, but would now include altering their fundamental structure. One goal, for example, is to reduce the amount of lignin, a substance that gives plants the stiffness to stand upright but interferes with turning a plant’s cellulose into ethanol.

Such prospects are starting to alarm some environmentalists, who worry that altered plants will cross-pollinate in the wild, resulting in forests that practically droop for want of lignin. And some oppose the notion of altering corn to feed the nation’s addiction to automobiles.

“I don’t think people want extra enzymes in the food supply put there to better fit the crops for energy production,” said Margaret Mellon, director of the food and environment program at the Union of Concerned Scientists.

But proponents of designer fuel crops argue that the risks are small compared with the threat of dependence on foreign oil. Some studies also suggest that ethanol use could help fight global warming because the crops that help produce ethanol absorb carbon dioxide.

So far, much of the attention on bioenergy has focused on improving the chemical processes for turning crops into ethanol. But experts say that if biofuels are to make a significant dent in the nation’s petroleum consumption, the crops themselves must be improved to provide more energy from an acre.

And new agricultural sources beyond corn must be developed, they say. Even if the nation’s entire corn crop were converted to ethanol production, it would replace only about 15 percent of petroleum use, according to an Energy Department report.

“Half the improvement we make over the next 10 to 15 years will come from improving the feedstocks,” said Gerald A. Tuskan, a biofuel expert in the department, referring to the crops fed into the ethanol factories.

Some of the work will not necessarily involve genetic engineering. Notably, Monsanto, the leader by far in crop biotechnology, says that its biofuel development will focus on conventional breeding, which it says is quicker.

Monsanto has tested its existing corn varieties to determine which ones are better for ethanol production. Pioneer Hi-Bred International, the DuPont subsidiary that is Monsanto’s rival in the corn-seed business, is doing the same.

The companies say that the designated varieties, which have higher fermentable starch content, can increase ethanol production 2 to 5 percent over other corn. And some factories are starting to request certain types of corn or to pay a premium for more desirable corn, said Pradip Das, head of crop analytics at Monsanto.

Still, some ethanol factory operators say they do not really care which corn they get. The factories are so hungry that they take “pretty much all the commercial corn you can get your hands on,” said David Nelson, chairman of Midwest Grain Processors, which runs an ethanol plant in Lakota, Iowa.

William S. Niebur, vice president for crop genetics research and development at DuPont, said the demands of ethanol production would require extremely hardy corn.

“The demand for this corn grain could be so dramatic,” he said, “that it would change farming practices.” Instead of rotating corn with other crops, he said, farmers would be pressed to grow corn year after year, which could strain the soil and allow the buildup of insects and disease.

Many of the traits needed for energy corn — high yield as well as tolerance to disease, insects and drought — would also be desirable in corn used for human and animal food. That is not the case, though, with Syngenta's enzyme corn, which would be specifically for energy production.

Generally, the enzyme, known as amylase, is made in vats of bacteria. Ethanol manufacturers add the enzyme to corn to break down starch into sugar, which can be fermented into ethanol.

To get corn to produce its own amylase, Syngenta inserted a gene borrowed from a type of microbe called archaea that live near hot-water vents on the floor of the ocean.

The gene — actually a composite of three amylase genes — was developed with the help of Diversa, a San Diego company that specializes in finding chemicals in organisms that inhabit extreme environments.

Diversa says that because its enzyme is derived from a heat-loving microbe, ethanol factories can operate at higher temperatures and under more acidic conditions, improving efficiency.

Some people in the biofuel industry question what the advantage is of having the enzyme in the corn rather than just buying the very similar amylase that Diversa is already selling.

While Syngenta's corn is meant for industrial use in the United States, it is almost inevitable that some of it will get into human and animal food supplies, including exports, because of cross-pollination or seed intermingling. That is what happened in 2000 with Aventis CropScience's StarLink corn, which was approved only for animal use, yet ended up in human food, forcing recalls and disrupting exports.

To prevent such liability, Syngenta is seeking approval of the corn for human and animal food use, not only in the United States but in Europe, South Africa and elsewhere. Syngenta says the amylase enzyme is safe, noting that these enzymes are found in saliva.

But Bill Freese of the Center for Food Safety, an advocacy group in Washington opposed to biotechnology crops, said that this particular amylase is from a little-studied exotic microbe and that some amylase induces allergy.

The Agriculture Department has asked Syngenta for more information on its application.

Regardless of what is done to corn, some experts say that starch alone will not provide enough ethanol. The new frontier is to produce ethanol from cellulose, the fibrous material in all plants. Cellulose is made of complex carbohydrates that can be broken down by enzymes into simpler sugars for fermenting into ethanol.

While some of the cellulose for biofuels could come from agricultural residue like corn stalks, there will probably be a need for other crops grown specifically for energy production — in particular, perennial plants like grasses that require far less energy-consuming irrigation and fertilization than crops like corn that have to be replanted each year.

That is why Ceres, a privately owned supplier of genetics technology to Monsanto, sees a future in switch grass. The company's greenhouses are filled with versions of tall, gangly grass plants, some developed by conventional breeding and some by genetic engineering.

The grasses are meant to have higher yields, to withstand drought or to break down easily in the ethanol factory — “the energy crop that melts in your mouth, if you will,” Mr. Hamilton said.

Ceres, based in Thousand Oaks, Calif., is not working with Monsanto on switch grass but is collaborating with the Samuel Roberts Noble Foundation in Ardmore, Okla., a leading research institute on forage grasses. Mr. Hamilton said the partners were already testing conventionally bred switch grass varieties that yield eight or nine tons of biomass an acre, compared with about five tons for typical switch grass.

Mendel Biotechnology, based in Hayward, Calif., is looking more at miscanthus, a perennial grass native to China, where Mendel has set up an operation.

The company said miscanthus could produce well over 20 tons an acre each year. “No planting, no fertilizing, no irrigation,” said its chief executive, Chris Somerville, who is also the director of plant biology at the Carnegie Institution and a Stanford University professor. “You can just cut it every year for 10 years.”

Another cellulose candidate is poplar, which recently became the first tree to have its entire genome sequenced, an effort led by the Energy Department.

At first, significantly higher-yielding cellulose sources can come from conventional breeding, experts say. But later, genetic engineering may be needed. That could raise concerns because trees and grasses live longer and spread more easily than currently engineered crops like corn and soybeans.

And yet, energy crops may also be an opportunity for the industry to burnish its public image.

“After all,” the journal *Nature Biotechnology* said in a recent editorial, “it’s difficult to oppose a technology that’s helping to save the planet.”

Correction: Sept. 15, 2006

An article in *Business Day* last Friday about the development of crops for energy production misstated a figure on ethanol conversion from a Department of Energy report. The report said that even if the nation’s entire corn crop was converted to ethanol, it would replace only 15 percent of the nation’s transportation fuel needs — not its overall petroleum needs.

## Item 7. Updates on Previously Identified Issues

### 7.1 Toxic Waste Disposal of Global Growing Concern

#### Poisonous days

*The Economist* print edition. Sep 14th 2006 | ABIDJAN

[http://www.electronicconomist.com/world/africa/displaystory.cfm?story\\_id=7923227](http://www.electronicconomist.com/world/africa/displaystory.cfm?story_id=7923227) (by subscription only)

A toxic-waste scandal shows up the country's fragility

IT IS not normal for an environmental scandal to bring down a government, but then Côte d'Ivoire is anything but normal. The country, once West Africa's most stable, has been split in two by a four-year civil war. A succession of peace deals imposed an unwieldy national-unity government composed of members of the ruling party, the opposition, some former rebels and others. On September 6th, as the growing scale of a toxic-waste dumping scandal became clear, the prime minister, Charles Konan Banny, offered the resignation of this government. But at this the cabinet expressed bewilderment, and some ministers are refusing to take part in the new government that Mr Banny, who was asked to stay on by President Laurent Gbagbo, hopes to name soon.

Meanwhile the numbers affected by toxic waste keep growing: by this week, six people had died and more than 16,000 had sought treatment. The crisis began in August when 528 cubic metres (116,000 gallons) of toxic liquid unloaded from a ship called the Proba Koala were dumped in 11 open-air sites in residential areas around the commercial capital, Abidjan. The Dutch-based company which chartered the boat, Trafigura Beheer BV, says that it had informed the Ivorian authorities that the “residue washings [slops] from its gasoline cargo” were dangerous, and that, from then on, it was Ivorian responsibility to dispose of the stuff safely.

That did not happen. More and more people began to fall ill, and thousands took to the streets in protest, but the government's response was slow. Yet when Mr Banny offered its resignation, opposition and rebel ministers were sceptical, arguing that the supposedly neutral prime minister was just using the toxic-waste scandal to push through a cabinet reshuffle.

The scandal shows up the ineffectiveness of a national-unity government composed of factions that disagree on just about everything. The government took too long to act, and then got lost in mudslinging over who was to blame. The port authority, run by one of Mr Gbagbo's cronies, and the minister of transport, an opposition politician, are accusing one another. And now that the government no longer exists, who will clear up the mess?

A team of French experts has arrived to try to identify what exactly the liquid was, and several other Western countries have said they will help. The Dutch government is investigating the role of the chartering company. Meanwhile the hospitals are short of medicine, and all unemployed doctors have been called up.

The political fallout from the scandal reveals just how fragile the peace process is. On September 20th the UN will examine the Ivorian crisis at a special meeting in New York. Elections are due in October but will not happen: the country is still split in half and electoral lists have not been drawn

up. The UN-appointed mediators of the International Working Group have accused all sides of failing to work towards peace. At the same time, the group made it clear where it felt the fault lies: Mr Banny has not been given the powers he needs to take the country to elections, and it recommended a new UN resolution ensuring that he gets them.

This, by implication, allots the largest share of the blame for the botched peace process to Mr Gbagbo. The president's supporters, already angry, will be infuriated if the UN votes for a resolution reinforcing the prime minister's mandate. Yet this is what it is likely to do next month.

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### 7.3 Climate Change

#### A more complete list of sources:

World 'warmest for 12,000 years'

<http://news.bbc.co.uk/2/hi/science/nature/5381456.stm>

Global temperature change

<http://www.pnas.org/cgi/content/full/103/39/14288>

Human Activities Are Boosting Ocean Temperatures in Areas Where Hurricanes Form, New Study Finds

<http://www.ucar.edu/news/releases/2006/oceantemps.shtml>

Study Strengthens Link Between Global Warming, Fiercer Storms

<http://www.ens-newswire.com/ens/sep2006/2006-09-12-02.asp>

Deep ice tells long climate story

<http://news.bbc.co.uk/2/hi/science/nature/5314592.stm>

Overview of current sea ice conditions

[http://nsidc.org/news/press/2006\\_seaiceminimum/20060816\\_arcticseaicenews.html](http://nsidc.org/news/press/2006_seaiceminimum/20060816_arcticseaicenews.html)

Melting Greenland Ice Sheet Spells More Bad News On Climate Change

[http://www.terraily.com/reports/Melting\\_Greenland\\_Ice\\_Sheet\\_Spells\\_More\\_Bad\\_News\\_On\\_Climate\\_Change\\_999.html](http://www.terraily.com/reports/Melting_Greenland_Ice_Sheet_Spells_More_Bad_News_On_Climate_Change_999.html)

Melting glaciers in southeast Alaska have scientists worried

[http://www.mailtribune.com/archive/2006/0922/life/stories/melting\\_glaciers.htm](http://www.mailtribune.com/archive/2006/0922/life/stories/melting_glaciers.htm)

Arctic summer ice anomaly shocks scientists

[http://www.esa.int/esaEO/SEM7ZF8LURE\\_index\\_0.html](http://www.esa.int/esaEO/SEM7ZF8LURE_index_0.html)

New Evidence Shows Antarctica Has Warmed In Last 150 Years

[http://www.terraily.com/reports/New\\_Evidence\\_Shows\\_Antarctica\\_Has\\_Warmed\\_In\\_Last\\_150\\_Years\\_999.html](http://www.terraily.com/reports/New_Evidence_Shows_Antarctica_Has_Warmed_In_Last_150_Years_999.html)

Climate 'time bomb' forecast

[http://www.boston.com/news/nation/articles/2006/09/07/climate\\_time\\_bomb\\_forecast/](http://www.boston.com/news/nation/articles/2006/09/07/climate_time_bomb_forecast/) (article available free for a limited time; full text [below](#))

Scientists find new global warming threat from melting permafrost

[http://www.usatoday.com/tech/science/discoveries/2006-09-06-permafrost-warming\\_x.htm?POE=TECISVA](http://www.usatoday.com/tech/science/discoveries/2006-09-06-permafrost-warming_x.htm?POE=TECISVA)

Diary: Siberia and climate change

<http://news.bbc.co.uk/2/hi/science/nature/5323964.stm>

Science tempers fears on climate change

<http://www.theaustralian.news.com.au/story/0,20867,20332352-601,00.html> (article available free for a limited time; full text [below](#))

Rising sea forces islanders to relocate

<http://www.earthsky.org/shows/show.php?date=20060814>

Global warning: Devastation of an atoll

<http://news.independent.co.uk/environment/article1222595.ece> (article available free for a limited time; full text [below](#))

World Bank: Climate threatening programs

[http://www.businessweek.com/ap/financialnews/D8JQ7VIG1.htm?sub=apn\\_home\\_up%26chan=db](http://www.businessweek.com/ap/financialnews/D8JQ7VIG1.htm?sub=apn_home_up%26chan=db) (article available free for a limited time; full text in this [below](#))

Development Under Climate Threat

<http://web.worldbank.org/WBSITE/EXTERNAL/NEWS/0,,contentMDK:21035991~pagePK:34370~piPK:34424~theSitePK:4607,00.html>

Global warming is more than just a green issue, says Secretary-General

<http://www.un.org/apps/news/story.asp?NewsID=20091&Cr=climate&Cr1=change>

### **Global warning: Devastation of an atoll**

Villagers on the South Pacific island of Tegua are packing up and leaving their homes for good - the first real victims of increasing sea levels caused by climate change

By Peter Boehm, Published: 30 August 2006

<http://news.independent.co.uk/environment/article1222595.ece> (article available free for a limited time)

As a Pacific island destination, Lateu struggles to sell itself. A typhoon wiped away its only beach a few years ago and today a handful of squalid thatched huts stand forlornly on its coastline. It will soon be a deserted village, its population the first real victims of rising sea levels brought about by global warming.

Even the village's palm trees are dying, their roots washed away by inexorably rising seas. The roofs of its thatched huts are leaking, there are gaping holes in the palm frond walls. All that remains of several are a few pathetic looking poles, braced against the prevailing wind from the vast expanse of the Pacific.

Lateu's people don't bother to patch their huts anymore, and an unpleasant mould covers the ground of every dwelling as a result of frequent flooding. For a while the islanders tried to rise above the surging seas by putting their huts up on makeshift foundations of coral, but they soon gave up. Now they are preparing to move to higher ground, some 300 metres inland, where they have already built six communal structures with financial aid from Canada.

Lateu is the only village on Tegua island, a half-moon-shaped speck of land less than four miles long and 10 miles wide in the South Pacific. It is one of five coral atolls in the Torres Group, 650 miles north of Vanuatu's main island, Efate. Getting here involves a flight in a small plane that

goes once a week to the Torres' main island, Loh, and a prohibitively expensive, wet and frightening 40-minute ride over the open sea in a fisherman's boat.

The impact climate change has had on Tegua atoll is hard to ignore. Everywhere on the windward side of the island, palm trees are immersed by the sea. Some have survived the ordeal, others have fallen, littering the shallow waters of the coast line. "At the end of the Eighties, our village was flooded for the first time," says Reuben Seluin, 63, Lateu's village head. "Nowadays it happens every other month."

When the islanders resettled Tegua in the Sixties, they built Lateu directly next to the bay. During low tide, a tiny pond of sweet fresh water appears between the sea's coral ground. The pool gave Lateu its name. Aside from a rain water tank, the only thing Vanuatu's administration ever built on this island, it used to be the only source of drinking water for the atoll. Now the women use it to do their laundry.

During high tide, waves crash on a low pile of coral that separates the village from the sea, but Mr Seluin says that Lateu used to have a white sand beach. Part of it, he says, was washed away by a tsunami, triggered by an earthquake on Torres in 1997. "With every big tide that followed, the sea came a bit closer. I can't tell you whether this is due to climate change. I just know that we used to have a beach, and that it's gone."

The effects of climate change and rising sea levels can be seen on many islands in Vanuatu. In 1993, Australian scientists set up the Sea Level and Climate Monitoring Project. They recorded the sea level at 12 points in the South Pacific and detected a rise of, on average, 6mm per year, or 7.8cm (3.1 inches) in total. Vanuatu's Meteorological Department monitors the number of storms that have hit the nation since 1941. In the Forties, says the department's head, Jotham Napat, the number in their records was five, but in the past few years, the average has been 15.

Some climatologists, such as Stephen Koletti from the University of Southern California, say it is still too early to jump to conclusions. He warns that washed out beaches alone are not sufficient evidence for a rise in the sea level. "The ocean and the beach are part of a dynamic system," he says. "During the storm season, the ocean washes out the beaches, while in the summer they are replenished." But the fact that the coastlines of Vanuatu don't seem to recover has worried him.

Mr Seluin is not interested in the intricacies of scientific climate discussions, and when he recounts Tegua's fate, there is no bitterness in his voice. No, he is not angry, he says while thoroughly examining a shell on the ground in front of him, when it is put to him that the pollution in the developed world is responsible for the rise in sea level but the impact is felt on their island. He mumbles eventually: "I would never say something like that."

Life is not all bad on this tiny atoll. It is after all remarkably fertile. The islanders grow fruit and vegetables in their plots of land in the rainforest, a half hour walk straight up the hill. If they want meat with their meals, they go for walk to pick up some crimson-coloured homemade crabs, or, a little deeper into the forest, coconut crabs, which are a sought-after delicacy in restaurants of far-away Port Vila, on Efate. When the sea is calm, they go fishing in crudely carved dugouts, or dive at night with a waterproof flashlight to rouse some lobsters.

From time to time, a group of four to six paddle two hours in their kayaks to the main part of the island to sell a few coconut crabs and buy merchandise such as matches, batteries, and other material. Little else gets through to Tegua. One islander owns a shortwave radio. A one-man news agency, if he hears something interesting, he spreads the news. Neither the World Cup nor the war in Lebanon made the cut.

Mr Seluin's feet look wide and flat, from walking barefoot his whole life. He sports the same washed-out shorts every day and a T-shirt with the slogan: "Life's a bitch... And then you dive."

The crew of a passing yacht donated it to him a few years back. Mr Seluin is not only the head of administration, the sole policeman, and only judge of the island, he is the clan chief as well, because all of the 60 inhabitants on Tegua belong to one extended family. Aden Seluin, the village head's eldest son, mans the tiny health station. With its shiny blue wooden walls, it comes closest to what a regular house looks like. Anyone suffering from something more severe than malaria has to be taken to the main island.

Godwin, Seluin's middle son, acts as a catechist for the small Anglican church in Lateu. He says that when a government delegation came to Tegua in 1998 and told them that the flooding was due to global warming, the pastor from the main island joined them. "He wanted to give us some comfort. We were really shocked. He told us that, yes, we were experiencing climate change, but that God would help us and not everybody was going to die."

When the islanders go to their gardens in the morning, they leave their children with Bettina Seluin, the village head's niece, in Lateu's tiny kindergarten.

As the children play with cardboard toys, she says: "In school we were never told about climate change. Because of the tsunami, a government delegation came to Tegua. That's when we heard about it for the very first time."

The government delegation that visited Tegua in early 1998 actually came because Vanuatu had become eligible for relief funds, having just signed the United Nations Framework Convention on Climate Change. Delegations visited all of Vanuatu's 83 islands to assess what impact global warming had had and would be likely to have in the future. That is how they learned about Lateu's plight.

After the tsunami, the villagers had decided to move their village inland, and the administration agreed to use part of a Canadian relief fund to support them. They settled for a clearing 300 meters inland, but up a steep hill from their old village, Lirak. With \$50,000 (£27,000), they built six shacks. They will drink rain water, collected from the roofs of the communal buildings, and they will get a satellite-based radio system, through which the Meteorological Department will send weather updates.

Only two families have built their private huts in Lirak so far. Titus Woilami, the village head's brother-in-law, with his wife and four daughters, is one of them. He says: "During full moon and new moon Lateu was always in danger. Then we have king tides. That really put a strain on me. I

could barely sleep, because it constantly swirled around my head: Will the water run into our hut again?"

The village head says moving the whole village with the church, kindergarten and health station will take a few more months. He is, of course, grateful for the new communal buildings. "Everything we ever owned, we put into Lateu," he says. But his clan will not leave Tegua. "We love our island. We have our gardens, we have fish in the sea, we have crabs to feed us. It doesn't matter that we don't have a radio, or a boat. We will stay here."

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The impact climate change has had on Tegua atoll is hard to ignore. Everywhere on the windward side of the island, palm trees are immersed by the sea. Some have survived the ordeal, others have fallen, littering the shallow waters of the coast line. "At the end of the Eighties, our village was flooded for the first time," says Reuben Seluin, 63, Lateu's village head. "Nowadays it happens every other month."

When the islanders resettled Tegua in the Sixties, they built Lateu directly next to the bay. During low tide, a tiny pond of sweet fresh water appears between the sea's coral ground. The pool gave Lateu its name. Aside from a rain water tank, the only thing Vanuatu's administration ever built on this island, it used to be the only source of drinking water for the atoll. Now the women use it to do their laundry.

During high tide, waves crash on a low pile of coral that separates the village from the sea, but Mr Seluin says that Lateu used to have a white sand beach. Part of it, he says, was washed away by a tsunami, triggered by an earthquake on Torres in 1997. "With every big tide that followed, the sea

came a bit closer. I can't tell you whether this is due to climate change. I just know that we used to have a beach, and that it's gone."

The effects of climate change and rising sea levels can be seen on many islands in Vanuatu. In 1993, Australian scientists set up the Sea Level and Climate Monitoring Project. They recorded the sea level at 12 points in the South Pacific and detected a rise of, on average, 6mm per year, or 7.8cm (3.1 inches) in total. Vanuatu's Meteorological Department monitors the number of storms that have hit the nation since 1941. In the Forties, says the department's head, Jotham Napat, the number in their records was five, but in the past few years, the average has been 15.

Some climatologists, such as Stephen Koletti from the University of Southern California, say it is still too early to jump to conclusions. He warns that washed out beaches alone are not sufficient evidence for a rise in the sea level. "The ocean and the beach are part of a dynamic system," he says. "During the storm season, the ocean washes out the beaches, while in the summer they are replenished." But the fact that the coastlines of Vanuatu don't seem to recover has worried him.

Mr Seluin is not interested in the intricacies of scientific climate discussions, and when he recounts Tegua's fate, there is no bitterness in his voice. No, he is not angry, he says while thoroughly examining a shell on the ground in front of him, when it is put to him that the pollution in the developed world is responsible for the rise in sea level but the impact is felt on their island. He mumbles eventually: "I would never say something like that."

Life is not all bad on this tiny atoll. It is after all remarkably fertile. The islanders grow fruit and vegetables in their plots of land in the rainforest, a half hour walk straight up the hill. If they want meat with their meals, they go for walk to pick up some crimson-coloured homade crabs, or, a little deeper into the forest, coconut crabs, which are a sought-after delicacy in restaurants of far-away Port Vila, on Efate. When the sea is calm, they go fishing in crudely carved dugouts, or dive at night with a waterproof flashlight to rouse some lobsters.

From time to time, a group of four to six paddle two hours in their kayaks to the main part of the island to sell a few coconut crabs and buy merchandise such as matches, batteries, and other material. Little else gets through to Tegua. One islander owns a shortwave radio. A one-man news agency, if he hears something interesting, he spreads the news. Neither the World Cup nor the war in Lebanon made the cut.

Mr Seluin's feet look wide and flat, from walking barefoot his whole life. He sports the same washed-out shorts every day and a T-shirt with the slogan: "Life's a bitch... And then you dive."

The crew of a passing yacht donated it to him a few years back. Mr Seluin is not only the head of administration, the sole policeman, and only judge of the island, he is the clan chief as well, because all of the 60 inhabitants on Tegua belong to one extended family. Aden Seluin, the village head's eldest son, mans the tiny health station. With its shiny blue wooden walls, it comes closest to what a regular house looks like. Anyone suffering from something more severe than malaria has to be taken to the main island.

Godwin, Seluin's middle son, acts as a catechist for the small Anglican church in Lateu. He says that when a government delegation came to Tegua in 1998 and told them that the flooding was due to global warming, the pastor from the main island joined them. "He wanted to give us some comfort. We were really shocked. He told us that, yes, we were experiencing climate change, but that God would help us and not everybody was going to die."

When the islanders go to their gardens in the morning, they leave their children with Bettina Seluin, the village head's niece, in Lateu's tiny kindergarten.

As the children play with cardboard toys, she says: "In school we were never told about climate change. Because of the tsunami, a government delegation came to Tegua. That's when we heard about it for the very first time."

The government delegation that visited Tegua in early 1998 actually came because Vanuatu had become eligible for relief funds, having just signed the United Nations Framework Convention on Climate Change. Delegations visited all of Vanuatu's 83 islands to assess what impact global warming had had and would be likely to have in the future. That is how they learned about Lateu's plight.

After the tsunami, the villagers had decided to move their village inland, and the administration agreed to use part of a Canadian relief fund to support them. They settled for a clearing 300 meters inland, but up a steep hill from their old village, Lirak. With \$50,000 (£27,000), they built six shacks. They will drink rain water, collected from the roofs of the communal buildings, and they will get a satellite-based radio system, through which the Meteorological Department will send weather updates.

Only two families have built their private huts in Lirak so far. Titus Woilami, the village head's brother-in-law, with his wife and four daughters, is one of them. He says: "During full moon and new moon Lateu was always in danger. Then we have king tides. That really put a strain on me. I could barely sleep, because it constantly swirled around my head: Will the water run into our hut again?"

The village head says moving the whole village with the church, kindergarten and health station will take a few more months. He is, of course, grateful for the new communal buildings. "Everything we ever owned, we put into Lateu," he says. But his clan will not leave Tegua. "We love our island. We have our gardens, we have fish in the sea, we have crabs to feed us. It doesn't matter that we don't have a radio, or a boat. We will stay here."

### **Science tempers fears on climate change**

<http://www.theaustralian.news.com.au/story/0,20867,20332352-601,00.html>

By Matthew Warren. 02sep06

THE world's top climate scientists have cut their worst-case forecast for global warming over the next 100 years.

A draft report by the Intergovernmental Panel on Climate Change, obtained exclusively by The Weekend Australian, offers a more certain projection of climate change than the body's forecasts five years ago.

For the first time, scientists are confident enough to project a 3C rise on the average global daily temperature by the end of this century if no action is taken to cut greenhouse gas emissions.

The Draft Fourth Assessment Report says the temperature increase could be contained to 2C by 2100 if greenhouse gas emissions are held at current levels.

In 2001, the scientists predicted temperature rises of between 1.4C and 5.8C on current levels by 2100, but better science has led them to adjust this to a narrower band of between 2C and 4.5C.

The new projections put paid to some of the more alarmist scenarios raised by previous modelling, which have suggested that sea levels could rise by almost 1m over the same period.

The report projects a rise in sea levels by century's end of between 14cm and 43cm, with further rises expected in following centuries caused by melting polar ice.

The new projections forecast damage by global warming, such as stronger cyclones, modest sea-level rises and further shrinking of the arctic sea ice.

CSIRO research predicts the biggest impact of sea-level changes of this scale would be to increase the effect of storm surges, particularly on Australia's tropical northern coastline.

The forecast temperature rises would also result in lower rainfall over most of the Australian mainland and exacerbate the threat to the survival of coral reefs and shellfish by increasing the risk of bleaching and increasing the acidity of the ocean.

Australian Conservation Foundation energy program manager Erwin Jackson said the projections required an urgent and immediate response from the federal Government to drive accelerated investment in low-emissions technology in Australia.

"Every day we delay taking action, the problem gets worse," Mr Jackson said.

"The Government keeps throwing up the costs of action but totally ignores the costs of inaction.

"No one ever said that saving the planet would cost nothing - that's the bottom line."

A recent Australian Bureau of Agricultural and Resource Economics report on the cost of cutting greenhouse gas emissions estimated Australians would incur a fall in real wages of about 20 per cent if the nation was to unilaterally cut greenhouse gas emissions in half by 2050.

John Howard this week said that sort of scenario would have an "enormously damaging" effect on the economy. "I accept that climate change is a challenge," the Prime Minister said. "I accept the broad theory about global warming. I am sceptical about a lot of the more gloomy predictions.

"I also recognise that a country like Australia has got to balance a concern for greenhouse gas emissions with a concern for the enormous burden to be carried by consumers ... of what you might call an anti-greenhouse policy. It's a question of balance."

Federal Environment Minister Ian Campbell said the draft IPCC report was still undergoing a thorough review process before its approval by the panel next year.

"It highlights the need for an effective global response to climate change as Australia alone cannot alter the pattern of world emissions," Senator Campbell said. "We are taking a leading role internationally to achieve effective engagement by all major greenhouse gas-emitting countries."

The new projections are based on the results of 23 climate models, developed by government climate scientists from IPCC member countries.

According to current climate change models, stabilising global greenhouse gas levels to 400 parts per million offers a good chance of avoiding 2C global temperature increases.

This would require global emissions to be 50 per cent below 1990 levels by 2050.

CSIRO recently concluded that the goal of 60 per cent reductions might be considered the minimum needed to avoid dangerous climate change.

Any further reductions in global temperatures would require cuts in emissions of about 80-90 per cent in industrialised countries by 2050, which would require a faster transition to near-zero emissions technologies.

The Kyoto Protocol is an international agreement for developed countries to meet greenhouse gas emissions targets by 2012.

Australia and the US have refused to sign the protocol, instead proposing a global climate pact that focuses on working with developing countries such as China and India to reduce their greenhouse emissions.

Mr Jackson said the IPCC draft report highlighted the inadequacy of Australia's policy response to the threat of climate change.

"If these projections become a reality, our children face living in an Australia with no Barrier Reef, no Kakadu wetlands and a Murray River reduced to a trickle."

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### **Climate 'time bomb' forecast**

Methane bubbles out of permafrost at increased rate

By Seth Borenstein, Associated Press | September 7, 2006

[http://www.boston.com/news/nation/articles/2006/09/07/climate\\_time\\_bomb\\_forecast/](http://www.boston.com/news/nation/articles/2006/09/07/climate_time_bomb_forecast/)

WASHINGTON -- Global warming gases trapped in the soil are bubbling out of the thawing permafrost in amounts far higher than previously thought and may trigger what researchers warn is a climate time bomb.

Methane -- a greenhouse gas 23 times more powerful than carbon dioxide -- is being released from the permafrost at a rate five times faster than thought, according to a study being published today in the journal *Nature*. The findings are based on new, more accurate measuring techniques.

"The effects can be huge," said the lead author, Katey Walter of the University of Alaska at Fairbanks. "It's coming out a lot and there's a lot more to come out."

Scientists worry about a vicious global-warming cycle that was not part of their already gloomy climate forecast: Warming already underway thaws permafrost, soil that has been continuously frozen for thousands of years. Thawed permafrost releases methane and carbon dioxide. Those gases reach the atmosphere and help trap heat on earth in the greenhouse effect. The trapped heat thaws more permafrost and so on.

"The higher the temperature gets, the more permafrost we melt, the more tendency it is to become a more vicious cycle," said Chris Field, director of global ecology at the Carnegie Institution of Washington. "That's the thing that is scary about this whole thing. There are lots of mechanisms that tend to be self-perpetuating and relatively few that tend to shut it off."

Some scientists say this vicious cycle is already underway, but others disagree.

Most of the methane-releasing permafrost is in Siberia. Another study earlier this summer in the journal *Science* found that the amount of carbon trapped in this type of permafrost -- called yedoma -- is much more prevalent than originally thought and may be 100 times the amount of carbon released into the air each year by the burning of fossil fuels.

It won't all come out at once or even over several decades, but if temperatures increase, then the methane and carbon dioxide will escape the soil, scientists say.

The permafrost issue has caused a quiet buzz of concern among climate scientists and geologists.

"It's kind of like a slow-motion time bomb," said Ted Schuur, a professor of ecosystem ecology at the University of Florida and coauthor of the study in *Science*.

### **World Bank: Climate threatening programs**

[http://www.businessweek.com/ap/financialnews/D8JQ7VIG1.htm?sub=apn\\_home\\_up%26chan=db](http://www.businessweek.com/ap/financialnews/D8JQ7VIG1.htm?sub=apn_home_up%26chan=db)  
(article available free for a limited time)

AUG. 29 1:56 P.M. ET About one quarter of World Bank development programs may be at risk because of climate change, the organization warned Tuesday at an environmental summit.

Projects in small island states are already being affected because of rising sea levels and storm surges, which have affected the water supply and infrastructure, World Bank environment director Warren Evans said.

He said dry countries in sub-Saharan Africa also were bearing the brunt of the damage because of the impact of climate change on crucial farm production.

"A large number of projects we finance are at some risk of not succeeding because of climate change," Evans said. A World Bank report on Managing Climate Risk said this could be as high as one quarter.

The report urged the international community to integrate climate risk concerns now in development strategies in order to safeguard economic growth and poverty reduction gains in the short and long term.

The warnings came at the opening of a conference of the Global Environmental Facility -- a partnership with the U.N. Development Program, the U.N. Environment Program and the World Bank and the biggest source of funding for projects to combat pollution and promote sustainable development.

Governments on Monday pledged \$3.1 billion (2.42 billion euros) to the fund's operations.

However, South African Environment Minister Marthinus Van Schalkwyk complained that the resource allocation was "inequitably skewed," with many African countries "relegated to the margins."

South African Deputy President Phumzile Mlambo-Nckuka said the fight against global warming should be as intense as the struggle against apartheid.

"It is about time that we get decisive on the importance and economics of saving the planet," she said.

"This tip of the African continent is also potentially challenged by the impact of climate change, global warming, and with warming temperatures threatening the wine and fruit industries, and indications of declining rainfall also likely to have a significant socio-economic impact," she said.

During the past century the global climate warmed by about 0.7 degrees Celsius because of human activities, with accompanying changes in rainfall patterns, extreme weather events, and sea levels, and another 1.4C-5.8C temperature rise is projected in the next hundred years.

This is expected to lead to an increased risk of floods, droughts and diseases such as malaria in many regions, falling agricultural productivity and damage to fisheries and many ecological systems.

The World Bank report said too much emphasis had been placed on mitigating the impact of climate change rather than adjusting to it, given its inevitability.

Evans said that far from being reduced, greenhouse gas emissions were likely to rise because of the rapid development of India and China -- with China alone starting the equivalent of one new power plant per week. The United States, the world's biggest producer of greenhouse gases, has refused to commit itself to targets to curb emissions.

"We are trying to help countries deal with risk of climate change today, then they will be in better position to manage and adapt in future," he said.

But he said there was huge uncertainty. For instance, decisions to build water dams were typically based on a century's worth of hydrological data.

"That data doesn't make any sense any more," he said. "We have to look to the future and guess what the hydrology will look like. Right now, the question is are we building the right thing in the right place at the right time."

## **Item 8. Reports Suggested for Review**

### **8.2. New Reports on Nanotechnology Risk Assessment**

#### **8.2.3 Reaction to Voluntary Nanomaterial Reporting Scheme**

##### **Nanotechnology report urges better safety standards**

Mostly positive findings on the National Nanotechnology Institute suggest safety and measuring economic returns as areas for improvement

By Kerry Grens

The Scientist, 26th September 2006

<http://www.the-scientist.com/news/daily/24910/> (by subscription only)

A new report from the National Research Council's Committee to Review the National Nanotechnology Initiative delivers a mostly positive review of the initiative's progress in overseeing the government's role in developing nanotechnologies. However, the report also points to places where improvement would be possible, including determining the potential safety risks associated with nanomaterials and tracking economic returns on federal funding.

The committee's first triennial review, requested by Congress, praised the National Nanotechnology Initiative (NNI) for its efforts in coordinating nanotechnology research and development across government agencies.

However, the report calls for expanding research funds to establish safety standards for workers, consumers, and the environment. "The body of published research addressing the toxicological and environmental effects of engineered nanomaterials is still relatively small," the report states.

Committee chair James Williams, a professor at Ohio State University, said, "There is some concern that the effort nationally—I don't know whether it's fair to map that onto the NNI—is a little slow in getting started on the possible health consequences of nanomaterials in the workplace."

E. Clayton Teague, director of the federal National Nanotechnology Coordination Office, agrees with the committee's recommendations. "Certainly, research funding has been growing," Teague said in an interview with *The Scientist*. He pointed out that the federal budget for environment, health, and safety research regarding nanotechnology will expand from \$38 million in 2005 to \$44 million in 2007.

Teague said that, overall, the recommendations in the review "are parallel to the directions we have been thinking about and moving in directly."

For example, the Nanoscale Science, Engineering, and Technology Subcommittee (NSET) of the National Science and Technology Council's Committee on Technology released a report last week detailing areas of research necessary to understand environmental, health, and safety issues surrounding nanotechnology. Teague said his group is committed to filling those research needs.

"It's gratifying that they do recognize the need for further research and the need to underpin safe nanotechnologies," Andrew Maynard, chief science advisor for the Project on Emerging Nanotechnologies at the Woodrow Wilson International Center for Scholars, said in an interview with *The Scientist*.

However, Maynard called the NSET's report a "shopping list" and said that the committee's review of the NNI did not go as far as it could in laying out precisely what research will establish safety standards for nanotechnology and how to get it done quickly.

"In the short term, this is such a critical issue that we need to move fast," Maynard said.

Other areas of improvement the committee highlighted include the need for the NNI to work toward a better system for keeping track of financial data. The review found a "dearth of data" on federal budget requests, investments, authorizations, and expenditures, making it impossible to link federal funding to measures of progress.

Williams is confident the NNI will be able to meet more of its goals as the program matures. "Nanotechnology is still in its infancy, and doing things like measuring economic impact, it's just too early," he said.

He told *The Scientist* that, overall, the institute's work thus far has been a success. "The (NNI's) ability to produce a cohesive, coordinated program amongst so many federal agencies is as well as it's ever been done," he said.

### 8.3 UK Defence Ministry Highlights the Link between Environment and Security

#### Overseas Deployment and Environmental Change



Source: UK MoD, Sustainable Development Report 2005