

CORRESPONDENCE

Non-lethal weapons and the civilian death toll in war time

SIR — The scientific community should think twice before it turns its back on non-lethal weapons, as Malcolm Dando suggests in his Opinion piece 'Biologists napping while work militarized' (*Nature* **460**, 950–951; 2009).

It is true that fentanyl killed scores of civilians when it was used to end the Moscow theatre siege in 2002. But that was partly down to Russia's desire to hide its use of caltivate agents, which meant that no life-saving antidote was to hand: the Russians had not disclosed the agent's identity even to their medical personnel.

Dando rightly points out that the US Army misused BZ and other chemical agents during the Vietnam War. But the US Army's use of BZ no more serves as a model for fighting with non-lethal weapons than Vietnam now serves as a model for conducting asymmetric wars — conflicts in which the two sides have very different strategies or levels of military power.

Modern asymmetric war poses a stiff challenge to military organizations searching for the means to defeat guerrilla and insurgency forces while sparing the surrounding civilian population. Many innocent civilians are still being killed as armies turn to drones, real-time surveillance and precision-guided missiles. Could chemical agents, electromagnetic devices and other non-lethal weapons reduce the death toll of modern armed conflicts? We don't yet know the answer.

The use of non-lethal weapons need not cause excessive casualties. Any weapon system carries the spectre of abuse. The purpose of humanitarian law in war is to prevent the abuses that Dando describes and to restrain the carnage of modern war. Sometimes it is successful and sometimes not. But it would be

strikingly ironic if disagreement in the scientific community left military organizations free to pursue their penchant for high-explosive weaponry without considering any of the available non-lethal alternatives.

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Don't overlook the rigorously reviewed novel work in patents

SIR — Why are patent citations so conspicuously absent across academic journals, with most even omitting formatting instructions for these in their author guidelines? Patents present novel, rigorously reviewed unpublished work, as well as providing an unmatched resource for detail.

We randomly selected one month (December 2008) and reviewed all citations in the reviews, articles and letters/reports in *Nature* (1,773 citations) and *Science* (1,367). These citations included textbooks, arXiv.org preprints and abstracts — but no patents.

The lack of cited patents may come about partly because authors find academic papers more readable, or perhaps because the work reported and discussed in academic journals is not being commercialized. However, the scientific data within some patents may appear in abbreviated form in subsequent academic publications.

In 2008, the US Patent Office issued 185,246 patents. In the past, the patent literature has been difficult to search, but this is no longer the case. Matters have improved with the introduction of services such as Espacenet (<http://ec.espacenet.com>) from the European Patent Office, which is able to search more than

60 million patent publications worldwide, and Google Patents (www.google.com/patents), a free search engine indexing more than 7 million patents from the US Patent Office. Searches can also be undertaken at the US Patent and Trademark Office (www.uspto.gov) and the World Intellectual Property Organization (www.wipo.int).

These advances mean that there should now be a more comprehensive citation of the patent literature in scientific publications.

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Keeping track of the Earth's carbon-cycle components

SIR — In a recent Editorial (*Nature* **460**, 436; 2009), you call for improved Earth-monitoring tools to verify whether climate policies are effective. I am pleased to report that the global carbon-monitoring activities of the Group on Earth Observations (GEO) are well on the way to meeting your recommended course of action and should make a useful contribution to climate discussions in Copenhagen at the end of the year.

More than 130 governments and leading international organizations are collaborating through the GEO to establish a Global Earth Observation System of Systems by the year 2015. They are interlinking their respective Earth-monitoring systems and developing common technical standards to pool information effectively and to promote the free dissemination of data.

This expanding coalition is

already transforming the ability of governments to manage their natural resources.

Our system for analysing the three components of the carbon cycle (atmosphere, land and ocean) aims to provide high-quality information on carbon dioxide and methane concentrations and on emission variations. Carbon tracking and carbon storage is being evaluated from atmospheric CO₂ observations, air-surface exchange flux networks, surface ocean CO₂ and related marine biochemistry observations, for example.

These coordinated data should help provide the monitoring, reporting and verification information that is likely to be required by future regulatory frameworks for the inclusion of forests in post-Kyoto climate agreements. They will build on the GEO's existing and planned efforts in forest monitoring. With collaboration from national governments, space agencies and relevant technical experts, a template should emerge for a reliable global carbon-monitoring system.

Close cooperation with the Committee on Earth Observation Satellites and with the GEO Carbon Community of Practice means that plans can be implemented for collecting space-based greenhouse-gas data, particularly those provided by Japan's GOSAT ('greenhouse gases observing satellite') mission and NASA's replacement Orbiting Carbon Observatory.

Understanding the ability of the carbon cycle to continue to act as a partial sink for fossil-fuel emissions is crucial to future carbon budgeting. The GEO's projects will enable participating governments to benefit from their investment in Earth observations and to provide essential environmental information to policy-makers.

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