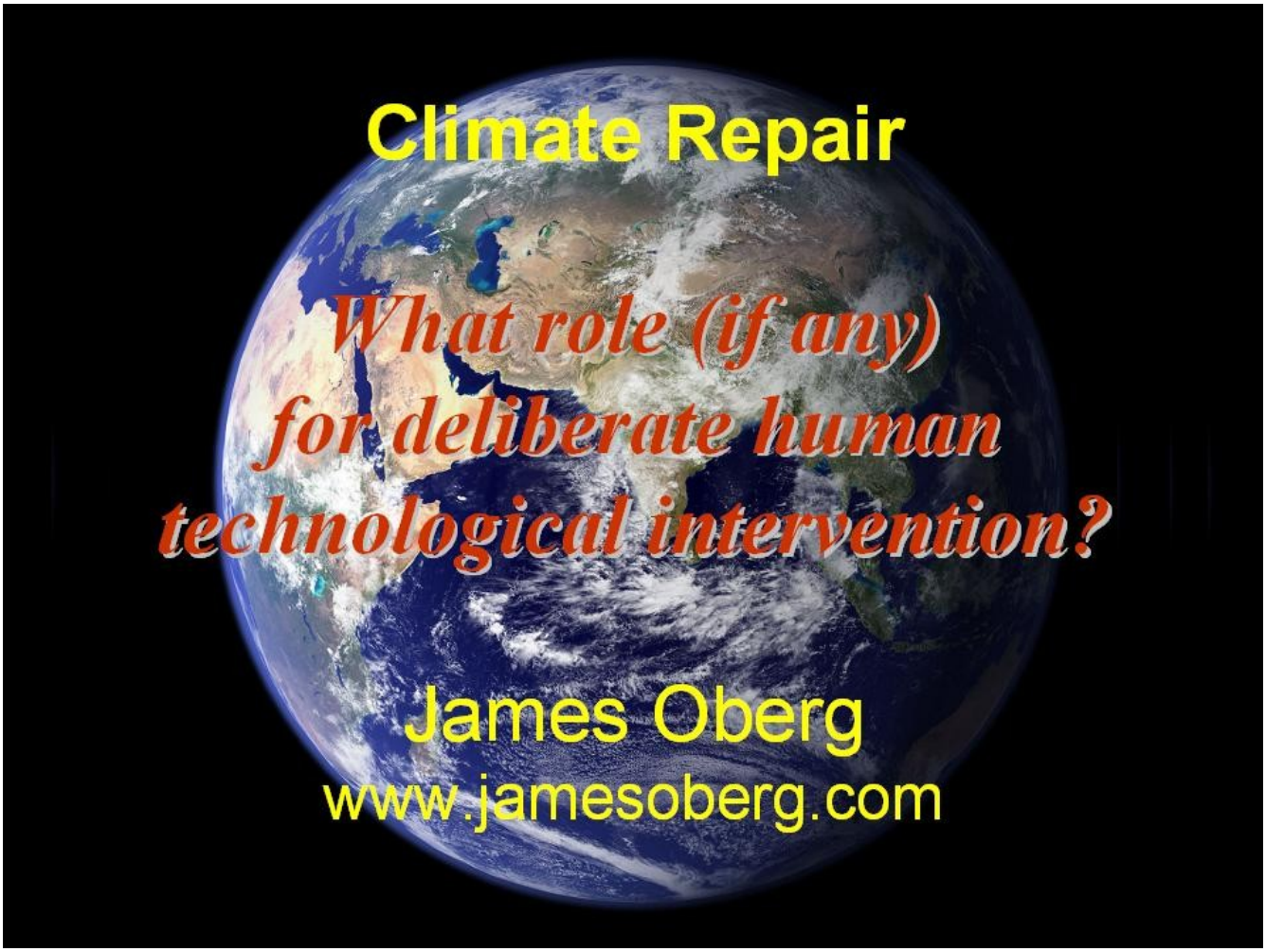
Climate Repair
What role (if any) for deliberate human technological intervention?
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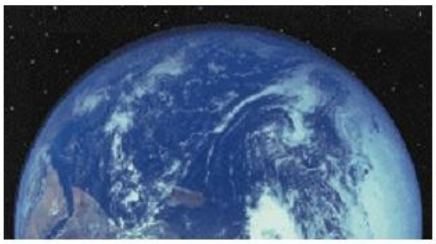
Quod erit (not ‘erat’) demonstrandum



- To control climate threats in the future, we are beginning to imagine an entire spectrum of purposeful human intervention in Earth's biosphere at all scales.
- We must as a society discover a strategy of responding to the many unintentional but global impacts of human industrial and agricultural activity. Use of both passive and active responses may provide higher efficacy.
- In parallel, we must actively assess natural threats at all scales and develop both passive and active remedies.
- ***An activist, interventionist approach to artificially repairing damage and threats to Earth's biosphere -- both accidentally man-made and randomly natural in origin -- could be one of the most intense ideological and philosophical arguments of the new century.***

The Lake Nyos Catastrophe

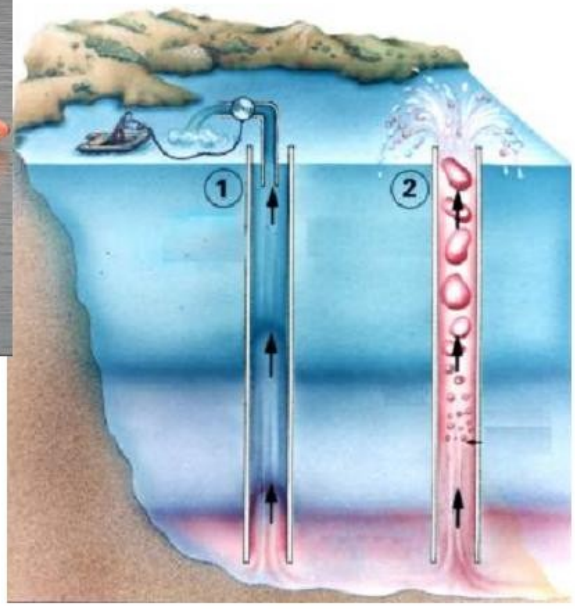
In a remote corner of Cameroon, in West Africa, people lived in harmony with nature, with no local industry, and no large agricultural operations. There was plenty of rain, and fertile soil easy for family farms. The human presence there had no impact on the stable ecosystem. It didn't save them.

Ruined sign of the wiped-out town

Survivor retells the doom of his village

Developing a cure

[left] Over the deepest portion of the lake, scientists took water samples down to the bottom – aware they might trigger a new instability.



[right] The solution was to lower strong pipes to the bottom, begin pumping water (1), and then get out of the way as the gas-loaded water rose and burst into froth naturally.

implications

** The issue of ethical objections to human "interference with nature" never arose

** The key to developing a remedial strategy was in attaining an accurate understanding of the real causes of the catastrophe

** Questions of national sovereignty were handled

** The environmental "repair strategy" entailed some risk even when performing initial small-scale tests

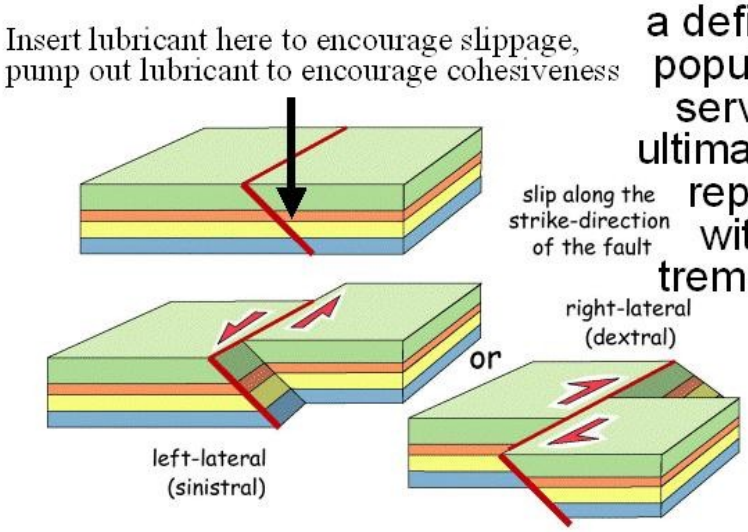
** These risks even went beyond a 'mere' replay of the original catastrophe, since the lake natural dam was (and remains) in danger of collapse

** The chosen solution, which appears to be working, did not require application of expensive external energies but literally re-channeled natural forces

Artificial Earthquakes -- discussion

The earthquakes are being 'triggered' by the intervention, but the basic causation is natural tectonic forces. Tell that to a judge.

At first, the goal would be to cap the maximum energy of any eventual quake. Next would be a goal of forcing a quake to occur in a defined interval when the population and emergency services are on alert. The ultimate benefit would be to replace one major quake with many many smaller tremors that fell below any significant damage threshhold.



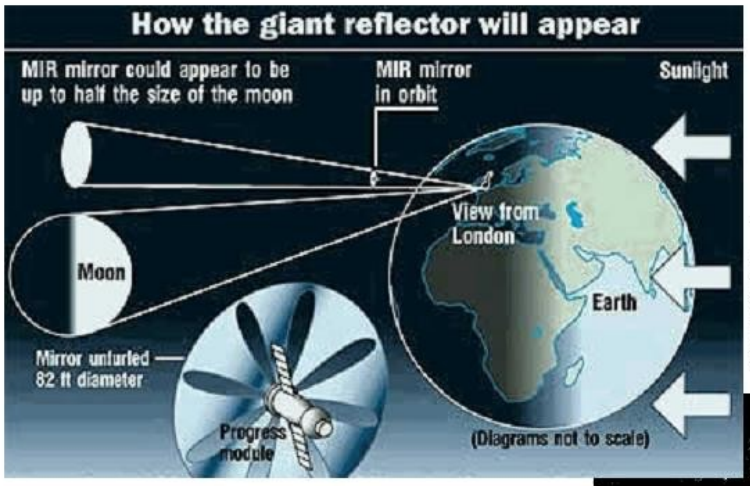
surface albedo modification

Amount of sunlight reflected back from ground impacts cloud formation and rainfall

[left] Space view of New Zealand park shows effect of fence to keep grazing herds outside of preserve near volcano

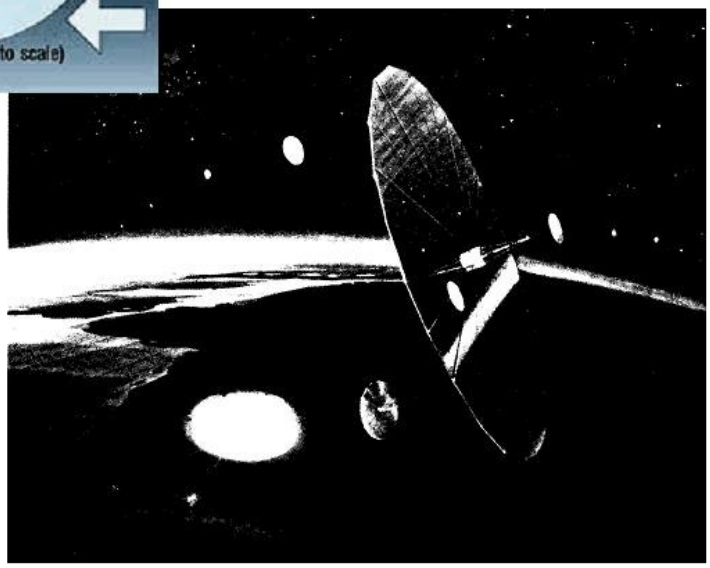
Israeli-Eqyptian border has been clearly visible to space travelers since the 1960s

Insolation modulation experiments



[left] Actual Russian test of small 'space mirror' for night illumination

[below] NASA study of a fleet of orbiting mirrors for ground environmental effects



Both the desirability and the technology for using space mirrors for directing sunlight at desired nightside targets have been discussed for decades and have already been tried out in orbit

The Tunguska Blast and New York City

The H-bomb-sized Tunguska blast in 1908 was big enough to inflict massive damage on any city unlucky enough to be under its fall. Map (rt) shows area of knocked-down trees.

Earth moves 18 miles per second in its orbit. If this object had crossed Earth's path only three minutes sooner, it could have hit Moscow and killed a million people.

Is it dangerous to be able to defend the Earth?

- Carl Sagan's warning: it may be MORE hazardous to possess a technological defense against this unlikely hazard.
- Reason: If it's doable, it's possible some madman will use it to deliberately steer a 'safe' asteroid onto a collision course.
- Concern is groundless because it mixes up the navigation problem of 'collision avoidance' with the totally different navigation, guidance, and control requirements for 'space rendezvous'
- Size of uncertainty ellipsoids and limited magnitude of gentle course-altering techniques guaranty that hypothetical would-be colliders will not have sufficiently-powerful steering authority by the time they have sufficiently-accurate relative position data. They will miss anyway.
- Moral: knowing 'science' isn't enough to make sense of this kind of problem, one also needs familiarity with operational control limitations (& Sagan also warned against expelling Saddam from Kuwait because setting fire to the oil wells would trigger a global 'non-nuclear winter').
- Nice 'Cosmos' guide, poor practical techniques advisor.

A Final Thought – Where Does This Policy Fit Into The Evolution of Human Technology?

Our ancestors feared natural threats, and with good reason. Lightning, floods, fires, and other hazards all were always on the verge of killing them, and often did kill many of them and their loved ones. But through human cleverness and vision, gradually these threats were subdued, brought under control, and even exploited for human benefit, to the prosperity of those who tamed natural forces.

It may be that the human response to climate threats will evolve into safety and gain, in much the same time-tested manner

Argument by analogy

- There's a long, long list of medical interventions in natural body processes and states, sometimes in response to self-imposed situations, sometimes in response to external factors. It's all part of the same big two-part strategy for physical health.
- Earth's global health can be treated the same way. Humans on Earth do have to "live clean" and limit inflicting damage, but that's not going to be enough in the long run. They also will have to intervene in processes unrelated to human actions, because natural threats can be even worse than human-inflicted ones.

Why the single-solution strategy is dangerous

- Premature selection of one ‘perfect answer’ dissuades consideration of better alternatives as they appear.
- Politicians tend to desire first of all to appear to be ‘right’, & to defend any previous position rather than admit error.
- Any ‘solution’ that is actually a pre-selected ‘desirable’ policy suggests that the rationale is post hoc. The answer came FIRST, then came the argumentation.
- Once chosen, such a single-solution would take decades to implement and then take decades more to measure the effectiveness of, and years more to argue, and even then might prove irreversible if it turned out to be wrong.

A less ‘wrong’, less dangerous approach

- So the "enemy" is not merely unintentional human pollution and land ravaging, no matter how visible and how graphic may be those and other anti-biosphere effects. These do need fixing, but it’s not ALL that needs fixing. The enemy is also Mother Nature with her wind and rain patterns, her biological interactions (including epidemics), her geologic and oceanic threats, and even her asteroids.
- Thus I believe that this new millennium will see the rise of an ethic -- hesitantly at first, then overcoming fierce emotional and philosophical opposition -- that people will step in and interfere on purpose with natural processes. They will reduce and avoid and neutralize human impacts on Earth’s environment, but they won’t stop there.
- By adding in the **second phase** of this philosophy to the care of Earth (the same two-phase philosophy we use to maintain our own individual health), we can begin to see technological solutions to technological AND natural problems. We can begin to see effective, affordable defenses and mitigations against threats. And in the more distant future we can glimpse yet-to-be-defined desired engineered improvements to this planet, and ultimately to others as well.

How can ‘fixes’ be tested without ‘killing the patient’?

- We are severely constrained in our ability to experiment on the only subject of our planned ministrations, Earth itself. Don’t add risks.
- However, proposals that allow sub-scale and short-term pilot projects to build confidence are attractive -- and can be started immediately.
- Furthermore, computer modeling is growing in credibility and more progress is predictable.
- If we can’t trust the climate models to validate one set of’solutions’, how can we use them to argue for another SINGLE solution instead?
- We can also test these models “at the extreme” by intensive studies of atmospheres of other worlds – Venus, Mars, Jupiter, Titan, etc.