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Cutting through the propaganda on global warming:

the educator's responsibility?

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After the publication of a recent article, Rob Bartels wrote to me from Indiana, USA, as follows.

"I appreciated your recent article regarding the global warming hysteria. My children have been filled with dread by all of the hype coming through our school system, reinforced by interminable media support. I have patiently explained things as best I can, but being a simple grocer from the Midwest I have less credibility than the experts. I'd appreciate a bit of steerage towards some good information (in addition to your article) that will help me refute the current pop-culture pseudo-science."

An educator, or a person preparing explanatory material on climate change for visitors to a museum or a zoo, should find this letter disturbing. Those who are self-aware will

immediately ask themselves - is Mr Bartels' assertion true? And, if so, how well does my teaching, or the explanatory material that I am responsible for, reflect a balanced account of the vexed topic of global warming?

Well, here are four simple tests of how you are doing.

Do your pupils (or zoo visitors) believe that average global temperature has increased over the last few years? How do they know? Did you tell them, or did you just allow them to gain that impression from the remorseless global warming propaganda churned out daily by radio, television and newspapers? For, to most people's surprise, global temperature has remained static for the last 7 years, the late 20th century warming of about 0.4 deg. C ending in 1998 (FIG. 1). A further oddity is that during this temperature stasis, human emissions of carbon dioxide continued their inexorable increase (FIG. 2); yet isn't carbon dioxide supposed to be causing the much feared but not at the moment apparent global warming?

Which leads to our second test. Do your pupils believe that the pattern of increasing atmospheric carbon dioxide is a deadly hazard to the planet? Do they believe that the overall rise in temperature of about 0.6 deg. C during the 20th century was CAUSED by accumulating carbon dioxide in the atmosphere, and that therefore carbon dioxide is a disbenefit? Because if they do, then they have been badly misinformed in several ways.

Data from Antarctic and Greenland ice cores show unequivocally that over the recent geological past major temperature shifts have PRECEDED their parallel shifts in carbon dioxide by periods of a few hundred to a few thousand years (FIG. 3). It is also the case that within Earth's annual (plant-driven) carbon dioxide cycle, seasonal change in temperature precedes the parallel seasonal change in carbon dioxide by five months. The inevitable conclusion is that at both short and long time scales, carbon dioxide cannot be the primary driver of temperature change - after all, lung cancer does not cause smoking. Second, though carbon dioxide is a greenhouse gas, any warming caused by its increase during the 20th century is so mild that it cannot be identified as distinct from natural warming trends; and, anyway, such warming is more likely to be environmentally beneficial than harmful. Third and finally, another major benefice of increasing carbon dioxide is the stimulus that it provides for vigorous plant growth, plus water economy through efficient evapo-transpiration. In the geological past, atmospheric carbon dioxide has commonly reached levels of 1000 ppm and greater (compared with 380 ppm, and rising, now), resulting in prolific plant growth without other known untoward effects.

The third test is to ask your pupils whether they think that catastrophic melting of glaciers is taking place throughout the world, especially at the two poles, and that this melting is caused by human greenhouse gas emissions? For such is certainly the message propagated on the evening television news bulletins. What have you, as an educator, done to correct this misimpression? Have you told your pupils that -

yes - many glaciers throughout the world are retreating but that that retreat started in the late 19th century, which far predates the great 20th century increase in carbon dioxide emissions (FIG. 4)? Have you told them that as modern glaciers retreat some are now exposing the trunks of subfossil trees several thousand years old, demonstrating that in the Early Holocene - when climate was a degree or so warmer than today - forests grew where subsequently glaciers expanded. Do your pupils know that though local glaciers are retreating in West Antarctica, the great East Antarctic ice sheet is characterised by falling temperatures and thickening ice at the South Pole and increasing areas of sea ice around the periphery (FIGS. 5A, 5B)? Do they know that the Greenland ice cap too is thickening, and that the melting sea-ice in the Arctic Ocean is in response to a temperature rise which is only now reaching the level of a previous natural temperature peak in about 1940 (FIGS. 6A, 6B), which the polar bears seem to have survived well enough?

Fourthly, what do your pupils or visitors know about the so-called biodiversity crisis? Do they believe - as assiduously pushed by the biological modellers - that a temperature rise of only 1 or 2 deg. C is going to lead to widespread "unnatural" extinctions? Well, if they do then, like the modellers, they must be innocent of knowledge of not only the main cause of contemporary climate change but also of one of the great unifying principles of biology, which is evolution. Yes, of course climate change causes extinctions, but it just as surely causes the isolation of small groups of organisms, followed by diversification and, sometimes, the

origin of new species. Climate change - as a major driver of general environmental change - is the very engine room of evolution. Temperature changes, weather changes, precipitation changes - and biomes and ecosystems in turn adjust by migrating either laterally or vertically so that they stay within their particular ecological comfort zones (Fig. 7). During this process multifarious new niches are created, which opportunistic populations can occupy and diversify within. Climate change thus drives evolution. Renaming this phenomenon a "biodiversity crisis" is alarmism, not science.

A quick tot-up of your answers to the above questions should provide a fair indication of how you are doing as an educator or communicator on climate change. If you answered "yes" to most of the questions, then you can be confident that you are doing a great job. If you answered mostly "no", then you have some homework to do.

Communicating accurate information about complex environmental issues to the public, including especially young persons, is not easy. Nor is it aided by the widespread zealotry of government agencies and non-government organisations (NGOs) for spreading propaganda on environmental causes of the day. A quick visit to a range of "educational" websites on climate change (Departments of Education or Environment, Science Academies, major museums, environmental organisations etc.) will reveal that the authors of most would accumulate many "nos" if their writings were subjected to the four tests above. A typical example from New Zealand reads: *"Earth is getting warmer*

faster, due largely to greenhouse gas emissions from human activity"". This, the very first sentence of a website aimed at school children (www.4million.org.nz), presents two unsubstantiatable and highly controversial statements as if they were unassailable facts. A critique of other similarly biased material at this website can be found in a June 2 press release at http://www.climatescience.org.nz. And all this misinformation is on an official website which contains the disclaimer: "*The information on this website is, according to the Ministry for the Environment's best efforts, accurate at the time of publication and the Ministry makes every reasonable effort to keep it current and accurate".* The message to educators is that we need to beware of the information posted on all such "official" climate websites, for nearly all of it has a more or less subtle propaganda slant.

If such "official" sources cannot provide unbiased advice on processes of climate change, where can we turn for help with our homework? Well, unfortunately not to the UN's Intergovernmental Panel on Climate change (IPCC), for though detailed IPCC reports contain much excellent science, it is nonethless often tainted by a subtle "human-caused global warming" bias. Overall, the IPCC unfortunately now acts as an alarmist advocate regarding human-caused climate change.

Discharging our obligations as educators or communicators, and doing our homework, therefore involves at least two things. First, we must make strenuous efforts to use our own critical faculties to filter the daily stream of global

warming alarmism that pours out of uncritical media sources. Second, we need to seek out the writings and information provided by expert climate scientists who maintain an agnostic stance towards human-caused global warming. Such persons are often derogatorily termed "climate sceptics", as if scepticism was somehow an unhealthy, rather than necessary, attribute in a scientist.

Some material to get started with is listed below. Reading it will open the windows to a new world for any reader who has formerly only been exposed to the alarmist view on global warming. Enjoy your new found uncertainty, all the while bearing in mind John Meynard Keynes' provocative rhetorical question: "When I discover new facts, I change my mind. What do you do, Sir? ".

Professor Bob Carter works on palaeoclimatic research at James Cook University, Townsville, Australia. He is a former Director of the Australian secretariat for the Ocean Drilling Program.

Books

Burroughs, W. (ed.) 2003 Climate into the 21st Century. World Meteorological Organisation & Cambridge Univ. Press, 240 pp. *(An excellent, well-balanced account of the basic meteorological principles of climate change).*

Essex, C. & McKitrick, R. 2002 Taken by Storm. The Troubled Science, Policy and Politics of Global Warming. Key Porter paperback (ISBN 1 55263 212 1, available from Amazon CANADA). *(An insightful, critical and fun analysis of global warming).*

Gerhard, L.C. et al. 2001 Geological Perspectives of Global Climate Change. American Association of Petroleum Geologists, Studies in Geology #47 (ISBN 0 89181 053 6, available from AAPG website). *(An excellent, though technical, collection of papers on geological aspects of human-caused global warming).*

Michaels, P. J. 2004 Meltdown. The Predictable Distortion of Global Warming by Scientists, Politicians, and the Media Cato Institute, 208 pp. (ISBN: 1-930865-59-7; order at). *(A useful history, and critical analysis, of the human-caused global warming hypothesis).*

Websites

www.co2science.org. *(Extensive easy-to-read, critical analysis and comment on a wide range of climate-related issues).*

www.lavoisier.com.au. *(Contains many useful links to balanced and critical analyses on greenhouse issues).*

www.uoguelph.ca/~rmckitri/research/trc.html. *(Critical analysis of the influential "hockey-stick" graph).*

www.numberwatch.co.uk. *(Humorous and insightful analyses by John Brignell on the unsound use of public statistics).*

Sharpgary.org/GCCFuture.html. *(A valuable list of web resources about climate change).*

climatesci.atmos.colostate.edu/?p=53. *(Authoritative comment by Professor Roger Pielke Snr. on climate change issues).*

www.friendsofscience.org/index.php?ide=3. *(Web-based video documentary on climate change by Canadian scientists).*

FIGURE CAPTIONS

Fig. 1. Average global temperature for the period 1980 to 2005. Note that the late 20th century phase of gentle warming ended in 1998, after which the average temperature has neither increased nor decreased (after the Climate Research Unit, University of East Anglia).

Fig. 2. Average global temperature compared to human-caused carbon dioxide emissions for the period 1865 to 2000. Note that temperature between 1905 and 1940, which preceded the large rise in emissions, increased naturally by a similar amount and at a similar rate to temperature between 1970 and 1998, and that temperature decreased during the

1940 to 1980 period of greatest increase in emissions (after the Intergovernmental Panel on Climate Change, 3rd Assessment Report).

Fig. 3. Comparison of temperature change and atmospheric carbon dioxide change across the last glacial-interglacial warming. Note that warming temperature (A) precedes increased atmospheric carbon dioxide (B) by about 2,000 years (after Monnin et al., Nature, Jan. 5, 2001).

Fig. 4a. Twenty glacier length records from different parts of the world, starting before 1600. Note that a general decline in glacier length commenced in the mid-19th century, and that some glaciers (Norway, New Zealand) show late 20th century re-advance (after IPCC, 2001, TAR Fig. 2.18; original data from http://www.geo.unizh.ch/wgms/).

Fig. 4b. Mt. Cook and the Tasman Glacier (right). During the last glaciation, 20,000 years ago, the glacier expanded tens of kilometers further down the valley and the ice thickened so much that it coalesded with ice in adjacent valleys to create a small ice cap, through which only the tips of the mountain peaks protruded through it.

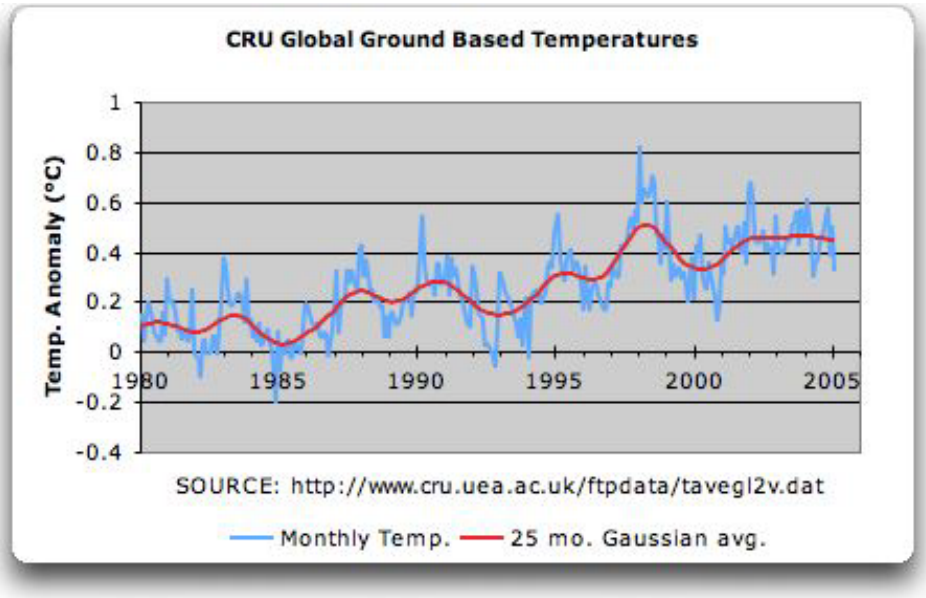
Fig. 5a. Surface temperature between 1957 and 2000 at the South Pole, with atmospheric carbon dioxide from 1973. Temperature falls as carbon dioxide rises (after John Daly, 2003).

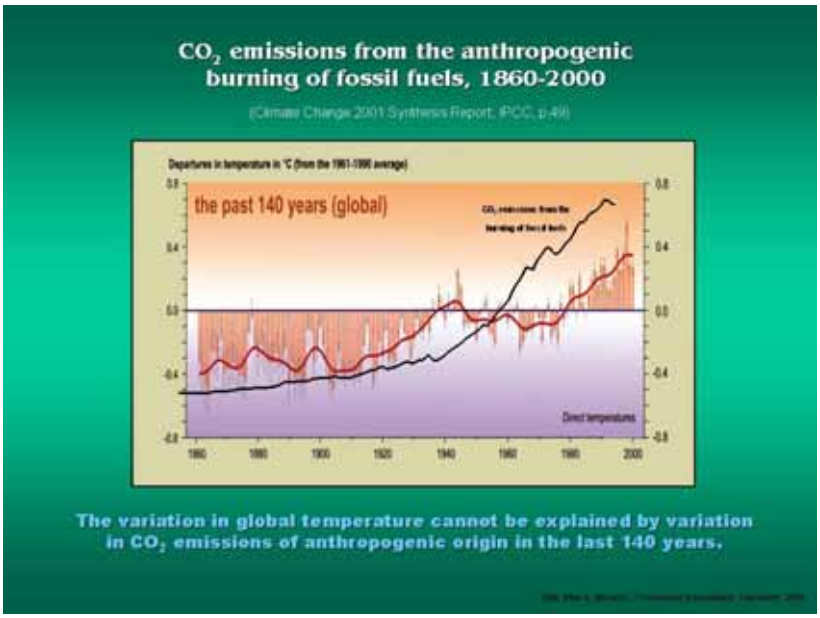
Fig. 5b. Average annual area of sea-ice around Antarctica between 1979 and 1998. Note that the overall area increased by 212,000 sq km (after J. Zwally, Journal of Geophysical Research, 2002).

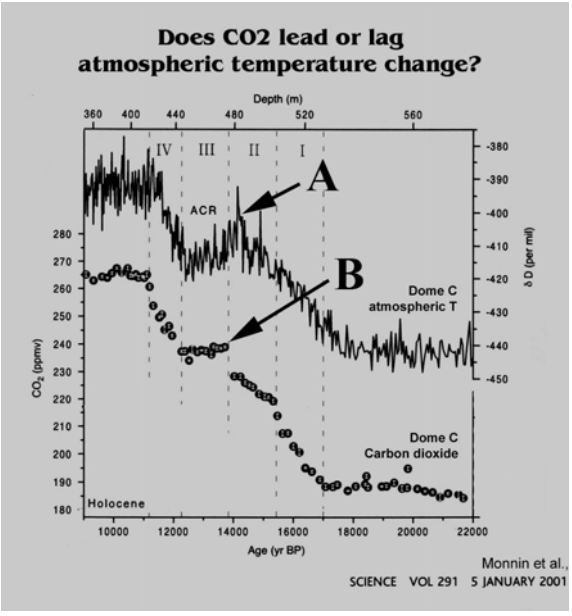
Fig. 6a. Elevation of the surface of the Greenland ice sheet as measured by satellite. Note the minor melting around the periphery, but that the thickness of the bulk of the ice sheet increased by an average of 5.4 cm/yr between 1992 and 2003.

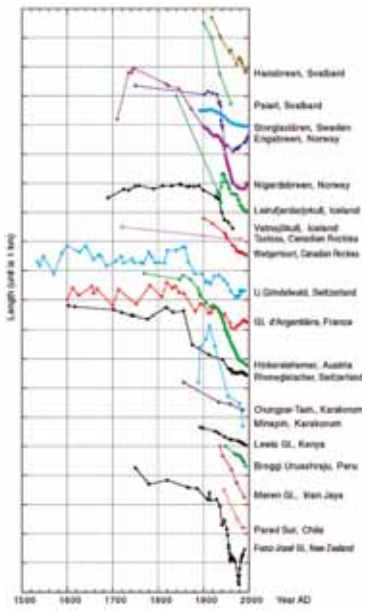
Fig. 6b. Arctic annual mean temperature record between 1880 and 2003. Note that the late 20th century warming occurred at a similar rate, and is now attaining a similar magnitude, to the previous natural warming between 1917 and 1938 (data after NASA, as plotted at Junk Science, Nov. 18, 2004).

Fig. 7. Takahe Valley, Fiordland New Zealand, a classic glacially-scoured, U-shaped valley that was filled with several hundred metres of ice only 20,000 years ago. It was only after deglacial warming, and ice melting, that this valley became a suitable habitat for the preservation of the rare gallinule *Notornis*.


CRU Global Ground Based Temperatures
Temp. Anomaly (°C)
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
1980
1985
1990
1995
2000
2005
SOURCE: http://www.cru.uea.ac.uk/ftpdata/tavegl2v.dat
Monthly Temp.
25 mo. Gaussian avg.


CO_2 emissions from the anthropogenic burning of fossil fuels, 1860-2000
(Climate Change 2001 Synthesis Report, IPCC, p.49)
the past 140 years (global)
Direct temperatures
The variation in global temperature cannot be explained by variation in CO_2 emissions of anthropogenic origin in the last 140 years.


Does CO2 lead or lag atmospheric temperature change?
Depth (m)
360
400
440
480
520
560
IV
III
II
I
A
ACR
B
Dome C atmospheric T
Dome C Carbon dioxide
Holocene
CO_2 (ppmv)
δ D (per mil)
Age (yr BP)
10000
12000
14000
16000
18000
20000
22000
Monnin et al.,
SCIENCE VOL 291 5 JANUARY 2001



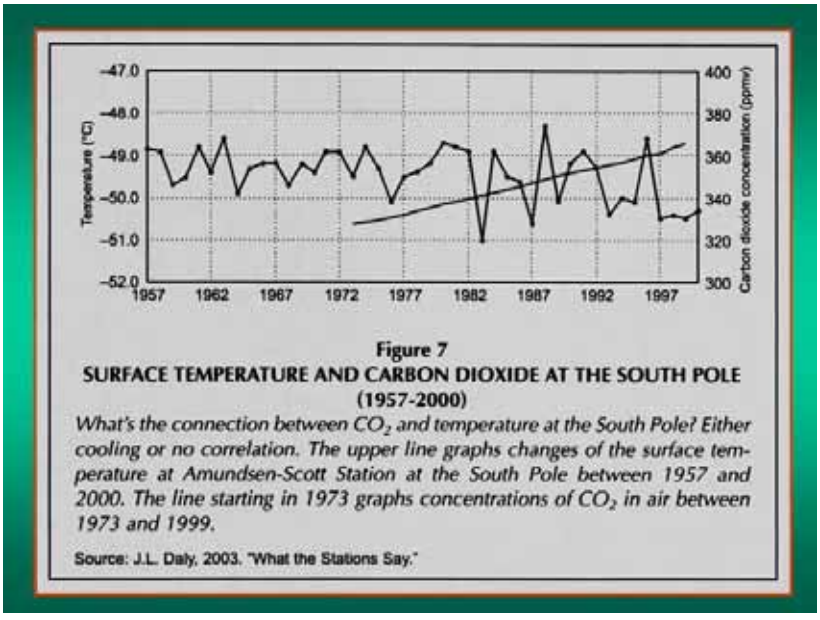
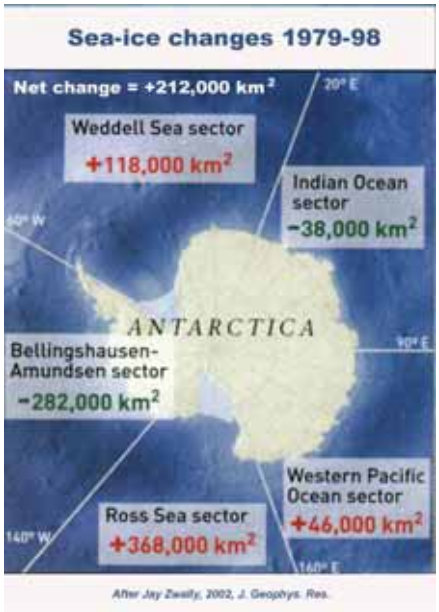
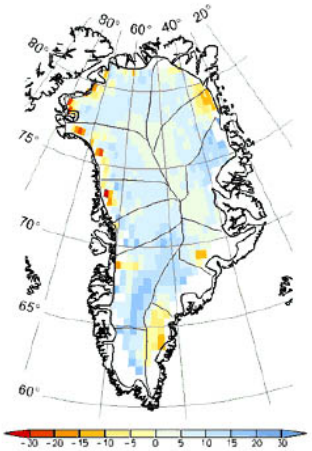


Figure 7
SURFACE TEMPERATURE AND CARBON DIOXIDE AT THE SOUTH POLE (1957-2000)

What's the connection between CO_2 and temperature at the South Pole? Either cooling or no correlation. The upper line graphs changes of the surface temperature at Amundsen-Scott Station at the South Pole between 1957 and 2000. The line starting in 1973 graphs concentrations of CO_2 in air between 1973 and 1999.

Source: J.L. Daly, 2003. "What the Stations Say."





Greenland ice-sheet elevation change in cm/year (see colour scale) derived from 11 years of ERS-1/ERS-2 satellite altimeter data, 1992-2003. Result: 5.4 cm/year *increase*.