

WORLDWIDE EMERGING ENVIRONMENTAL ISSUES AFFECTING THE U.S. MILITARY
Contract No: DAAD19-02-D-0001/ Delivery Order 0456 with Battelle Columbus Operations for the
U.S. Army Environmental Policy Institute

FEBRUARY 2006 REPORT

Note to Readers: Pages 1-13 comprise the summary and analysis of this report. Expanded details for some items are in the Appendix beginning on page 14.

Item 1. UN Reforms in Development, Humanitarian Assistance, and Environment to be Proposed by High-Level Panel.....	1
Item 2. New International Strategy for Chemicals Management and 9th Special Session of the UNEP Governing Council.....	1
Item 3. Void in High Seas and Coastal Governance.....	2
Item 4. Arctic Northern Passage Opens New International Issues of Regulation.....	3
Item 5. Sixth UN Forum on Forests Agrees to Multi-Year Work Plan.....	4
Item 6. Technological Breakthroughs with Environmental Security Implications.....	4
6.1 Inorganic Fullerene-like Materials May Lower Hazards.....	4
6.2 Microlenses for Bio-Chemical Detection.....	5
6.3 New Nanotechnology Batteries with Long Shelf Life.....	5
6.4 Hydrogen Farming as a Possible Alternative to Petroleum.....	5
Item 7. Biodiesel Increasingly Considered a Viable Alternative to Crude Oil.....	6
Item 8. Updates on Previously Identified Issues.....	7
8.1 Climate Change.....	7
8.1.1 Rising Concerns over Rising Seas.....	7
8.1.2 Climate Change Dialogue Initiative Launched.....	8
8.1.3 New REN21 Report Links Renewable Energy to Climate Change Solutions....	8
8.1.4 Second Australia-New Zealand Climate Change and Business Conference.....	8
8.2 Biotechnology and Biodiversity.....	9
8.2.1 The Debate over Genetically Modified Organisms (GMOs) Continues.....	9
8.2.2 Cartagena Protocol on Biosafety—Second Working Group on Liability and Redress.....	10
8.2.3 Europe to Redouble Efforts to Stabilize Biodiversity by 2010.....	10
8.3 Nanotechnology—Health Implications of Quantum Dots.....	11
8.4 Mercury Instruments May Be Banned in EU.....	12
8.5 Recommendation for a Biosecurity Watchdog.....	12
8.6 Bird Flu Spreads Increasing Threats of a Human Pandemic.....	13
Appendix.....	14

Report Documentation Page

Form Approved
OMB No. 0704-0188

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

1. REPORT DATE FEB 2006		2. REPORT TYPE		3. DATES COVERED 00-00-2006 to 00-00-2006	
4. TITLE AND SUBTITLE Worldwide Emerging Environmental Issues Affecting the U.S. Military. February 2006				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) The Millennium Project ,4421 Garrison Street, N.W. ,Washington,DC,20016-4055				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

Item 1. UN Reforms in Development, Humanitarian Assistance, and Environment to be Proposed by High-Level Panel

The UN Secretary-General has appointed a 15-member international high-level panel to explore how to improve the work and efficiency of the UN system in the areas of development, humanitarian assistance, and environment. The study's outcomes will be used for the comprehensive UN management reform, complementing such other major reform initiatives as the new Peacebuilding Commission and the new Human Rights Council. The study is expected to be completed by the summer and its recommendations formally presented to the UN General Assembly in September 2006, with possible implementation in 2007.

Military Implications

Via appropriate diplomatic channels, military personnel should both offer advice on roles for the military in environmental security efforts and keep abreast of the panel's deliberations that affect military operations.

Source:

Secretary-General Announces Formation of New High-Level Panel on UN System-Wide Coherence in Areas of Development, Humanitarian Assistance, Environment
<http://www.unis.unvienna.org/unis/pressrels/2006/sgsm10349.html>

Item 2. New International Strategy for Chemicals Management and 9th Special Session of the UNEP Governing Council

The International Conference on Chemicals Management (ICCM) focused on safe handling of chemicals in order to minimize adverse effects on human health and the environment by improving the production, trade, transportation, and storage of chemicals worldwide. The large number of chemicals already on the market, and the expected 80% growth over the next 15 years, has made it impractical to deal with separate regulations for individual compounds or groups of chemicals. As a result, the Conference adopted the Strategic Approach for International Chemicals Management (SAICM), a voluntary and comprehensive framework of measures pertaining to risk assessment, labeling, and stockpiling of chemicals, as well as handling of obsolete products. It also covers capacity building and staff training—primarily in the developing countries—in chemicals safety issues such as spills and accidents. UNEP will house the SAICM secretariat. The conference was held in Dubai, United Arab Emirates, from 4-6 February 2006, prior to the 9th Special Session of the UNEP Governing Council and Global Ministerial Environment Forum, which formally approved the SAICM.

The 9th Special Session of the Governing Council and Global Ministerial Environment Forum discussed strengthening international environmental governance, including transforming UNEP into a United Nations Environment Organization (UNEO) and the proposal to introduce universal membership of the Governing Council. No agreement was reached, but negotiations are expected at the next meeting. Other issues included environmental aspects of energy, tourism, and chemicals; assessment, monitoring and early warning; and revitalization of the Environmental Management Group.

Military Implications:

Relevant military personnel should monitor the new developments concerning international environmental governance and eventually consider providing input for the next discussions. The SAICM should be reviewed for potential insights in anticipating potential new international requirements (new treaties and revisions of existing treaties), improving the general framework of military environmental performance and as a source of input for eventual assistance provided to developing countries in improving their chemicals safety management.

Sources:

International Conference on Chemicals Management, Dubai, 4-6 February 2006

<http://www.chem.unep.ch/ICCM/ICCM.htm>

9th Special Session of the Governing Council /Global Ministerial Environment Forum

7 - 9 February 2006, Dubai, UAE

<http://www.unep.org/gc/gcss-ix/>

New Global Chemicals Strategy Given Green Light by Governments

<http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=469&ArticleID=5137&l=en>

9th Special Session of the Governing Council /Global Ministerial Environment Forum 2006

4-9 February 2006, Dubai, United Arab Emirates

<http://www.gcssdubai.com/welcome.htm>

Summary Of The International Conference On Chemicals Management And Ninth Special Session Of The UNEP Governing Council/Global Ministerial Environment Forum

<http://www.iisd.ca/vol16/enb1654e.html>

Item 3. Void in High Seas and Coastal Governance

The Third Global Conference on Oceans, Coasts, and Islands, “Moving the Global Oceans Agenda Forward,” organized by the Global Forum on Oceans, Coasts, and Islands, took place at the UNESCO headquarters in Paris, January 24-27. Over 400 participants from 78 countries agreed to accelerate progress for achieving the international ocean policy targets, including integrated ocean and coastal management, and examined two major emerging ocean policy issues: high seas governance and the effects of climate change on oceans and coastal environments. No international organization holds responsibility for tracking the progress of programs in integrated coastal and ocean management, and there is no regular collection of information on the social and economic well-being of coastal communities, where half of the world's population lives.

Military Implications:

It is reasonable to assume that an international body will be established to coordinate the collection and assessment of data on oceans, coasts, and islands, as well as monitoring policy and regulations implementation and compliance. Military logistics and information resources could be helpful to any such future international body. The conference called for a broad coalition to further the ocean, coastal and small island agenda. After reviewing the papers and agreements available from the website below, the military might seek liaison with the sponsoring organizations to participate in future policy discussions and keep abreast of potential military implications of proposed regulations.

Sources:

Third Global Conference on Oceans, Coasts, and Islands Moving the Global Oceans Agenda Forward
<http://www.globaloceans.org/paris3/>

UNESCO conference eyes planet's threatened oceans and coastal communities
<http://www.un.org/apps/news/story.asp?NewsID=17341&Cr=ocean&Cr1=coast>

3rd Global Conference on Oceans, Coasts and Islands Bulletin
<http://www.iisd.ca/yimb/globaloceans3/yimbvol68num3e.html>

Item 4. Arctic Northern Passage Opens New International Issues of Regulation

Thawing of the Arctic sea ice opens up the Northern Passage as an international shipping route, triggering international disputes over sovereignty and ecological implications. Although scientists, politicians, and environmental activists are increasingly warning about the complexity of the problem, no international regulations are yet in place for this fragile region. Alex Wolfe, from the University of Alberta and leading researcher on the Arctic, says that besides the sovereignty and ecosystem issues of the opening of the Northern Passage, there are also shipping safety problems that are not yet adequately addressed. As of our information, there are no international shipping standards or regulations in place for ecosystem protection for Northern navigation. Canada claims that the waterway is Canadian territory, while other countries consider it international waters. There is no international treaty dividing the Arctic between the eight countries with claims: Canada, Denmark, Finland, Iceland, Norway, Russia, Sweden, and the U.S. This exposes the northern passages to other possible problems, such as: transportation of illicit materials and illegal immigrants and as a place and route for terrorism, as well as difficulty in solving eventual disputes over tanker accidents, contamination, and overfishing. In March 2006, Canadian military forces will begin Operation Nunalivut ("land that is ours" in Inuktitut, the Inuit language), over the Arctic islands and sea ice of the Northwest Passage.

Military Implications:

It is likely that discussions for clear international regulations concerning Northern Passage navigation will increase rapidly and more military action will be called for to ensure the safety of individuals and ecosystems. Relevant military personnel should cooperate with their counterparts in the other countries and international organizations in developing adequate national and international regulations and enforcement procedures regarding the Arctic Northern Passage navigation, as well as planning to defend U.S. interests against intrusion in this "new frontier" by other nations.

Sources:

As the Arctic ice retreats, the old Great Game begins to boil over. Ben Macintyre, Norway
<http://www.timesonline.co.uk/article/0,,13509-2034643,00.html>

Forces plan Arctic 'land is ours' mission. *National Post* (Canada), 02.09.06
<http://www.canada.com/nationalpost/news/story.html?id=d75acb3e-7643-4f47-8a62-d21c9e001002&p=1>

The Need to Defend Our New Northwest Passage
<http://thetyee.ca/Views/2006/01/30/DefendNorthwestPassage/>

Alex Wolfe, Ass. Prof., Department of Earth and Atmospheric Sciences, Univ. of Alberta, and leading international researcher of Arctic region. “Futures First Tuesday” Teleconference

Canadian Arctic Shelf Exchange Study

http://www.cases.quebec-ocean.ulaval.ca/CASES06_detailed_agenda_Final.pdf

See also some background articles in the [Appendix](#)

Item 5. Sixth UN Forum on Forests Agrees to Multi-Year Work Plan

The two-week UN Forum on Forests held in New York, February 13–24, assessed the issues of management, conservation, and sustainable development of all forests worldwide. The focus was on re-assessing the International Agreements on Forests (IAF), and the establishment of an international legally binding instrument (LBI), promoted by members such as Canada and China; however, countries like Brazil emphasized voluntary measures. The accord on the LBI will be concluded and adopted next year, at the Seventh UN Forum on Forests. Agreement was reached on a multi-year program of work, including more substantial progress on reporting. Most speakers highlighted that besides the forests’ ecological role, their management has important security implications, since the livelihood of millions of people depends on forests.

Military Implications:

The International Agreements on Forests and the multi-year work program should be reviewed for opportunities to express the Army Strategy on the Environment, other military implications affecting its exercises, and eventual support for compliance offered to local authorities in some areas.

Sources:

Sixth Session of the United Nations Forum on Forests (UNFF-6)

<http://www.iisd.ca/forestry/unff/unff6/>

Sixth Session of UN Forum on Forests Opens at Headquarters

<http://www.un.org/News/Press/docs/2006/envdev883.doc.htm>

Item 6. Technological Breakthroughs with Environmental Security Implications

6.1 Inorganic Fullerene-like Materials May Lower Hazards

The Nano-materials Synthesis Group in the Israeli Weizmann Institute has developed a new class of nanomaterials, inorganic fullerene-like substances, based on tungsten disulphide and similar compounds, rather than carbon. These materials, marketed commercially by ApNano, have many of the physical properties of true fullerenes, but are reported to be easier and cheaper to produce, chemically stable and less reactive, and less flammable. They also have been tested and purportedly found to be safe.

Military Implications:

The military might consider monitoring the development of these materials and their possible use in some applications as a more environmentally friendly substitute for conventional fullerenes.

Sources:

Nano-Armor: Protecting The Soldiers Of Tomorrow

http://www.isracast.com/tech_news/091205_tech.htm

Nano this, Nano that, what the...

<http://www.physorg.com/news10452.html>

6.2 Microlenses for Bio-Chemical Detection

Scientists at the Georgia Institute of Technology's School of Chemistry and Biochemistry have created a promising new detection device for environmental biological or chemical threats, in the form of reusable hydrogel microlenses that swell and hence change focal length when they come in contact with a particular agent. The change in optical properties can be instantly detected; the change is reversible, so the lens is reusable. The lenses used in the experiments (which detected biotin, a B-vitamin) are 2 μ m wide, are compatible with existing optical techniques, and are suitable for hand-held devices. Lenses with different sensitivities could also be assembled into a detection array. The hydrogel microspheres are initially coated with an antigen to the sought-for agent, and a photo cross-linking compound. They are then attached to a surface, deforming them into lenses. When the coated lens is exposed to the agent, the reaction between the agent and the antibody causes the swelling.

Military Implications:

The military should explore the possible use of these components to produce small, fast detection devices for environmental toxins and for use in surveillance and/or cleanup.

Source:

Reversible Microlenses to Speed Chemical Detection

<http://www.gatech.edu/news-room/release.php?id=812>

6.3 New Nanotechnology Batteries with Long Shelf Life

Scientists at Lucent Technologies Bell Labs have developed a new class of batteries, which they call "nanobatteries". They are estimated to have a shelf life of at least 15 years, and are based on a silicon "nanomembrane" whose tiny honeycomb-like grid holds the electrolyte away from the electrodes until power is needed, at which point it becomes liquid-permeable, releasing the electrolyte drops to pass through, activating the cell.

Military Implications:

The military should investigate the use of these devices as power sources for pre-positioned environmental surveillance systems that need to be activated on demand. Safety, health and environmental characteristics will need to be explored and compared with current and other developing technologies.

Source:

Long Life Battery

http://www.sciencentral.com/articles/view.php3?article_id=218392734

6.4 Hydrogen Farming as a Possible Alternative to Petroleum

If biological and technological obstacles (already identified) can be resolved, then hydrogen farming might become an alternative to petroleum production in 10-20 years, according to Tasios

Melis of the University of California, Berkeley. His research is one of several funded by the DOE, aimed at trying to use algae to provide cheap and environmentally friendly hydrogen. It is based on the use of transparent tubes full of water inoculated with the green alga *Chlamydomonas reinhardtii*, which when put out in the sun naturally produces hydrogen as a by-product of photosynthesis. A system of such tubes with hydrogen collection capacity would form a hydrogen farm. "To displace gasoline use in the US would take hydrogen farms covering about 25,000 square kilometers" (less than a tenth of U.S. soy bean fields), says the researcher.

Military Implications:

Since hydrogen could replace oil as an energy medium for transportation, its safe, economical, and local production should be considered a national security priority. In cooperation with DOE, the military should verify the feasibility of this approach to hydrogen production. Energy companies may be skeptical about investing in this approach to hydrogen farming due to the sophisticated genetic manipulation needed to make it a commercial success, hence the need for government leadership.

Source:

Growing hydrogen for the cars of tomorrow

By Peter Aldhous, *New Scientist*, 25 February 2006

<http://www.newscientist.com/channel/mech-tech/mg18925401.600;jsessionid=IAACLHIKFBBN>

(by subscription only; full text in the [Appendix](#))

Item 7. Biodiesel Increasingly Considered a Viable Alternative to Crude Oil

Growing demand for green fuels brings biodiesel into the spotlight of the global oils industry. It was the focus of the two-day Price Outlook Conference for edible oils, held in Kuala Lumpur, Malaysia, as Southeast Asian countries are looking into increasing their biofuels production. Malaysia and Singapore are the world's leading palm oil producers. Solomon Islands plans to replace its imported fuel with internally produced coconut oil with the help of three Australian companies. Major increased biodiesel demand is expected to stem from the EU policy that, by 2010, 5.7% of its diesel fuel must be biodiesel.

Military Implications:

Developments of this scale in the energy industry may affect some states' foreign policies and reliance on oil, foster sustainable economic development of some developing countries, and change some geopolitical interest points, thus directly affecting the military role in protecting energy interests.

Sources:

Rapeseed and palm oil in biofuel race. *The National* Papua New Guinea

<http://www.thenational.com.pg/022706/column6.htm>

Traders upbeat on palm oil's performance. *Business Time*, Malaysia

http://www.btimes.com.my/Current_News/BT/Saturday/Nation/BT553096.txt/Article/

Govt Pushes for Biodiesel

<http://www.solomonstarnews.com/drupal-4.4.1/?q=node/view/6966> (website works randomly; full text in the [Appendix](#))

Coconut Oil as a Biofuel

<http://www.solomonstarnews.com/drupal-4.4.1/?q=node/view/7019> (website works randomly; full text in the [Appendix](#))

Item 8. Updates on Previously Identified Issues

8.1 Climate Change

8.1.1 Rising Concerns over Rising Seas

Several recent articles have again raised the threat of rising sea levels that could ultimately cause massive coastal and island destruction. A U.S. analysis of satellite data has indicated that the volume of ice falling into the sea from Greenland's ice cap has doubled over the past ten years, and that the current contribution of Greenland to oceanic level increase is 0.57 mm/year. Australian research has determined that the average level of the oceans has risen 19.5 cm since 1870 and the rate is increasing, with a prediction of a 31 cm rise by 2100. British reports suggest the possibility of a 5-meter increase over the next several centuries, and mention the effect of increased river outflows on ocean levels.

The nine tiny atoll islands of Tuvalu, with the highest point merely 4.5 meters above water, are expected to receive their worst high tides ever. In January 2006, Tuvalu had already experienced the highest January tides on record. Australian scientists from the South Pacific Sea Level and Climate Monitoring Project have predicted that as of 17:56 pm February 28th 2006, the country would face the highest tide from the period 1990 to 2016 [at the time of this writing, there was no published information available as to whether this had actually occurred]. Should this prediction become true or not, Tuvalu is definitely facing future widespread flooding affecting the human security of the islands' 11,000 inhabitants. [See also *Several Small Asia/Pacific Countries at Risk because of Rising Sea Levels* in January 2006, *First People Displaced Due to Rising Sea Levels* in December 2005 and other related items in previous environmental scanning reports.]

Military implications:

[Similar to previous on the same issue] The prospect of rising sea levels, changes in sea salinity, and floods, with consequently expected large-scale relocation of individuals, is likely to trigger new international environmental security policies and cooperation to avoid potentially large scale disasters and conflicts.

Sources:

Studies back fears sea levels are rising rapidly

http://www.theaustralian.news.com.au/common/story_page/0,5744,18002634%5E30417,00.html

Greenland's less-icy mountains. *The Economist* print edition, Feb 16th 2006

http://www.economist.com/displaystory.cfm?story_id=5518916 (by subscription only; full text in the [Appendix](#))

Scientists Warn of Melting Ice in Arctic. *Anchorage*, Alaska, Feb. 7, 2006

<http://www.cbsnews.com/stories/2006/02/07/ap/tech/mainD8FK1HMO0.shtml>

Full to bursting. *The Economist* print edition, Feb 16th 2006

http://www.economist.com/research/articlesBySubject/displayStory.cfm?story_id=5518909&subjectid=348924 (by subscription only; full text in the [Appendix](#))

‘Extreme high tides expected to hit Tuvalu’. *Solomon Star*, Monday 13th February 2006 (no online link; article sent in by Eric St-Pierre <ericstpierre@gmail.com>, ACUNU intern, presently in the Solomon Islands)

8.1.2 Climate Change Dialogue Initiative Launched

Government officials and business leaders of G8 and five major developing countries (India, China, Brazil, Mexico, and South Africa) launched the Climate Change Dialogue initiative to campaign for more aggressive action to tackle climate change. Part of the new group are also institutions such as the World Bank, International Energy Agency, and oil giant BP. The group hopes to attain some concrete policy proposals for the G8 summit in Japan in 2008.

Military Implications:

The Army should consider joining the Climate Change Dialogue initiative as an example of its interest in climate change issues and as part of the Army Strategy for the Environment.

Source:

World lawmakers set up global warming monitor group

<http://go.reuters.com/newsArticle.jhtml?type=scienceNews&storyID=11333880&src=rss/scienceNews>

8.1.3 New REN21 Report Links Renewable Energy to Climate Change Solutions

Changing Climates, the Role of Renewable Energy in a Carbon-Constrained World, a new report by Renewable Energy Policy Network for the 21st Century (REN21), was launched during the 9th Special Session of UNEP’s Governing Council/Global Ministerial Environment Forum [see Item 2 above]. Noting “emerging consensus” in both the scientific and political communities that renewable energy is a major player in meeting the growing global energy demand and the increasingly serious environmental and economic threats of climate change, the report highlights the need for more aggressive strategies and specific economic and policy tools adapted to local circumstances. Also, remarks the report, with the current development of the global market for renewable energy, “it is not necessary to wait for strengthened global agreements before taking action at the national level.”

Military Implications:

This report, along with similar others, might be a good resource for improving green energy efficiency strategies and should be reviewed for that purpose.

Source:

New REN21 Report Links Renewable Energy to Climate Change Solutions

<http://www.ren21.net/climatechange/default.asp>

8.1.4 Second Australia-New Zealand Climate Change and Business Conference

“Climate change responses are going to be delivered by business, responding to Government policy-setting,” said Gary Taylor, Environmental Defence Society chairman at the second Climate Change and Business Conference held in Adelaide, February 20–21. Over 300 delegates representing business, environmental, and governmental organizations, discussed how individual businesses could help in coping with climate change and greenhouse gas emission issues. Many suggested that Australia would continue to get hotter while New Zealand would continue to get

wetter. The problem posed for Australia would be lower crop outputs and higher pest problems, with consequent food security implications.

Military Implications:

The military should consider sharing strategies and logistics with South Pacific countries for dealing with food and other upcoming security issues, considering the potential for environmental refugees and population migration from the Small Island Countries.

Sources:

‘2nd Australia-New Zealand Climate Change and Business Conference’ in Adelaide

<http://www.climateandbusiness.com/>

Call for businesses to act on climate change

<http://www.stuff.co.nz/stuff/0,2106,3577681a13,00.html>

8.2 Biotechnology and Biodiversity**8.2.1 The Debate over Genetically Modified Organisms (GMOs) Continues**

A preliminary ruling by the World Trade Organization established that the EU regulatory framework of GMOs is in non-concordance with its obligations under the Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement). The EU defends its legislation as being consistent with the internationally recommended approach and the requirements of the Cartagena Protocol on Biosafety. Several environmental groups consider the WTO ruling conflicting with the democratic principle of peoples' right to know and decide, and, along with the EU, argue that the WTO is not the appropriate forum for this kind of decision.

Meantime, the biotechnology industry is pushing to abolish the Genetic Use Restriction Technologies (GURTs) (de facto moratorium on sterile seed technologies) at the next high-level meeting of the Convention on Biological Diversity (CBD) to be held in Curitiba, Brazil, March 20-31, 2006. Over 300 organizations worldwide campaign for a global ban on Terminator technology, asserting that sterile seeds threaten biodiversity and food sovereignty, and undermine the livelihood of the 1.4 billion people who depend on farm-saved seed.

A new report by experts of the European Commission's Joint Research Centre (JRC), *New case studies on the coexistence of GM and non-GM crops in European agriculture*, concludes that the unintended occurrence of GMO content threshold of 0.5% in harvested crops is safe for coexistence farming of crops like maize, cotton, and sugar beet before the grain has to be labeled as biotech. This is still under the EU's 0.9% threshold for food and animal feed. Reducing the threshold under 0.5% would require extra farming measures like arranging seed plots as a function of dominant wind patterns, notes the report. [See also *GMOs Controversy Continues* in July 2005 and other related items on the same issue in previous environmental security reports.]

Military Implications:

The WTO ruling and biotechnology industry stance on Terminator technology seem to be igniting the ongoing disputes over GMOs. It is likely that the framework of regulations, compliance and enforcement concerning GMOs will be reviewed at international forums to be more comprehensible. The military should be prepared for eventual new labeling and transboundary procedures updates.

Sources:

WTO GE Crop Ruling a Setback for National Safeguards

<http://www.iatp.org/>

WTO ruling's conclusions and recommendations

<http://www.tradeobservatory.org/library.cfm?refid=78475>

Monsanto May Commercialize Terminator

<http://etcgroup.org/article.asp?newsid=544>

New report considers co-existence of GM and non-GM crops and seeds

<http://europa.eu.int/rapid/pressReleasesAction.do?reference=IP/06/230&format=HTML&aged=0&language=EN&guiLanguage=en>

New case studies on the coexistence of GM and non-GM crops in European agriculture

<http://www.jrc.es/home/pages/eur22102enfinal.pdf>

8.2.2 Cartagena Protocol on Biosafety—Second Working Group on Liability and Redress

The second meeting of the international working group on liability and redress in the context of the Cartagena Protocol on Biosafety, held February 20–24, 2006 in Montreal, Canada, discussed the issues of damage caused by trans-boundary movements of living modified organisms and further considered options available for liability and redress. Specific talks focused on options for elements of rules and procedures as referred to in Article 27 - Liability and Redress. The discussions included definition of damage, effectiveness criteria, functional scope, clear rules on burden of proof and standing, and rules and procedure on compensation beyond national jurisdiction. Although no agreement was reached on any of the substantive issues, the final report acknowledges progress in mapping out the issues and in articulating their underlying legal rationales. There are presently 132 Parties to the Cartagena Protocol on Biosafety; the U.S. is neither Party, nor signatory. [See also *The First Meeting of the Conference of the Parties to the Cartagena Protocol on Biosafety (COP MOP 1)* in February 2004 environmental security report]

Military Implications:

[Similar to previous on this issue] Unless some waiver provisions have been developed and implemented, the military should prepare their supply systems for compliance with the new procedures, including GMO labeling of food containers it brings into Protocol member countries. Relevant military personnel should consider reviewing the concluding report for eventual inputs for the next meeting(s). (Member of the U.S. delegation: JP Passino, FAS Biotech Group, International Organizations and Agreements, email: john.passino@usda.gov)

Sources:

Second Meeting of the Open-ended Ad Hoc Working Group on Liability and Redress under the Biosafety Protocol. 20-24 February 2006 | Montreal, Canada

<http://www.iisd.ca/biodiv/wglr2/20february.html>

Cartagena Protocol on Biosafety

<http://www.biodiv.org/biosafety/default.asp>

8.2.3 Europe to Redouble Efforts to Stabilize Biodiversity by 2010

At the fourth Intergovernmental "Biodiversity in Europe" Conference, held February 22–24 at Lake Plitvice National Park, Croatia, officials from 40 European governments and 32 environmental

organizations agreed to redouble their efforts to achieve the goal of halting Europe's biological diversity decline by 2010. Climate change, human activities, and low political priority of biodiversity were noted as the main factors that should be addressed to curb present trends. The benefits of the development of the Pan European Ecological Network and the initiatives of several banks to establish European biodiversity investment funds were stressed. The conclusions of the Conference will be advanced at next month's meeting of the Convention on Biological Diversity.

Military Implications:

The outcomes of the "Biodiversity in Europe" Conference are important both as addressing biodiversity decline causes, and as guidelines for eventual regional and/or global framework of regulations, compliance and enforcement for reducing it. The military should follow the new developments on the issue and how they might impact its field activities.

Source:

Fourth Intergovernmental conference 'Biodiversity in Europe' and 10th meeting of the Council of the Pan-European Biological and Landscape Diversity Strategy
<http://www.strategyguide.org/200602/Documents.html>

8.3 Nanotechnology—Health Implications of Quantum Dots

Quantum dots (QD) are nanoparticles that consist of a metalloid core and a shell that surrounds the core and makes the particle biologically active. They form an important class of elements in nanotech-based applications, particularly biological ones, but raise the same environmental safety questions as other nanomaterials. A recent toxicological review of QD at Duke Univ. indicated that:

- "QD toxicity depends on multiple factors including their physico-chemical properties (e.g. size, charge, concentration, outer coating bioactivity, and stability) and environmental conditions.
- "Human exposure to QD may result from environmental, workplace and therapeutic exposure. There may be a risk of bioaccumulation of these materials within organs and tissues (e.g. in lungs) with still unexplored or under-explored health risks."
- QDs may enter the environment in wastes from any (QD) activity, their persistence may be long, and the exposure risk varies with the host material - water, air, or various soil types.
- The principal concern with QD relates to the possible effects from toxic metals (e.g. Cd, Se) in the metalloid core, in particular as determined by the physical, chemical, and physiological properties of the core/coating complex. Some in vitro studies suggest that prolonged exposure may be toxic to cells.

[See also *Nanotechnology* in January 2006 and previous environmental security reports.]

Military Implications

[Similar to others on the same issue] This study, along with similar others, could help the military improve the environmental health risks assessment of nanotechnology.

Source:

A Toxicologic Review of Quantum Dots: Toxicity Depends on Physicochemical and Environmental Factors
 Environmental Health Perspectives • VOLUME 114 | NUMBER 2 | February 2006
<http://www.ehponline.org/members/2005/8284/8284.pdf>

8.4 Mercury Instruments May Be Banned in EU

The European Commission has proposed a ban on the use of mercury in new fever and room thermometers, barometers and blood pressure gauges because of the serious risk the heavy metal poses to human health. The proposition will go for further debate to the European Parliament and European Ministers. Specialized applications, in particular medical measuring devices, where adequate substitutes may not be available, would not be subject to the restriction. [See also *Recycling Regulations in the EU* in August 2005, *EU Sets 2011 Deadline to Ban Mercury Exports* in June 2005, and *Governments Call for Global Assessment and Control of Mercury Pollution* in February 2005 environmental security reports.]

Military Implications:

The military should review its future plans for such devices, and ensure that adequate acceptable substitutes will be available if the prohibition comes into effect in the countries of the EU where US forces are stationed.

Sources:

Commission proposes to ban mercury in fever thermometers

<http://europa.eu.int/rapid/pressReleasesAction.do?reference=IP/06/193&format=HTML&aged=0&language=EN&guiLanguage=en>

EU Plans to Ban New Thermometers with Toxic Mercury

<http://www.planetark.com/dailynewsstory.cfm/newsid/35234/story.htm>

8.5 Recommendation for a Biosecurity Watchdog

Globalization, Biosecurity, and the Future of the Life Sciences, a report by the U.S. National Research Council and Institute of Medicine of the National Academies assesses the evolution of science and technology capabilities over the next 5-10 years with implications for next-generation bio-threats. Acknowledging that the accelerating pace of life sciences discoveries worldwide has fundamentally changed the spectrum of threats, it looks into next-generation bio-weapons and recommends ways to prevent misuse of science, including strengthening the scientific expertise of security organizations, and the creation of an independent science-and-technology advisory committee for intelligence agencies, as well as the promotion within the international scientific community of a common culture of awareness and responsibility to prevent misuse of science. In that context, one of the co-authors of the report, Canadian Peter A. Singer, suggests the creation of a global advisory group that would act as a watchdog to prevent science being misused to produce biological weapons. He advocates that Canada should advance the idea of such a network at the upcoming G8 Meeting to be held this summer in Russia and which would have infectious disease as one of its three priorities.

Note: the preliminary negotiations for setting up a verification body to strengthen the Biological Weapons Convention, failed. The talks took place this month in Tokyo in preparation for the next review conference to be held in November, in Geneva. [See also *Codes of Conduct for Scientists to Strengthen the Biological Weapons Convention* in December 2005, and *Time to Strengthen the 1972 Biological Weapons Convention* in December 2004 environmental security reports.]

Military Implications:

Military and governments from around the world should examine the report's recommendations and consider their implementation accordingly. Also, a follow-up with Canada on its eventual recommendation of a global biotech watchdog organization should be considered.

Sources:

Globalization, Biosecurity, and the Future of the Life Sciences (prepublication copy)

<http://newton.nap.edu/books/0309100321/html>

Working together against bioterror

http://www.utoronto.ca/jcb/home/news_bioterror.htm

Talks to Prepare for BWC Negotiations Conclude

http://www.nti.org/d_newswire/issues/2006_2_15.html#809EF5F4

8.6 Bird Flu Spreads Increasing Threats of a Human Pandemic

Bird flu is spreading around the world with new cases confirmed in Europe and—as feared—in Africa, where poverty and disease, and humans' intimate proximity to poultry increases the potential of a human pandemic. Scientists argue that since a global flu pandemic cannot be avoided solely by containing an outbreak at its source, plans should focus on how to limit the chance of pandemic-forming viruses emerging in the first place. There are also debates that migrating wild birds might not be the only cause of the worldwide spread. Dr. David Nabarro, the UN System Coordinator for Avian and Human Influenza, sketched a framework of a global four-prong approach to control the spread of the deadly avian influenza virus, highlighting the different roles of governments, civil society, the private sector, and the media. [See also *Bird Flu Updates* in November 2005 and other previous environmental security reports on this issue.]

Military Implications

[Same as in previous reports on the same issue] The military should continue to coordinate with the networks of WHO and CDC country representatives and their local information collection system and help strengthen these networks to become more globally integrated with the use of pattern recognition and analytic software.

Sources:

Containing outbreak 'would only delay a flu pandemic'

<http://www.scidev.net/News/index.cfm?fuseaction=readNews&itemid=2671&language=1>

UN bird flu coordinator advocates multi-prong effort to control deadly virus

<http://www.un.org/apps/news/story.asp?NewsID=17458&Cr=bird&Cr1=flu>

The aves, and ave nots. Avian influenza is spreading to many new countries. But migrating wild birds may not be the only culprits. *The Economist*, Feb 24th 2006

http://www.economist.com/agenda/displaystory.cfm?story_id=5515929&fsrc=nwl (by subscription only; full text in the [Appendix](#))

Bird flu update: 27 February 2006

<http://www.scidev.net/News/index.cfm?fuseaction=readNews&itemid=2681&language=1>

Other background information 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 4. Arctic Northern Passage Opens New International Issues of Regulation

Some additional background material:

Global warming causing record Arctic ice melt

Updated Wed. Sep. 28 2005 11:36 PM ET. CTV.ca News Staff

http://www.ctv.ca/servlet/ArticleNews/story/CTVNews/20050928/arctic_sea_ice_050928/20050928?hub=CTVNewsAt11

Rapidly shrinking Arctic ice could spell trouble for the rest of the world

By Robert S. Boyd. Knight Ridder Newspapers

<http://www.realcities.com/mld/kashington/13593302.htm>

Scientists Warn of Melting Ice in Arctic

Anchorage, Alaska, Feb. 7, 2006

<http://www.cbsnews.com/stories/2006/02/07/ap/tech/mainD8FK1HMO0.shtml>

The polar road to riches

Mick Hamer, NewScientist.com news service, 21 January 2006

<http://www.newscientist.com/article/mg18925355.900;jsessionid=BHCJGOPFLING> (by subscription only; full text follows)

ON 17 August 1977, the Russian nuclear-powered ice-breaker Arktika became the first ship to reach the North Pole. It was 10 years before the feat was repeated. But what was once a remarkable achievement is now relatively commonplace: in the past two years 17 ice-breakers visited the pole.

Shrinking ice cover in the Arctic Ocean is gradually making it easier for ships to travel through these waters. But while scientists focus on the causes and consequences of this climatic change, industry is lining up to take advantage of the greater freedom to move around the region and exploit its untapped resources. And it will be helped by the appearance of ice-breaking and satellite technologies designed to ease the passage through one of the planet's final frontiers.

The commercial attractions of better access to the Arctic range from tourism to pristine fish stocks and mineral wealth. With a quarter of the world's remaining oil and gas reserves, the Arctic is also on the verge of an oil rush. In the past, the region's inhospitable nature has deterred fuel companies, but declining reserves and crude oil prices of around \$60 a barrel are encouraging them to venture

northward. To do this they will need vessels to carry the petroleum prospectors, supply ships to set up production platforms and tankers to transport the oil and gas.

Travelling through Arctic waters also opens up the prospect of shorter sea voyages between Europe and ports in China, Japan and Korea. The Northern Sea Route round the north of Russia is about 40 per cent shorter than the journey through the Suez Canal. The fabled North-west Passage between the Pacific and the Atlantic is an alternative to the Panama Canal for ports in Europe and the US eastern seaboard, and there is even the increasingly busy route straight over the top of the world.

So the shrinking ice could ultimately lead to a reorganisation of the world's trade routes. "It's intriguing, but it's the wild card," says Lawson Brigham of the US Arctic Research Commission in Anchorage, Alaska, and a former ice-breaker captain who sailed to the North Pole in 1994. "There is still a heck of a lot of ice. No one knows how this will develop."

Since the 1970s the area of seasonal ice that is laid down each winter has shrunk by 3 to 4 per cent per decade. More significant for shipping is the loss of older ice, which is shrinking twice as fast as the seasonal ice. Because old ice becomes compacted and hardened after several cycles of freezing, thawing and amalgamation with other loose ice, it is a far tougher obstacle to shipping than first-year ice.

The Northern Sea Route is already free of ice for several days a year. Models predict that by the end of the century the entire route will be easily navigable for at least half the year. But long before that there will be a boom in shipping in the western parts of the route, thanks to the lure of oilfields in western Siberia. Pipelines linking these reserves with St Petersburg and the rest of Europe are already near capacity, so the Russians will have to begin shipping the oil out.

The warm tail end of the Gulf Stream licking round the top of Scandinavia keeps Murmansk, at the western end of the Barents Sea, virtually clear of ice. But the eastern end, where the oilfields are, is only ice-free for about 110 days a year. Although Russian ice-breakers keep a channel relatively navigable year-round, ice-strengthened ships still have to cope with ice up to 1.5 metres thick at times.

To get round this problem, the Russians plan to operate a shuttle service using ice-breaking tankers to take oil across the Barents Sea to Murmansk for transfer to conventional ships. To run this service the Russian shipping company Sovcomflot has ordered three 70,000-tonne ice-breaking oil tankers of a novel design developed by Aker Arctic Technology of Helsinki, Finland.

Traditional ice-breakers slide their bows up onto the ice to break it with their weight and push the debris aside. But the stubby, strengthened bows needed for the task are far from hydrodynamic in open water, and mean ice-breakers can burn up to 40 per cent more fuel than conventional ships across open sea.

Instead of ploughing into the ice with their bows, the new tankers will use reinforced sterns instead. They will move stern-first when breaking the winter ice at the eastern end of the Barents

Sea and then switch direction and travel forwards in open water, meaning their bows can be more hydrodynamic.

“The new ice-breakers will move stern first through the ice and forwards in open water”

The new design is possible thanks to a kind of rotatable thruster called an azipod (New Scientist, 27 March 2004, p 24). Suspended beneath the stern on rotating mounts, each watertight pod houses an electric motor that drives an external propeller. Azipods can be swivelled through 360 degrees to produce the maximum level of thrust in any direction, unlike conventional fixed propellers that can only produce maximum thrust going forwards.

Naval architects have spotted their potential for ice-breaking, since experiments show that ice-breakers are far more effective when travelling astern than going forwards, because the churning of the water beneath the ice by the propeller helps to break it up. Tests in Aker's ice tanks in Helsinki show that a model ship can crunch through 80 centimetres of flat ice at 3.5 knots when travelling astern, but only 30 centimetres when going forwards.

"The efficiency of azipods is very impressive in first-year ice," says David Snider of Canadian Arctic navigation consultancy Martech Polar of Brentwood Bay, British Columbia, an adviser to the Canadian government. But he warns that azipods still have to prove themselves in sea trials through difficult ice. "Multi-year ice has a nasty habit of sliding under the ship. You've got to be careful with an azipod. You don't want it lopped off by ice."

The Arctic also lacks some of the basic modern navigational aids that mariners take for granted in other waters. GPS coverage at latitudes above 70° north is very patchy. Meanwhile the most useful satellite images for avoiding ice come from a craft that is about to be mothballed, the Canadian Space Agency's Radarsat-1. Experienced ice navigators can use Radarsat-1's images to cut journey times by 20 to 30 per cent.

The satellite is now near the end of its life, and is supposed to be replaced this year by Radarsat-2, which will carry remote-sensing radar with a resolution down to 3 metres rather than Radarsat-1's 50-metre resolution. It will also produce more up-to-date images of the ice for navigators by imaging locations more frequently. However, although this is due to be launched from the Baikonur Cosmodrome in Kazakhstan in December, its launch date has been repeatedly delayed.

Mariners will also be confronted with a far more basic problem as the Arctic opens up to shipping. Many parts of the Canadian and Russian coasts have never had a modern hydrographic survey: many of today's depth charts are based on soundings taken in the 1800s. The ice may be shrinking, but these northern waters are still a long way from plain sailing.

From issue 2535 of New Scientist magazine, 21 January 2006, page 24

Item 6. Technological Breakthroughs with Environmental Security Implications

6.4 Hydrogen Farming as a Possible Alternative to Petroleum

Growing hydrogen for the cars of tomorrow

By Peter Aldhous, New Scientist Print Edition, 25 February 2006

<http://www.newscientist.com/channel/mech-tech/mg18925401.600;jsessionid=IAACLHIKFBBN> (by subscription only)

DOWN at the farm, glistening polythene tubes stretch into the distance across the salt flats of the southern Californian desert. But they aren't propagating some miraculous new crop that can grow on this barren, sun-baked earth. These water-filled tubes are teeming with countless microscopic algae that have been engineered to soak up the sun's rays and produce hydrogen to fuel the state's cars and other vehicles.

That, at least, is the vision of Tasios Melis of the University of California, Berkeley. And he's not stopping at California. "We've done some calculations," he says. "To displace gasoline use in the US would take hydrogen farms covering about 25,000 square kilometres." To put that in perspective, that's less than a tenth of what the US devotes to growing soya.

Crucially, you can farm algae where conventional crops don't stand a chance. The best areas will be sun-drenched deserts like the salt-covered dried lake beds in southern California, says Melis. "Nothing will grow on that salt, but it reflects light."

These hydrogen farms are still a dream, but if Melis and those who share his vision are successful, the first one could be built within a couple of decades. Not only would they provide an environmentally friendly source of hydrogen - the most likely fuel for the post-gasoline generation of vehicles - but they might also be cheap enough to take off in developing economies, which at present look set on an environmentally catastrophic path to a future dependent on fossil fuels. "Poor countries could use this technology," says Melis.

Melis isn't the only one banking on algae to deliver cheap hydrogen. Several research groups are working on ways to persuade the microbes to produce the gas, either by genetic engineering or by manipulating the composition of their growth medium. And the US Department of Energy (DOE) is investing several million dollars a year in the research to see if it can be made commercially viable.

The idea is incredibly simple: take a transparent tube full of water, inoculate it with the green alga *Chlamydomonas reinhardtii*, and put it out in the sun. Algae naturally produce hydrogen as a by-product of photosynthesis, so all you need is a system to collect the gas and you've got a working hydrogen farm.

But before you rush to invest in the technology, bear in mind that realising the vision will require some formidable feats of bioengineering. So far, researchers have got no further than a few prototypes in a clutch of labs. Melis assumes that a commercial hydrogen farm would need to convert the energy of sunlight into hydrogen with an efficiency of about 10 per cent. Right now, the algal cultures that he and other researchers are experimenting with are less than 0.1 per cent efficient at producing the gas. Making *C. reinhardtii* belch out large quantities of hydrogen will require a radical re-engineering of photosynthesis in algae.

Photosynthesis involves two processes. In the first, chlorophyll and other pigments harness the energy of sunlight to split water into oxygen, protons and electrons. The electrons and protons are used to create molecules that provide the chemical energy for a second process, the Calvin cycle, which converts carbon dioxide and water into sugars. The plant then consumes these sugars as it grows.

Although only the process of splitting water requires light, both reactions shut down at night. When the sun returns each morning, the water-splitting reaction gets up to speed more quickly, so cells can suddenly find themselves producing reactive electrons that go unused by the still sleeping Calvin cycle. If not mopped up, they could damage the cell's photosynthetic apparatus. To prevent such biochemical havoc, a hydrogenase enzyme dumps the electrons onto protons, forming harmless hydrogen.

However, the hydrogenase is inhibited by oxygen. So as photosynthesis gets going, oxygen released by the splitting of water soon deactivates the enzyme. By this time the Calvin cycle is up and running, and the cell gets on with the business of making sugars.

This is a big problem for hydrogen farmers. The last thing you want is for the mechanism that produces hydrogen to shut down shortly after sunrise. So how do you help the hydrogenase to keep working through the day?

The first hint that it might be possible to subvert the oxygen feedback mechanism came in 2000. From previous research Melis and Mike Seibert of the National Renewable Energy Laboratory in Golden, Colorado, had a hunch that reducing sulphate levels in the *C. reinhardtii* cultures would slash the rate of photosynthesis. Experiments showed that the rate dropped by 90 per cent. As a result, oxygen levels fell to a point where the hydrogenase enzyme kept working, diverting electrons to produce hydrogen instead of making sugars.

However, simply reducing sulphate levels isn't the answer, since *C. reinhardtii* cells get sickly and die when starved of sulphates for a week or more. So Melis is now trying to block the production of an enzyme that moves sulphate into the chloroplast, the cellular structure in which photosynthesis takes place. To do this he is genetically engineering the alga to trigger RNA interference, a mechanism which can selectively shut down genes - in this case the one for the sulphate transport enzyme. He hopes this will reduce the rate of photosynthesis by about 80 per cent, so the cells should stay healthy rather than die, and yet still continue to produce hydrogen.

Seibert, on the other hand, thinks crippling photosynthesis isn't such a good idea. Reducing the rate of photosynthesis inevitably slashes the amount of hydrogen the algae produce, and that is not something a hydrogen farmer would want to do. "If we want to make full use of the sun's energy, we have to address the core problem: the sensitivity to oxygen of the hydrogenase enzyme," he says.

To tackle that problem, Seibert has turned to a related hydrogenase enzyme whose three-dimensional structure has been determined in detail, from the bacterium *Clostridium pasteurianum*. Through computer simulations of the enzyme's behaviour, Seibert and his

collaborators have shown that oxygen diffuses into the enzyme along two distinct pathways, whereas hydrogen escapes by a multitude of routes. So they reasoned it should be possible to mutate the enzyme so it no longer lets oxygen in, yet still produces hydrogen.

Seibert and his colleagues are creating specific mutants of the enzyme that should, according to their computer simulations, block the oxygen pathways into the cell. The trick is finding modifications that don't compromise the activity of the enzyme. So far they have identified an oxygen-blocking mutation that boosts the enzyme's tolerance to oxygen by up to 30 per cent. Now they are working to create double mutants in which both pathways are disabled. "We're trying to 'button up' the protein," Seibert says.

If they are successful, it should be relatively straightforward to create similar mutant versions of *C. reinhardtii*'s hydrogenase - or alternatively, to genetically engineer the algal cells to make the mutant bacterial enzyme in place of their own version.

But that still leaves another obstacle. When algae make hydrogen rather than sugars, one side-effect is that concentrations of protons accumulate near the photosynthetic apparatus, acting like a build-up of static electricity. This inhibits the transport of the electrons split from water. "It will limit the rate of hydrogen production by a factor of more than 10," says James Lee of Oak Ridge National Laboratory in Tennessee.

Lee has designed genes to produce novel proteins that should pump the excess protons away from the photosynthetic apparatus (see Diagram). Having built different variants of these genes from scratch and inserted them into algal cells, he now has to exhaustively test each variant to find one that has the desired effect.

Finally, to maximise the efficiency of a hydrogen farm, it will be important to ensure that sunlight permeates throughout the tubes containing the algal cultures, rather than being completely absorbed by cells at the surface. Melis thinks the answer could be to tinker with how much photosynthetic pigment the algal cells produce, so that they don't shade one another too much (see "Lighter shade of green").

Given the sophisticated genetic manipulation needed to make hydrogen farming a practical prospect, the big energy companies are content to watch from the sidelines. It is difficult for engineers to think about designing a hydrogen farm until they know the precise characteristics of the microbe they'll be dealing with, says Steve Schlasner, head of long-range R&D with energy firm ConocoPhillips in Bartlesville, Oklahoma.

For example, if Seibert succeeds in creating his oxygen-tolerant hydrogenase, the algae will pump out both hydrogen and oxygen, and farms will need to incorporate a mechanism for separating the two gases safely. Melis's idea of limiting the production of oxygen in the algal culture, while making much less efficient use of sunlight, would avoid this problem and mean the plant could be much simpler.

Meanwhile, the DOE is hoping its investment will bear fruit. Farmed hydrogen would be the ultimate green fuel, with virtually no damaging impact on the environment. "We know the concept

has merit," says Steve Chalk, who manages the DOE's hydrogen programme. But it has to compete favourably with every other method of hydrogen production to retain the DOE's backing.

By 2015, the DOE calculates that hydrogen will have to cost no more than \$3 per kilogram to be viable, making it no more expensive than gasoline. At that date, the DOE will concentrate its investment on whatever technologies seem most competitive, and drop the rest.

Based on their results to date, researchers working on hydrogen farming think they're in with a good chance. According to Melis, the cost of farmed hydrogen might eventually fall as low as \$1.40 per kilogram. It would set the stage for a whole new breed of energy companies, staffed by people with a different outlook from the engineers and geologists that have dominated the oil industry. "You would have to think more like a farmer," says Melis.

When Tasios Melis at the University of California, Berkeley, set up his prototype hydrogen "farm", the results were visually spectacular. He seeded a polythene tube full of water with the alga *Chlamydomonas reinhardtii*, and within a week, the clear water turned almost black with multiplying algal cells. "It was so dense that you couldn't see through it," he says.

But therein lies a problem. Algae such as *C. reinhardtii* have evolved to photosynthesise under murky conditions, not in the full glare of the sun. To make the most of gloomy conditions, they possess arrays of chlorophyll and other pigments organised into structures called "antenna complexes" that are remarkably efficient at soaking up sunlight.

In a sun-drenched hydrogen farm, however, these extensive antenna complexes wouldn't be necessary, and would in fact prevent sunlight from reaching the cells at the centre of the tube. So Melis is now working to engineer algae that contain less chlorophyll.

The antenna complexes of normal *C. reinhardtii* cells contain a total of 470 chlorophyll molecules, but they should still be able to photosynthesise if these were stripped down to just 132 chlorophylls - and Melis has calculated that this would increase a hydrogen farm's productivity by a factor of four.

Unfortunately, that alga doesn't yet exist. So Melis is creating a strain that has these properties. To do this he is going through the laborious process of making thousands of mutant *C. reinhardtii*, disrupting their genes by inserting marker sequences of DNA into the cells, which get randomly incorporated into the genome. So far, his team has identified five promising mutants - one of which is close to his target minimal complex size.

Item 7. Biodiesel Increasingly Considered a Viable Alternative to Crude Oil

Govt pushes for biodiesel

Submitted by Moffat Mamu on 10 February, 2006 - 11:58am. Nation

By JOY A. RIKIMAE

<http://www.solomonstarnews.com/drupal-4.4.1/?q=node/view/6966> (website works irregularly)

COCONUT oil may soon become the dominant fuel in the country as the Government moves to reduce its import bill on overseas fuel.

Three Australian companies will establish their biodiesel plants in the country this year to extract coconut oil for usage in automobiles.

Kenneth Bulehite, Energy Project Officer in the Ministry of Mines and Energy, says the Government is pushing ahead to produce its own fuel due to the high price fuel in the world market.

He said the three Australia companies, Nomos Corporation Pty Ltd; Ever Green Pty and Australian Biodiesel Group, are keen in investing in the industry.

“We’ve decided to invite all three companies to establish their biodiesel plants here because they are interested.

“Allowing three producers to exist at the same time will also avoid business monopoly, and encourage competition.

“We must encourage competition to ensure prices remain at a competitive level,” Mr Bulehite told the Solomon Star yesterday.

To make coconut oil is compatible to automobiles, Mr Bulehite said there are three options to be considered.

The first two, he added, would require some adjustments and refitting to automobile engines.

But the third alternative does not require any adjustments.

He said only fat would be removed from the coconut oil to avoid clogging the engines.

“We are going for the third alternative because it is efficient and does not cost much.

“The extraction of fat from the coconut oil would not affect the quality or quantity of fuel extracted so we regard this as the best alternative,” Mr Bulehite said.

According to official figures in the 1990s, Solomon Islands produced a maximum of 35 thousand metric tonnes of copra every year, which is equivalent to 17 million litres of coconut oil.

Mr Bulehite said if the three Australian companies established their biodiesel plants here, one plant is only capable of producing two million litres of copra oil in one year.

He added that Solomon Islands would run out of copra if the companies produced above 17 million litres a year.

Mr Bulehite said his department anticipates the copra production would increase once the biodiesel production starts.

“I believed our copra production would increase above the annual 35 thousand metric tonnes because now, a lot of people are not cutting copra due to low prices.

“We believe everybody will slowly come back into production once prices go up.”

Mr Bulehite said fuel is one of the country’s highest imported commodities, adding biodiesel production would save the country a lot of foreign reserves.

“Fuel accounts for 27 per cent of our yearly imports. At the same time, SIEA consumes 17 million litres of fuel a year.

“So producing our own fuel would mean a reduction of fuel imports, opening up more economic opportunities for our people and increasing people’s income.

“Economic wise, it would be a positive move for the country as it would mean more foreign reserves for Solomon Islands,” Mr Bulehite said.

He encourage all copra producers to start clearing their coconut plantations because the number one policy of the government is to encourage rural people to participate more in economic development.

“I truly believe biodiesel is the way forward for Solomon Islands because it is sustainable and will not cause damage to the environment.”

Mr Bulehite said the Government had allocated \$2 million for the facilitation of energy developments and part of that money would be used for the facilitation of the biodiesel project.

He said the companies would meet the cost of establishing their production plants.

The Government, he added, would only play a facilitatory role.

He said the Department of Energy anticipates the project would be off the ground before mid this year.

Coconut oil as a biofuel

Submitted by Arthur Wate on 14 February, 2006 - 9:28am. Private View

By JAMES PORAKARI, University of South Pacific

<http://www.solomonstarnews.com/drupal-4.4.1/?q=node/view/7019> (website works irregularly)

THE purpose of this article is to highlight some very important facts and information with respect to using coconut oil (CNO) as alternative fuel to diesel due to its rising price.

The use of CNO is not new as it was used during the World War II, in Philippines by the armies fighting there due to shortage and disruption of diesel supply. In the Pacific Islands Countries (PICs), different projects and trials using CNO oil as fuel were implemented and tried.

Between 1991 and 1999 on the island of Ouvea (New Caledonia) two projects were established to use CNO as fuel to generate electricity.

The first CNO generator was a 90 kVA supplied to the islands co-operative for a coconut oil plant in 1995 and the second is a 180 kVA CNO power generator and was installed in 1999. The success of these two projects demonstrated the technical viability of the processed and the possibility of using CNO in diesel engines.

In Fiji, there are also two projects established by the Department of Energy (DOE) in two of its remote islands between 2000 and 2001. Generator sets of 45 kVA and 90 kVA were commissioned at Welagi village and Vanuabalavu to electrified three villages respectively. Results were not as successful as the projects in New Caledonia.

Some of the issues and constraints are: distance and travel constraints, lack of communication between DOE and project operators, lack of planning for maintenance, low load, copra oil supply etc.

In other PICs like Samoa, Marshall Islands, Vanuatu and even our country Solomon Islands there are small trials of using CNO as biofuel.

With respect to using CNO as fuel for vehicles, Tony Deamer, a garage owner and vehicle supplier based in Port Vila, Vanuatu, has successfully developed different mixer of CNO and diesel which he called “Island Fuel”. Now over 200 buses and vehicles are using this “Island fuel”.

Technical difficulties

The main drawback with using CNO in diesel engines is that it starts to solidify at a temperature below 25oC, and by 14oC it is close to solid and does not flow at all. In tropical countries like ours, the temperatures are usually above 25oC but at times can fall below 22oC.

If the engine is started while the temperature is below 25oC, the fuel filter is likely to become blocked. CNO used as fuel should have water content lower than 100 ppm, be filtered below 10 _m and have a free fatty-acid (FFA) content lower than 10%.

OPTIONS

To overcome the technical difficulties mentioned above, there are three options that are available to improve the properties of CNO to be used in standard engines.

- Diesel blended with CNO (blend < 20% CNO)

This process involves just mixing CNO with diesel to produce a blended fuel. Most studies suggested that blended fuel should contain less than 20% of CNO. In Vanuatu the “Island fuel” is a mixer of around 60% CNO and 40% diesel. Other trials using CNO and kerosene had also been carried out.

- CNO used straight in an adapt engine

It is also possible to adapt the fuel system of a compression engine to start and stop on pure CNO. Mostly, these engines features adapted injectors, dedicated fuel pumps and extra filters. A Good example of this is the 750 kVA multi-fuel engine operated by Enercal in Ouvea, New Caledonia. As CNO has up to 30 times higher viscosity than regular diesel at the same temperature, most engine modification include a fuel heater that heats the fuel up to 80oC. As heat is exchanged between the engine coolant and the fuel, the oil viscosity approximates that of diesel. Also as CNO solidifies below temperature of 25oC, often an electrical heater is incorporated in the fuel tank as well. This has been successfully trialed and used in vehicles in Vanuatu.

- CNO used to make biodiesel (Esterification)

The third option is to produce biodiesel. Biodiesel is a standardized fuel that consists of vegetable oil (CNO) Methyl Ester. It is a product of vegetable oil that reacts with an alcohol (either methanol or ethanol) and a catalyst (sodium hydroxide). This process generates two products: glycerine, which can be often used in soap production and biodiesel. The major disadvantage of biodiesel is its high costs through the use of a chemical facilities and the requirement of imported methanol or ethanol.

What are the options for Solomon Islands?

A study must be carried out to estimate the current potential of CNO in the Solomon Islands. It was estimated around 59000 ha of coconuts in the country but our current production of copra and CNO suggested that we are only utilizing around 20 000 ha of plantation. Producing copra and CNO is a labour intensive task and a study should be carried out to determine options our government should take to encourage copra farmers to produce more copra and CNO.

The government through the department of energy has announced that it is pushing for biodiesel. As mentioned above biodiesel is a standard fuel which has properties similar to diesel. Feasibility study should be carried out to see whether making biodiesel in Solomon Islands is viable and sustainable. Currently there is a study underway at the University of South Pacific looking at that possibility for Fiji.

For Solomon Islands I would prefer our Government to try options one and two above: blend CNO with diesel or use modified diesel engines. The reasons are that the two options do not required extra chemicals and expertise to produce the biofuel. Also whatever technology we adopt, we should not forget that majority of our people are living in the rural areas and they do may want to use it to generate electricity in their villages and used it for transportation.

Coconut Oil Technology is not very complex and does not require overseas experts but required commitment from our Government. Currently there is no policy regarding renewable energy development. This is the first task for the government and I believe with help from SOPAC our government is now working on these policies. The next step is for someone like Tony Deamer in Vanuatu to invest in producing different blended fuels for use in our country.

Item 8. Updates on Previously Identified Issues

8.1 Climate Change

8.1.1 Rising Concerns over Rising Seas

Greenland's less-icy mountains

The Economist print edition, Feb 16th 2006

http://www.economist.com/displaystory.cfm?story_id=5518916 (by subscription only)

Evidence that sea levels will rise more rapidly than previously thought

THE biggest unknown factor in making predictions of rising sea levels in response to global warming is the role played by the massive ice sheets that cover Antarctica and Greenland. If parts of these were to melt, the sea level would rise far more rapidly than in the past (when much of the rise has been because water expands as it warms). Until recently, it was thought that any melting going on in the ice caps was fairly gentle. But four years ago a small Antarctic ice shelf suddenly disintegrated, leading many people to think again. This week brings further pause for thought, with alarming news from the other end of the world.

In the past, researchers have used data from planes that fly criss-crossing paths over Greenland to assess the extent of its ice sheets. It is a mammoth undertaking. The Greenland ice sheets cover 1.7m square km—an area only a little smaller than Mexico—and the surface of the ice rises to an altitude of 3km. Not surprisingly, the flights leave some areas unmonitored, and so computer models have been used to fill in the blanks and to estimate the role played by these patches. The conclusion, combining data and models, was that the Greenland ice sheet is relatively stable in the centre, but thinning slowly at the edges.

That conclusion, however, has been questioned by Eric Rignot of the California Institute of Technology and Pannir Kanagaratnam of the University of Kansas. They used satellite data concentrating on Greenland's coastline to examine how fast the thinning is happening, and they have found that the flow-speed of 12 glaciers, which together account for about half the discharge of water from the ice sheet, is increasing—and fast.

According to their calculations, published in this week's *Science* and to be presented in more detail on February 18th at a meeting of the American Association for the Advancement of Science, *Science's* publisher, the speed at which the glaciers flow has doubled to 12km a year. As a result, the volume of ice falling into the sea from Greenland has also doubled over the past decade.

That is worrying enough. But Dr Rignot and Dr Kanagaratnam also found that the Greenland ice sheet experienced a greater area of surface melting in 2002 and 2005 than at any previous time since records began in 1979. Most of this has been in the south of the island, which is where the accelerating glaciers lie. Water flowing from the surface could ease the passage of the glaciers into the sea. Taking both factors into account, the contribution made by the Greenland ice sheet to the rise in global sea levels has increased from 0.23mm a year in 1996 to 0.57mm in 2005.

On top of this, since glacial ice contains no salt, the water formed when it melts is fresh. Such an increased flow of fresh water from Greenland could, according to the best available models of ocean circulation, change the way that currents flow in the North Atlantic, to the detriment of the Gulf Stream, the current that keeps north-west Europe warmer than its latitude suggests it should be. In the context of a report late last year that the Gulf Stream may, indeed, be weakening, the news from Greenland is doubly disturbing.

Full to bursting

The Economist print edition, Feb 16th 2006

http://www.economist.com/research/articlesBySubject/displayStory.cfm?story_id=5518909&subjectid=348924 (by subscription only)

Rising levels of carbon dioxide will dump even more water into the oceans

THE lungs of the planet, namely green-leafed plants that breathe in carbon dioxide and breathe out oxygen, also put water vapour into the atmosphere. Just as people lose water through breathing (think of the misted mirror used to check for vital signs), so, too, do plants. The question is, what effect will rising concentrations of carbon dioxide have on this? The answer, published in this week's *Nature* by Nicola Gedney of Britain's Meteorological Office and her colleagues, would appear to be, less water in the atmosphere and more in the oceans.

Measurements of the volume of water that rivers return to the oceans show that, around the world, rivers have become fuller over the past century. In theory, there are many reasons why this could be so, but some have already been discounted. Research has established, for example, that it is not, overall, raining-or snowing, hailing or sleeting-any more than it used to. But there are other possibilities. One concerns changes in land use, such as deforestation and urbanisation. The soil in rural areas soaks up the rain and trees breathe it back into the atmosphere, whereas the concrete in urban areas transfers rainwater into drains and hence into rivers. Another possibility is "solar dimming", in which aerosol particles create a hazy atmosphere that holds less water. And then there is the direct effect of carbon dioxide on plant transpiration.

Dr Gedney used a statistical technique called "optimal fingerprinting" or "detection and attribution" to identify which of these four factors matter. Her team carried out five simulations of river flow in the 20th century. In the first of these they allowed all four explanations to vary: rainfall, haze, atmospheric carbon dioxide and land use. They then held one of them constant in each of the next four simulations. By comparing the outcome of each of these with the first simulation, the team gained a sense of its part in the overall picture. So, for example, they inferred the role of land use by deducting the simulation in which it was fixed from the simulation in which it varied.

As with any statistical analysis, the results are only as good as the model, the experimental design and the data. Dr Gedney and her colleagues acknowledge that their model does not fully take into account the use of water to irrigate crops-particularly important in Asia and Europe-nor the question of urban growth. They argue, however, that these aspects, taken together, would remove water from rivers, which makes their conclusion all the more striking. And it is this: fuller rivers

cannot be explained by more rainfall or haze or changes in land use, but they can be explained by higher concentrations of atmospheric carbon dioxide.

The mechanism is straightforward. A plant breathes through small holes, called stomata, found in its leaves. Plants take in carbon dioxide, and when the atmosphere is relatively rich in this gas, less effort is needed. The stomata stay closed for longer, and less water is lost to the atmosphere. This means that the plant doesn't need to draw as much moisture from the soil. The unused water flows into rivers.

Optimal fingerprinting had been used before to put climate trends down to both natural and manmade causes. Recent rises in surface temperature have been pinned on rising levels of greenhouse gases, particularly carbon dioxide. However, Dr Gedney's work is the first to identify a direct effect of that gas on ecosystems.

The finding is a mixed bag. On the one hand, fuller rivers threaten more flooding. This week, hundreds of families were forced from their homes in Thailand, where several cities are more than one metre under water. More alarmingly, if rivers dump more water into oceans, then rising sea levels (see article) will rise more rapidly still. Such changes would be felt especially in low-lying, populous and poor countries such as Bangladesh.

On the other hand, access to fresh water represents a blessing, if rivers can be safely controlled. In 2000 the World Health Organisation estimated that, of the world's then 6 billion people, at least 1.1 billion were without safe drinking water and 2.4 billion had no sanitation. If rising concentrations of carbon dioxide mean that plants consume rather less water, leaving more for humans, that might not be such a bad thing after all.

8.6 Bird Flu Spreads Increasing Threats of a Human Pandemic

Some additional background information:

H5N1 bird flu reaches Africa

By Debora MacKenzie, NewScientist.com news service, 09 February 2006

<http://www.newscientist.com/article.ns?id=dn8695> (by subscription only; full text [follows](#))

Fears of Africa flu spread

The virus has probably been killing poultry for weeks, but migratory birds are likely not to blame

By Stephen Pincock, [Published 14th February 2006]

<http://www.the-scientist.com/news/display/23120/>

India suspects foreign hands in artificially introducing bird flu into India - biological warfare?

Babu Ghanta, Indiadaily.com, Feb. 19, 2006

<http://www.indiadaily.com/editorial/7060.asp>

Austria finds bird flu in swans

The deadly H5N1 bird flu virus has been confirmed in swans in Austria. The swans were among 21 dead wild fowl examined in Austria. They were found at Mellach, near Graz, where restrictions on poultry are now in effect.

<http://news.bbc.co.uk/2/hi/europe/4713536.stm>

Germany confirms bird flu cases

Infected birds have been found in five European countries this month

<http://news.bbc.co.uk/2/hi/europe/4714574.stm>

First Swiss Bird Flu Case Reported in Geneva

<http://www.planetark.com/dailynewsstory.cfm/newsid/35303/story.htm>

The aves, and ave nots

Avian influenza is spreading to many new countries. But migrating wild birds may not be the only culprits. *The Economist*, Feb 24th 2006

http://www.economist.com/agenda/displaystory.cfm?story_id=5515929&fsrc=nwl (by subscription only)

IN AROUND a month, bird flu has appeared in a seemingly alarming number of new countries. The disease is already endemic in the poultry flocks of much of Asia. In the face of the relentless march of the H5N1 virus around the world, fatalism is not an appropriate response. Better to look at exactly what is going on.

The arrival of bird flu in European Union countries has caused most of the flap, yet the cases in Azerbaijan, Bulgaria, Greece, Italy, Slovenia, Austria, Germany, Hungary and Croatia are only in wild birds; the cases found this week at a turkey farm in France would, if confirmed as H5N1, mark the first time the virus had spread to domestic poultry in the EU. In Nigeria, Egypt and India, by contrast, the virus has already been discovered to be widely distributed across poultry flocks.

While the presence of the virus in any form is a concern, obviously Nigeria, Egypt and India face the biggest problems, and they are less well equipped to deal with them. More significantly, it is increasingly apparent that the real issue du jour is the extent to which wild birds, or humans themselves, are responsible for the infection's spread in poultry.

A research paper in Proceedings of the National Academy of Sciences, published online on February 10th, shows that the H5N1 virus has persisted in its birthplace, southern China, for almost ten years and has been introduced into Vietnam on at least three occasions, and to Indonesia. The authors suggest that such transmission events are perpetuated mainly by the movement of poultry and poultry products, rather than by migrating birds.

This is significant because it strongly supports bird conservationists, who have been arguing that most outbreaks in South-East Asia can be linked to movements of poultry and poultry products or infected material from poultry farms, such as mud on vehicles or people's shoes. Conservationists also argue that live animal markets have played an important role in the spread of H5N1. Such markets were the source of the first known outbreak in Hong Kong in 1997 when 20% of the chickens in live poultry markets were infected.

BirdLife International, a conservation group, reckons there are three likely transmission routes for H5N1: commercial trade and the movement of poultry; trade in wild birds; and the use of infected poultry manure as agricultural fertiliser. Bird conservationists add that although migratory birds

can carry and transmit the virus, it is often not clear whether they picked up the infection from poultry.

In Nigeria, there is the suggestion that it was trade, and not migratory birds, that caused the outbreak. For one thing, the infection was first detected in a commercial farm with 46,000 poultry and not among backyard flocks, which represent 60% of the country's poultry production—and which would be expected to have greater contact with wild birds.

The United Nations Food and Agriculture Organisation (FAO) estimates Nigeria imports around 1.2m day-old chicks every year. Further, there are rumours that many of these chicks are still arriving from countries with domestic H5N1 infections, such as China and Turkey. Joseph Domenech, head of the animal health service at the FAO's headquarters in Rome, says the importation of chickens from contaminated countries is forbidden.

The Nigerian government is, finally, taking action to eliminate the virus after a period of panic. Its challenge will be to get the message to ordinary Nigerians about the urgent need to cull birds, prevent poultry movement and disinfect farms. Dick Thompson of the World Health Organisation responded to a report that Nigerians had been seen retrieving dead chickens from a pit of culled birds by saying it was a “really scary activity and something not seen before”.

Neighbouring countries are also moving into action. This week a meeting was held in Senegal to try to establish a regional strategy for containment. Money should be available. Last month, \$1.9 billion was pledged by countries and international groups for the fight against avian flu—half a billion more than expected, which underscores the extent to which the disease is seen as a global threat. Infection across Africa would increase the probability that the virus will mutate to become transmissible between humans. But there is another vital dimension: the combination of lost earnings from poultry and the loss of a vital source of protein could also be devastating for Africa. Now that is food for thought for Europeans, whose problems, for now at least, pale in comparison.

Copyright © 2006 The Economist Newspaper and The Economist Group. All rights reserved.

H5N1 bird flu reaches Africa

By Debora MacKenzie, NewScientist.com news service, 09 February 2006

<http://www.newscientist.com/article.ns?id=dn8695> (by subscription only)

The H5N1 bird flu virus has been confirmed in north-central Nigeria. Scientists had feared the virus would reach Africa, where human poverty and disease could combine with millions of highly susceptible backyard poultry to produce many human infections, and potentially a human pandemic virus.

But New Scientist can reveal that the location of Africa's first reported outbreak should not come as a surprise. The region affected is right beside a major wintering ground for two relatively common species of duck. Those ducks shared breeding grounds in Siberia last summer with birds that winter in Turkey and around the Black Sea, where the virus also appeared recently.

“We are facing a serious international crisis,” said Samuel Jutzi, head of animal health at the UN Food and Agriculture Organisation in Rome, Italy. He is pleading for any further die-offs of poultry in the region to be reported immediately.

The World Animal Health Organization (OIE) in Paris, France, reported on Wednesday that 40,000 poultry, mainly laying hens, have died since 10 January at a commercial farm near Igabi in Kaduna state, a small town 150 kilometres south of the northern city of Kano. The owners initially tried antibiotics.

But the cause has now been confirmed as highly pathogenic H5N1 by the OIE’s collaborating centre for bird flu in Padua, Italy. Moreover, it is the same strain that appeared in wild birds at Qinghai Lake in China in spring 2005, and has since travelled across Siberia to Turkey and the Black Sea.

Summer breeding grounds

As it has everywhere it has gone, the virus is devastating poultry in the region, with Nigerian agricultural authorities reporting the death of 150,000 birds in Kano and Kaduna states, and more outbreaks reported in other parts of Nigeria.

Furthermore, Kano is near the Hadejia-Nguru inland river delta, which is a major wintering location for Northern pintail and garganey ducks. These species summer in breeding grounds across Siberia, where the Qinghai strain of H5N1 infected poultry and wild birds in summer 2005. They then winter in Turkey, around the Black Sea, and in West Africa. The Qinghai strain has already broken out in Turkey and around the Black Sea, apparently carried by migrants..

The authoritative 1996 Atlas of Anatidae [ducks, geese and swans] Populations of Africa and Western Europe says the Northern pintail wintering in the Black Sea and Mediterranean basins “are lumped with those wintering in West Africa as a single large population”. On average, 18,000 pintails winter each year at Hadejia-Nguru. Similar numbers of garganey ducks follow the same migration and 500,000 of each species winter at nearby Lake Chad.

Some of the Northern pintail wintering now in Britain and along Europe’s North Sea and Atlantic coasts also spent last summer on the same breeding grounds as the pintail that subsequently flew to the Black Sea, Turkey and West Africa.