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WORLDWIDE EMERGING ENVIRONMENTAL ISSUES AFFECTING THE U.S. MILITARY

Control No. (TCN) 08152 with Battelle Chapel Hill Operations for the U.S. Army Environmental Policy Institute

NOVEMBER 2008 REPORT

Note to Readers: Pages 1-14 comprise the summary and analysis of this report. Expanded details for some items are in the Appendix beginning on page 15.

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Item 1. New UN-linked Body Proposed to Protect Biodiversity and Ecosystem Services

As the IPCC helped to put global climate change on the world agenda, a new organization is proposed to do the same for biodiversity and ecosystem services. Building on the Millennium Ecosystem Assessment and the Consultative Process Towards an International Mechanism of Scientific Expertise on Biodiversity, the proposed Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) would bring together the policymaking and scientific communities from the biodiversity and ecosystem areas to provide timely information to support decision making. The framework for the new UN-linked body was discussed at an ad hoc intergovernmental and multi-stakeholder meeting held November 10-12, 2008 in Putrajaya, Malaysia, attended by over 175 participants from nearly 100 countries and more than 20 organizations. The meeting's results will be presented at the 25th session of the UNEP Governing Council.

Military Implications:
Defense of the biosphere is the responsibility of many organizations, and increasingly the military will be called upon to help. As a result, it would be wise for military planners to take biodiversity and ecosystem services into consideration in its future scenarios and planning. Once the new intergovernmental body is created, existing biodiversity-related regulations are more likely to be better enforced and new regulations are likely to be created. The new body should also improve global strategic analysis to better address biodiversity loss. The military should also consider its future roles with this organization, and how tougher biodiversity and ecosystem protection standards could affect its training and operations planning.

Sources:
Ad hoc Intergovernmental and Multi-Stakeholder Meeting on an Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
http://ipbes.net/en/index.aspx
Summary of the Ad Hoc Intergovernmental and Multi-Stakeholder Meeting on an Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
http://www.iisd.ca/ymb/ipbes/html/ymbvol158num1e.html
How Best to Put 'Nature-Based Assets' at the Top of the International Political Agenda Focus of Malaysia Meeting
http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=550&ArticleID=5972&l=en

Item 2. International Conference on Military's Role in Climate Change

The Importance of Military Organizations in Protecting the Climate 2008 conference, attended by over 100 military and environmental experts from 25 countries, plus the EU and UNEP, discussed the security implications of climate change and the role of the military community in addressing it. There was consensus that climate change is a conflict multiplier with global security implications such as: "creating new geopolitical areas of concern; inhibiting the ability to project power; jeopardizing coalition partnerships; increasing operations other than war; overloading UN peacekeeping deployments; and requiring urgent actions by military and civilian leaders and the public" [1]. Therefore military organizations should increase their role in protecting the climate by showing leadership in increasing energy efficiency through

procurement and operations, R&D centers of excellence, and transfer of knowledge. Several best practices were discussed and a project was proposed for a global public-private partnership to cooperate in efforts to collect and destroy ozone-depleting substances. Some "visionary military climate strategies" included "self-sustaining energy at the battlefront; a Carbon Non-Proliferation Treaty; and cooperation on Arctic passage & resources" [2]. The conference, which is the fifth in a series that began in 1991, was held in Paris, November 3-5, co-hosted by the Institute for Governance and Sustainable Development and collaborators.

Military Implications:
Outcomes of the conference should be widely disseminated—including to military contractors—and such opportunities should be used to improve global networks for information sharing of environmental best practices to reduce the army environmental footprint, as well as for preparation to mitigate possible climate change-induced conflict situations. DOD personnel attending the conference can be reached for further information.

Sources:
The Importance of Military Organizations in Protecting the Climate: 2008
http://www.igsd.org//conferences/Paris2008.php
[1, 2] Conference Conclusions and Opportunities for Co-operation. Stephen O. Andersen, EPA Climate Liaison to the US Department of Defense
http://www.igsd.org//conferences/Paris2008/3%20Andersen%20conclusions.pdf
Key role for military in climate change, US experts say
http://www.euractiv.com/en/climate-change/key-role-military-climate-change-us-experts/article-177141

Item 3. Arab Mediterranean Governments' Environmental Security Cooperation

The Environmental Security in the Arab and Mediterranean sphere: Role of the Civil Society conference was organized by the Association of the Mediterranean Network for Sustained Development (ARREMED) and the Arab Environment and Development Network (RAED), in Tunis. Attended by high-ranking diplomats and environment and security experts, the conference discussed cooperation and common policies for addressing environmental and human security in the Arab Mediterranean spheres. "Governments should unify policies on environmental security and strengthen partnership in matter of scientific research between Arab countries and prepare a survey of possible risks to evaluate their impact and their cost," stipulates the conference declaration. Highlighted was that tackling environmental issues is imperative mainly in conflict-threatened regions. Along the same lines, the *Arab Environment: Future Challenges* report launched at the annual conference of the Arab Forum for Environment and Development held in Manama, Bahrain, recommends urgent action in four major areas: fresh water scarcity, desertification, air quality, and marine pollution, all of which will likely worsen due to climate change.

Military Implications:
Relevant environmental security military personnel should review the outcomes of this conference for possible cooperation and implications for military planning and operations in the region.

Sources:
Environmental experts advocate common Arab-Mediterranean vision
http://www.magharebia.com/cocoon/awi/xhtml1/en_GB/features/awi/features/2008/11/11/feature-01

Arab, Mediterranean governments urged to boost cooperation in environmental security
http://www.chinadaily.com.cn/world/2008-11/10/content_7188556.htm
Regional conference on environmental security opens
http://www.tap.info.tn/en/index.php?option=com_content&task=view&id=23393&Itemid=255
Arab Environment: Future Challenges
http://www.afedonline.org/afedreport/
State of the Arab environment 2008: 'A lot has been achieved, but much more is still needed'
http://www.dailystar.com.lb/article.asp?edition_id=1&categ_id=2&article_id=97278

Item 4. An International Energy and Environmental Security Foresight Network

The Energy and Environmental Security Ecosystem (EESE) is a project initiated by the U.S. Energy Department's intelligence and counterintelligence unit, for compiling and sharing intelligence and improving understanding of possible security implications of energy and environmental security issues. It will involve a coalition of countries and will consist of a members-only website for selected government, industry and expert representatives, and eventual face-to-face meetings. "The character of the energy and environmental security challenge requires a radically different, more globally systemic process," says a report by Natural Resources Canada, mentioning the EESE project. Countries involved or interested include Australia, Bangladesh, Brazil Canada, China, France, Germany, India, Italy, the Netherlands, Sweden and the U.S. Others may join later. The project is to be launched in the first half of 2009.

Military Implications:
If not already involved, senior military environmental security and energy personnel should seek inclusion in the EESE Project.

Source:
Canada may join U.S.-led energy, environment security project
http://canadianpress.google.com/article/ALeqM5idqDzQ-rStLqmwfoW2VXiMY7E7UQ
Global Intelligence; Developing a Globally Networked Intelligence Capacity (power point presentation)
http://www.dniopensource.org/Conference/files/Carol%20Dumaine%20FINAL%2009-12-08.ppt
Support Grows for Integrating Environment, Energy, Economy, Security in U.S. Government
http://newsecuritybeat.blogspot.com/2008/11/support-grows-for-integrating.html

Item 5. Vietnam Cracking Down on Environmental Violators

Over the past several months, Vietnamese authorities have taken strong measures against some environmental polluters, and the Minister of Natural Resources and Environment has ordered the government to get tough on polluters, levied heavy fines on one factory, and threatened criminal prosecutions. The country is having a hard time, however, in balancing the need for cleaning up its environment with the necessity of attracting and keeping industrial development.

Military Implications:
This could be an opportunity to explore military-to-military environmental security cooperation.

Source:
Vietnam Cracks Down on Polluters
http://www.time.com/time/world/article/0,8599,1851331,00.html

Item 6. Technological Advances with Environmental Security Implications

6.1 Autonomous Robots May Need Environmental Concerns

Current work on intelligent battlefield robots by Ronald C. Arkin at Georgia Tech is focused on building into their programming regard for such elements as rules of engagement and the Geneva Convention.

Military Implications:
Along these lines, the military should also consider including in autonomous robots' design and programming concerns related to the environment.

Source:
A Soldier, Taking Orders From Its Ethical Judgment Center
http://www.nytimes.com/2008/11/25/science/25robots.html?_r=1

6.2 New Technique May Solve Wind Farm Interference with Radars

Cambridge Consultants Ltd. of Cambridge UK and Boston MA is working on the development of a holographic-infill radar, which aims to solve the problem of wind turbine interference with air traffic radars. The system works by covering the area of the turbines with a short-range radar "patch" with a different characteristic. A test has shown that the method provides a Doppler effect for a target moving on the ground different from one produced by a turbine, a distinction, which it is believed would enable a full-scale system to detect an aircraft intrusion into a wind farm interference area. Flying tests are planned.

Military Implications:
The military should follow this development in the hope that it would eliminate the need for restrictions on the placement of environment-friendly wind farms near air surveillance radars.

Source:
Cambridge Consultants Ltd. http://www.cambridgeconsultants.com/news_pr202.html
Is it plane? How to make radar work in wind farms
http://www.economist.com/science/displaystory.cfm?story_id=12551574

6.3 New Detection and Cleanup Techniques

6.3.1 Variable Heating Provides New Flexibility for Gas Sensors

Researchers Barani Raman and associates at the US National Institute of Standards and Technology (NIST) have developed a new "sensitive detector technology capable of distinguishing hundreds of different chemical compounds with a pattern-recognition module that mimics the way animals recognize odors", according to a NIST announcement. The current unit comprises eight types of sensors in the form of oxide films deposited on the surfaces of 16 microheaters that allow the sensors to be heated to 350 temperature points between 150°C and 500°C, and "relies on changes in electrical conductance in the sensing film to detect the presence of adsorbed gases. Temperature changes may be used to create response 'fingerprints' for

different gases." The new technology is better than previous devices at recognizing previously un-sensed compounds and at dealing with sensor wear over time.

Military Implications:
The military should explore this new methodology for its usefulness in systems for detecting and identifying environmental contaminants and battlefield chemical signals of enemy and friendly action.

Source:
Sniffing Out a Better Chemical Sensor
http://www.nist.gov/public_affairs/techbeat/tb2008_1028.htm#nose

6.3.2 New Material Stores Methane in Dry Form
An inexpensive dry material that will absorb large quantities of methane is being developed by Prof. Andy Cooper, Director of the Centre for Materials Discovery at the University of Liverpool's Department of Chemistry. The technique is to form methane hydrate by mixing water droplets with a special form of silica that stops them from coalescing, forming a 'dry water' powder that absorbs large quantities of methane rapidly at around 0° C.

Military implications:
The military should follow this development to assess its assistance in systems for transporting cleaner-burning natural gas for power generation purposes and reducing the military greenhouse gas emissions footprint.

Source:
Chemists at the University of Liverpool have developed a way of converting methane gas into a powder form in order to make it more transportable.
http://www.physorg.com/news146398407.html

6.4 Increasing Energy Efficiency Technologies

6.4.1 Compressed Air Car May Offer Environmental Advantages
Zero Pollution Motors of New Paltz, NY is developing a compressed air vehicle planned for US production in 2010. The car may be viewed as an analogue of an electric car, with the battery replaced by a tank filled with air previously compressed by any electric energy source. The air runs a 2-, 4- or 6-cylinder engine, replacing the pressure otherwise generated by the explosion of fossil fuel vapors in the cylinders.

Military Implications:
The military should explore this technology to see what vehicle substitutions are practical and consider ordering some for test purposes.

Source:
Pure Driving: The Revolutionary Compressed Air Vehicle
http://zeropollutionmotors.us

6.4.2 Proposed Uniform Device-Charging Scheme Could Yield Environmental Benefits
Green Plug of San Ramon California seeks adoption of its environment-friendly charging technology for battery-operated devices. The technique depends on a "smart" universal

plug-in-the-wall charger that communicates with a proprietary chip in the attached user device to determine what voltage level to provide to it for recharging. Adoption of this hardware (which would use a single connector configuration) would allow a single multiple-outlet charger to service all portable devices at a given location. In addition to eliminating the proliferation of discarded obsolete chargers into electronic waste dumps, the technology, unlike conventional transformer-type chargers, also uses almost zero power when not actually supplying current.

Military Implications:
The military should investigate this development to determine if it can be usefully applied to its electronic materiel; and hence, contribute to a lower environmental footprint.

Sources:
Pulling the Plug on Phantom Power
http://www.greenercomputing.com/podcast/2008/11/21/pull-plug-phantom-power
Green Plug:
http://www.greenplug.us/index.php

6.5 Environmentally Polluting Ash Turned into Concrete-like Structural Material

Prof. Mulalo Doyoyo of Georgia Tech's School of Civil and Environmental Engineering has developed a new structural material, Cenocell, that is produced by treating with organic chemicals fly ash and bottom ash left over from coal burning systems. It offers high strength and light weight, uses no cement, and could replace concrete, wood and other materials in many applications.

Military Implications:
The military should investigate the possible use of this environmentally friendly product in military construction.

Source:
Strong, lightweight green material could replace concrete, but contains no cement
http://www.physorg.com/news146851488.html

Item 7. Updates on Previously Identified Issues

7.1 UN Secretary General Reiterates the Link between Environment and Security

On the International Day for Preventing the Exploitation of the Environment in War and Armed Conflict, celebrated on November 6, UN Secretary General Ban Ki-moon renewed the call for "protecting the environment as a pillar of our work for peace." Reiterating that "The environment and natural resources are crucial in consolidating peace within and between war-torn societies," he gave the example of the transboundary cooperation in the Great Lakes Region of Africa to manage their shared natural resources, and underlined that lasting peace in war-torn regions like Darfur and Afghanistan is not possible without restoration of the ecosystem to support livelihoods. He noted that although "The natural environment enjoys protection under Protocol 1 of the Geneva Conventions… this protection is often violated during war and armed conflict." [See also *UN Secretary-General on the International Day for Preventing the Exploitation of the Environment in War and Armed Conflict* in October 2007 environmental security reports]

Military Implications:
Using such statements by the UN Secretary-General, the military should continue to increase collaboration with UN organizations such as UNEP, UNHCR, WFP, UNDP, and their partners to prevent environmentally induced conflicts and to manage postwar efforts for sustainability.

Sources:
A Day to Prevent Exploitation of the Environment in War
http://www.ens-newswire.com/ens/nov2008/2008-11-06-02.asp
Action on Nature Part of United Nations Approach to Peace, Says Secretary-General, In Message for World Day to Prevent Exploitation of Environment during Conflict
http://www.un.org/News/Press/docs/2008/sgsm11900.doc.htm
Global pact on explosive remnants of war vital tool to end scourge – Ban
http://www.un.org/apps/news/story.asp?NewsID=28869&Cr=weapon&Cr1=treaty

7.2 Forums Discuss Water-Related Security Issues

The conference Water for Peace – Peace for Water: Lessons from the Past and Current Challenges, jointly organized by the UNESCO International Hydrological Programme (IHP), the Chirac Foundation, and the French Agency for Development, addressed two issues: transboundary water and cooperation, and access to water in fragile states. The outcomes [to be available soon] will be considered in the Political Process of the Fifth World Water Forum, to be held in Istanbul, March 15-22, 2009.

The International Conference on Water Resources and Arid Environment and the First Arab Water Forum took place in Riyadh, Saudi Arabia, November 16-19, 2008 and addressed challenges related to water resources in the area and strategies to address them, including new technologies and Arab water policies for development and water crisis management. In his opening address, Prince Khalid bin Sultan bin Abdulaziz warned of possible terrorism targeting water resources and called for a water summit similar to the world economic summits. [See also *Unless Water Management Improves, Conflicts over Water Are Inevitable* in August 2006 and other related items in previous environmental security reports.]

Military Implications:
Outcomes of such forums should be reviewed for potential additions to policies, training, and plans to help prevent, contain, and resolve water-related conflicts.

Sources:
Water for Peace and Peace for Water Conference
http://www.fondationchirac.eu/en/water-for-peace-and-peace-for-water-november-13/
The 3rd International Conference on Water Resources and Arid Environments (2008)
And The 1st Arab Water Forum
http://www.psipw.org/article_208.html
International Conference on Water Resources and Arid Environment Opened
http://www.mofa.gov.sa/Detail.asp?InNewsItemID=86326

7.3 The Convention on Cluster Munitions Opens for Signature on December 2nd

The Convention on Cluster Munitions (CCM) will be open for signing at a special conference in Oslo, December 2–4, 2008. The CCM prohibits the use, development, production, stockpiling, and transfer of cluster munitions. It was adopted at the Dublin Diplomatic Conference on Cluster

Munitions in May 2008. [See also *International Convention on Cluster Munitions Adopted by 111 Countries* in May 2008 and other related items in previous environmental security reports.]

Military Implications:
[Same as previous on this issue] Although the U.S. does not support the Cluster Munitions Convention, it would be wise for the military to make plans for the elimination of cluster bombs, as international support for their prohibition continues to grow.

Source:
Banning Cluster Munitions – making it happen in Oslo
http://www.osloccm.no/

7.4 EU Arctic Policy Guidelines

The recently published EU 'Communication' concerning the Arctic stipulates that the Arctic becomes a priority in the European Northern Dimension policy due to potential implications for European security and stability. It outlines the EU Arctic framework built around three main policy objectives: "1) Protecting and preserving the Arctic in unison with its population; 2) Promoting sustainable use of resources; and 3) Contributing to enhanced Arctic multilateral governance." [See also *European Parliament Adopted Resolution on Arctic Governance* in October 2008 and other related items in previous environmental security reports.]

Military Implications:
[Similar to previous on the same issue] Negotiations for clear international regulations concerning the Arctic region are accelerating. The potential for new military roles in the region increases for both national security and protection of the ecosystems. Relevant military personnel should cooperate with their counterparts in other countries and international organizations for developing adequate strategies, regulations, and enforcement procedures.

Sources: (see a more expanded list in the Appendix)
The EU and the Arctic region
http://ec.europa.eu/maritimeaffairs/arctic_overview_en.html
Commission green-lights industrialisation of Arctic
http://euobserver.com/9/27152/?rk=1
Shippers, oil companies gauge benefits of less Arctic ice
http://www.adn.com/news/alaska/story/603373.html

7.5 Outer space policy

7.5.1 Increasing Militarization of Space Might Require Outer Space Treaty Review

The European Space Agency Ministerial meeting in The Hague, Netherlands held November 25–26 adopted a new European space policy, which increases ESA's role in addressing climate change and global security, setting new objectives and budgets for the agency. The programs include: Earth Observation activities (including the second segment of the Global Monitoring for Environment and Security Space Component); the Meteosat 3rd generation and a novel Climate Change Initiative; continued improvement of the Galileo navigation satellite system; and start of a Space Situational Awareness programme to help protect European space systems against space debris and the influence of adverse space weather. [See also *Increased Use of Space Technology*

for Monitoring Environmental Events in September 2008 and other related items in previous environmental security reports.]

The *Space, Security and the Economy* report by Economists for Peace and Security warns that the present U.S. space dominance policy threatens an arms race in space with possible devastating consequences for the economy and the growing scientific and commercial uses of space. The report calls for greater transparency in military space spending, and detailed information about government and commercial space activities. Along the same lines, the report *From Venus to Mars: the European Union's steps towards the militarisation of space* by the Netherlands-based think-tank Transnational Institute argues that European and international trends to increasingly use space for military rather than civilian objectives might trigger a new arms race; and, therefore, the UN Outer Space Treaty might need to be reconsidered and broadened.

Military Implications:
[Same as previous on similar issues] Further developing an integrated environmental monitoring capability to provide informed data to the public and policy- and decision-makers would considerably improve the assessment of potential environmental impacts of different actions, facilitate enforcement of international treaties worldwide, and could help mitigate environmental and social consequences induced by conflicts or natural disasters. The military should consider full cooperation in all the phases—from development to implementation and use of international space-based observation systems.

Sources:
Ministerial Council 2008
http://www.esa.int/SPECIALS/Ministerial_Council/index.html
From Venus to Mars. The European Union's steps towards the militarisation of space
http://www.tni.org/detail_pub.phtml?&know_id=276&menu=11e
Space, Security and the Economy
http://www.epsusa.org/publications/papers/spacesecurity.pdf

7.5.2 Experts Call For Global Network to Prevent Asteroid Disasters

The report *Asteroid Threats: A Call for Global Response* by the Association of Space Explorers presented for consideration by the UN calls for an international contingency plan to counter threats from Near Earth Objects (NEO), such as an asteroid impact on the Earth. It points out that although a possible collision is predictable up to 15 years in advance, developing the technology needed to divert an incoming asteroid may require international cooperation. The UN Committee on the Peaceful Uses of Outer Space will debate the report at its 2009 session to be held in June 2009.

Military Implications:
Military personnel involved in the development of international space-based systems to protect against NEOs should review this report, if not already accomplished, for input to increasing international cooperative activities.

Sources:
Asteroid Threats: A Call for Global Response
http://www.space-explorers.org/ATACGR.pdf

Experts call for global network to prevent asteroid disasters
http://www.spacedaily.com/reports/Experts_call_for_global_network_to_prevent_asteroid_disasters_999.html

7.6 U.S. Supreme Court Rules in Favor of Navy in Sonar Case

On November 12th the U.S. Supreme Court ruled to lift restrictions on the Navy's use of sonar off the coast of California, arguing that national security interests prevail over possible damages that such sonar might cause to whales and dolphins. [See also *Sonar Restrictions Debate Continues* in January 2008 and other previous environmental security reports on the same issue.]

Military Implications:

[Similar to previous on this issue] Not withstanding the Supreme Court's decision, continuous research producing additional evidence of dangers, as well as increasing advocacy from conservation groups, might trigger negotiations for an international ban. In the meantime, monitoring of marine mammals' presence in areas of sonar use should be incorporated in Navy policy to allow for responsiveness in the event that further changes of policy were to occur.

Sources:

Navy Wins, Whales Lose U.S. Supreme Court Sonar Case
http://www.ens-newswire.com/ens/nov2008/2008-11-12-10.asp

7.7 Climate Change

7.7.1 Scientific Evidences and Natural Disasters

The World Meteorological Organization's Global Atmosphere Watch reports that climate-warming greenhouse gases reached record levels in 2007. Using the NOAA annual greenhouse gas index, it found that the total warming effect of long-term greenhouse gases has increased by 1.06% compared to 2006 and by 24.2% since 1990. WMO's *Greenhouse Gas Bulletin* reports that, compared to the previous year, CO_2 rose 0.5%, methane 0.34%, and nitrous oxide 0.25%, while slight decreases were noted for chlorofluorocarbons (mainly due to the implementation of the Montreal Protocol).

The 2008 Atlantic hurricane season set a few records in U.S. and Cuban recorded history—as to number, force, frequency and length of storms, say meteorologists. Data on consequences are still being calculated.

7.7.2 Food and Water Security

About 960 million were malnourished and over 100 million people worldwide were driven into poverty this year due to the food and fuel crisis. The World Bank warns that the situation will continue to get worse as unemployment rates rise, commodity prices remain volatile, and governments face shortages in public money and outside financial assistance. The financial crisis is eclipsing and aggravating the food crisis. Production is threatened by: farmers' increasingly difficult access to credit, high input costs, and a growing monopoly over seed and agrochemical sales.

"The impact of natural resource degradation is potentially even more devastating in financial terms than the current global meltdown," said Christian Mersmann, Managing Director of the Global Mechanism of the UN Convention to Combat Desertification, at the seventh session of the Committee for the Review of the Implementation of the Convention. Some 12 million

hectares of land are lost yearly due to degradation and environmental causes. Desertification threatens regions that are already the most vulnerable: 65% of agricultural lands in Africa—where 60% of the population depends on agriculture, and nearly 70% of the Arab region.

Countries still strongly affected by food crises include Kenya (where officials have been accused of artificially creating a maize shortage), Zimbabwe (where the political impasse has only made the situation worse), Afghanistan (where attacks on food convoys amplify food insecurity), Swaziland (threatened by another year of drought), Haiti (where 26 children have died in just four weeks from malnutrition), Bangladesh (where broken dams have flooded 13 Khulna villages), North Korea (where there are signs of massive malnutrition despite efforts to hide the evidence), West Africa (where the UN is seeking US$361 million to solve the crisis), and the horn of Africa (with 12 million hungry in Ethiopia, 3 million in Somalia, 2 million in Kenya and Uganda, plus more in Eritrea and Djibouti).

In Latin America, the UN Economic Commission for Latin America and the Caribbean (ECLAC) projects that 10 to 15 million more people could slip below the poverty line in 2008 as a result of food price volatility.

Experts reiterated that half the world will face water shortages by 2080, with Asia being the most affected due to its large population, melting of Himalayan glaciers, and low-lying costal areas. Southeastern U.S. states are being advised to diversify their water supplies in expectation of a drier future climate. In Australia's Murray-Darling Basin, irrigated agriculture could be halved by 2050; and in the Sahel region, an estimated 110 million people might be affected by Niger's seasonal flooding decrease due to changes in rainfall patterns and human exploitation.

7.7.3 Migration

Because rising sea levels are expected to eventually submerge most if the Maldives' 1,200 islands, President Mohamed Nasheed announced that the country will create a $1 billion fund from tourist revenues to explore the possibility of buying land to move its 400,000 population.

A year after cyclone Sidr hit in Bangladesh, 1 million people are still homeless. Additionally, some Bangladeshis have already begun relocating to higher lands. They argue that developed nations should be more open to accepting refugees.

Half of Nigeria's 150 million people might face displacement, as it is threatened by three effects of climate change: desert expansion in the North, farmland erosion in the East, and flooding from the Atlantic Ocean in the South.

7.7.4 Melting Glaciers and Sea Ice

Advanced computer models using new surface temperatures data showed that changes in temperatures at the poles over the 20th century could occur only if greenhouse gas emissions and ozone depletion are factored in. This improved understanding of how the ice sheets will evolve over this century, explained the team of scientists led by East Anglia's Nathan Gillet.

A report by the Dirección General de Aguas de Chile, the country's official water authority, warned that the Echaurren glacier and other smaller glaciers near Santiago could disappear over the next half-century. The Echaurren glacier supplies 70% of Santiago's water needs and is the main source for the Maipo River and its tributaries, the water sources for the region's agriculture. Water scarcity might cause massive population displacement in central Chile.

7.7.5 Rising Sea Levels

Satellite observations reveal that since 1993 sea level has risen by 3.3 mm a year, almost double the rate of the previous 50 years. While for 1993-2003, about half of the sea level rise was due to the oceans expanding as they became warmer and the other half was due to shrinking land ice, since 2003, about 80% of the annual sea level rise can be attributed to land ice loss from glaciers, Greenland, and Antarctica.

7.7.6 Early Warning

Indonesia launched a sophisticated new tsunami warning system that runs a computer-simulated model and can predict waves' arrival times and heights, enabling fast emergency measures. Although it will take some more years to cover all the coastal regions, the construction of the system is ahead of the 2010 completion target and was able to predict the tidal wave that struck the Sumatran coast in September.

An 'adaptation scan' developed by Tauw and BuildDesk of the Netherlands could help policymakers assess the effects of climate change in their respective areas. It operates using complex combinations of two databases—one with effects and the other with measures, and generates several direct and indirect possible consequences.

7.7.7 Adaptation

Preparations of coastal communities for addressing possible natural disasters are increasing across the globe. The UK has commissioned a study on towns vulnerable to flooding. California is starting a series of adaptation efforts including moving a highway farther inland and constructing flood-resistant buildings. An Alaska village is planning to move their entire community due to rising sea levels. The coasts of New Jersey and New York City have to prepare to be radically altered by 2100. The Netherlands is considering a proposal to build islands off the coast like barrier reefs to deal with rising waters. Australia and Indonesia are in talks to create a center to prepare the region to deal with natural disasters. The coasts of Bangladesh, and of Gujarat in India, are already changing and, as a result, some families are moving. The EU pledged to provide technical and financial assistance to Pacific nations affected by climate change.

The sixteenth Asia-Pacific Economic Cooperation (APEC) forum adopted a declaration to enhance cooperation for improving risk reduction, preparedness, and management to fight climate change, including building domestic disaster management capabilities.

7.7.8 Post-Kyoto Negotiations

In the preamble to the Poznan meeting to be held December 1-12 as part of negotiations for a post-2012 treaty, the UN released an analysis of greenhouse gas emissions, showing that of 40 industrialized countries that have greenhouse gas reporting obligations under the Kyoto Protocol 16 are on target, and 20 countries—including Canada, Germany, Ireland, Italy, Japan, New Zealand and Spain--are lagging. However, it notes, "the biggest recent increase in emissions of industrialized countries has come from economies in transition, which have seen a rise of 7.4% in greenhouse gas emissions within the 2000 to 2006 time-frame." The report did not include large emerging economies like those of India and China.

Australia said that it will advocate that rich developed countries—such as Singapore and South Korea—be also included in any binding targets.

The "Algiers Declaration" by Africa's 53 countries calls for the development of a common vision and to act as a bloc in the negotiations for the new global warming treaty.

Military Implications:
[Same as previous on similar issues] The military should identify all its resources and programs for reducing GHGs and responding to effects of climate change, update information continuously, forecast how it may be called upon for both mitigation and adaption, and perform a gap analysis in anticipation of future requests. International discourse over climate change increases the emergence of international policies trying to tackle the causes and develop strategies to mitigate climate change effects.

Sources: (see the complete list in the Appendix)
WMO Greenhouse Gas Bulletin 2007: Atmospheric Carbon Dioxide Levels Reach New Highs
http://www.wmo.int/pages/prog/arep/gaw/ghg/documents/GHG_833_en.pdf
Latin American ministers gather at UN to tackle social impact of financial, food crises
http://www.un.org/apps/news/story.asp?NewsID=29087&Cr=Latin+America&Cr1=
UN gathering takes on causes and impact of land degradation
http://www.un.org/apps/news/story.asp?NewsID=28810&Cr=Desertification&Cr1=
Environmental experts advocate common Arab-Mediterranean vision
http://www.magharebia.com/cocoon/awi/xhtml1/en_GB/features/awi/features/2008/11/11/feature-01
Experts: Half world faces water shortage by 2080
http://www.iht.com/articles/ap/2008/11/18/asia/AS-Malaysia-Water-Shortage.php
O give me a home...
http://www.economist.com/research/articlesBySubject/displayStory.cfm?story_id=12601940&subjectID=348924&fsrc=nwl
The Dutch adaptation scan for local authorities
http://www.cosis.net/abstracts/EMS2008/00647/EMS2008-A-00647.pdf
Indonesia launches tsunami warning system
http://www.guardian.co.uk/world/2008/nov/11/indonesia-tsunami-warning-system
Climate Change-Latin America: Frightening Numbers
http://www.ipsnews.net/news.asp?idnews=44818
Press briefing on Key Greenhouse Gas Data and expected outcomes of Poznań:
http://unfccc.int/press/items/2794.php

7.8 Nanotechnology Safety Issues

Detailed descriptions of the following nanotechnology issues are in the Appendix

- Biodegradation of carbon nanotubes, through enzymatic catalysis, could mitigate potential toxic effects (more)
- Microplastics recognized as environmental threat to marine environment (more)
- The EU FP7 "ObservatoryNANO" project has expanded its operation (http://www.observatory-nano.eu/) (more)
- *Novel Materials in the Environment: The case of nanotechnology* report by the UK Royal Commission on Environmental Pollution is now available http://www.rcep.org.uk/novelmaterials.htm (more)
- Latin American nanotech scientists seeking cooperation opportunities (more)

Military Implications:
[Same as previous on this issue] Military personnel concerned with nanotech issues should contribute their views to these activities. Also, relevant military personnel should review the information generated by such activities to improve military and contractor practices, as well as to assist and cooperate with the organizations working on those issues for enriching their studies.

Sources:
Biodegradation of carbon nanotubes could mitigate potential toxic effects
http://www.nanowerk.com/spotlight/spotid=8093.php
International scientists to discuss effects of 'microplastics' on marine environment
http://www.tacoma.washington.edu/news/2008_0903.cfm
Novel Materials in the Environment: The case of nanotechnology
http://www.rcep.org.uk/novelmaterials.htm
Interviews with visiting researchers in the NanoforumEULA project
http://www.mesaplus.utwente.nl/nanoforumeula/interviews_visiting_researcher/

Item 8. Reports and Information Suggested for Review

8.1 World Energy Outlook 2008

World Energy Outlook 2008 is the authoritative report on energy prospects. The WEO-2008 provides new energy projections to 2030 by regions and fuel types. It focuses on the two sectors that it considers the most pressing today: oil and gas production, including future global oil and gas supply and post-2012 climate scenarios, including possible outcomes of the international negotiations and carbon schemes and implications for global energy markets.

Military Implications:
The report might provide inputs on future energy security issues and possible resource-related disputes, as well as hints on potential scenarios concerning the post-2012 climate change pact.

Source:
World Energy Outlook 2008
http://www.worldenergyoutlook.org/

8.2 *Global Trends 2025: A Transformed World*

Global Trends 2025: A Transformed World by the US National Intelligence Council is an analysis of threats to security and potential geopolitical developments. It features four scenarios: "A World Without the West"; "October Surprises"; "BRICS's Bust-up"; and "Politics is not Always Local." It includes a chapter on "The Demographics of Discord" (chapter 2), as well as a section on "Water, Food, and Climate Change" (in chapter 4: "Scarcity in the Midst of Plenty?")

Military Implications:
The report provides a comprehensive outlook on possible future threats, their causes, and likely outcomes; hence, it provides good input to the military planning processes.

Source:
Global Trends 2025: A Transformed World
http://www.dni.gov/nic/NIC_2025_project.html

APPENDIX

Reference Details

This Appendix contains expanded background information on some items.

Item 7. Updates on Previously Identified Issues

7.4 EU Arctic Policy Guidelines

Sources: (a more expanded list)
The EU and the Arctic region
http://ec.europa.eu/maritimeaffairs/arctic_overview_en.html
Commission green-lights industrialisation of Arctic
http://euobserver.com/9/27152/?rk=1
Shippers, oil companies gauge benefits of less Arctic ice
http://www.adn.com/news/alaska/story/603373.html
EU makes pitch for 'unified' Arctic research
http://www.terradaily.com/reports/EU_makes_pitch_for_unified_Arctic_research_999.html
Europe joins international contest for Arctic's resources
http://www.guardian.co.uk/world/2008/nov/21/arctic-energy-eu
Europe takes first step towards 'Arctic policy' to protect energy security
http://www.guardian.co.uk/environment/2008/nov/20/poles-arctic-europe
Europe's Arctic adventure - The new cold rush for resources
http://euobserver.com/880/27035

7.7 Climate Change

Sources: (a more expanded list)

7.7.1 Scientific Evidences and Natural Disasters
WMO Greenhouse Gas Bulletin 2007: Atmospheric Carbon Dioxide Levels Reach New Highs
http://www.wmo.int/pages/prog/arep/gaw/ghg/documents/GHG_833_en.pdf
WMO Greenhouse Gas Bulletin. The State of Greenhouse Gases in the Atmosphere Using Global Observations through 2007
http://www.wmo.int/pages/prog/arep/gaw/ghg/documents/ghg-bulletin-4-final-english.pdf
Atlantic hurricane season blows away records
http://www.google.com/hostednews/ap/article/ALeqM5j9FuPiM261M_Buek1hO5pcrph-0AD94MRNF00
One mln Bangladesh cyclone survivors await homes-Oxfam
http://www.alertnet.org/thenews/newsdesk/DHA385680.htm

Thousands evacuate as Vietnam capital battles flood
http://www.independent.co.uk/news/world/asia/thousands-evacuate-as-vietnam-capital-battles-flood-993649.html
Floods kill at least 120 in Vietnam, China
http://www.alertnet.org/thenews/newsdesk/HAN169086.htm

7.7.2 Food and Water Security
Latin American ministers gather at UN to tackle social impact of financial, food crises
http://www.un.org/apps/news/story.asp?NewsID=29087&Cr=Latin+America&Cr1=
Who Owns Nature?
http://www.etcgroup.org/en/materials/publications.html?pub_id=706
UN gathering takes on causes and impact of land degradation
http://www.un.org/apps/news/story.asp?NewsID=28810&Cr=Desertification&Cr1=
Environmental experts advocate common Arab-Mediterranean vision
http://www.magharebia.com/cocoon/awi/xhtml1/en_GB/features/awi/features/2008/11/11/feature-01
Experts: Half world faces water shortage by 2080
http://www.iht.com/articles/ap/2008/11/18/asia/AS-Malaysia-Water-Shortage.php
Tibetan glaciers rapidly melting
http://www.abc.net.au/science/articles/2008/11/25/2428885.htm?site=science&topic=latest
Southeast must adapt for drought, report says
http://www.ajc.com/services/content/metro/stories/2008/11/21/southern_drought.html
South Africa: Flood-Hit Farmers Face Tough Season
http://allafrica.com/stories/200811210673.html
Experts: Half world faces water shortage by 2080
http://www.iht.com/articles/ap/2008/11/18/asia/AS-Malaysia-Water-Shortage.php
Himalayan glaciers 'melting away'
http://www.metro.co.uk/news/climatewatch/article.html?Himalayan_glaciers_melting_away&in_article_id=403107&in_page_id=59
Garnaut's grim reality here to stay
http://www.theaustralian.news.com.au/story/0,25197,24546508-11949,00.html
Water scarcity in the Sahel
http://www.guardian.co.uk/journalismcompetition/wate.scarcity.sahel

7.7.3 Migration
O give me a home...
http://www.economist.com/research/articlesBySubject/displayStory.cfm?story_id=12601940&subjectID=348924&fsrc=nwl
Maldives Considers Buying Dry Land if Seas Rise
http://www.nytimes.com/2008/11/11/science/earth/11maldives.html?_r=1&oref=slogin
Tiny island nation seeks dry land
http://www.theglobeandmail.com/servlet/story/RTGAM.20081113.wisland13/BNStory/International/home
Sea surges could uproot millions in Nigeria megacity
http://www.reuters.com/article/environmentNews/idUSTRE4AI74G20081119?sp=true
Bangladesh's climate refugees search for higher ground
http://www.terradaily.com/2007/081128042240.mr74ma5g.html

7.7.4 Melting Glaciers and Sea Ice
Antarctica feeling the heat too, says study
http://www.terradaily.com/reports/Antarctica_feeling_the_heat_too_says_study_999.html
Chilean glacier will vanish in 50 years: study
http://www.terradaily.com/reports/Chilean_glacier_will_vanish_in_50_years_study_999.html

7.7.5 Rising Sea Levels
Satellites reveal sea level has risen by 3.3 mm a year since 1993
http://www.newspostonline.com/uncategorized/satellites-reveal-sea-level-has-risen-by-33-mm-a-year-since-1993-2008111413999
Melting ice in Arctic and Antarctic main driver of sea level rise.
http://www.terradaily.com/2007/081119013943.qwokctbv.html

7.7.6 Early Warning
The Dutch adaptation scan for local authorities
http://www.cosis.net/abstracts/EMS2008/00647/EMS2008-A-00647.pdf
Indonesia launches tsunami warning system
http://www.guardian.co.uk/world/2008/nov/11/indonesia-tsunami-warning-system

7.7.7 Adaptation
From the village green to the village blue
http://www.guardian.co.uk/environment/2008/nov/26/defra-flood-town-plans
Big changes could come for little Shishmaref
http://www.ktuu.com/Global/story.asp?S=9409598
California bulks up defenses against tide of global warming
http://www.sacbee.com/378/story/1422503.html
Leaders team up to combat natural disasters
http://www.theaustralian.news.com.au/story/0,25197,24695576-2702,00.html
Indonesia 'crucial' in weathering climate storm
http://www.theage.com.au/national/indonesia-crucial-in-weathering--climate-storm-20081122-6eip.html
EU pledges climate change help
http://tvnz.co.nz/view/page/536641/2323222
Sea surges could uproot millions in Nigeria megacity
http://www.reuters.com/article/environmentNews/idUSTRE4AI74G20081119?sp=true
Crimson tide: Rise in sea level changing Gujarat's contours
http://www.expressindia.com/latest-news/crimson-tide-rise-in-sea-level-changing-gujarats-contours/383315/
Extreme events claims mounting
http://www.theaustralian.news.com.au/story/0,25197,24546515-11949,00.html
A Low Country Seeks Higher Ground
http://www.nytimes.com/2008/11/07/world/europe/07dutch.html?_r=1
APEC declaration
http://www.apec.org/etc/medialib/apec_media_library/downloads/news_uploads/2008/aelm/aelm.Par.0002.File.tmp/08_aelm_LeadersStatement.pdf

Climate Change-Latin America: Frightening Numbers
http://www.ipsnews.net/news.asp?idnews=44818

7.7.8 Post-Kyoto Negotiations
Australia cries foul over climate rules on developing countries
http://www.theaustralian.news.com.au/story/0,25197,24708236-30417,00.html
Africans to stick together in climate change talks
http://www.montereyherald.com/search/ci_11032312
Press briefing on Key Greenhouse Gas Data and expected outcomes of Poznań:
http://unfccc.int/press/items/2794.php
UN says greenhouse gas emissions rose 2.3 percent in 40 industrialized nations in 2000-06
http://www.startribune.com/business/34600224.html?elr=KArks:DCiU1OiP:DiiUiD3aPc:_Yyc:aUU
From Bad to Worse: Latest Figures on Global Greenhouse Gas Emissions
http://www.sciam.com/article.cfm?id=from-bad-to-worse-with-greenhouse-gas-emissions
The Poznan conference opens on December 1. Agenda and scheduled events are available at:
http://regserver.unfccc.int/seors/reports/events_list.html

7.8 Nanotechnology Safety Issues

7.8.1 Biodegradation of Carbon Nanotubes Could Mitigate Potential Toxic Effects
Work done by Dr. Alexander Star, Dr. Valerian Kagan, and colleagues, at the Univ. of Pittsburgh, and reported in Nanowerk, has shown that carbon nanotubes, which can have negative biological effects, can be destroyed by natural biodegradation through enzymatic catalysis, using horseradish peroxidase and hydrogen peroxide over a period of several weeks. This technique is milder and more natural than the previous method, which involved a harsh solvent consisting of sulfuric acid and high concentrations of hydrogen peroxide.

Military Implications:
The military should take note of this technology in preparation for possible future findings of biological hazards from carbon nanotubes in the environment.

Source:
Biodegradation of carbon nanotubes could mitigate potential toxic effects
http://www.nanowerk.com/spotlight/spotid=8093.php

7.8.2 Microplastics Recognized as Environmental Threat to Oceans
A note has been published on the results of a conference held last month to discuss the increasing threat to the maritime environment posed by plastic "microparticles" (< 5 mm). A report quoted a speakers as stating that, "as plastic items break down, any toxic additives they contain—including flame retardants, antimicrobials, and plasticizers—may be released into the ocean environment", "plastics can act like sponges to collect hydrophobic persistent organic pollutants, such as PCBs", and "microplastics can impact marine food chains".

Military Implications:
The military should keep in touch with continuing work on this area through contacts with such organizations as the Univ. of Washington's Center for Urban Waters and NOAA's Marine

Debris Program, in anticipation of possible future environmental protection measures related to this threat.

Source:
International scientists to discuss effects of 'microplastics' on marine environment
http://www.tacoma.washington.edu/news/2008_0903.cfm
Why small plastic particles may pose a big problem in the oceans
http://pubs.acs.org/cgi-bin/sample.cgi/esthag/asap/html/es802970v.html

7.8.3 EU ObservatoryNANO Project in Expanded Operation

The EU FP7 "ObservatoryNANO" project (See this report, April 2008, Item 6.5.1) has expanded its operation. Its Web site, http://www.observatory-nano.eu - is now on-line, and contains (click on "Catalogue"),most of 56 recently written interim reports on scientific and technological developments in all sectors of nanotechnology, including energy, environment, and health.

Military Implications:
Military personnel concerned with nanotechnology should monitor this site to keep in touch with current developments in the field.

Source:
EU ObservatoryNANO Project
http://www.observatory-nano.eu

7.8.4 UK Report on Novel Materials in the Environment: The case of nanotechnology

The UK Royal Commission on Environmental Pollution issued this latest report, which "examines issues related to innovation in the materials sector and the challenges and benefits arising from the introduction of novel materials (specifically nanomaterials) … [and] makes recommendations on how to deal with ignorance and uncertainty in this area". This document is accompanied by four supplemental reports and is partly based on input solicited from more than 100 organizations with relevant experience.

Military implications:
Military personnel concerned with nanotech risk assessment should review these reports for useful ideas on assessment policies and procedures.

Source:
Novel Materials in the Environment: The case of nanotechnology
http://www.rcep.org.uk/novelmaterials.htm

7.8.5 Latin American Personnel Offer Nanotech Cooperation Opportunity

A recent study among Latin American researchers temporarily working in European nanotechnology research organizations has indicated that they "want to cooperate with European colleagues in nanoresearch." and "Access to high quality research infrastructure and equipment not available in their country is an important reason for cooperation."

Military Implications:
In-country USSOUTHCOM personnel should consider trying to arrange opportunities for interested members of Latin American militaries to visit the US for education in nanotech-related environmental security problems and solutions, especially regarding materiel. It would also be

advantageous, if those members could recommend non-military scientific and technical personnel for whom similar arrangements could be made.

Source:
Interviews with visiting researchers in the NanoforumEULA project
http://www.mesaplus.utwente.nl/nanoforumeula/interviews_visiting_researcher/