On Cucumbers and Flooded Pits

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Synopsis

The way we humans use Nature, and the price we must pay for dispensing with her services, to varying degrees, is reviewed, using as examples our cultivation of a salad vegetable, and the choices we must make when cleaning up after destructive industrial activities. I link the two themes, via the fate of agriculture and industry in the former German Democratic Republic, starting with a scene from the recent film, *Good bye, Lenin*. The Spreewald region, south of Berlin, has an ideal climate for growing cucumbers, but the surrounding countryside was also exploited for its brown coal reserves. The abandoned open-cast mines are now being restored, partly into uneconomic fields and forests, using huge sums from the central authorities, and partly by natural processes, requiring far less funding.

Our discussion leads us, through human efforts to create artificial, sustainable environments, such as the International Space Station and Biosphere 2, to the consideration of wide vistas of space and time: from the early history of life on Earth, to the prospect of life in the imminent future; from our planet's surface, to the outer reaches of the solar system.

Some conclusions:

— With enough resources, cucumbers may be grown anywhere in the Solar System. Water is no problem.

— Reversing the threatened greenhouse warming using air conditioning is ridiculously expensive: it is much cheaper to reduce fossil-fuel emissions or extract the greenhouse gases from the atmosphere.

— Optimal restoration of the environment may require us to take minimal action and spend rather little, but this can conflict with public safety, job creation, and property development.

— The natural environment provides extremely resilient surroundings which can tolerate a lot of human disturbance, but if we push it too far, it may push us back, out of existence.

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In the recent film *Good bye, Lenin*, a loyal supporter of the East German regime suffers a heart attack, and lies in a coma for eight months. During this period, the Berlin wall comes down, and the political system changes beyond all recognition. When she wakes up, her son and daughter try to protect her from the new reality by decorating her room with old-fashioned wallpaper and furniture, and drawing the curtains against a newly-visible Coca-Cola sign. To her children's alarm, the first thing she asks for is a dish of *Spreewald pickled cucumbers*, a local brand by now impossible to obtain, having been replaced in the stores by cheaper imported products.

The Spreewald is a swampy, forested region, an hour or so south-east of Berlin, with a mixed German-speaking and Slavic population. Abundant water and a warm growing season make the land ideal for growing vegetables, particularly cucumbers. When my wife and I made a visit there this year, the local economy appeared to have recovered from the re-unification 'disaster': the area now hosts a thriving tourist industry, with visitors from many ethnic groups, and claims to have the World's Only Cucumber Museum. The local cucumbers have now become a luxury ecological product, sampled, together with brown ale, bread and dripping, by seekers after traditional fare.

The cucumber provides a good example of how we try to distance ourselves from natural conditions. In the climate of the Spreewald, cucumbers may be grown outdoors. In Britain, where cooler summer temperatures prevail, they are traditionally grown under glass, in 'cucumber frames': miniature, unheated greenhouses. In the present day, of course, cucumbers must be available the whole year round, so they are grown in heated glass-houses in the winter, subjected to massive irrigation in dry climates, and trucked or air-freighted in if they are not produced locally. Hydroponic techniques dispense with the necessity for soil, so, in principle, cucumbers may be grown using pure, 'unnatural', chemicals. If we were to abandon our own environment and take ourselves off to outer space, we wouldn't lack for cucumbers: abundant water for their cultivation, far more than exists around the Earth's thin outer shell, is present in the icy giant planets, their orbiting moons, and comets.

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The last-mentioned extreme example gives us an idea of how we need Nature: we may, to varying degrees, ignore the natural environment, but we then have to pay a price. How high the price is, and what we must pay it with, depends upon the circumstances. The most unnatural environment that has supported human life for extended periods is the International Space Station, which has now had humans in continuous residence for over two years, and is projected to cost around $100 billion [1]. The ground-based attempt to create a closed environment, Biosphere 2, in Arizona, which started operating fully in 1991, ran into difficulties when its levels of oxygen and carbon dioxide began to decline [2]. It is now operated as an experimental partially-open facility by Columbia University, and its running costs include $600,000 a year in electricity for cooling and ventilation [3].

The cost of cooling Biosphere 2 is a revealing point, and the reason for this is the *greenhouse effect*. Incoming light from the Sun, which is required for the plants in the facility to grow, together with solar radiation at near-infra-red wavelengths, warms the plants and their surroundings up. The long-wave thermal infra-red radiation which they then give off is unable

to pass through the surrounding glass, so the temperature would rise unacceptably in the absence of artificial cooling. The same effect occurs in the global environment where we live, at the bottom of the Earth's atmosphere. The outgoing thermal radiation is blocked by atmospheric water vapour, and the so-called 'greenhouse gases', including carbon dioxide, methane, and the notorious ozone-destroying chlorofluorocarbon compounds. If the global greenhouse effect did not exist, the Earth's surface would be entirely covered with ice and snow; and this '*snowball Earth*' condition may, in fact, have occurred in the distant past, roughly 600–700 million years ago [4], some time before the rapid increase in abundance of life forms in the Cambrian period around 550 million years ago. The increase in greenhouse gas concentration which is occurring today, as a result of the burning of fossil fuels, is predicted in the rather near future to increase global average temperatures by a few degrees. This rise in temperature, though small at first glance, may in some places cause climatic changes which are unacceptable for agriculture or the local animal and plant life.

Artificial cooling or 'air conditioning', which merely redistributes heat, will be unable to counteract an excessive global greenhouse effect. That is, unless the waste heat which is generated isa transported through the atmosphere, either by constructing impracticably high towers, or by generating powerful beams of microwave, visible or near infra-red radiation, to send the heat off into space. The costs of such a 'reverse greenhouse' operation, which will require energy generated by nuclear or other non-fossil-fuel sources, can easily be seen to exceed almost any other method of ameliorating the problem, including, of course, reducing fossil-fuel emissions, or even removing greenhouse gases already present. The ridiculously uneconomic nature of the 'reverse greenhouse' technique is a clear example of why we should usually not try to oppose natural forces, but let them assist us.

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Let us now return to the German cucumber-growing Spreewald. Only a few kilometres away from the market-gardening swamps lies a very different kind of environment, our reactions to which exemplify the problems, challenges and opportunities that lie in our interaction with Nature. The open-cast mining of brown coal in the former GDR, and the subsequent abandonment of most of the mines, has left the countryside littered with huge pits, which invariably fill with water. An excellent overview of the situation has recently been published in *Die Zeit* [5]. Billions of euros have been allocated to restoring the land after this vast despoliation, but the result is often agricultural land of minimal fertility, or forests of conifers which turn out to have no economic value. In fact, a cost–benefit calculation suggests that it may be best to leave the mined areas alone. They have been found to act as refuges for many rare and threatened plant and animal species. Also, since they undergo rapid transformations, due to land-slips, erosion by water, and colonization by new species, they have become natural laboratories for biological research.

The social and political situation is, however, not so simple. The instability of the terrain is a worry to the responsible mining engineers, for whom safety has the highest priority, particularly since land-slips and the resulting tidal waves have caused a number of fatal accidents. The acid water in the pits, though beneficial to some rare plants and waterfowl, may damage freshwater fisheries. Moreover, responsibility for the area is dispersed amongst a number of bodies, which all have different priorities. Land restoration is paid for by the federal government

and the European Union, but nature conservation is the responsibility of the ill-funded *Länder.* The local authorities hope to develop the newly-formed lakes for boating and other forms of tourism. Property speculators want to develop the most desirable sites for their own purposes. The land restoration projects, though of doubtful economic value, provide many hard-to-find jobs in this depressed region. And so on.

The choices to be made when considering how to heal the damage caused by industrial activities are thus complex ones. Nature conservation may often be best served by the most inexpensive method: that of leaving the system alone and letting it take care of itself. This idea has even been confirmed in the case of massive oil pollution incidents, such as those caused by the *Amoco Cadiz*, *Braer*, and *Exxon Valdez*, where more environmental damage was caused by dispersant chemicals and other cleanup operations than by the oil spill itself.

To put it brutally: we may need Nature, but Nature does not need us. James Lovelock's 'Gaia' hypothesis, though it may not be correct in detail, can provide us with a realistic perspective. Life on Earth, coupled with the atmosphere–ocean climate system, acts in a self-regulating manner, and provides robust surroundings which can tolerate a considerable amount of man-made disturbance. We may thus carry on our industrial and social activities far more easily than if we had to regulate the environment ourselves. On the other hand, if we put too much pressure on the natural system, it may regulate us out of existence.

References

[1] European Space Agency, 2001. International Space Station, how much does it cost? http://www.esa.int/export/esaHS/ESAQHA0VMOC_iss_0.html

[2] Biosphere 2, history. http://www.bio2.edu/history.htm

[3] Marguerite Holloway, The glass house in the desert. *Scientific American*, January 2002.

[4] Paul F. Hoffman et al., A Neoproterozoic Snowball Earth. *Science*, 28 August 1998.

[5] Hans Schuh, Das Paradies im Restloch. *Die Zeit,* 7 August 2003, p. 23.