EARTH REGENERATION SOCIETY, INC.

CLIMATE CHANGE — GLOBAL WARMING AND COOLING

Proposed Legislation

Emergency Climate Stabilization and Earth Regeneration Act of 1990

CURRENT SITUATION

ACTION PROPOSALS

SUPPØRTING MATERIAL

EARTH REGENERATION SOCIETY, INC.
1442A Walnut Street #57, Berkeley, California 94709
(415) 525-4877

Sequence of article numbers, as shown in summary statement [83-4]

* *These items have a prior listing above.*

EARTH REGENERATION SOCIETY, INC.
1442A Walnut Street #57, Berkeley, California 94709
(415) 525-4877

July 4, 1990

To those concerned with climate change and supporting the "Global Warming and Cooling" proposed legislation placed in the Congressional Record November 21, 1989 by Representative Ronald V. Dellums. [769]

Attached you will find background material on climate change. Below is an outline of subject material with notations for the relevant attachments.

Introduction

We have a human right to survive. This right is to be expressed by bringing back a balance between the earth and its atmosphere [722]. This right calls upon us to understand a few things in our own interest:

1. For the last two million years, around 90% of the time there have been glacial periods with ice coming down to New York, Illinois, Southern France, Southern USSR.

2. For about 10% of the time we have had interglacial periods, the climate we know.

3. We are at the end of the present one: C. Bertrand Schultz (USA) [473], Alexis Dreimanis (Canada) [37-12], George Kukla (USA) [KUKL 69], Gifford Miller (USA)].

4. The turn around can happen in a short period of 20 to 40 years [G. Woillard (France)].

The Problem of Climate Change

It is essential to look at the primary physical processes of our earth: soil demineralization, forests dying and being overcut, CO/2 increase, cloud increase, snow and ice increase, and climate intensities by season and latitude [81-21A]. We hear about temperature data. Temperature is a reflection of the primary physical conditions of the soil, biota (forests, swamps, plankton in the ocean), CO/2, clouds, snow/ice, oceans, and the changing processes taking place. Temperature data is, of course, limited in how much it can tell us about the primary processes themselves [673].

The structure of the problem of climate stabilization is: remove a quantity of carbon from the world's atmosphere in a certain number of years, or it will be too late. Crops will be too badly destroyed and the permanent snows will be coming too far down and will not melt back in the summer.

Our estimate is that in the next 15 years the reduction of CO/2 can be brought about through reforestation (75%), marshlands and wetlands (5%), ocean phytoplankton (20%). This means: remove 170 billion tons of carbon worldwide in 15 years. Do so by remineralizing forests to bring them back to life and speed their growth, as in Austria — Gernot Graefe, Austrian Academy of Science program [676A] — in Australia, New Zealand, FRG, GDR, and some in the USA and the USSR. Add in expansion of marshlands and wet lands, and phytoplankton in the oceans where possible — John H. Martin (USA), English, German and other marine research laboratories. [III-1, II-8]

Kenneth E.F. Watt, of the US, is finding a lack of correlation between the amount of fossil fuel used and the rise in atmospheric CO/2, and a strong case for the relation of CO/2 increase to soil mineral depletion, forests dying and more susceptible to fires

and pests, and the impact of increasingly irregular freezing spells on northern and mid-latitude forests [532A].

System of Problems

1. The atmospheric CO/2 level, now at 350 parts per million or above, is apparently as high or higher than it was during the last turn-around from interglacial to glacial conditions about 130,000 years ago [N.J. Shackleton (England); Vostok Antaractic ice-core drilling analysis (USSR and France)].

2. Heat and drought increase in the lower latitudes is associated with clouds, snow and increased freezing in the higher latitudes, a continuous warming and cooling process -- Kenneth E.F. Watt (USA) [673], Victor Kovda (USSR) [519]. For cloud, snow and ice conditions see sections below.

3. The heat and drought, as well as the more intense freezing and shorter growing seasons, are destroying crops in the U.S. (as well as many other countries). The U.S. is faced with cutting back on exports -- U.S. Department of Agriculture, Statistics Office. Other countries hardest hit have been Africa, China, USSR, Iran, Australia [669], England [658] and France (Paris recently flooded).

The effect on crops coming from heat, drought, storms, flooding, tornadoes, freezing, and unusual alternating warm and freezing weather, has hit much of the U.S. particularly Maine, Arkansas, Carolinas, Texas [755], Ohio and California [the great flood of 1986, 50,000 people flooded out].

4. Buckling of the jet stream causes regional drought, heat waves, freezes, and flooding, depending on a region's position relative to the jet stream loops. Excessive looping in the jet stream is associated with cooling climates; and jet stream expansion (moving further south) is promoted by action of increased CO/2 in increasing low altitude to high altitude temperature differences, and low latitude to high latitude temperature differences.

5. Cloud cover over the world is increasing and causing more cooling than the additional heating that is caused by the increased "greenhouse" effect — E. Roeckner et. al. (Federal Republic of Germany) [ROEC 572], Hubert H. Lamb (England).

6. Permafrost is moving downward from the north and the cooling mode is dominant — Victor Kovda (USSR) [I-7], Kenneth E.F. Watt (USA) [673].

7. Snow has been increasing significantly in Northern hemisphere coverage [477] and in depth in Alaska and Tibet — Maynard Miller (USA); in Eastern Canada and Baffin Island — Gifford Miller (USA); in Antarctica (reported by returning workers). Ice depth has been increasing in parts of the Antarctic an average of four to five feet per year for 25 years [78-7].

The snow line in parts of Canada is now 90 to 150 miles further south, comparing the 1980s with the 1970s [791]. Parts of Canada have not had enough frost free days to grow wheat — stated by C. Bertrand Schultz (USA) in Philadelphia in 1986 at the AAAS (American Association for the Advancement of Science), at the meeting of the member association ISGSR (International Society for General Systems Research), and now common knowledge in Canada according to Peter Petronek, Coordinator of Special Projects for Earth Day Canada [798].

Snow depth is increasing in Tibet and on the glaciers in Alaska — Maynard Miller (USA) -- in Northeast Canada and Baffin Island -- Gifford Miller (USA) [II-3] -- in Greenland, in the USSR, and in parts of the Antarctic [78-7].

8. In the period of 1960 to 1980, advancing glaciers increased from 6% to 55% of observed glaciers -- Fred Bruce Wood (USA) [WOOD 406]. Glaciers are changing depending on where they are in the world, with a majority of those monitored showing expansion over those 20 years.

9. The increase of snow and ice over the last 20 years in the Antarctic, on the glaciers of Alaska, Eastern Canada, Baffin Island, Greenland, the USSR, are the rough equivalent of an inch or two drop in ocean level -- it has been recommended that this whole question be given more analytical attention.

Ships have fewer ice-free days during the summer to go around Alaska to the north slope and return; and some harbors in the Antarctic are now too iced over to be used by ships.

10. We are in transition into the next glacial period -- C. Bertrand Schultz (USA), Alexis Dreimanis (Canada) [37-12], Gifford Miller (USA) [II-3], Fred Bernard Wood (USA) [800].

System of Solutions

11. The trunk and branches of trees are about 45% carbon. The health and growth of trees is enhanced by soil with sufficient minerals and trace minerals. Forest net growth rate information is provided by Paul Zinke (USA) [504]. Due to mineral depleted soils, forests are drying out, burning faster [694], are more subject to pest infestation, and are less able to take in CO/2 and put back oxygen.

Forests are dying back also from cold conditions [532A], as well as from drought and acid rain. Over half of the world's forests have been cut down over the last 2500 years.

12. Remineralization of forests with rock dust plus organic material is bringing them back to life -- Gernot Graefe (Austria) [676A], Australia [726, 699] and other countries. Large areas of the USA and other countries have mineral and trace mineral depletion in the range of 25% to 40% -- Mark A. Flock, Agronomist (Brookside Farms Laboratory, New Knoxville, Ohio, testing approximately a million soil samples per year, from various countries).

The soil minerals and trace minerals are essential for forest, crop, animal and human health. Most soils are lacking minerals after 10,000 years of leaching and erosion [Brookside Farms Laboratory, Ohio].

The best solution is the fertilization of soil by fine rock dust, with a broad natural cross section of minerals (i.e., inorganic material) [642]. This is soil remineralization. There is another gain, and that is elimination of the need for most pesticides when the soil is sufficiently remineralized [752, 752A].

13. Solar thermal electric power can replace most of oil burning for power plants, and provide electricity for electric vehicles (mass transit and cars) to replace fossil fuel [762, 796].

14. Ocean remineralization can increase phytoplankton, and significantly add to atmospheric CO/2 reduction -- John H. Martin (USA) [777]. Oceans can be remineralized with iron particles in areas primarily lacking this mineral; but further research and investigation into environmental effects is necessary. This may produce as much as one fifth of global CO/2 reduction over the next 15 years.

The amount of snow increase over the last 40 years (Alaska, Canada, Greenland, USSR, and Antarctica) suggests a drop in ocean levels of one to two inches; oceans are not rising, but tides and storms are becoming more violent -- E. Bryant

(Australia), William F. Tanner (USA) [778], Stephen Rattien (USA) [60-33].

15. General articles.

82-2 "Sonoma Earthweek" talk by Alden Bryant. Sonoma State University, California. April 23, 1990. ..."Earth Day must be viewed as protection of the environment and human life. The environment is being transformed from natural processes (climate change), and human processes (toxic pollution, resource destruction and speeding climate change)."

74-22 Comparison of "Emergency Climate Stabilization and Earth Regeneration Act of 1989" with previous legislation on climate change. There are 16 points described plus a listing of primary scientists of reference.

79-24 Letter from ERS to Andrew Card of the Office of John Sununu, The White House, February 3, 1990, regarding the pending speech by President Bush to the International Panel on Climate Change.

797 "The Role of CO/2 Budgets in Climate Stabilization." Paper by Alden Bryant for the Annual Meeting, International Society for the Systems Sciences, Portland, Oregon. July 9-13, 1990.

541 "U.S. Employment Plan — Earth Regeneration Program" from a 1985 paper by Alden Bryant showing an estimated distribution by sector for 20 million additional jobs in the U.S. required for work on soils, forests, alternative energy technology development, oceans, and cleaning up pollution.

67-8 Press Release, January 5, 1989, regarding ERS participation in various countries, during November and December of 1988, on matters of climate change and climate stabilization.

67-9 Letter from Alden Bryant to Dr. Alexander Borg Olivier, Ambassador, Permanent Representative of Malta to the United Nations, January 5, 1989, regarding the conference at the United Nations building in New York jointly sponsored by Malta and ERS on December 9, 1989.

68-20 Comments on the adequacy of "climate" computer models (started in the 1970s). This two-page outline lists aspects not included significantly (or not at all) in "climate" models.

447 Interview by Alden Bryant and Barbara Logan with Irving Kaplan, January 18, 1984, regarding the origin of the campaign by certain parties to push "warming only" and obscure the rapidly increasing climate change intensities in the summer and winter, and obscure the nature of the full climate change cycle. Objective: put off change in fossil fuel operations, a major source of carbon dioxide.

[83-4 7-4-90]

[FINAL DRAFT - 11/15/91]

This draft replaces the original publication in the U.S. Congressional Record dated November 21, 1989, pp. E4034-4036, and is more comprehensive without changing the original thrust.

H. R. _____

IN THE HOUSE OF REPRESENTATIVES

Mr. DELLUMS introduced the following bill; which was referred to the Committee on _____

A BILL

To provide for participation by the United States in a climate stabilization program.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE; TABLE OF CONTENTS.

(a) SHORT TITLE.--This Act may be cited as the "Emergency Climate Stabilization and Earth Regeneration Act of 1991".

(b) TABLE OF CONTENTS.--The table of contents of this Act is as follows:

TABLE OF CONTENTS

SECTION 2. FINDINGS.

(a) DEVELOPING GOVERNMENT AWARENESS OF RESPONSIBILITY FOR CLIMATE CONDITIONS.--In 1969 Congress recognized both the seriousness of climate change and the responsibility of the Federal government to develop domestic and foreign policies to contribute to the preservation of the environment. The findings of Congressional policy and responsibility in the National Environmental Policy Act of 1969, 42 U.S.C. 4331, and its enforcement led to further identification of the problem in the National Climate Program Act of 1978, 15 U.S.C. 2901, and its enforcement led to the Global Climate Protection Act of 1987, which found "the global nature of this problem" and the need for "vigorous efforts to achieve international cooperation aimed at minimizing and responding to adverse climate change." The Foreign Assistance Act, 22 U.S.C. 262, P.L. 101-167, Sec. 533, provided that (a) "It is the policy of the United States that sustainable economic growth must be predicated on the sustainable management of natural resources. The Secretary of the Treasury shall instruct the United States Executive Directors of each multilateral development bank (MDB) to promote vigorously within each MDB the expansion of programs in areas which address the problems of global climate change." Sec. 534 (b) (1) "In order to achieve the maximum impact from activities relating to energy, the Agency for International Development shall focus energy assistance activities on the key countries, where assistance would have the greatest impact on reducing emissions from greenhouse gasses."

(b) HISTORICAL DATA ON CLIMATE CHANGE PROBLEMS.--Congress recognizes that basic information on climate change was developed in 1975 by the U.S. Committee for the Global Atmospheric Program, National Research Council, Washington, D.C., which issued a report "Understanding Climate Change" which included data on the rising carbon dioxide and curves of glacial cycles for the last 900,000 years.

(c) ACCELERATING PLANETARY CLIMATE CONDITIONS.--(1) The Congress finds

that existing laws have not produced sufficient climate stabilization effort because human technological activity is accelerating the rate of carbon dioxide buildup in the atmosphere. The net result of this buildup is to speed up the greenhouse effect, leading to shifts of global climate, whether global warming and/or increasingly extreme and variable weather conditions. If these shifts continue, destruction of lives and property and, according to geological evidence, transition past the point of no return can follow. It is the consensus of a majority of workers in the field of ecology that we are now in a period of ecological destabilization that, given the time and effort needed to stabilize climatic conditions, constitutes an ecological emergency. Serious debate must be held on the earth-atmosphere system producing climate change, on defining the goals to bring about climate stabilization, and on the best ways of achieving these goals.

(2) For purposes of paragraph (1)--

(A) the term "destruction of lives and property" refers to the world-wide effects a carbon dioxide-induced climate shift is having upon agriculture and the technology base; and

(B) the term "point of no return" refers to the point past which the shift of climate into destabilized conditions is no longer humanly controllable.

(d) PROGRAM NECESSITY.--(1) The Congress also finds that, because the earth is already into the transition into seriously destabilized conditions, and that soil, forest and climatic changes are already occurring (such as abnormal weather patterns), a coordinated, international, emergency climate-stabilization program is imperative. This program should reduce from the present 356 parts per million to 280 ppm or less atmospheric carbon dioxide to levels low enough to prevent this rapidly accelerating transition. Climate stabilization can be accomplished through a program of ecosystem regeneration which re-establishes balance between atmospheric carbon dioxide and other gases which interact to influence atmospheric conditions. A significant means to re-establish this balance is large-scale soil remineralization, which supports the regeneration of planetary vegetation and significant natural carbon sinks, which remove atmospheric carbon dioxide. Additional and essential means of climate stabilization include reforestation, saving swamps and estuaries, and rapid and extensive reduction of fossil fuel consumption through conservation and development of alternative energy technology.

(2) For purposes of paragraph (1)--

(A) the term "soil remineralization" means adding rock dust, with appropriate proportions of minerals and trace minerals, to the soil to support the growth of microorganisms and plant life that transforms atmospheric carbon dioxide to carbon and oxygen; and

(B) the term "program of ecosystem regeneration" means a program of sufficient magnitude and of such timing as to permit climate stabilization before climate conditions preclude action. This includes major reductions in activities that produce carbon dioxide such as fossil fuel consumption; and in activities that impair natural mechanisms for removing carbon dioxide from the atmosphere, such as forestry practices that reduce forest acreage beyond minimal requirements for fuel and building materials. It also involves replacing improper agricultural practices that deplete the soil, such as excessive use of petrochemical fertilizers, pesticides and

herbicides, with methods of sustainable agriculture that enhance soil fertility.

(e) TIME PERIOD TO ACCOMPLISH OBJECTIVES.--The Congress also finds that the key time period for accomplishing the purposes of this Act is ten to fifteen years, with implementation to begin as soon as possible.

SECTION 3. PURPOSES.

(a) OVERALL PURPOSE.--The purpose of this Act is to establish a process whereby the Congress and the President of the United States shall cooperate in a national and international program to--

(1) reduce heat, drought, and subsequent famine and forest fires, tornadoes, and to decrease the freezing extremes, snow buildup, flooding, cloud cover, and storms in the winter;

(2) promote regeneration of the earth through reforestation, soil and ocean remineralization, conservation, and alternative energy technology development; and

(3) maximize our food and agricultural security through research on soil remineralization and other environmentally sound, sustainable means that increase the health and hardiness of crop plants and their resistance to climatic extremes and pest infestation;

(4) in these ways assist in the creation and development of a secure, environmentally sustainable way of life that is consistent with long-term climate stabilization.

(b) SPECIFIC MEANS.--(1) Reduction of carbon dioxide is to be accomplished by several means--

(A) A program to plant fast-growing mixed species of trees on suitable land, in the United States and/or other regions, especially in climatic and geographical regions that foster rapid tree growth, to consume additional carbon dioxide from the atmosphere;

(B) A program to revitalize the soils of existing forests and newly forested areas with finely ground mixed gravel dust, plus finely ground limestone on soils that have already become very acidic, to increase the growth of plant life so that it will more quickly consume atmospheric carbon dioxide. The Congress notes that the effectiveness of rock dust in substantially increasing the health and growth of plant life is supported by extensive research, and by the well-documented role of glacially-ground rock dust in restoring soil fertility.

(C) Conservation of energy, by means of thermal insulation of dwellings, factories and public and private office buildings; solar, wind, geothermal, and other non-carbon dioxide producing energy sources other than nuclear; work on increased energy efficiency; and by other feasible means of conserving energy;

(D) Remineralization of other major natural carbon sinks, to substantially increase the vitality and fecundity of their life forms as a means of removing carbon dioxide from the atmosphere, including bays, rivers, lakes, marshes, swamps and other wetlands, and the continental shelves;

(2) Whether acting alone or in a coordinated international effort, the United States

recognizes that its contribution to this global program to reduce the greenhouse gases and stabilize the world's climate should be at least proportional to its past and current emission of greenhouse gases relative to the other nations of the world.

SECTION 4. CLIMATE STABILIZATION PROGRAM.

(a) IN GENERAL.--The President shall, within 270 days from the date of the enactment of this Act, promulgate a regulation providing for a climatic stabilization program to be coordinated by the Board established by section 5(b) and other appropriate Federal agencies, as determined by the President. The President shall begin and continue the implementation of the program to the extent funds are appropriated for such purpose or are available in the Fund established by section 9(a).

(b) OBTAINING INFORMATION.--(1) The regulation promulgated under subsection (a) shall provide for information development and processing centers which shall cooperate with international agencies concerning data outside the United States and shall develop and process data about world climatic conditions, including the following:

(A) Land surface air temperature.

(B) Rural surface air temperature.

(C) Desertification.

(D) Sea surface temperature.

(E) Troposphere temperature.

(F) Stratospheric air temperature.

(G) Cloud cover and optical characteristics.

(H) Precipitation.

(I) Mapping of soil mineral quality as it bears on forest and crop conditions.

(J) Trends in land use, including forests, swamp cover, marsh lands, and wetlands.

(K) Forest fires and dying forests.

(L) Phytoplankton in ocean areas, nutrient requirements and potential increase in phytoplankton from nutrient supplementation, (e.g., iron).

(M) Snow cover, depth and volume of snow.

(N) Sea ice, arctic and antarctic ice cover.

(O) Losses due to environmental conditions, including, but not limited to, record heat spells, drought, storms with heavy rain and wind, floods, landslides, tornadoes and hurricanes, record cold conditions, abnormal frost and freezing conditions, blizzards, snowstorms, snow and ice buildup, length of growing seasons by region, forests dying, forest fires, forest and agricultural insect infestation, acid rain, lake damage, earthquakes, and volcanic action.

(2) The information development and processing centers shall assess and publish information on developing climate conditions, and their effects upon life on earth, in the following ways:

(A) Data shall be used to track and analyze the losses of food crops, utilities, buildings, roads, trees, production facilities of all types, human life, and

elements of the technological infrastructure, including the magnitude of such losses over the 10 years immediately preceding the date of the enactment of this Act.

(B) When volcanic eruptions occur, the contribution of volcanic ash to soil remineralization shall be reviewed by an appropriate interagency force.

(C) The magnitude and rate of future breakdown of technological systems due to climate shift shall be estimated on a periodic basis.

(c) OVERALL PLAN.--The regulation promulgated under subsection (a) shall include a plan for the implementation of the climate stabilization program that provides for--

(1) participation at city, county, and State levels, through councils described in section 5(c), and at national and international levels;

(2) preliminary Federal, State, and local plans to be developed and implemented as soon as practicable;

(3) goals for the United States, including those that will determine the--

(A) quantity and quality of rock dust and other amendments to be applied to soil for at least five years of forest or crop growth;

(B) land areas to be remineralized by application of rock dust, and the quantity and quality of rock dust and other amendments to be applied to soils to substantially increase forest growth during the next fifteen years;

(C) priorities for regions and areas to be remineralized with rock dust to gain the greatest benefit in reduction of atmospheric carbon dioxide;

(4) description of international, national, State, and local policies that will support the climate stabilization program;

(5) international cooperation to maximize the primary activities of soil, forest, and energy work and reduction of atmospheric carbon dioxide, including--

(A) preferential support of climatic regions where forests can be developed and atmospheric carbon stored in biomass sinks the fastest;

(B) assistance for other countries in meeting their tree planting and soil remineralization objectives;

(6) planning and coordination of Federal actions through appropriate agencies for the purpose of stabilizing climate conditions by--

(A) immediately initiating emergency projects until more permanent programs are established;

(B) establishing a national "CO/2 Budget", which shall include current rates of carbon dioxide increase or decrease by source, annual rates, and plans for reductions for each of the next five years;

(C) redeveloping and expanding forests, swamps, marsh lands, and wetlands;

(D) preparing estimates for additional net growth of existing remineralized forests and of newly planted forest areas;

(E) developing, enhancing, and mass-producing remineralization technology, including equipment to manufacture rock dust and equipment to apply it to the soil;

(F) participating in international research, investigating environmental implications, and plans to increase ocean phytoplankton, where addition of

particular nutrients in specific areas will produce rapid, beneficial increases in phytoplankton and thereby add significantly to reduction of global atmospheric carbon dioxide;

(G) implementing changes in industry, transportation, energy technology, and agriculture that support the program;

(7) the enlistment of cooperation and participation by both the public and private sectors at city, county, State, and Federal levels as provided for in sections 5 and 6 in ways that will maximize--

(A) employment efforts in a manner that will provide full employment (with support services such as food, housing, health and childcare, and education) of the Nation's work force in a climate of international cooperation as this effort becomes a central theme of the Nation's productive activity until there is a restoration of earth-atmosphere balance; and

(B) cooperative enterprises to provide the rock grinding equipment necessary to produce sufficient rock dust for the purposes described in paragraph (3);

(8) the curtailment of counterproductive technological practices, including--

(A) reduction of fossil fuel use (including current oil wells and coal burning facilities) through conservation and development of alternative energy technology other than nuclear sources;

(B) the reduction of fossil fuel development projects, such as off-shore drilling for oil and further development in Alaska;

(C) providing appropriate guidelines for the cutting of trees for timber, fuel, and other agricultural, industrial, or residential purposes; and

(D) the reduction in the use of toxic and radioactive materials that are harmful to living tissue;

(9) support for ecologically sound technology and practices, including funding for--

(A) agricultural technology that supports remineralization and energy technology that improves the efficiency with which petrochemical fuels are used or develops an alternative, ecologically sound energy technology, the waste products of which rapidly recycle in the ecosystem and whose ecological effects are within the tolerances of the ecosystem for supporting life native to this geological period;

(B) development of alternative, benign energy technology such as cost-and energy-efficient solar thermal electric power plants in lieu of coal, oil, or nuclear plants; and

(C) more fitting waste management policies, such as the composting of urban solid waste and the depositing of this material back into the soil in the region near which it is generated;

(D) environmentally and climatically sound waste-management

policies, including the remineralizing and composting of urban solid wastes and wastes from animal feedlots and the depositing of this material back into the soil in the region near which it is generated.

(10) employment and community requirements of the program, including--

(A) training and retraining people to be employed on soil, forest, and energy projects; and

(B) maintaining the stability of local communities so that people working on the program can continue to reside in the locale in which they were residing before beginning such work; and

(11) the implementation of Articles 2.3 and 2.4 of the Charter of the United Nations (requiring the settlement of international disputes by peaceful means) and Articles 55 and 56 of such Charter (promoting higher standards of living, full employment, and conditions of economic and social progress and development).

SECTION 5. ORGANIZATION.

(a) CONGRESSIONAL COMMITTEES.--The Speaker of the House of Representatives and the President pro tempore of the Senate shall take steps to establish, through the rulemaking procedures of the Senate and the House, a Joint Committee on Climate Stabilization for the purpose of carrying out oversight activities with respect to the climate stabilization program established pursuant to this Act.

(b) ESTABLISHMENT OF FEDERAL COUNCIL.--(1) The Council on Climate Stabilization and Earth Regeneration is hereby established as an independent Federal agency responsible directly to the President.

(2) The Council shall draw upon the research findings and action programs of the Committee on Earth Sciences of the Federal Coordinating Council on Science and Engineering Technology, the National Academy of Sciences, the National Oceanic and Atmospheric Administration, the National Science Foundation, the National Aeronautic and Space Administration, the Department of Energy, the Environmental Protection Agency, and other organizations engaged in climate stabilization efforts.

(3) The President shall appoint 24 members to the Council, with the advice and consent of the Senate, from various political, labor, business, ethnic, environmental, scientific and other backgrounds, including a representative each from the National Governors Association and the National Council of Mayors, to assure the proper implementation of the program carried out under this Act.

(4) The Board shall review and report directly to the President concerning the implementation of the program carried out under this Act, especially with respect to ensuring the participation and coordination of Federal agencies.

(5) Members of the Board shall serve for a term of four years, except that one-half of the members first appointed to the Board shall serve terms of two years. Members may be reappointed.

(6) The Chairman shall be appointed by the President, with the advice and consent of the Senate, and such Chairman shall serve a term of four years, but may be

reappointed.

(7) Sufficient funds for staffing for the board shall be appropriated.

(c) STATE AND LOCAL COUNCILS.--(1) The President and the Council established by subsection (b) shall take steps to encourage the establishment of councils at the State and local levels of government to assure implementation of the climate stabilization program at those levels through the participation of State and local governments, trade unions, industry, environmental organizations and other citizen groups in an interdisciplinary manner.

(2) These State and local councils shall prepare measures to prevent or minimize agricultural and technological damage and to maintain the technological and agricultural infrastructure. They shall also estimate, monitor, and report the effects of climate change on agricultural and technological systems, including utilities, transportation, communication, and industry.

SECTION 6. DISTRIBUTION OF RESPONSIBILITY.

The President shall provide, in the regulation promulgated under section 4(a) for maximum participation and cooperation at the international, Federal, State, and local levels of government including--

(1) the development and implementation of plans at each level by the councils established under section 5(c) with appropriate cooperation among the councils at each level within a State;

(2) Federal agencies, under the direction of the Council established in section 5(b), being responsible for reviewing, coordinating, and providing assistance with respect to each State plan resulting from the cooperation of the councils at the various levels in a State;

(3) designation of proper procedure for the management of funds at each level;

(4) private participation through the manufacture and installation of cost- and energy-efficient solar thermal electric power facilities that displace carbon dioxide producing facilities;

(5) widespread public participation; and

(6) extensive cooperation with international organizations.

SECTION 7. CRISIS MANAGEMENT.

The President shall provide, in the regulation promulgated under section 4(a), for a unified crisis management operation through coordinated international, Federal, State, and local interdisciplinary activity designed to minimize damage from, and to maintain agricultural and industrial production under, changing atmospheric conditions that cause natural disasters.

SECTION 8. EVALUATION.

The President shall provide, in the regulation promulgated under section 4(a), for extensive and ongoing evaluation of the climate stabilization program established under this Act, including--

(1) evaluation conducted by the Council created by section 5(b) and the State and local councils created pursuant to section 5(c) of the decrease in carbon dioxide achieved by reforestation, soil improvement, energy conservation, and alternative energy technology development;

(2) inclusion in each environmental impact statement made under the National Environmental Policy Act of an estimate of the proposed project on the carbon dioxide levels annually; and

(3) compliance with national law and international treaties and agreements affecting ecology standards.

SECTION 9. FUNDING.

(a) TAX REVENUES.--

(1) IMPOSITION OF CORPORATE TAX SURCHARGE.--

(A) IN GENERAL.--Subchapter A of chapter 1 of the Internal Revenue Code of 1986 (relating to determination of tax liability) is amended by adding at the end thereof the following new part:

"PART IX--CORPORATE TAX SURCHARGE

"Sec. 60. Corporate tax surcharge.

"SEC. 60. CORPORATE TAX SURCHARGE.

"(a) IMPOSITION OF TAX.--In addition to the other taxes imposed by this chapter, there is hereby imposed on the income of every corporation for each surtax year a tax equal to five percent of the tax imposed by this chapter (determined without regard to this section) for such surtax year.

"(b) SURTAX YEAR AND PERIOD.--For purposes of this section--

"(1) SURTAX YEAR.--The term 'surtax year' means any taxable year beginning or ending during a surtax period.

"(2) SURTAX PERIOD.--The term 'surtax period' means the period beginning on January 1, 1992 and ending on December 31, 1996.

"(c) NO CREDITS AGAINST TAX.--The tax imposed by this section shall not be treated as a tax imposed by this chapter for purposes of determining any credit allowable under subpart A, B, or D of part IV of this subchapter or under section 936.

"(d) SPECIAL RULES.--

"(1) SPECIAL RULE WHERE ENTIRE TAXABLE YEAR NOT WITHIN SURTAX PERIOD.--In the case of any surtax year any portion of which is not within a surtax period, the amount of the tax imposed by subsection (a) shall be an amount equal to the amount of the tax which would be imposed by subsection (a) for the surtax year (determined without regard to this paragraph) multiplied by a fraction--

"(A) the numerator of which is the number of days in the surtax year

which are within the surtax period, and

"(B) the denominator of which is the number of days in the entire surtax year.

"(2) SECTION 15 NOT TO APPLY.--Section 15 shall not apply to the tax imposed by this section.

"(e) ESTIMATED TAX.--For purposes of applying section 6655 (relating to estimated tax for corporations) with respect to any installment which is required to take into account the tax imposed by this section, section 6655(d)(1)(B)(ii) shall not apply.

"(f) ADMINISTRATIVE PROVISIONS.--For purposes of this title, to the extent the tax imposed by this section is attributable (under regulations prescribed by the Secretary) to a tax imposed by another section of this chapter, such tax shall be deemed to be imposed by such other section."

(B) CLERICAL AMENDMENT.--The table of parts for subchapter A of chapter 1 of such Code is amended by adding at the end thereof the following new item:

"Part IX. Corporate tax surcharge."

(C) EFFECTIVE DATE.--The amendments made by this paragraph shall apply to taxable years ending after December 31, 1991.

(2) CLIMATE STABILIZATION TRUST FUND.--

(A) IN GENERAL.--Subchapter A of chapter 98 of such Code (relating to trust fund code) is amended by adding at the end thereof the following new section:

"SEC. 9511. CLIMATE STABILIZATION TRUST FUND.

"(a) CREATION OF TRUST FUND.--There is established in the Treasury of the United States a trust fund to be known as the 'Climate Stabilization Trust Fund', consisting of such amounts as may be appropriated or credited to such Trust Fund as provided in this section or section 9602(b).

"(b) TRANSFERS TO TRUST FUND.--There is hereby appropriated to the Climate Stabilization Trust Fund the amount determined by the Secretary to be equivalent to the taxes received in the Treasury under section 60 (relating to corporate tax surcharge).

"(c) EXPENDITURES FROM TRUST FUND.--Amounts in the Climate Stabilization Trust Fund shall be available, as provided in appropriation Acts, to carry out the Emergency Climate Stabilization and Earth Regeneration Act of 1991."

(B) CLERICAL AMENDMENT.--The table of sections for such subchapter is amended by adding at the end thereof the following new item:

"Sec. 9511. Climate Stabilization Trust Fund."

(b) STATE AND LOCAL FUNDING.--Eighty percent of the funding for any project carried out under this Act shall be from Federal sources. The remainder of the funding for any such project shall be divided equally between State and local governments.

(c) AUTHORIZATION OF APPROPRIATIONS.--There are authorized to be appropriated such sums as may be necessary to carry out this Act.

FORMAT AND DESCRIPTION FOR A CO/2 BUDGET

Earth Regeneration Society CO/2 Budget — soil, forest, energy work

Increase of CO/2	Grams of carbon input to the atmosphere		
	Current 12 month period	Future period 10 years	
gasoline use	xxx	xxx	(2)
oil use	xxx	xxx	
coal use	xxx	xxx	
natural gas use	xxx	xxx	
cutting trees	xxx	xxx	
soil deterioration	xxx	xxx	
natural disasters (1)	xxx	xxx	
Total	xxx	xxx	

Reduction of CO/2	Grams of carbon removed from the atmosphere	
Plant life		
forests (based on net growth rate)	xxx	xxx
swamps " "	xxx	xxx
grass lands " "	xxx	xxx
oceans - phytoplankton	xxx	xxx
Soil		
soil remineralization, resulting in renewed and faster plant growth	xxx	xxx
Energy		
conservation (equivalent CO/2 reduction) [Range of energy conservation and fossil fuel offset activities]	xxx	xxx
alternative technology (equivalent CO/2 reduction) [Range of energy activities that will result in reduction of CO/2 output]	xxx	xxx
Total	xxx	xxx
Net effect on CO/2	xxx	xxx
Portion of global reduction of CO/2 required (This figure is more significant in the case of a state or country CO/2 Budget)		xxx

(1) Combination of effects throughout the regional economy — from heat, drought, fires, infestation, floods, hurricanes, tornadoes, storms, feezing, and shorter growing seasons. Translate into terms of increase in CO/2 (direct and indirect) — fossil fuel use to recover from the disaster, loss of tree cover and loss of alternative energy facilities.

(2) Each country, state, county, or other region, will have its own numbers to put in place of xxx for the one-year or 10-year column.

Considerations for developing a CO/2 Budget

1. The world's forests, swamps, deltas, and grasslands are a major source of taking in carbon dioxide (CO/2) from the atmosphere. The oceans are also a CO/2 sink, but they change relatively slowly — except for possible phytoplankton expansion in mid-Pacific and Antarctic Ocean areas. The forests and swamps, and the soil they grow in, together with the oceans, are the key to our efforts to stabilize climate.

2. CO/2 is the main driving force in the climate change. The increase (from less than 280 parts per million [ppm] in the atmosphere for about 120,000 years since the last change from interglacial to glacial conditions, to 350 ppm now) means an increased "greenhouse" effect. This increase produces more heat, drought, moisture evaporating in the lower latitudes, and more condensing, clouds, snow, and freezing in the higher latitudes, resulting in all-time record cold moving down from the north in the winter and sporadically in the summer as well.

3. The purpose of a CO/2 budget is to explain the balance between the CO/2 being put into the atmosphere, and the amount being taken out by forests, swamps, and oceans, and how much is being offset by conservation and alternative energy development. This budget is a chart which indicates progress toward reducing CO/2 and achieving a stable level of approximately 280 ppm.

4. Climate stabilization means our effort to bring CO/2 back to the level that human society has known in the past, with a livable pattern of summers and winters and the ability to grow sufficient food.

5. A CO/2 Budget means analysis of the changes in agriculture, industrial production, services and individual living patterns required to bring about the necessary changes in soil, forest, and energy conditions.

6. One interesting problem for the short run is to show how much fossil fuel will be necessary to produce alternative energy technology, and to carry out soil, forest and ocean work.

7. We need to evaluate elements and sub-elements for the CO/2 Budget. This will require input from groups in the region involved with the activities included in the CO/2 Budget, such as mass transit and reforestation. Show how these groups see the changes; and what will be their part in implementing the CO/2 Budget.

8. Projections of future work and results must, to the extent possible, be tied to the qualitative changes taking place as the earth goes further into glacial conditions. The earth went from primarily warming mode up to the 1940s, and from then on into a primarily cooling mode (with more cloud and snow buildup and record cold in the winter).

9. The goal of a CO/2 Budget is to develop a sufficiently thorough base for information, and out of this a comprehensive integrated jobs and environment program for a region. The assumptions and calculations must have the broadest possible assistance from specialists in different disciplines, from public and private agencies, and citizen response throughout the areas concerned.

10. The international goal for a CO/2 Budget, coordinated through the United Nations, is the combining of data from actual regional work programs and providing an effective process for planning and keeping track of CO/2 reduction on a word-wide basis.

10

Earth Regeneration and the Environment

by

Alden Bryant

Prepared for the Conference

HUMAN RIGHTS AND THE FUTURE

University of California at Berkeley

August 7-17, 1989

Human rights, environment and climate stabilization

On December 10, 1948, came the birth of the Declaration of Human Rights. That was a time following the destruction of war. That was a time of creation, the formation of the United Nations, the international forum and guiding body for all nations [1].

That was a time when the environment was viewed by most people as unchanging and permanently life supporting.

That was a time when geologists searched for clues and studied the age of the earth, the movement of continents, the periods of expanded ice formation, and, yes, the relatively recent series off twenty or more glacial periods (each lasting from about 70,000 to 120,000 years).

Did anyone connect glacial periods to the environment around us, our weather, the growing of our food? Did anyone connect glacial periods to human rights?

That was a time back in the 1940s.

That was when the average annual temperature in the northern hemisphere had been rising since the beginning of the century. Atmospheric carbon dioxide (CO/2) had also been rising significantly — a jump of ten or more points in the later 1800s, as farmers seriously cut back forests in Europe and North America, then a rapid rise in the 1900s. The "greenhouse effect" increases with CO/2 in the atmosphere. The cycle has been moving. The cycle includes increased warming and evaporation where the sun hits more directly and increased cloud cover and snow in the higher latitudes — more freezing climate coming down, shorter growing seasons for food crops. The additional warming was predominant until about 40 years ago. By then the increased cloud and snow conditions started to become predominant and northern hemisphere temperatures started down.

We are now well into the transition into the next glacial period. The 40 years of the Declaration of Human Rights is also the very same time of seriously increasing weather extremes — areas and periods of heat as well as areas of increasing and more erratic freezing.

Extending the recent history of natural catastrophies, driven by increasing hot and cold air masses (and resultant air and water currents), gives an estimate of ten to fifteen years and our lives will all be at risk from the destructive effects of climate change, particularly from shorter or insufficient growing

7 ✓ ✓

seasons.

Our environment is no longer supportive and infinite. Industrial, military, agricultural and urban pollution is causing illness and death at a rate not yet fully understood (or exposed to public knowledge).

Our climate is no longer the variable climate (but within stable bounds) that humans have known for the 10,000 plus years of the interglacial period.

What we have been doing so far is setting forth a context for the most supreme effort humans have ever made. When the ice melted back at the end of the last glacial period (from about 18,000 to 11,000 years ago) there may have been about five million people total. Now we are five billion, and we are all going to be at risk.

The proof and "hard data"

Soil minerals and trace minerals (a few cubic centimeters per acre, such as zinc) have been leeched down by 10,000 years of rains, or eroded away. In the main soil testing laboratory in the US, in New Knoxville, Ohio, the Director suggests we view the situation as roughly a 25% to 40% reduction. Forests are reduced by nearly half compared with 2500 years ago. CO/2 is up from 270 parts per million to 350 ppm in the atmosphere. Cloud coverage is up in middle latitudes. The recent study by scientists in the Federal Republic of Germany [2] indicates that the amount of cloud coverage now is reflecting more than half again as much heat away from the earth as is generated by the warming in the lower latitudes. Hubert H. Lamb, of England, stressed this effect many years ago. The snow cover is greater, deeper, and lasts longer into the spring, shortening growing seasons in northern latitudes. These are the primary physical conditions, when taken from a general system approach, are now seen to be determing the transition into the next glacial period.

For three years now the International Society for General Systems Research has, in its annual meetings, included a session on climate — with attention to the primary systems determing climate change (relations between soil mineralization, forests, CO/2, clouds, snow/ice, and erratic weather extremes in summer and winter) [3]. The concern has been for the rapidity with which the earth is moving into a next glacial period [4]. The concern has been with the increasing tempo over the last 40 years of warming in the lower latitudes, producing increased cloud cover and snow — greatly increased snow conditions on the glaciers in Alaska, in the Northeast of Canada, in Tibet and the Antarctic. Snow depth is greater and the snow is lasting longer into the spring. Growing seasons are shorter in parts of Canada. Reference C. Bertrand Schultz, Gifford Miller, Maynard Miller, Dreimanis, Kukla and Watt.

Kenneth E.F. Watt, of the US, is finding a lack of correlation between the amount of fossil fuel used and the rise in atmospheric CO/2, and a strong case for the relation of CO/2 increase to soil mineral depletion, dying forests, more susceptibility to fires and pests, and the impact of increasingly irregular freezing spells on northern and mid-latitude forests [5,6].

Often we find references to increased rate of plant growth in response to increased CO/2, with no mention of soil mineral content. When there is a general depletion condition in the soil, no amount of CO/2 in the atmosphere can encourage plant or forest growth. The proof lies in the dying forests and the opposite, i.e., remineralization work carried out by Graefe under the Austrian Academy of Sciences [7].

Focus on the problem and the solution

There is a gap between the required soil-forest-energy program (e.g., 42-year strong, or 27-year super program) and the destruction of food supplies and functioning infrastructure from rapidly increasing heat/drought, freezing, snow and ice, irregular frosts, high winds, hurricanes, floods, and shorter growing season.

To close the gap means to bring the biospheric balance of earth and atmosphere from 25 to 15 years and mobilize for cooperative survival, to the extent possible, during the next ten or fifteen years [8].

It is essential to look at the primary physical processes of our earth [9]: soil demineralization, forests dying and being overcut, CO/2 increase, cloud increase, snow and ice increase [10], and climate intensities by season and latitude. We hear about temperature data. Temperature is a reflection of the primary physical conditions of the soil, biota (forests, swamps, plankton in the ocean), CO/2, clouds, snow/ice, oceans, and the changing processes taking place. Temperature data, is, of course, limited in how much it can tell us about the primary processes themselves [11].

Consider, for example, the value of taking material (a) on "greenhouse" gases and climate by K. Ya. Kondratyev of the USSR, (b) on permafrost, soils, cooling, by Victor Kovda of the USSR [12], and (c) on soil remineralization with rock dust and organic additives to bring dying forests back to life by Gernot Graefe of Austria [7]. Consider the possible results from the combining of findings and analysis of three such sources, and possible programmatic outcomes more interesting than any one of them might have anticipated.

In this context, two climate stabilization programs are indicated on Figure 1. These programs are based on simple assumptions, but the main point is highlighted, i.e., that a "best possible" biospheric program (using 0.3 Gt C reduction/yr. and then 0.5) still leaves us approximately ten years short of the goal of stabilizing climate. The critical conditions have to do with rapidly increasing disasters from flooding, hurricanes, tornadoes, heat and drought, freezing spells in the winter and spring, dying and burning forests, and more. There is at least a ten year time gap between our climate needs and environmental possibilities.

Figure 1 Move the "population" curve and the "27-year program" curve towards each other, and close the gap. This is what survival means from now on, "close the gap".

ACTION: Attempt to move the "population" curve outward and upward — protect against climate disasters. Try to speed up still further the "27-year Program" curve — remove the excess CO/2 before it is too late (this would be reflected in Figure 1 as a shift to the left. Enough shift and much of the world's population would be saved from being wiped out.)

Figure 1 is developed in a simple format in order to focus on the basic conditions, the basic problem, and the direction that research, planning and action must take from this time forward.

Close the gap from two sides

The point of this paper is urge that future work on climate analysis, planning and stabilization efforts focus on the two sides of this gap: (1) how regional societies can support themselves and help each other as conditions get rapidly worse; and (2) how we can speed up the CO/2 reduction, given the time frame

indicated [13].

We consider that Figure 1 is the best indicator of what we are facing. This suggests the following set of programs.

Our Common Goals

It is time to search for common international understanding of:

(1) carbon in the world's atmosphere: 745 Gt, 1988;

(2) the amount of carbon to remove in order to attempt climate stabilization: reduce 350 ppm to 270 = -80 ppm x 2.13 Gt C/ppm = 170 Gt C;

(3) the amount and type of forests, or other biota, to plant, to rejuvenate, or to save from destruction: regional CO/2 plans throughout the world, optimize CO/2 reduction;

(4) area of soil remineralization to save forests, hectares of rock dust application with organic additives, as specific to each region (for example, note: Austrian methods, Dr. Gernot Graefe, Vienna) — include as part of regional CO/2 plans. Try to optimize, i.e., plant the fastest growing forests first;

(5) regional plans showing estimated contribution to CO/2 increase or decrease, by region, in each of the next five years, coordinated through the United Nations, covering most of the world's land surface, and some of the ocean area: regional plans need to come from the people of the area, and to some extent in cooperation with people from other areas;

(6) financial and resource transfers between developed and lesser developed countries to expedite climate stabilization programs: this suggests annual budgets of what each country can give to the whole and then what each country needs;

(7) peace — increase efforts by the United Nations to participate with local forces to resolve situations in those areas where violence and armed conflict continue. Do so in order that the people of those areas may bring about conditions under which they can create sustainable local and regional economic systems, combined with an adequate quality of life, which can provide the basis for earth regenerative programs. Proceed region by region, and tie into CO/2 plans for each region. CO/2 plans can be quite comprehensive on soil, forests, and certainly as regards energy activities. One example for the near future which has not been given sufficient public recognition — NATO bases can be converted into environmental centers for the regions in which they are located, for purposes of climate stabilization. This is real security.

Additional program directions

Divide the globe into working regions, each to have its CO/2 reduction goal in quantity and time. The sum total of the regions should be brought — to begin with — on paper at least, in line with the figure of 170 Gt C.

Each region has its own specific conditions of soil, trees, ground cover, food production, people, their culture and history, and needs its own region-specific plan. Some regions will be able to have a net reduction effect on CO/2 in a coming year; others will not. It is the sum of all regions that must relate to the figure of 170 Gt C.

Here is the time when much of the best science, technical, and social talent must

be brought together to work out carbon-reduction activities beyond any previous plans [14]. Here is one line of transition from military to earth regeneration programs.

Industry groups will have to help set and reach targets -- in soil, forest and energy work. Both industry and labor will each have strong parts to play, or the job cannot be done [15]. See the CO/2 Council proposals in the Emergency Climate Stabilization and Earth Regeneration Act of 1989.

Production, price, and distribution plans must be developed and implemented as necessary with those industry sectors that have the main role in each region's meeting its CO/2 reduction goal.

Investment guidelines and controls will follow the same process.

Appropriate soil, forest and energy programs will differ greatly from region to region. The combined effect is the goal. The United Nations, and its various bodies, is the logical center for establishing "first round" coordination of regional plans and their desired relation to global targets.

A degree of early comprehensiveness is put forward in the Malta resolution passed unanimously by the United Nations General Assembly on December 6, 1988, which urged: "Conservation of climate as part of the common heritage of mankind."

To carry the planning forward, every part of earth regeneration programs will require the best materials wherever available, their being put to the best use, and resolving the source of payment for them. The central bodies (such as in the UN) must perform as a gigantic international clearing house.

We have not even started on some of the main courses of action that can be undertaken. For example: where are all the best areas in the world for constructing solar thermal electric plants? 125 megawatts are built and functioning in Southern California. Here is the appropriate type of technology to replace nuclear, oil and coal burning power plants, wherever there is available sun, land, distribution grid, technical support for design, building, operation and maintenance. Here is a prime example of a solution that has been held up by the weight of the past (investment in oil and nuclear plants); but a solution that is essential to the new conditions of climate change, climate stabilization, and the survival of human society.

Climate change is causing terrible havoc. Governments and industry councils tend to move only when there is sufficient popular organization and demand for new programs. Hence a steady international education program is essential, as universal as possible, and working its way into the furtherst corners of the world's people. The circle comes around again, because popular understanding and support comes from involvement, from having food and other essentials for daily living, and for at the same time carrying out a limitless array of earth regeneration activities.

The tendency toward organizational strength, progress on climate stabilization, toward implementing an earth regeneration program, implementing physical work on soil, forests and energy to bring down CO/2, can come through use of the CO/2 Budget [16].

The CO/2 Budget represents the physical units determining the climate change, the rate of natural disasters, the loss of human population with its food and infrastructure, and the rate and intensity of the oncoming glaciation process.

The CO/2 Budget is in essence the opposite of a financial budget. The dollar

figures in a budget represent units necessary for the production and distribution of goods and services. You can't eat them or use them directly. They are a kind of fiction to facilitate the production process in a society. The CO/2 Budget is qualitatively different. It is made up of CO/2 units, physical grams of carbon in the atmosphere, the increase and decrease of the CO/2 during a time period (basically a year, with shorter and longer budgets for planning purposes).

The nature of the emergency suggests a preliminary goal: each country submit a first CO/2 Budget to the United Nations by the end of 1989. Assistance teams, drawn from various countries, provide technical help where neded, and the process to be coordinated through the United Nations.

We are now in a new period of history. The growing threat of destruction of most of human life with the changing climate is creating a central and unifying effect. Private enterprize countries, countries with mixed economies, those with planned economies are all being confronted with growing climate intensities. It is the same problem, with each society looking at it with different structure and ways of operation. It is the same problem confronting political parties whether conservative, central, or left. How they respond comes out of the conditions of the lives of their members, where they are in the social, economic and political structure and the conflicts they now face. In the case of England, how will the Tory, the Labour, and the smaller parties respond to the necessity of climate stabilization and the question of human survival over the next ten to fifteen years?

In the U.S. the time can not be very far off when President George Bush, leading elected Democrats, Reverend Jessie Jackson, the Green movement, community organizations, and representataves of various center and left movements, must sit down together and look at the same climate stabilization problem, at the common goals within the U.S. and in cooperation with other countries. How they relate to basic conflicts, to the question of bringing up the quality of life for all people in the country, to transfer of military resources to soil, forest and energy work, to the transfer of operations from fossil fuel and nuclear sectors into benign non-toxic alternative energy technology. These are the basic conflicts, the method of solution of which will determine whether or not we manage to stabilize climate in time.

In summary: affirm the right of every person to a healthy and sustainable environment; and support the United Nations in its work to transform present operations, including the U.N. Environment Programme, into an agency through which the world's governments and people can work toward the fulfillment of this right.

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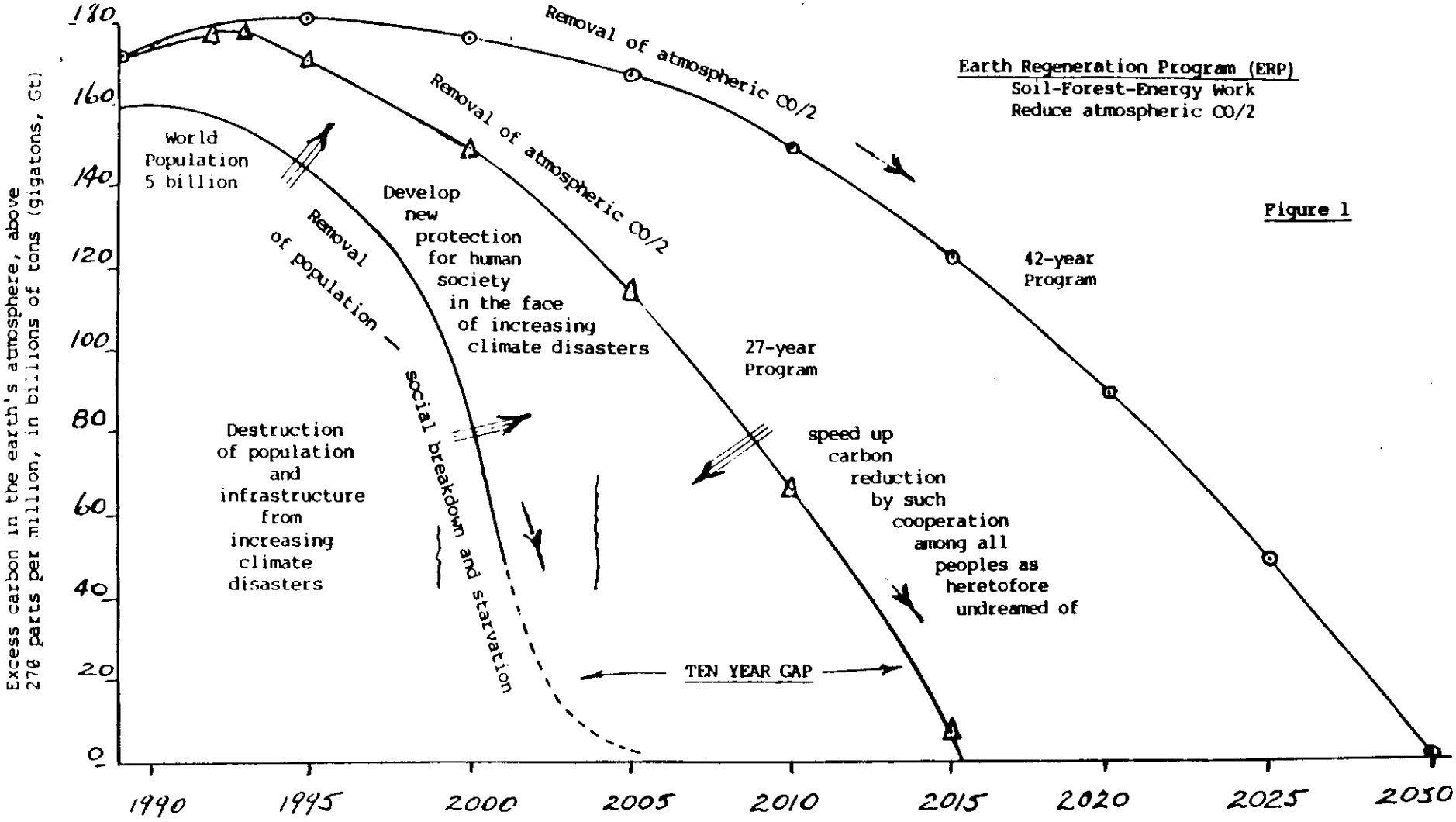

42-yr. program ERP at 0.3 Gt C/yr net removal; with 2.5 Gt net C increase/yr for 8 yrs. and 2.0 for 34 yrs. Carbon removal (new forest, marsh and swamp growth) and carbon increase activities (fossil fuel, forest dying, cutting and burning) are treated as separate activities.

27-yr. program ERP at 0.5 Gt C/yr net removal; with 2.5 Gt net C increase/yr for four yrs., 2.0 for one yr., zero for 22 yrs. Primarily, transition to (benign) alternative energy technology within five years.

'Mini-Ice Age' due, predicts scientist

10-20-85

LINCOLN, Neb. (AP) — The director of the Nebraska Academy of Sciences believes the Northern Hemisphere is heading for a "mini-Ice Age."

C. Bertrand Schultz, a retired University of Nebraska-Lincoln professor of geology, said Nebraska's climate has resembled a kind of "golden age" since the turn of the century.

"During approximately 60 years of the present century we fortunately have had the best agricultural climate in perhaps 3,000 years," he said. "Now we must try to forecast the future scientifically if human populations are to remain in regions such as the central Great Plains, which had to be partially abandoned at times in the immediate past due to erratic, hostile weather conditions."

Schultz said he has traveled to 61 countries during the past 30 years studying changing climates.

"WE'VE BEEN STUDYING Iceland very closely," he said. "Whatever happens to Iceland happens here. It is the world's barometer."

Schultz concurs with other geologists who say that by the year 2010 an Ice Age will engulf the Northern Hemisphere, resulting in Canada's inability to grow grain and the Soviet Union's inability to feed itself.

Even now, he says, parts of Alberta, once rich in wheat, do not have the necessary 41 frost-free days in the growing season needed for a harvest.

"If only people will just pay some attention," Schultz said. "It (the climate) is changing and people have to realize it."

"The mean annual temperature of the Northern Hemisphere has continued to fall," he said. "It has been dropping since 1947, at least as far as we've been able to determine."

EVEN IN RECORDED history of the Great Plains, early settlers experienced a "little ice age," he said.

In the late 1800s, the Great Plains had 11 years of drought and cold temperatures that Schultz said forced about 50,000 people out of eastern Nebraska.

Scientific and historical information indicates there were two major climatic fluctuations in the past 1,000 years. One was at the beginning of the Dark Ages in the late 12th century and the other at the beginning of the "Little Ice Age" during the middle of the 16th century. Temperatures dropped drastically both times.

EARTH REGENERATION SOCIETY, INC.
470 VASSAR AVENUE, BERKELEY, CALIFORNIA 94708 U.S.A.
(415) 525-4877

Professor Aleksis Dreimanis
Geology Department
University of Western Ontario
London, Ontario N6A 3K7
Canada

International Quaternary Research Association
President of working group:
Commission on Genesis and Lithology of Quaternary Deposits, from 1973 to 1987.

Professor Dreimanis knows that we are in the interglacial/glacial transition and is concerned that we understand what is happening, the human role in the process, and that we organize a global response.

Note his "Extended Comment" in Global Change, T.F. Malone and J.G. Roederer, editors. New York, International Council of Scientific Unions Press, 1985. p. 219. Comments are to chapter on "20,000 Years of Global Climatic Change: Paleoclimatic Research Plan."

"We presently live in an interglacial, approaching a transition to the next glacial interval. In order to fully understand the interaction of the second-order effect of human activities upon the first-order transition from the present interglacial to the next glacial climate, we should pay particular attention to the availabe terrestrial and oceanic geologic records of the prrevious transitions from interglacial to glacial intervals, and also should reappraise their probable cause."

[37-12 10-5-85]

Meetings

When Will the Present Interglacial End?

A group of scientists interested in Quaternary research gathered recently to review the possibility that their data concerning climates of the past might be valuable for long-term global climatic forecasting. They met at a working conference entitled "The Present Interglacial, How and When Will it End?" held at Brown University, Providence, Rhode Island, on 26 and 27 January 1972 (*1*). The discussion was divided into five sections: (i) environmental changes in the historical period (independent of man), (ii) the pattern of change within the last 10,000 years, (iii) the last interglacial and its end, (iv) comparison of the last interglacial with the present warm interval and projection of future change, and (v) consideration of the causes of global climatic change.

The present global cooling, which reversed the warm trend of the 1940's, is still under way. Even though man-made pollution may have contributed to the observed fluctuations, the bulk of the change is probably of natural origin (Mitchell). The present cooling is especially demonstrable in certain key regions in arctic and subarctic latitudes. Thus, snowbanks today cover areas of Baffin Island that were seasonally free of snow for the 30 or 40 years preceding the present summer cooling (Andrews, Barry, Bradley, Miller, and Williams); pack ice around Iceland is once again becoming a serious hindrance to navigation (*2*); and warmth-loving animals, such as armadillos, which expanded northward into the American Midwest in the first half of the century, are now retreating southward (Schultz).

Periods of cooling more severe than the present one are known to have occurred in the past 5000 years. They are recognized not only in deep-sea sediments (Burckle and others) but also in advances of mountain glaciers (Denton and Karlen). The climatic shifts recorded in pollen-rich lake beds in northern mid-latitudes or in the sequences of stream alluviation and downcutting are closely related in time to the social disorders that ended or severely castigated flourishing civilizations in Egypt, Mesopotamia, and the Indus Valley about 4000 years ago and the lowland Mayas in A.D. 770. This suggests that former human civilizations may have been severely affected by (*3*) "failure in the rain supply, without which neither man, nor beast, nor growing vegetation can survive" (*4*). It is hard to envision how our modern economy and social structure would react to widespread droughts several decades long, should they occur in the near future.

On the geologic time scale, the general warmth and basic bipartite pattern of the last 10,000 years of the earth's history (the elapsed part of the Holocene), which are characteristic of interglacials, were underlined by several workers (Fairbridge, Wright, and others). It has long been recognized that the climatic optimum passed 6000 to 7000 years ago and was succeeded by slow, oscillatory cooling, interrupted by milder episodes like the one in the 10th and 11th centuries (Burckle, Fairbridge). In some places, the present fauna and flora can be compared to those of the early portion of the Holocene (Absolon, Wright). The warmth-loving species of the climatic optimum have migrated south (Lozek).

One conclusion reached at the session was that there is no qualitative difference between the climatic fluctuations in the 20th century and the climatic oscillations that occurred before the industrial era. The present climatic trends appear to have entirely natural causes, and no firm evidence supports the opposite view.

The next group of contributions dealt with the structure of the last interglacial and its end. Participants considered the periodic occurrence of interglacials within the stratigraphic record to be sufficiently well established to warrant comparison with the present interglacial. There are discrepancies concerning the time-stratigraphic boundaries of interglacials (McIntyre, Mörner, Ruddiman, Terasmae), but at least for the purpose of the meeting the interglacial was tacitly defined as one uninterrupted warm interval in which the environment on a global scale reached present or even warmer climatic conditions (*5*).

These discussions focused on two points: the length of interglacials and the environmental change that marked their end. Out of more than 800 determinations of ^{18}O in fossil planktonic foraminifera (the ^{18}O content is a function of the temperature and salinity of the surface waters) covering about the last 0.5 million years, only about 10 percent indicate conditions similar to or warmer than those of today (Emiliani). In lake beds of Germany and England the length of an interglacial was found to be about 10,000 years (Shackleton, Wright). Pollen diagrams of interglacial lake beds so closely parallel the Holocene records in composition and thickness that basically the same duration must be expected for both intervals. However, recent soils in the American West are weaker than those believed to be of the last interglacial age (Morrison, Richmond), an occurrence consistent with views that the last interglacial was somewhat warmer and wetter than the Holocene (Fairbridge, Lozek).

Sea level is related inversely to the volume of continental glaciers. Thus, information concerning the duration of an interglacial high stand of the sea can be directly correlated with the ice volume of continental glaciers. On Barbados, sedimentological considerations suggest that the high stand associated with the last interglacial (terrace III, 124,000 years ago) lasted no longer than about 5,000 years. Further, preliminary evidence suggests that the interglacial high stand was immediately followed by a drop in sea level of more tens of meters within 10,000 to 15,000 years (Matthews). For this same time interval, data from deep-sea cores show that the cold subarctic waters of the North Atlantic extended to latitudes about 15 degrees south of where they are today, or roughly two-thirds of their maximum full glacial southward displacement in the late Wisconsin (McIntyre, Ruddiman). Summer temperatures at the sea surface dropped by 7°C at 50°N latitude in the Atlantic (Imbrie). During this same time inter-

fine sand and dust were blown from Africa into the central Atlantic, which indicates a time of considerable disruption of the vegetation cover on the continent (Hays).

Some data indicate how rapid the cooling could have been near the end of an interglacial. In the Greenland ice core (Camp Century) a spectacular drop in ^{18}O values appears to have occurred within a time interval only about 100 years long. The event is considered to have happened around 90,000 years ago. A similar event could have happened 20,000 years earlier, but a critical segment of ice core is missing (Clausen, Dansgaard, Johnsen, Langway). A rapid cooling event is also indicated at about 90,000 years ago by the temporary complete disappearance of the warmth-loving *Globorotalia menardii* group from the southern Gulf of Mexico, an event completed within less than 500 years (Kennett). In the vicinity of Prague and Brno in Czechoslovakia, where mixed broadleaf forests flourished in past interglacials as they do today, the end of an interglacial is marked by the replacement of forests with grassland. Eolian dust of distant origin then buried the vegetation, and torrential rains turned the countryside into badlands. Woolly rhinoceros and the land snail *Puppilla loessica*, cold-resistant species of Pleistocene fauna, lived there at this time, about 110,000 years ago. The date is supported by a magnetic event interpreted as Blake (Kukla, Koci). At Tenaghi Phillipon in Greece, the interglacial forest was succeeded by grassland within a few centuries (*6*), and in the Netherlands and Denmark subarctic tundra with heath and birch replaced the temperate forests (*7*).

When comparing the present with previous interglacials, several investigators showed that the present interglacial is in its final phase (Emiliani, Imbrie, Lozek, Mörner, Wright) and that if nature were allowed to run its course unaltered by man, events similar to those which ended the last interglacial should be expected to occur perhaps as soon as the next few centuries.

The possible causes of past climatic changes were discussed in the last section. The ice-age preconditioning of the present globe (Fairbridge), the instability of atmospheric and oceanic circulation (Broecker, Flohn, Hendy, MacCracken, Mitchell, Shaw, Van Donk, Weyl), and the possibility of rapid antarctic ice "surges" (Hollin) were stressed. Theoretical considerations and some empirical data suggest that climatic change is closely related to the earth's precessional torques and thereby to the earth's magnetic field, episodic volcanism, and so forth, and to elements of the earth's orbit (Emiliani, Kukla, Stuiver). It was speculated that the astronomical motions of the earth may have led to stresses within the lithosphere with a maximum every 40,000 years. Enhanced volcanism, tectonic activity, and changes in magnetic parameters would be expected to follow this periodicity, contributing to glaciations and speeding evolution (Emiliani). Artificial heating, and production of dust and CO_2 by man's activities were shown to have diverging effects on global temperatures (Mitchell, Schneider), at present subordinate to natural processes. However, with continuing human input these effects might eventually trigger or speed climatic change. The general conclusion of this section of the conference was that knowledge necessary for understanding the mechanism of climatic change is lamentably inadequate, and that the ultimate causes remain unknown.

At the end of the working conference, the majority of the participants agreed to the following points:

The global environments of the last several millennia is in sharp contrast with climates that existed during most of the past million years. Warm intervals like the present one have been short-lived and the natural end of our warm epoch is undoubtedly near when considered on a geological time scale. Global cooling and related rapid changes of environment, substantially exceeding the fluctuations experienced by man in historical times, must be expected within the next few millennia or even centuries. In man's quest to utilize global resources, and to produce an adequate supply of food, global climatic change constitutes a first order environmental hazard which must be thoroughly understood well in advance of the first global indications of deteriorating climate. Interdisciplinary attacks on these problems must be internationally organized and encouraged to develop at a rate substantially exceeding the present pace.

In the view of the majority of participants, further investigation is especially needed in the following fields: (i) detailed reconstruction of the history of intervals of rapid environmental change, especially of the termination of the last interglacial, as well as those periods of cold or dry "events," or both, in historical times; (ii) periodicity in climatic change on all time scales; (iii) records of past climatic change contained in stratigraphic sequences of the deep-sea sediments, of continental basins in loess areas, in ice sheets, and in mountain glaciers; (iv) computer modeling of past climatic systems based on boundary conditions prescribed by the stratigraphic data; and (v) the possible interrelationships between solar radiation, solar magnetics, earth magnetics, episodic volcanism, and global climatic change.

G. J. KUKLA*
Czechoslovakian Academy of Sciences, Prague

R. K. MATTHEWS
Department of Geological Sciences, Brown University, Providence, Rhode Island 02912

References and Notes

1. Participants present at the working conference were R. G. Barry (Institute of Alpine and Arctic Research, University of Colorado, Boulder); L. H. Burckle, J. D. Hays, C. Hendy, and A. McIntyre (Lamont-Doherty Geological Observatory, Palisades, New York); G. Denton and J. Hollin (University of Maine, Orono); C. Emiliani (Institute of Marine Sciences, Miami, Florida); R. W. Fairbridge (Columbia University, New York); J. Imbrie and R. K. Matthews (Brown University, Providence, Rhode Island); W. Karlen (University of Stockholm, Stockholm, Sweden); J. P. Kennett and D. W. Shaw (University of Rhode Island, Kingston); G. J. Kukla (Czechoslovakian Academy of Sciences, Prague); J. M. Mitchell, Jr. (Environmental Data Service, National Oceanic and Atmospheric Administration, Silver Spring, Maryland); G. M. Richmond (U.S. Geological Survey, Denver, Colorado); W. Ruddiman (Office of Naval Research, Washington, D.C.); C. B. Schultz (University of Nebraska, Lincoln); N. J. Shackleton (University of Cambridge, Cambridge, England); T. W. Webb III (University of Michigan, Ann Arbor); and P. W. Weyl (State University of New York, Stony Brook).

Participants who sent contributions were A. Absolon, A. Koci, and V. Lozek (Czechoslovakian Academy of Sciences); J. T. Andrews, R. S. Bradley, and G. H. Miller (Institute of Alpine and Arctic Research); W. S. Broecker and J. Van Donk (Lamont-Doherty Geological Observatory); H. B. Clausen, W. Dansgaard, and S. J. Johnsen (University of Copenhagen, Copenhagen, Denmark); H. Flohn (Meteorologisches Institut, Bonn, West Germany); C. C. Langway (U.S. Cold Regions Research Laboratory, Hanover, New Hampshire); M. C. MacCracken (University of California, Livermore); N. A. Mörner (University of Stockholm); R. Morrison (U.S. Geological Survey, Denver); S. H. Schneider (Institute for Space Sciences, National Aeronautics and Space Administration, New York); M. Stuiver (University of Washington, Seattle); J. Terasmae (Brock University, Quebec, Canada); L. D. Williams (University of Colorado, Boulder); H. E. Wright, Jr. (University of Minnesota, Minneapolis).

Papers resulting from this working conference have been accepted for publication in *Quaternary Research*.

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3. R. Carpenter, *Discontinuity in Greek Civilization* (Cambridge Univ. Press, Cambridge, England, 1966).
4. See also B. Beil, *Amer. J. Archeol.* **75**, 1 (1971).
5. The cold fluctuations of the historical period are considered to be within the range of present general climates and environments.
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7. T. Van der Hammen, G. C. Maarleveld, J. C. Vogel, W. H. Zagwijn, *Geol. Mijnb.* **45**, 79 (1967).

* Present address: Lamont-Doherty Geological Observatory, Palisades, New York 10964.

EARTH REGENERATION SOCIETY, INC.
1442A Walnut Street #57, Berkeley, California 94709
(415) 525-4877

March 27, 1990

ENVIRONMENTAL PENTAGON

Soil Forests CO/2 Oceans Ice — the clear and obvious realities surrounding us on this planet, five major areas determining climate and in turn acted on by climate change.

The accelerating climate change is roughly following the increase of atmospheric carbon dioxide. Climate change has been indicated by growing intensities of heat and drought in the summers and freezing in the winters and at irregular times during the year. Climate changes, including all weather intensities, are destroying our food supplies, houses, utilities, transportation, and very lives.

Soil: essential mineral and trace mineral content near the surface is reduced in the range of 25% to 40% in most areas over the last 10,000 years, i.e. the interglacial period.

Forests: reduced by about half over the last 2500 years, and now dying, burning and increasingly pest infested at an accelerating rate.

CO/2: increased from about 280 to 350 parts per million in the atmosphere in the last 100 years, the first time of such a rise since the last transition from interglacial to glacial conditions (over 120,000 years ago).

Oceans: phytoplankton can be increased in areas where there is almost none, by adding the primary missing nutrient (iron) — central Pacific Ocean, Gulf of Alaska and the Antarctic Ocean. This can remove CO/2 even faster than new forests.

Ice: snow and ice buildup is increasing in areas of Alaska, Baffin Island, Greenland, the USSR, and the Antarctic continent. The excess CO/2, excess greenhouse effect, additional evaporation, mostly in the lower latitudes, has meant more condensation in higher and cooler latitudes bringing more clouds, snow and ice formation.

The best current coverage of the these five aspects of our ecosystem, plus the history of action by major groups in our society, the solution in the form of legislation for the U.S. Congress (the Dellums bill), call for CO/2 Budgets (jobs and environment programs) for the U.S. and internationally through the United Nations, and the implementation of the Environmental Pentagon, is the 200-document Distribution List of the Earth Regeneration Society. (Available for $3.00 a copy, check made out to Earth Regeneration Society).

Join in the interesting new possibilities. Suggest new assignments of personnel and resources in the Military Pentagon. Suggest which general should be given tasks regarding soil remineralization, which general for reforestation, who in the Air Force given tasks relating to CO/2 reduction, which admiral for ocean phytoplankton, and can the various secret services be assigned to uncovering more of the "secrets" of nature.

The next moves are international in scope — in the emergency efforts to bring CO/2 back to the livable level of around 280 parts per million in our atmosphere through soil, forest, ocean, and benign alternative energy actions. Here is the central focus on protection of the environment and human life — the meaning of EARTH DAY 1990. How can there be stabilization of climate, and clean up of pollution, without peace, human rights, and a decent standard of living for all people?

[81-21A 3-27-90]

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Below is a partial listing of ERS publications, combined with a number of national and international articles which relate to the transition to a glacial period. The approximately 200 items comprise a collection relating to the climate change problem, its solution, scientific materials in the key areas, and history of the movement to get work started to attempt climate stabilization before it is too late.

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620A/619A Budapest, Hungary, Symposium on "Climate Change and Evolution of the Biosphere," International Society for General Systems Research, June 1-5, 1987, abstract of [620A], origin of the initial call for CO/2 Budgets. Author and title list [619A]. 2 pp.

74-13/14 ERS letter to corporations requesting support for the California CO/2 Budget. June 21, 1989. 2 pp.

727 Excerpt from Report of the California Democratic Party Executive Board Meeting. May 20-21, 1989, San Bernardino, California. Includes "Resolution in Support of Climate Stabilization and CO/2 Budgets." 2 pp.

70-6 "Climate stabilization support activities." ERS summary, March 21, 1989. 2 pp.

II -- Alden Bryant, articles and related material

79-24 Alden Bryant letter to the White House (John Sununu, Andrew Card), February 2, 1990, ref. President's speech on climate change to a group in connection with the International Panel on Climate Change. Response from Andrew Card. 2 p.

78-12 "Global Warming and Cooling," the unique national and international role of this proposed legislation, comparison of the proposed bill with previous legislation on climate change, and a brief summary of the problem and solution. 2 pp.

769 Emergency Climate Stabilization and Earth Regeneration Act of 1989 Printed in the U.S. Congressional Record, November 21, 1989, Part III, pp. 4034-36. 3 pp.

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EARTH REGENERATION SOCIETY SPECIAL PAPER NUMBER 673

Earth Regeneration Society, Inc., 1442 Walnut St. #57, Berkeley, CA 94709

The Strange Tale of the "Carbon Dioxide Greenhouse Warming of the Earth": The Expanding Influence of Politics in Science

Kenneth E. F. Watt

The widespread acceptance of the "Greenhouse Warming Theory" is one of the most curious tales in the history of science. This idea has been pushed at the public in Sunday Supplements, television "science" documentaries, and in numerous magazine articles. It has appeared with increasing frequency in the scientific literature since about 1976. Since June, 1986, there has been a vigorous and apparently carefully orchestrated effort to propagandize the idea of global warming in newspapers, newsmagazines, and, most intriquingly, the newsletters of citizen action organizations, particularly environmental organizations. As one might expect with all this media attention, government has awarded large amounts of money to researchers who would publish evidence in support of the greenhouse warming theory. Indeed, for the last decade, only those scientists supporting this theory have received any mony from government to do research on climate or weather.

What makes this so curious, is that there isn't a shred of evidence that the world is warming; indeed, all available evidence suggests that every part of the greenhouse warming theory is incorrect or incomplete and that the world is cooling rapidly. Even more curious, the evidence for global cooling isn't just in the form of esoteric, highly technical data such as computer tapes of weather records stored in government bureaus, or statistical analyses of climate trends locked up in scientists' file cabinets: newspapers and television are full of evidence for global chilling. It is thought-provoking that the same media that routinely give us news stories about unusually cold weather and its effects, push the carbon dioxide warming theory. Given that the popular media are routinely manipulated in the interest of covert political goals nowadays, this seems to be a case worth investigating. As we shall see, the story which unfolds is a sobering object lesson about how the good name of science can be invoked as a means of gaining credibility for an incorrect idea. We also want to know who is doing this, and why.

The greenhouse warming theory argues that as the world uses more and more fossil fuels each year, carbon dioxide resulting from their combustion will be injected into the atmosphere. This will gradually increase the concentration of carbon dioxide in the air worldwide. Infrared radiation (heat) passes through carbon dioxide gas less freely than through air. Therefore, increased carbon dioxide concentrations in the atmosphere make it less likely that heat from sun-induced warming of the earth's surface, and the waste heat from civilization will penetrate the atmosphere when it radiates outwards. The earth's atmosphere gradually traps an increasing proportion of this heat generated at the earth's surface. In effect, the earth's atmospheric shield acts as the glass in a greenhouse, to allow light in but keep heat from escaping. Accordingly, the theory goes., the planet will heat, the icecaps will melt, the ocean level will rise, and coastal real estate will be flooded.

The first fascinating feature of this tale is that the media are constantly presenting news stories about phenomena caused by cooling of the planet, yet never make the point that these stories are curious, given the widespread acceptance of the warming theory. A typical recent headline read "Record Lows Hit in 46 Communities" (November 14, 1986). In many cities, low temperature records were broken which had lasted for up to 130 years. In many cases, previous records were broken by large margins; Chicago was 6 degrees on November 13, whereas the lowest it had ever been before on that date was 11 degrees. At Fort Smith, Arkansas, the

temperature of 17 degrees was 2 degrees below a November record set in 1907. Once alerted to this phenomenon of news stories about record cold weather occurring simultaneously in many states, it is surprising how often they are noticed. There have been more and more of them in the last five years. It has become commonplace to read of records in some instances extending back as far as the nineteenth century being broken simultaneously in 27 cities in 9 states.

Once one starts to think about it, it is astonishing how many of the major news stories of the last few years resulted from extraordinarily cold, not extraordinarily hot weather. The explosion of the booster rockets for the shuttle Challenger on January 28, 1986, was caused by temperatures far below the range in which the shuttle had been designed to operate. There were large icicles covering the equipment. The temperature at Kennedy Space Center was below freezing for 10 hours the day of the launch. This was at Cape Canaveral, 28 degrees north of the equator, at sea level, and on the Gulf Stream, which veers northeast to warm all of Europe. Cairo, Egypt, is two degrees further north. It lies south of all of Europe, and most of North Africa and the Middle East, and we would certainly be stunned to hear of large icicles there.

Was the shuttle disaster the result of a strange statistical fluke that one had no reason to expect, or was it just one of a large number of bits of evidence that Florida, like most of the rest of the world, is chilling steadily? On July 14, 1986, the Wall Street Journal carried an article about U.S. orange juice prices. This article mentioned that Florida citrus growers had been "hit hard by four frosts in the past five years".

Once we are alerted to the existence of this chilling pattern, and start looking for evidence in the media, we find it everywhere. The Great Lakes, and Great Salt Lake in Utah, have received media attention in 1986 because they are far above normal levels, and causing great property damage. This is because gradually dropping temperatures, year after year, lead to increased precipitation relative to the evaporation from water surfaces. Cold air becomes supersaturated with far less water vapor than warm air; the surplus moisture falls as rain or snow. An Associated Press story of November 22, 1986, mentioned that above-average rainfall in the Great Lakes region for the last five years had raised the level of all five lakes. The average November height of Lake Ontario since 1900 has been 244 feet above sea level, and expected to rise to up to 247.5 feet by March. The U.S. Army Corps of Engineers is offering shoreline counties in Ohio, Pennsylvania and New York 5 million sandbags, tons of sand, and miles of plastic sheeting to protect vulnerable areas.

Another important source of information about climate trends is available to all of us, in the form of information from travellers or visitors, or that we pick up while talking to people when we travel. If you ask someone from Naples if the world is heating or chilling, they'll tell you that it must be chilling, because they see snow in places they have never seen it before. The Swiss tell you about glaciers and avalanches coming further down the mountains, scouring trees off the slopes down to lower levels, and necessitating the evacuation of high-altitude villages in winter. The Scandinavians talk about the return of an ice age, and about how the winters are getting longer and colder, and the summers shorter and cooler. This summer I heard the same story around the northern hemisphere, from Toronto or Thunder Bay to Copenhagen. People in Florida know that citrus groves are being bulldozed to make way for tract housing, because citrus can't be grown there anymore in most winters, due to the cold.

What do mainstream scientists have to say about whether the planet is heating or cooling? In 1986 the U.S. National Research Council published a report by their Environmental Studies Board. "Acid Deposition Long-Term Trends". This report contained a chapter on the possible role of climate in the tree mortality allegedly due to acid rain, because "Important regional climatic anomalies occurred when the

red spruce decline began and may have been a factor in triggering the response". The book reports that since the early 1920's, summer temperatures have decreased 1.5 degrees F. or more in a zone centered on Tennessee and Kentucky, and winter temperatures declined by 3 degrees F. or more.

One reason for great confusioon about trends in climate is that most thermometers providing data for the National Weather Service are located in cities, and hence reflect the elevated city temperature due to waste heat (from air-conditioned buildings, vehicles, manufacturing plants, space-heating, etc.). Recent research has shown that only 270 of the 11,600 thermometers feeding climate data to the National Weather Service are free from these local, urban effects, called the "urban heat island effect" by meteorologists. This urban effect is huge. It has been discovered, both by measuring temperature changes as a city grows, and by comparing temperatures in cities of various sizes, that the temperature of cities is related to the number of inhabitants. The greater the number of inhabitants, the more waste heat the city produces, and the warmer it is relative to the surrounding countryside. The significance of this is that the average temperature of the planet at high latitudes only drops 10 degrees C. in an ice age, relative to the temperature under optimum climate. Therefore, the urban heat island effect introduces an error into temperature measurements as large as the largest effect that an ice age might produce. Putting it differently, cities can warm up enough due to population growth to totally mask the fact that an ice age is occurring in the surrounding countryside.

One way to discover what is really happening to the earth's climate is to seek out temperature records from thermometers which experts agree are free from influence by these local effects. In 1975, the U.S. government published a list of 27 weather stations that experts considered to be free from local urban influences, and useful for determining climate trends. These stations were referred to collectively as "The Reference Climatological Network". The stations were at experimental farms or stations, or in remote locations such as an observatory, a national park, or the grounds of an abbey. The stations were scattered around all parts of the country, an only two states, California and Oregon, were represented by two stations. Since the government itself has designated these stations as being of great significance for detecting climatic trends, it is of great interest to determine what temperature trends show up in the records for these places.

A simple expression of the temperature drop is the average number of degrees F. decrease in the average annual temerature per year over the period 1941 to 1983. For representative locations that figure, and the total drop for the period are:

Climate Station	Average yearly drop in average annual temperature, 1941-1983	Total drop in trend line for avg. annual temp.,43 years
Geneva Experimental Farm, N.Y.	.076 degrees F	3.3 degrees F
University of Illinois farm, Urbana	.049	2.1
Beeville Experimental Station, Texas	.067	2.9
Calhoun Exp. Sta., Los Angeles	.098	4.2
Lewisburg Exp. Sta., Tennessee	.087	3.7
Winthrop College, S.C.	.048	2.1
Grand Canyon Nat. Park Headquarters, Arizona	.050	2.2

Clearly, we have already seen a drop in annual mean temperature about 20 to 40 percent of that which would produce an ice age, over a vast expanse of the United States, from the northeast and midwest down to the Gulf of Mexico. The only parts of the country where a temperature increase was observed over this period were

Southern California, Oregon, North Dakota, Minnesota, New Mexico and Montana: roughly, the northwest corner of the country (stations in Utah, Colorado and northern California had temperature decreases). Thus, what we see is evidence of a gradual major shift in the prevailing wind systems affecting the United States (and the entire northern hemisphere). Increasingly, the westerly winds bringing the weather to this country come, not from the north-central Pacific Ocean, but rather, they come from the northwest to the southeast, from Alaska.

Data sources other than temperature records support this notion of widespread chilling for the last few decades. The annual rings laid down in tree trunks can be used to measure temperature. The most objective and widely-applicable method is to measure the density of the wood using X-rays. The denser the wood in the part of each ring corresponding to late summer and early fall, the warmer it was in that part of the year, the most important growth period for northern hemisphere trees. This method has been applied to trees from Germany, the Alps, Eastern and Western Scotland, Sweden, and the Rocky and Appalachian Mountains. In each place, there is evidence of a marked chilling trend since 1950. Of course, data such as these not only support the notion of a global climatic chilling; they also challenge the notion that "acid rain" has been the primary cause of increased recent tree mortality. It appears that cold weather may be the key factor in causing recent mass tree mortality in the Northern Hemisphere. There are several reasons to believe that. There have been outbreaks of increased tree mortality rates in places with no acid rain, such as Hawaii. There were instances of mass tree mortality in the past, as in remote areas in the 1870's, when there was no pollution but the weather was extremely cold. Most embarassing, tree seedlings grown in soil with an inadequate concentration of mineral nutrients grow faster, not slower, the more acid rain is painted on them. Also, the order in which various trees are succumbing, supposedly to "acid rain", is the same order in which they succumbed to cold weather at the transition to ice ages in the past. All these arguments support the idea that recent widespread outbreaks of mass tree mortality are due to worldwide climatic chilling, not "acid rain".

Clearly, someting is amiss with the carbon dioxide warming theory. What? The theory is based on three key ideas, each of which, it turns out, is quite wrong.

The first idea is that the combustion of fossil fuels, worldwide, would keep increasing, indefinitely, in compound interest fashion. This idea has proved false: worldwide combustion of fossil fuels actually declined after 1979, and all estimates show that a lowered, not an increased amount of carbon entered the atmosphere from this source after 1979.

The second idea was that combustion of fossil fuels was the principal source of increased concentrations of carbon dioxide in the atmosphere. This idea also proved false: carbon dioxide concentration kept increasing after 1979, when release of carbon from combustion of fossil fuels was declining. Further, some scientists are now beginning to point out that the increase in carbon dioxide concentration of the global atmosphere began too early in the nineteenth century, if combustion of fossil fuel was the source. Rather, the buildup of atmospheric carbon coincided with the massive destruction of north temperate forests in Europe and North America in the nineteenth century. As forests are destroyed, there is less vegetation to remove carbon dioxide from the air and replace it by oxygen. Recently, a source of carbon dioxide in air more important than fossil fuel combustion appears to be the mind--bogglingly rapid destruction of tropical forests. An area of that forest in excess of the area of Austria is now being destroyed every year.

The third idea underlying the carbon dioxide warming theory was that increased concentrations of carbon dioxide in the atmosphere would warm the planet. That idea was not incorrest; it was simply incomplete. Increased concentrations of carbon dioxide in the atmosphere indeed cause increased temperatures at ground level, near the tropics. However, the carbon dioxide warming theory needs to be expanded to

deal with the effects of clouds and prevailing winds. The first part of this expanded theory notes that carbon dioxide-induced warming causes increased evaporation of water off the ocean surfaces, and this forms clouds which prevailing westerly winds move to high latitudes. There, the colder climate causes the moisture-laden clouds to lose their moisture, in the form of snowfall. The increased snowfall then fosters the formation of glaciers, by protecting the underlying ice sheets from being melted by the incoming solar radiation. Basically, it is increased snowfall in high latitudes that triggers an ice age. This extended version of the greenhouse theory is supported by correlation of satellite images with ground temperature readings. October snow cover in the Canadian arctic is now spreading, and the spread is related to temperatures about 3 degrees C. lower than before, on average.

Thus we have a strange tale indeed: a "scientific" theory has been widely accepted as self-evidently true, and supported by many experts, which is not only without theoretical of factual basis, but so obviously so that anyone could discover that by reading the newspapers and talking to people. In fact, it is an interesting exercise to identify leading meteorologists or climatologists, and ask them about this matter. Leading climatologists in three countries have assured me that there is no basis whatsoever for the notion that the world is warming, and that in fact, all the evidence points towards cooling. So how did the warming theory gain credibility? It wasn't from the work of the experts on large-scale mathematical models of climate, and computer simulation studies: they were careful to point out that their models were oversimplified versions of the real-world phenomena, and that cloud effects had been specifically excluded.

However, we do discover a curious correlation; a main source of funds for scientists supporting the warming theory has been the U.S. Department of Energy. So what is the political constituency represented by this agency? The answer is no secret: the nuclear power industry and the nuclear weapons industry. So why are these industries so interested in supporting the notion that increased combustion of fossil fuels will lead to a global warming? It is no secret that the public, worldwide, has turned against nuclear power. Chernobyl may have been a very large nail in the coffin of nuclear power. It is also no secret that building nuclear reactors has been a major source of wealth for the industries that build them. It seems reasonable to assume that those industries would see the value in a propaganda effort designed to convince the public that oil, gas and coal could have harmful environmental effects, thus making nuclear power seem relatively more attractive.

This tale has applicability to a more general phenomenon: we should all be alert to the possibility of great potential damage to science when massive funds enter research, under the control of a small number of people, who may represent a vested interest group, rather than the best interests of the public. The Penthouse article on cancer research (December 1986) has already made that point. Indeed, an increasingly widespread phenomenon now is the censorship of work by scientists who do not support the positions of the small vested interest groups in each field who control the distribution of grant and contract money, and publication in books and journals. The public would be surprised to discover the identities of the group being heavily censored and suppressed now: we are not talking about people who recently obtained doctorates, but rather, many of the people who were regarded, ten years ago, as the leaders in their fields.

This phenomenon of censorship of work by outstanding scientists has a number of serious national implications. The United States is losing out in international economic competition and the balance of trade because other countries are fostering first class basic science in all fields in a way that we are not. Some of the contrasts between nations are enlightening. Mainland China, for example, is well aware that many of the leading scientists in the United States are now being "bottled up". The Chinese know that they can never outcompete the United States by playing a game of "catchup". Rather, they must leapfrog over us. They do this by a

program of identifying the real leaders here, many of whom are the "bottled up" people, and importing them into China for extensive lecture tours that may go on for weeks or months. There is, and has been for a few years, a tidal wave of U.S. scholars visiting China to give courses to their leading scientists and advanced students. Typical instructions from the Chinese hosts to these scholars are to lecture, not on what has been already done in science and technology, but on the new directions in which they should evolve in future decades. When these U.S. experts pool stories as to their experiences in America and China, some curious patterns show up. One is the failure of the United States to capitalize on the discoveries of its best minds. Indeed, these discoveries are sometimes suppressed, because they represent a commercial threat to some vested interest group. These suppressed discoveries then subsequently appear as the basis for new high technology industries in other countries. Thus, America's best minds often turn out to be the source of the ideas that other nations now use to beat us in international competition in science, technology, and manufacturing. .....

Suppose an ice age is coming, what could we do about it? One clearly useful countermeasure would be mass planting of trees, and fertilization of forest soils to increase the vitality of existing trees. Both these measures would increase the removal of carbon from the atmosphere by the global stock of trees. Also, any and all political activity to decrease the rate of forest destruction in the third world would have an enormously useful effect. On the basis of all existing evidence, it is this rapid and massive destruction of tropical rain forests in Latin America, Africa and Asia which is causing the return to an ice age, not the combustion of fossil fuel.

DECEMBER 1986

Albert Bryant

30

Papers submitted to the
International Conference
on

PROBLEMS OF CONSTANCY AND CHANGE
the complementarity of systems approaches to complexity

VOLUME I.

31st Annual Meeting
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International
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676A

THE MISSING LINKS BETWEEN PLANT ROOTS AND COLLOIDAL SOIL PARTICLES

Dr. Gernot Graefe
Director of Institute for Bioenergetic Research
Austrian Academy of Science
(Forschungsstelle für Bioenergie der Österreichischen Akademie der Wissenschaften)
Bergstraße 10, A-7082 Donnerskirchen/ Austria
Tel. 02683/8543

Development of vegetation / CO_2 fixation/ Climate change/ Waldsterben / Re-structuring of linking systems in soils

Organisms, even highly organized ones as Homo sapiens, do not consciously perceive environmental influences, with few exceptions only. On the other hand, from the lowest to the highest species, all organisms react to influences on an existential level as to their beneficial or harmful effects: their answer is either heightened vitality or weakening and decay. While these interactions are at work continuously, natural science continuously faces the problem how to grasp and evaluate cross-connections.

When ecosystems get out of balance we should take this as an indication that links are missing: e.g. earthworms which mix organic substances with minerals and produce the clay-humus-complex; or mykorrhiza fungi which build bridges between plant roots and colloidal soil particles are no longer part of the system. Where on steep slopes soil is evidently starting to slide, the danger is caused by absence of networking and holding-to-each-other microorganisms which guarantee stability for the soil by closely interacting with the mykorrhiza.

Due to the high rate of anthropogenic influences, the number of links which undergo disturbances or destruction is ever rising and in all probability will rise even more tha less we sharpen our knowledge of the system as a whole: Up to now natural science has not given the necessary credit to the importance of soil-networks for the ecosystem. These networks should now be acknowledged as an existentially important part of General Systems Research, including the feedback of quality to the development of world-climate, soil erosion and yields as well as longevity of forest-soils and farmlands.

Reproduction of living species follows the laws of exponential growth. By doubling every species could, theoretically, reach a point where its gigantic populations would be forced to incorporate the bulk of biomass available. -This never happens because deficiendes hit at a much earlier stage. Apart from this, massive reproduction of species is prevented by competition for limited resources by the diversity of species and by their opposing interests.

Man emerges from this existential background and has become conscious of many deficiencies which cause considerable pain. Yet human consciousness still seems badly equipped to form an idea what really is existential for life on this earth. Man seems not very capable of forseeing the course and the effects of his own exponential growth. His ability to make use of nature's effective ways of building up ecosystems seem just as feeble.

If there are reasons to believe that, normally, competition prevents massive reproduction of one single species, we may assume that selfcontrol as far as reproduction is concerned was not a main issue for selection and that, consequently, man was not forced to build up perceptual ideas about how nature works. The history of Homo sapiens followed up the evolutionary pattern: selfcontrol is not desirable in the field of reproduction since it could become an obstacle whenever ecological niches turn up which invite colonization. - So Homo sapiens left his ecosystemal environment some 10.000 years ago without proper security measures against his rapidly developing ability to clean his path from obstacles, kill pest and nutrition competitors and become a paragon for exponential growth. The only built-in measure is his rising consciousness.

In order to direct man's "dualistic vitality" not into doubling steps of reproduction but into achieving new forms of integration with the ecosystemal environment pressure of selection confronts him with population densities and the degenerating effects of the industrial system for the ecosystem. - At this point General Systems Research could show that this integration, i.e. alleviation of problems, will lead us back to the soil. In future there will be not one field of research, be it the Sciences of the Arts which could afford to exclude the soil from its referential system. It would, otherwise, degenerate into nothing more than an auxiliary science.

Soil as a regional component carries the potential for regulation and improvement. Therefore it is so important.

Global phenomena, e.g. world climate, represent dangers, but their specific interactions with each region show a spectrum of regional phenomena, from destruction to beneficial effects. - Basically the thin layer of soil represents a level for exchange and buffering which is much more important for the ecological balance than is acknowledged yet. Therefore a realistic assessment for soil potential and soil value for the ecosystem as well as for global phenomena, e.g. world climate, will be necessary. Soil was the lifegiving element for the blooming human population, but the ignorance of man as to its efficiency to preserve existence on the globe has caused a vacuum which should now be filled quickly by Systems Sciences.

Life developed in the ocean more than three billion years ago. Water was not scarce, nutrients were available in solution just as in hydroponics. Terrestrial biotopes had to be conquered step by step some hundred million years ago. The carbon forests were situated in swamps. In places where humidity remained constant, vegetation pushed on into terrestrial regions, but nowhere it covered large expanses. Terrestrial land then mainly consisted of rock and stone rubble which was not able to hold humidity for longer periods: organic material as well as links for builing up longevity-soils were not yet to be found.

The mineral masses of the terrestrial biotopes represented a challenge for the exponential growth of microorganisms, plants and animals. The step-by-step colonization was successful and reached its height twenty million years ago when grass was covering large continental expanses. - Colonization of terrestrial biotopes and the build-up of soils was the existential challenge of the past three hundred million years. For our century the most important challenge is the acknowledgement that soil is the basis for our present and future existence and a factor for climate phenomena dangerously speeding up.

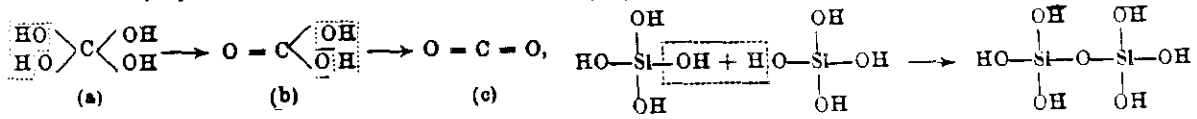
x x x

My personal knowledge as to the problematique of soil has benefited greatly from the works of highranking scientists in the UdSSR, the German Republic, Hungary and the USA. These scientists as well as many others have supplied the groundwork for further research and action which has to be done before the turn of the millenium: a cooperative comprehension instead of knowledge-accumulation by elites. The latter, part of our ecological fiasco, could be afforded only on the basis of ecosystems in full swing. Our time is one of

rapidly degenerating ecosystems. As far as the eminently important soil problematique is concerned, not only experts, whose achievements and limits are evident, are needed: Further approach into questions of soil will preferably been done by those who are not only able to understand the subtle system of linkage between organic and mineral material in the soil, but also to supply a frame for the re-structuring and re-building on all levels.

The colloidal system of the soil could be called a universal meeting point, a place for reality and integration. For instance organic and anorganic chemistry, split up on academic grounds, perfectly meet as a structure-building, fuctional unity in the clay-humus-complex. While in anorganic chemistry some tenthousand compounds are known today, organic chemistry has described somehundred thousand. Based on its ability to undergo double-binds, carbon is free to organize in large varieties of configurations. Although it belongs to those elements which are relatively less abundant, it preferably accumulates wherever it is needed most in the biosphere. Looking, on the other hand, for the most abundant elements in the stone-cover of our planet, silicium comes into view. It is second in abundancy, but it is never to be found in its pure form. It always combines with oxygen, the most abundant element.

C and Si both are quatrivalent. They follow each other vertically in group IV of the periodic system of elements, and they both build oxydes (CO_2 and SiO_2) which react quite differently in building up larger compounds of molecules. Carbon's ability of double-binding cannot be found in silicium which is shown in the following comparison of the chemical formulas for ortho-carbonic acid and ortho-silic acid. By intramolecular splitting off of water, ortho-cabonic acid (a) becomes carbonic acid (b) and then dissociates into carbon dioxide. In the course of this process first one double bind is formed (b) and then two ensue (c).



As to ortho-silic acid we observe an intermolecular splitting off of water only between two molecules which then form the compound ortho disilic acid. Further condensation leads to structures that resemble chains, ribbons and petals. If the polymerization goes on even further the spacenetting structure of quartz (SiO_2) is reached. While CO_2 escapes from the porous system of the soil into the atmosphere, the highly polymer sili-

cium molecules stay earthbound, massforming yet not inert. - There are parts which are very well equipped for catalysis, especially when the finest of mineral particles or those with lattice-disturbances are at work. HAMAKER and WEAVER in "The Survival of Civilization" (1982) for good reasons point out the importance of mechanical grinding by ice-age moraines as well as the effects of loess-drifts for soil-life and the development of vegetation. Their claim, we should imitate natural grinding and transport by technical measures to induce new pushes for the organic-mineral build-up of soil, seems pure logic.

If, between quartz-blocks and salt-ions in the soil solution, something which will be able to feed a manifold community of organisms is bound to develop, the structural elements of the colloidal sphere should lie between 100 Å and 2000 Å (0,002 mm). Colloids are higher ranking soil structures with a more luxurious energy-potential. Ground down, for example by glacier ice, rockdust will secure stability of the ecosystem soil wherever organic colloids join in. Organic colloids contain chemically bound sun-energy. Their own stability is high and, to a certain extent, they are able to stabilize mineral colloids, especially in the porous aggregate which is the conditio sine qua non of longevity and lasting fertility. If, on the other hand, acid immissions hit this subtle colloid system, the soil drifts into a dramatic situation with links between plant roots and colloidal particles getting lost.

As to organic colloids we should be aware that aromatic compounds are the most important. The "aromaticity" of cellulose by lignin has already secured the stability of woodplants, which would not have been achieved easily in unlignified cellulose. Without the incrustment of these durable phenolic substances, the first large-scale colonization of terrestrial biotopes would have gone into another direction. Ecosystems which are not only exposed to rain, snow, hoar-frost and especially storms but also display 75% of their biomass above ground, are in need of special physical properties to gain a secure footing and stability.

Also the second large colonization of further terrestrial biotopes by perennial grass species was the result of aromaticity. This time it was the soil itself that was aromatized by humic acids and clay-humus-complexes which can be very well observed in the chernozem. Perennial grass species deposit 75% of their biomass in a deeply penetrating root-system and produce the starting substance for the build-up of deep reaching black soil.

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High soil quality is the result of functioning links. These links must not be categorized as static structural elements but we should become conscious of their dynamics on the molecular level:

o When weathering breaks stone structures in the soil, clay-minerals are formed which, in comparison with the initial material, show a different structure: we find more irregularities, more crystal water and a higher capacity for adsorbing H_2O. During formation of these colloids central cations with a different charge are built into the mineral structure in some cases. So Al^{3+} changes place with Si^{4+}; or Mg^{2+} substitutes Al^{3+}. The effect is a negative charge which is balanced by cations of positive charge in the surface- and intermediate layer areas of the colloids. In high quality soils these cations are Ca^{2+}, Mg^{2+} and K^{+} which, by ion-exchange, are used up by soil-organisms or plant-roots. In acid soils H- and Al-ions become factors of grave disturbances; they are no longer able to serve the formation of links, and soils desintegrate.

o Wherever soils gain their inner consistency by sticky wrappings from bacteria and blue-algae or by threadlike growing actinomycetes and fungi, we owe this to the dynamics of the colloidal structure of organisms. Vitality is the result of their functioning on a high level of energy. Wherever these links are missing, reduction of vitality follows immediately.

o The earthworm has to be recognized as one of the most effective linking-devices for soils. Massive flow of organic and mineral substances make its way through the intestines of the earthworm and are turned into clay-humus-complexes. The deeply penetrating burrows of the earthworm allow for gas-exchange with the atmosphere and roots reaching down into greater depths. The finest roots preferably penetrate soil-particles which have gone through the earthworm passage.

o While the building up of colloids is the basis for the linking system, roothairs in interaction with capilary water are the basis for the exchange between soil colloids and plants. In high-acidity soils water vanishes with the breakdown of links.

o Links most endangered nowadays by acidity are the mykorrhiza-fungi which supply water and mineral nutrients in symbiosis with the roots of forest trees. The mykorrhiza has to rely on the supply with sugar by the tree. If this flow is cut off by deficiency- and reduction processes, the mykhorriza dies. This

is what "Waldsterben" boils down to: a disintegration of links with the colloidal system and consequently the degradation of the colloidal system itself which could be called the heart of life on this globe.

x x x

When forests die, biotopes vanish; cultures degenerate and man faces the end of his endeavors. The ongoing CO_2 drama is closely linked with dying forest ecosystems. While CO_2 absorption by the oceans is possible in large quantities, it is always a slow process. In comparison forests show a much higher potential to absorb CO_2 quickly but, on the other hand, they give it back to the atmosphere suddenly when forest fires occur. Upset of the CO_2 balance has accured since the tertiary period when plant covers reached their largest expansion: by the end of the tertiary period a slow cooling process set in, which, in the quaternary period, became part of a pattern: periodic climatic changes. There is ample evidence that CO_2 as an indicator for the efficiency of vegetation cover played and still plays its role in the development of cooling.

HAMAKER and WEAVER have offered important material for the understanding of the CO_2 problematique, especially by stressing the tectonic factor. For my understanding there was still one missing link which has now been delivered by Matthias Kuhle's work on "The glaciation of Tibet and the development of glacial periods". Kuhle states that in the tertiary period the Indian subcontinent starts to slide down under the eurasian landmasses by heaving up the Highland of Tibet. When in humid climate demineralisation by leaching starts under natural conditions, CO_2 rises. Rain, snowfall and albedo effects become more frequent in those parts of Tibet where it emerges from tropical zones with Monsunrains. Climatic stability is upset more and more: In biotopes which up to now absorbed sunrays and thus retained the warmth , suddenly snowcovers stay permanently and reflect the sunrays back into space. According to Kuhle at this point ice-age starts in this part of the world and comes to its end only after icecovers nearer the poles which have been formed at a later date, melt.

With CO_2 rising dramatically, evidence points to a new ice-age period approaching rapidly. It will need all our courage, knowledge and joint global activity, to slow down the impact. The starting point must be the build-up of the linkage system of soils: Man is still the missing link in the re-structuring of the biosphere he is in danger to destroy.

Journal articles

Kuhle, Matthias (1986)Die Vergletscherung Tibets und die Entstehung von Eiszeiten. Spektrum der Wissenschaft, 9, 42-54

Books and Monographs

Hamaker, John D. and Weaver, Donald A. (1982) The Survival of Civilizatian. Hamaker-Weaver Publishers

Western Regional Science Association
27th Meeting, February 24-28, 1988

CLIMATE STABILIZATION
THE CENTRAL FOCUS OF REGIONAL PLANNING

CO_2 & CLIMATE

Published by the Earth Regeneration Society, Inc.
1442A Walnut Street #57 Berkeley, CA 94709

Directors: Alden Bryant, Douglas W. Fryday, Dolores Huerta, Julianne M. Malveaux, PhD, Fred Bernard Wood, PhD.

VOL. III SPECIAL EDITION 1 2-25-88

This Newsletter is a call to focus more directly and fully on the emergency nature of climate change, the need for climate stabilization work, and the role of regions in carrying out such work.

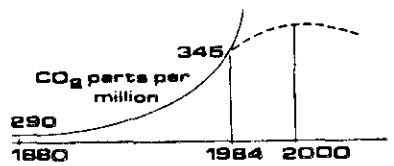
In summary, the intensities of climate change are becoming more destructive in both summer and winter. The full cycle of climate change goes from increased warming (heat and drought) in the lower latitudes to increased cold (snow, freezing weather, tornadoes, rain, floods, shorter growing seasons) in higher latitudes. See attached material regarding CO/2 increase this century reflecting dying and decimated forests, demineralization of soils leading to forest death, and the role of fossil fuels.

The opposite course of action includes restimulating and expanding forests, remineralization of forests, conservation and construction of alternative energy technology facilities. This we call an earth regeneration program. See attached.

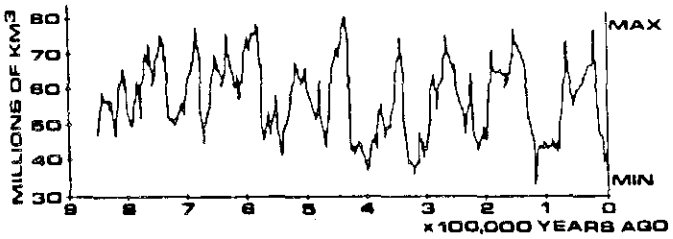
What is so new? Basically, humans have been taking resources from the earth during our expansion over the last 6,000 years; and now the problem is to re-establish and maintain a balance between the earth and the atmosphere. This is basically a matter of soil, the world's biota (forests, swamps, and, in the long run, oceans), and forms of energy use. This is the question of organizing human activity primarily around holding the CO/2 within equilibrium levels, i.e., regenerating the soil and forests.

What does this mean in a region? It means a new central theme, an independent variable to which most other planning elements become dependent: which activities increase atmospheric CO/2 and which reduce it? The international goal is currently to bring the 350 parts per million back down to 280 ppm or below. National, state and local areas have a responsibility, but in terms of the specific geography, land use possibilities, rural-urban balance, urban land use, soil/forest/energy possibilities, and above all the history, culture, conditions and needs of the people of the region.

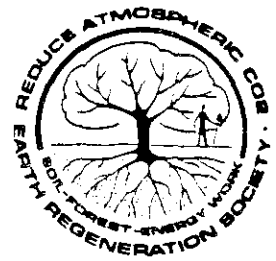
We invite your interest and support of the Earth Regeneration Society, its efforts to bring together information and people in many fields, put the problem and possible solutions before the public and encourage legislation through the U.S. Congress, and more rapid action by international bodies.



ATMOSPHERIC CARBON DIOXIDE INCREASE AND PROPOSED REDUCTION



VARIATION OF GLOBAL ICE VOLUME



A NEWSLETTER ABOUT CYCLES OF GLACIATION, THE NEGATIVE EFFECTS OF AN INTERGLACIAL/GLACIAL TRANSITION ON LIVING SPECIES, AND A COUNTER PROGRAM.

International Society for General Systems Research
Annual Meeting. St. Louis, MO. May 23-27, 1988.
Special Interest Group: Climate Change. Chair, Dr. Fred Bernard Wood
Sessions A15 and B15. Thursday May 26, 1:30 to 4:30 p.m.

Title: "Earth, Ocean, Biosphere, Glacial Cycles, Carbon Dioxide, Climate Change, Nutrition and World Hunger."
Session Chair, Dr. William J. Reckmeyer, Chair, Cybernetic Systems Program, San Jose State University, San Jose, California.

CLIMATE STABILIZATION THROUGH REGIONAL ACTION ON FOUR LEVELS.

Alden Bryant. President, Earth Regeneration Society. Possibly other
470 Vassar Avenue, Berkeley, California 94708 USA, co-authors.

Aostract. Regional action for climate stabilization is hereby broken down into a systems approach to earth regeneration programs for (1) the planet, (2) the U.S., (3) California, and (4) a house with yard. An Earth Regeneration Program (ERP) must be designed to reduce atmospheric carbon dioxide and establish a net CO/2 budget decrease. The CO/2 budget becomes the pivot of international and national planning and cooperation.

CO/2 can be reduced by practices such as reforesting the most productive areas, soil remineralizing, alternative renewable energy uses, mass transportation and conservation.

It is necessary to break down ERPs by regions respecting natural differences of biosystems, national boundaries, and sub areas within countries. Regional planning takes on new determining conditions -- optimum CO/2 reduction.

To survive, there must be sufficient global net CO/2 reduction to stabilize climate before we reach a point of no return in the current transition into the next glacial period.

[58-24 2-25-88]

"THE ICE AGE, WHICH HAS REALLY NOT LEFT THE PLANET FOR TWO MILLION YEARS IS REASSERTING ITSELF, THE WARM TIME, WHICH HAS LASTED LESS THAN 12,000 YEARS IS OVER. THE NEXT GREAT RETURN OF ICE HAS BEGUN."

— Samuel W. Matthews. Senior Assistant Editor. National Geographic. "Ice on the World." p. 84. January, 1987, National Geographic pp. 78-103.

"WHEN HISTORIANS OF THE FUTURE LOOK BACK ON 1986, THEY MAY WELL CONCLUDE THAT THE BIGGEST NEWS STORY OF THE YEAR THE ONE THAT BARELY MADE IT ONTO THE FRONT PAGE: A SUDDEN INCREASE IN GLOBAL CONCERN ABOUT THE 'GREENHOUSE EFFECT.' ... SUDDENLY THE GLOBAL COMMUNITY IS IN THE BUSINESS OF MANAGING THE BIOSPHERE, A COLLECTIVE ENTERPRISE OF A KIND THAT POLITICAL LEADERS HAVE NEVER DEALT WITH BEFORE AND THAT PRESENT INSTITUTIONS WERE NOT DESIGNED TO HANDLE. A NEW ITEM MOVES QUICKLY TOWARD THE TOP OF THE WORLD AGENDA, AND DEMANDS UNPRECEDENTED EFFORTS IN INTERNATIONAL COOPERATION."

— Walter Truett Anderson, writer for Pacific News Service. Berkeley Tri-City Post January 11, 1987.

ANALYSIS AND PLANNING

for

CO/2 REDUCTION

and

CLIMATE STABILIZATION

by

Alden Bryant

Revised November 29, 1984

CO_2 & CLIMATE

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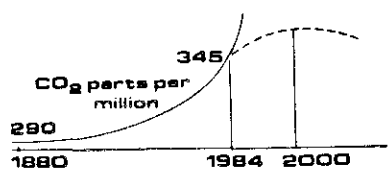
VOL II SPECIAL EDITION 8 1-28-88

Sixth Annual North American Conference of the
International Association of Energy Economists

The Energy Industries in Transition: 1985-2000

Fairmont Hotel, San Francisco, California November 5-7, 1984

(See other side for Figure 2, indicating the scope of a general systems approach to the dynamics of the full climate cycle now pushing us rapidly into the next glacial period.)



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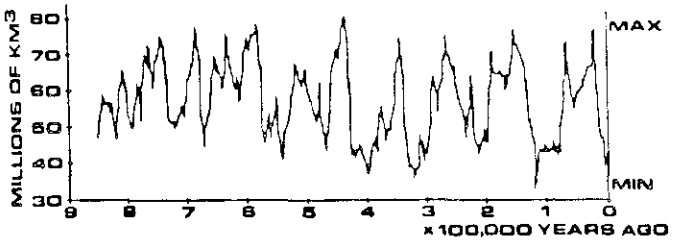

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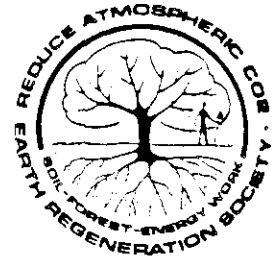


A NEWSLETTER ABOUT CYCLES OF GLACIATION, THE NEGATIVE EFFECTS OF AN INTERGLACIAL/GLACIAL TRANSITION ON LIVING SPECIES, AND A COUNTER PROGRAM.

Human society is being increasingly severely hit with heat and drought in the lower latitudes up to 30 and 40 degrees latitude, and the opposite from 40 to 50 degrees latitude and above: cloud formation, rain storms, flooding, hurricanes, snow, blizzards, all time record cold fronts, and shorter growing seasons.

If the climate is not stabilized through massive soil, forest and energy programs, together with many other related steps, we will all be pretty much at risk in ten to fifteen years from now.

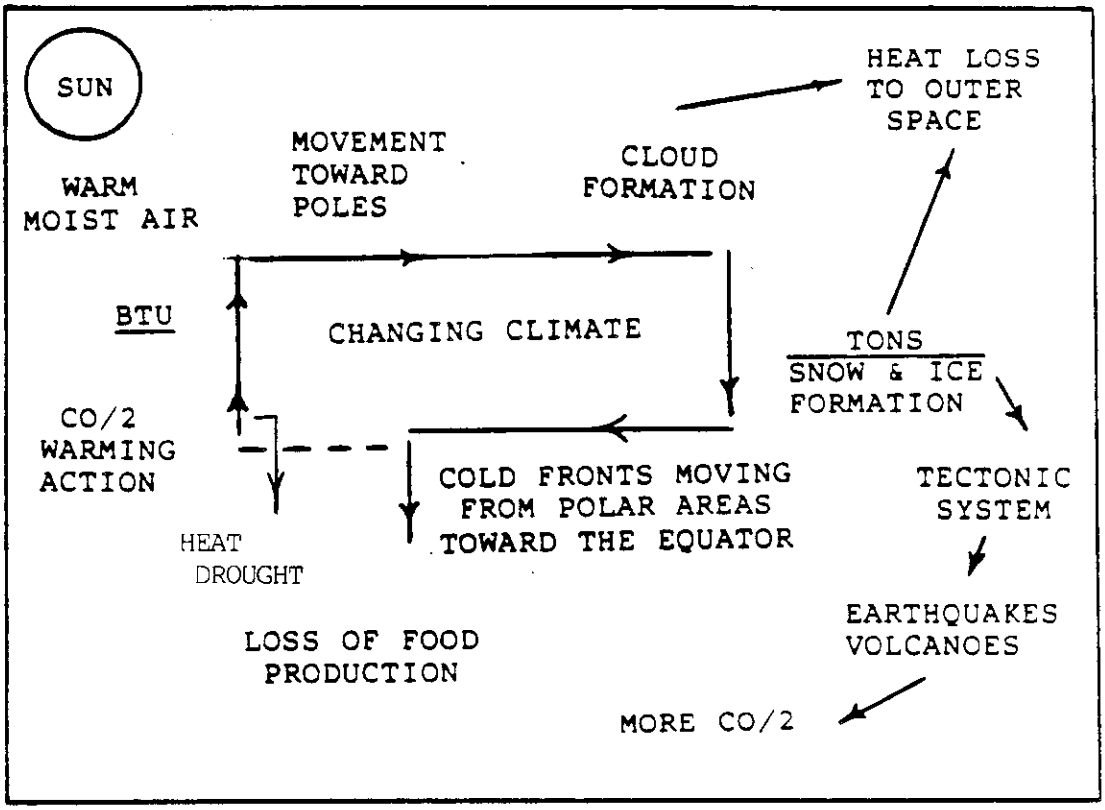


Figure 2. Climate Change from CO/2 Increase

General System Description.

AN ALTERNATIVE EXPLANATION FOR WIDESPREAD TREE MORTALITY IN EUROPE AND NORTH AMERICA

Kenneth E.F. Watt*

A common observation is the several-mile diameter circular area with no trees, or dead or sick trees surrounding an obvious point source of high concentration air pollution. This clearcut cause-effect association is now widely regarded as an extreme case of a much more widespread phenomenon: unusually high tree mortality rates in large forests fifty to several hundred miles away from pollution sources are believed to be due to "acid rain". It is curious that the acid rain hypothesis is so widely accepted, when formal tests of the hypothesis often lead to negative or ambiguous results. If acid rain is in fact the explanation for mass mortality of trees, there should be at least three types of supporting evidence: (1) results from carefully designed experiments in greenhouses or nurseries, (2) statistical correlations between year-to-year changes or place-to-place differences in tree death rates, and year-to-year changes or place-to-place differences in pollution intensity, and (3) failure to account for temporal and spatial patterns of widespread tree mortality using any other hypotheses. Surprisingly, all three types of evidence point away from acid rain as the sole cause of elevated tree mortality, and suggest that at most, it interacts with two other more important causes: soil demineralization, and a worldwide climatic downturn at high latitudes.

Experiments on acid rain

Tamm and Wiklander (1980) treated Scots pine with sulfuric acid; one experimental series used trees in fertilized soil, and in another, the soil was unfertilized. Greater applications of this artificial "acid rain" produced lower growth in the fertilized soil, but in unfertilized soil, greater applications of acid rain produced greater growth. One possible interpretation is that in unfertilized soil, the low level of nutrient availability is a more serious problem than the poisoning effects of acid rain. Of course, many conifers in high latitudes and altitudes are growing in nutrient-poor soil, and those are the sites where tree mortality rates have been most elevated.

Correlation between tree mortality and pollution over time.

If "acid rain" is in fact the primary cause of elevated tree mortality rates, then there should be correlations over time, at both gross and fine levels of data resolution, between tree mortality rates and measures of pollution, or fossil fuel-based energy production. At both levels of resolution, there are serious problems with the acid rain hypothesis. It appears to be widely accepted that tree mortality rates increased significantly after 1979. However, statistical yearbooks from all national and international governmental agencies agree that world and national combustion of fossil fuels declined significantly after 1979. Demand for coal held up better than for either oil or gas, but even in the case of coal, there has been little or no increase in combustion after 1979.

The correlation between elevated tree mortality and "acid rain" becomes much more problematical when detailed statistics are analyzed. Johnson and Siccama (1983) assembled data on the frequency of the trees in which abnormally narrow tree ring increments first appeared, at sites in New York, Vermont, and New Hampshire. They discovered a marked increase in the frequency of such trees beginning in 1962, and rising to a peak in 1966. After 1966, there was a pronounced decrease in the frequency of trees showing this pattern. While consumption of fossil fuels in the United States grew rapidly from 1962 to 1966, it grew to much higher levels thereafter. There is no apparent correlation between the time trend in pollution and the time trend in tree mortality, in any country. This is particularly problematical for the acid rain hypothesis, because there is another possible causal factor for elevated tree mortality for which there is a correlation with tree mortality: average temperature in the most important months for tree growth in the northern hemisphere.

Spatial distribution of elevated tree mortality

The spatial pattern of elevated tree mortality is not correlated with the level of pollutant concentration: regions of different pollutant levels are equally affected. Further, it has been noted in both North America and Europe that the damage to trees was most serious at high, as opposed to low altitudes (e.g. Johnson and Siccama, 1983; Blank, 1986). Study of the 1985 Swiss Sanasilva forest damage inventory map reveals that the percentage tree mortality is more correlated with altitude than with proximity to sources of pollution. As Blank (1986) notes, it now appears that the "acid rain" phenomenon may be the result of a series of different conditions operating in different regions, but with a common synchronizing factor triggering the onset of high tree mortality rates at all regions; "it seems plausible that this synchronizing factor is an overall climatic event such as drought or frost".

Decreased heat in the most important growth months for trees

There is so much discussion of the carbon dioxide-induced "greenhouse warming hypothesis" in all media that this tends to distract attention from the fact that the northern hemisphere is chilling rapidly. Further, the rate of chilling is much greater than most published statistics would suggest, because of a little-known source of bias in temperature measurements: the "urban heat island effect". Both longitudinal (historical) and cross sectional (comparative) studies show that the temperature of cities is elevated over that of the surrounding countryside, with the magnitude of the elevation being a rectilinear function of the logarithm of city population size (Landsberg, 1979, and Oke, 1973, respectively). Further, for the largest cities, the magnitude of the elevation is 10°C, which happens to be the maximum temperature difference between a climatic optimum and the temperature of the air during an ice age. Thus, a tremendous decline in global temperature could be masked, or veiled because most thermometers were in cities, where the increased waste heat from combustion would completely mask the climatic downturn in the surrounding countryside. The full significance of this source of bias has been recently revealed by Griffiths and Vining (1984). They found that only 270 of the 11,600 cooperative climate stations in the United States were free off this urban heat island effect, and "can be considered as base reference stations for the 1900 – 1970 period". Statistics based on all weather stations suggest that the northern hemisphere annual average temperature only dropped an average of 004°C per year from 1941 to 1981 (Jones et al., 1982). However, if one selects only the data for those weather stations designated as useful for estimating climate trends by the U.S. National Weather Service (i.e., stations in national parks, experimental farms, etc.), the average annual rate of drop in annual mean temperature at rural U.S. locations from 1941

Maple Tree decay? acid rain? climate? or else? **Photo: M.E.R.**

to 1983, inclusive ranged from .018°C per year to .054°C per year. The area chilling included all of the contiguous continental United States except for stations in California, Washington, Oregon, and Montana. This suggests the possibility that the circumglobal northern hemisphere "acid rain" – elevated mortality rate of trees is in fact due to inadequate heat in the important growing months of July, August, and September.

When correlation between years of unusually high tree death and years of unusually low summer heat was explored, it appeared that unusually cold summers were in fact the explanation for the subsequent elevated tree mortality rates.

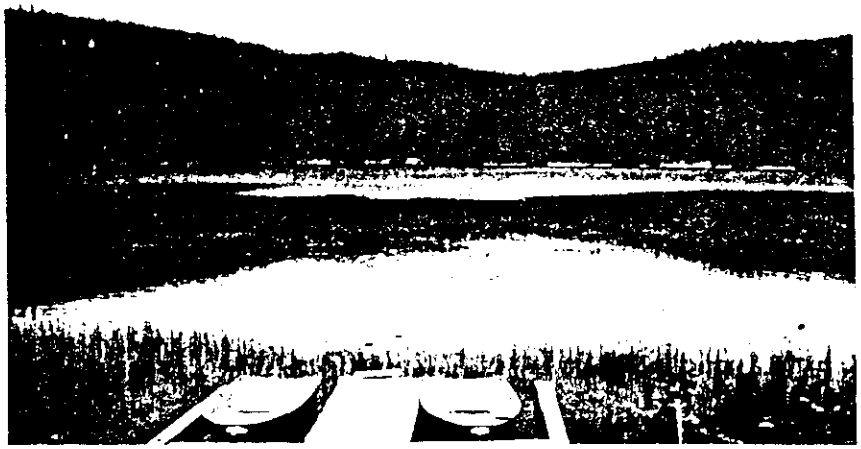
For example, in the U.S. northeast, there was a marked increase in the frequency of trees first showing abnormally narrow annual rings in 1962, rising to a peak in 1966, after which there was a pronounced decrease. Mean summer temperatures in rural northeast U.S. weather stations were unusually cold in the years 1962 to 1965, inclusive, even when expressed as deviations from the dropping trend line fitted statistically. Similar patterns have shown up in analyses of the data on year changes in tree mortality in Norway, for example.

These results by this author should come as no surprise. Authors in many specialty fields such as dendrochronology and paleoecology have published numerous papers suggesting that year-to-year climatic fluctuations account for almost all the year-to-year variation in tree growth, but it has somehow escaped notice that these papers collectively imply that elevated tree mortality rates may also be due to climate, not the "acid rain" phenomenon. Recent technical advances in dendrochronology suggest that data from this field are now the most accurate single source of information on climate changes outside built-up metropolitan areas. To illustrate, Schweingruber et al. (1979) used X-ray densitometry of tree rings to assess climate trends in conifers from Great Britain, central Europe, and the Appalachian and Rocky mountains of the United States. In all sites, there was evidence of diminished growth from 1950 to 1975, which they showed was statistically related to August and September temperatures. This marked downturn in recent climate also shows up in tree rings from the Yukon Territory (Jacoby and Cook, 1981), New England (Conkey, 1982), and Norway (Strand, 1980).

The other type of evidence pointing to climate, rather than air pollution, as the real cause of recent mass tree mortality in Europe and North America is the order in which different species die. Materna (1984) noted that in Europe, the most sensitive species in recent decades has been European Silver Fir; the most tolerant has been Silver Birch. However, Genevieve Woillard (1979) and other paleoecologists working on pollen series from the last 100,000 years discovered a characteristic successional pattern of forest tree species during the transition from interglacial to glacial climates. The shift from warm to cold climate is accompanied by replacement of fir and spruce-dominated forests by pine and birch-dominated forests. She concluded that we cannot exclude the possibility that we already are at the beginning of the present equivalent of a terminal interglacial pollen zone. Specifically, we may be heading into a dramatically rapid borealization of Western European forests, which about 115,000 years ago only took about 20 years.

Because of space limitations, only a minute fraction of the available evidence has been reported here, and all statistical details have been ommitted. However, even this brief summary may be adequate to convice many foresters that the recent elevated tree mortality over vast areas is not primarily due to acid rain, but rather results from significant cooling of large areas of the Northern hemisphere. It is noteworthy that this cooling extends south to, and including the northern half of Florida, as recent problems with freezing of the citrus groves, and icicles on the space shuttle remind us.

Dr. Kenneth E.F. Watt
Dept. of Zoology
University of California - DAVIS
STORER HALL
DAVIS CALIFORNIA,
95616 USA



Lake Laflamme, Forest Montmorency, Quebec, Canada, is the site of many research projects of acid rain impact on forest environment. **Photo: R. Barry.**

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49

Nr.———— 5th. November 1985 г.

To Dr Donald Weaver
Hamaker-Weaver Publishers
P.O.Box 1961
Burlingame, CA 94010
USA

Dear Donald,

I am most grateful to you for your letter, for the sent manuscript and for the copy of your wonderful Bulletin No 8 sent to me recently.

The Bulletin is of extreme interest, very informative and most useful for every ecologist. The collected information in these documents definitely confirms your-our (including myself) ideas on growing cooling (and aridization) of the Earth in current period of the epoch. The mechanism of cooling suggested by Dr Hamaker and by you (increased evaporation of ocean waters, transport of clouds, toward polar regions, increased snowfalls and ice formation, increase Albedo and movement of ice masses from poles to neighbouring territories), I consider as fully applicable and valid. In regard of CO_2 global management I have published 2-3 times earlier my advise and suggestions: reforestation of land, increase of humus content inside of the arable soils (+0,5; +1,0%), increase of agrobioproductivity of land by means of rational agriculture (no soil erosion, manuring, fertilisers, grass rotation, additional irrigation of arid land). These measures might ultimately adsorb 10-15 10^9 t CO_2 annually.

519

Remineralisation and liming of exhausted and particularly of acid soils will be most useful in that sense. But eroded, badly compressed (compacted) soils, salted, alkaline and waterlogged soils will require more expensive definite methods of amelioration (reclamation) . Any Nation of the globe must have national program of soil fertility preservation and soil amelioration. These measures will be resulted in considerable decrease of CO_2 content locally and globally.

Universally, arable soils required organic manure in big doses. The discussion on future CO_2 impact on global and zonal climate will be prolonged. I would like to keep our scientific contacts and exchange by publications.

Herewith I send you a copy of my future lecture in Hamburg (1986) Soil Science Congress.

My best regards to you and your colleagues

V. Kovda

Victor A. Kovda

The Sun
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96 Pages
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Bureau city forecast: Cloudy. Showers. Cool moderate southerly wind. Gale warning for bays. Expected top 18. Yesterday 16. ● Details, Page 56

46

Farm heartbreak

By NICK TROMPF, rural reporter

ABOUT 30,000 valuable fine wool merino sheep have died in the ferocious winds and rain squalls which have been sweeping across western Victoria.

At least 100 farmers around Hamilton awoke yesterday to discover thousands of freshly shorn sheep dead in their paddocks.

The sheep had a market value of $600,000 — but the deaths will cost farmers millions more in lost production over the next five years.

Michael Watt, a farmer at Vasey, north of Hamilton, told last night of his heartbreaking battle to save his flock.

"I went out into the paddock yesterday and there was only one sheep standing — one sheep in a mob of 200."

Mr Watt said he had lived in the district for 44 years and had never experienced winds like the howling easterly that ripped through his flock on Tuesday.

"I went out with the dog and fought with them for two hours, but couldn't get them home," he said.

"You couldn't drive them into the wind.

"I managed to get some of the other mobs in, but by one o'clock I said to my wife Margaret: 'Every sheep we've shorn is either in a shed or dead.'

Cruel death

"It was the cruellest death a farmer could see — to sit there and watch them die, unable to help them."

Mr Watt lost 500 five-month-old merino lambs which cut $30 each in wool when they were shorn on Monday.

The widespread sheep losses are the worst in recent years in Australia's most intensive wool growing area, and farmers last night were still cleaning up after the storm.

Most of the sheep killed were young merinos — in a year when their wool is at its highest value this decade.

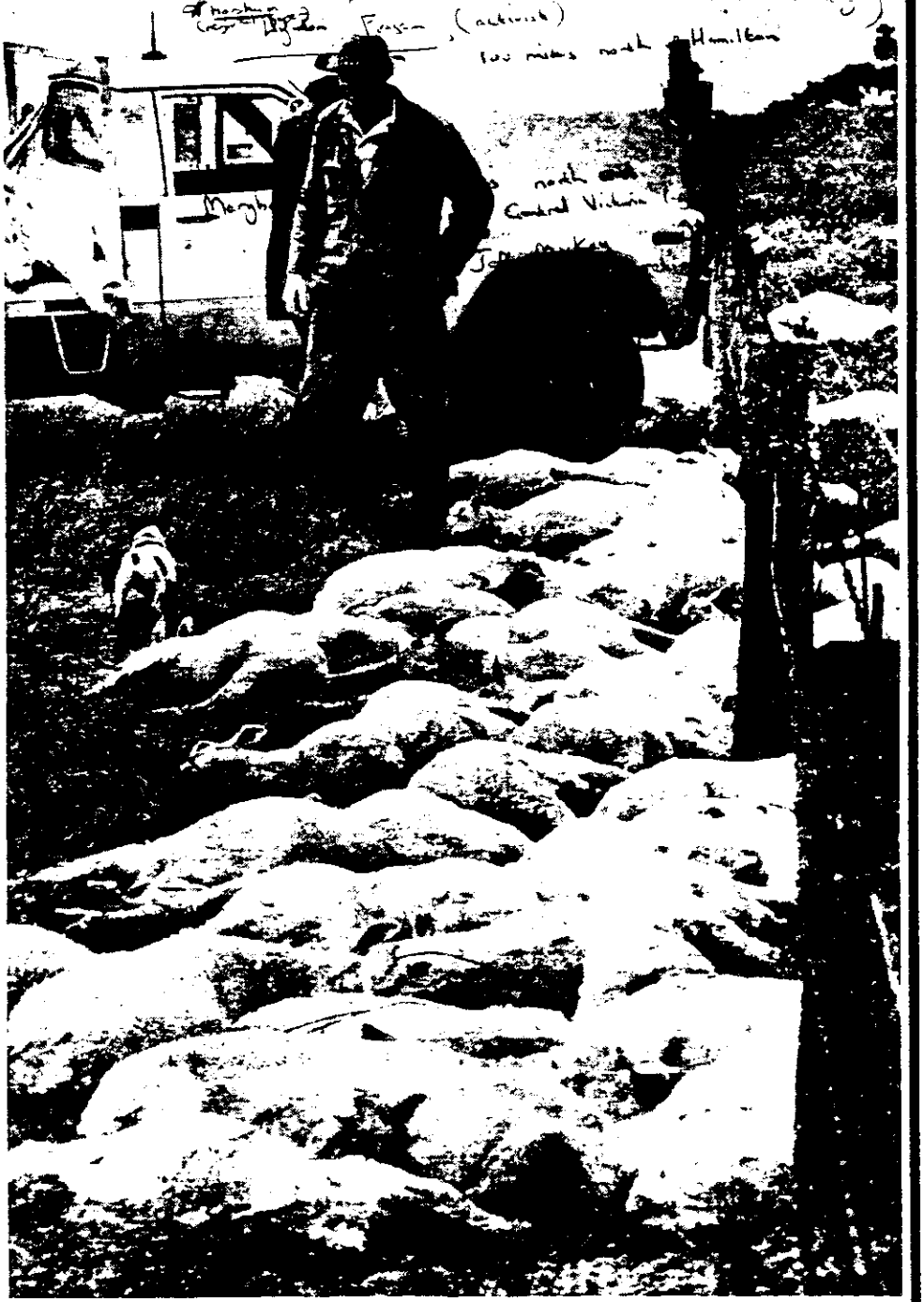
Yesterday several huge pits were dug at Balmoral and Cavendish north of Hamilton.

Teams of men and women with trucks and utilities carried out the grim task of carting countless loads of dead sheep to the waiting pits.

More than 70 mm of rain was dumped in the Hamilton district and winds gusted in gale force.

The Agriculture and Rural Affairs Department estimated the rain and strong cold winds killed about 30,000 sheep around Hamilton.

● Continued Page 2



● Former Michael Watt looks in despair at his flock of freshly shorn sheep by the fence where he found them dead after they had the fierce storm. Picture: MARK GRIFFIN

167

● Farmer Mike Watt with one of the sheep killed in the storm. Picture: MARK GRIFFIN

Paddocks of mass death

By NICK TROMPF, rural reporter, who grew up on farms in the Hamilton district

IN 23 years' association with farming, never have I seen anything like the mass deaths of young sheep at the hands of nature in Western Victoria.

Hypothermia struck down thousands of lambs and hoggetts, in some cases wiping out whole mobs.

Trying to avoid merciless wind and rain, the sheep clustered into fences, under logs and behind dam banks.

There they huddled, trying to keep warm. But, one by one, they succumbed to nature.

The toll was no more evident than on Michael Watt's farm near Balmoral yesterday.

In one paddock 200 young sheep lay heaped against a fence.

Many had fallen through the fence in a vain bid to avoid the cold. Legs spread-eagled, heads twisted in wire, their still-open eyes vividly portrayed the pain of death.

A lush grazing paddock had turned into a horrible mass grave.

"The poor blighters had just had their clothes taken off, and then they copped this," Michael Watt lamented.

As sheep were dumped by the truckload into giant pits late yesterday, memories flooded back of sheep being slaughtered in the 1982 drought, and during a price recession in the late 1970s.

But then death often was by bullet — far less painful than a freezing of fat around vital body organs, as happens during hypothermia.

But despite the tragic scenes yesterday, volunteers and farmers who banded together for the clean-up were typically resilient.

It was not a disaster, they stressed, and the farmers would recover, eventually.

But Michael Watt could not hide his sadness as he cradled a prize wether he was planning to show later this year.

"The tragedy is these lambs had their whole life ahead of them," he said.

"I've never seen anything like this — and I hope I never do again."

Heartbreak hits flocks

● From Page 1

The department's regional veterinary laboratory director, Dr George Riffkin, said last night the sheep loss was the biggest for years.

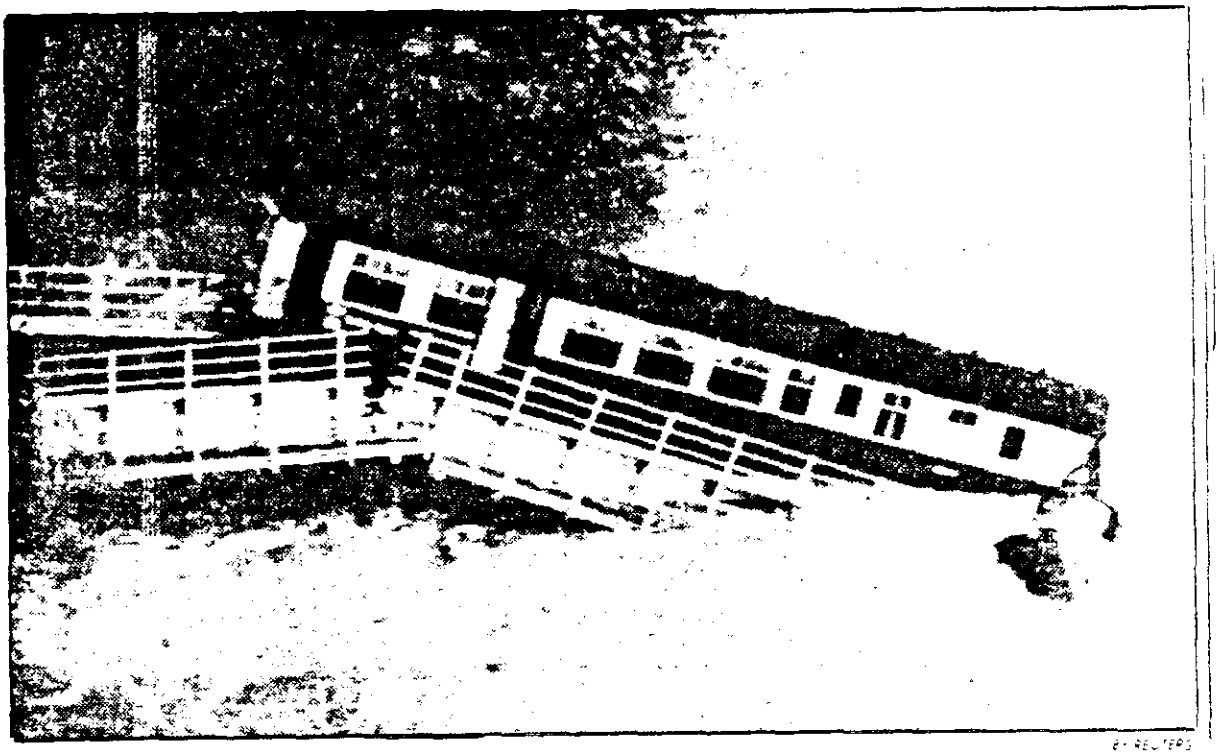
"We have had sporadic deaths but this one was more general and was so sudden," he said.

"I think a lot of farmers who have shorn sheep in the last two months would have lost some on Tuesday."

Dr Riffkin said 8500 sheep buried yesterday at Balmoral and Cavendish were only a portion of those which perished.

"I would believe that is just the proverbial tip of the iceberg," he said.

"Because of that the estimate of 30,000 is pretty close to the mark."



A passenger train plunged off a washed-out bridge over the rain-swollen River Tywi in Wales

Britain Will Try to Replant After Loss of Ancient Trees

Associated Press

London

The hurricane-force winds that uprooted thousands of London's ancient trees forever altered the Royal Botanic Gardens laid out at Kew more than 200 years ago.

The leafy squares and parks that make London the most liveable of capitals lost many of their finest trees in Friday's storm that blasted London and southern England, causing 17 deaths.

In every neighborhood, the drone of chainsaws can be heard and the people who live here understand that it will be generations before London can look as it did last Thursday.

The destruction is felt most deeply at Kew, which had about 11,000 trees in its 300-acre park, many of great age and many rare examples from around the world.

In a few hours before dawn, 500 to 1,000 trees were torn from the ground at Kew, which was established during the reign of George II in 1759. Many more were badly damaged and may have to be cut down.

Saddened staff members have barely begun to catalog the devastation. However, one thing is already clear: "The face of Kew Gardens will never be the same," said spokeswoman Christine Brandt.

Kew, a world-renowned horticultural center that preserves endangered species and shares its expertise with many countries, is on the River Thames at the southwest edge of London.

'The face of Kew Gardens will never be the same'

The toll across southeast England was very high because the ground was sodden after days of heavy rain and the trees were in full leaf, offering resistance to the wind. The bigger the tree, the greater the effect as gales reached 94 miles per hour in London.

Sevenoaks, in Kent County, lost six of the oaks that gave it its name.

658

In London noble oaks and some of Europe's finest plane trees, the heritage of wise 18th- and 19th-century builders, thudded down early Friday in Georgian squares and Victorian streets.

Hyde Park, Green Park and Hampstead Heath all suffered. Big trees were down in Berkeley Square, Belgravia and Soho. In Chelsea, the 17th-century Physic Garden lost many trees, including its oldest, a holm oak believed to have been planted in 1772.

The London Evening Standard newspaper already has started a fund aimed at planting a tree for every one lost in London, and offers of help have nearly swamped the Kew Gardens office.

"We have had nonstop phone calls from all over the world," said Brandt. "The first phone call I had this morning was from a tree surgeon in Oregon volunteering to come over and help. Another gentleman offered four of his men to come and help.

"There have been offers of cranes and equipment, offers of young trees people have in their gardens, offers of money," she said. "The public have been overwhelmingly generous."

Elsewhere, a passenger train plunged off a bridge washed away by torrential rain in Wales yesterday and four people were missing.

British Rail said

Royal Navy divers were flown in to search one of the train's three coaches, which sank into the swollen River Tywi near Carmarthen in south Wales. Three passengers and the driver were missing.

50

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Bill Fletcher *of Cincinnati brushes show from the side mirror of his car. As much as 6 inches of the white stuff was on the ground for the weekend.*

Icy temperatures sweep clear to Mexican border

ASSOCIATED PRESS

Temperatures plunged to record lows Saturday from the Midwest to the Mexican border as north winds held sway while a storm that dropped more than a foot of snow made travel difficult in New England by land and by air.

Thirteen deaths in seven states since Thursday night were blamed on the weather. Blowing snow also disrupted an aerial search for a missing private plane in New York, and ice and snow covered roads from Kentucky to New England. Cold forced postponement of a candlelight commemoration at a Civil War battleground in Maryland.

Police said they were busy with fender-benders, but less so with crime.

"When it's this cold, even the weasels stay inside," said Sgt. Will Connelly in Omaha, Neb., where the low was 11 degrees below zero.

The National Weather Service said even though the cold was less numbing Saturday than it had been Friday in the Midwest, a fresh supply of arctic air was on its way Sunday.

In Bloomington, Ill., the temperature was 7 degrees below zero but the wind-chill index made it feel like 44 below.

Record temperatures for the date were set or tied in more than 50 cities in 17 states, including 8 below zero in St. Louis; 16 below in Salina and 15 below in Topeka, Kan.; 15 below in Sioux City, Iowa; and 16 below in Lincoln, Neb.

Even Honolulu had a record low: 56 degrees Saturday morning.

755

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Cloud optical depth feedbacks and climate modelling

E. Roeckner*, U. Schlese*, J. Biercamp† & P. Loewe†

* Meteorologisches Institut der Universität Hamburg, D-2000 Hamburg 13, FRG
† Max-Planck-Institut für Meteorologie, D-2000 Hamburg 13, FRG

Recent general circulation model studies[1–3] performed to assess the equilibrium climate response to doubling atmospheric CO_2 suggested a global mean surface warming of 3.5–4.2 °C. Part of this warming was attributed to a change in cloud cover[1]. But all of these studies neglected changes of cloud optical properties which were shown to provide a substantial negative feedback in radiative-convective models if the cloud liquid water content was assumed to increase with increasing temperature[4,5]. This hypothesis is examined in a climate model where clouds are simulated interactively with dynamics, radiation and hydrological cycle[6]. The thermal forcing is introduced by a 2% increase of the solar constant which is equivalent to a doubling of CO_2[1]. The results show the anticipated increase of cloud liquid water and cloud optical depth. A feedback analysis of the simulated climate change supports earlier suggestions of the importance of cloud optical depth feedbacks[4,5]. The net effect of clouds is to provide a negative feedback on surface temperature, rather than the positive feedback found in earlier general circulation model studies without considering cloud optical depth feedbacks[1].

The characteristics of the climate model used in this study are similar to those quoted above[1–3]. It consists of (1) a general circulation model of the atmosphere, (2) a mixed-layer ocean model and (3) a sea-ice model. The model has a global computational domain with realistic topography. The governing equations for the atmosphere are solved by finite-difference techniques at three levels in the vertical and on a spherical grid of 11.25° resolution. Turbulent surface fluxes of heat, water vapour and momentum are calculated from Ekman layer similarity theory. Convective energy fluxes developing in conditionally unstable air are related to the water vapour supply in the planetary boundary layer. Solar and terrestrial radiation fluxes are calculated at eight levels using the two-stream formulation of the flux equations[7]. The distributions of ozone, carbon dioxide and aerosols are prescribed according to climatology while those of water vapour and clouds are computed from the respective budget equations. The diurnal and seasonal cycles of incoming solar radiation are included. Land surface properties are either predicted (temperature, wetness, snow amount) or prescribed (albedo).

A novel feature in climate modelling is the cloud scheme applied. It is based on the numerical solution of the cloud liquid-water continuity equation including simple parameterizations for partial cloud cover and cloud microphysical terms such as condensation of water vapour, evaporation of cloud droplets and rain drops and conversion of small droplets to large rain drops by coalescence[6,8]. No distinction is made between liquid and ice phase except that we take into account an efficient diffusional growth of ice crystals in the temperature range of −0 °C to −20 °C where a mixed phase of cloud droplets and ice crystals is supposed to occur[9]. Cloud radiative properties such as shortwave albedo and longwave emissivity are parameterized according to Stephens[10] in terms of the cloud liquid-water content which forms a reliable basis for such a parameterization in most parametric ranges. Thus, other than in most general circulation models, the cloud radiative properties are linked to the rest of the model physics via cloud dynamics.

The sea surface temperatures are computed from the heat balance of the ocean mixed layer which is allowed to vary in depth according to the local energy budget and momentum input at the surface[11]. The ocean heat transport is prescribed as constant in time at every grid point according to a value obtained from a simulation with seasonally varying climatological sea surface temperatures[1]. This procedure implies vanishing heat divergence in a steady state which is close to the observed, thus permitting a realistic simulation of the long-term mean sea surface temperature distribution. But, because we apply the method also in a climate perturbation experiment, ocean transport feedbacks cannot be considered. The lateral and vertical growth or decay of sea ice is computed from the local energy budget, separately for open water and ice in each grid box.

To assess the feedbacks resulting from radiative forcing we conducted two experiments with different values of the solar constant, a 20-yr control simulation with the present value of $S_0 = 1{,}370\ W\ m^{-2}$ and a 30-yr perturbation experiment with the increased value of $S_0 + 2\% = 1{,}397.4\ W\ m^{-2}$. The results will be presented as averages over the last 10 years of each run.

Table 1 shows a set of observed and simulated climate variables relevant for understanding the feedback mechanisms resulting from the forcing. Obviously, the control simulation successfully reproduces the observations. All parameters except the planetary albedo with a too low value are simulated within observational uncertainties. This is desirable because the induced climate change is likely to depend on the global mean control climate[12]. The 2% increase of the solar constant causes

Table 1 Observed and simulated globally averaged climate parameters

	Surface temperature (°C)	Precipitation (mm per day)	Total cloud cover (%)	Total liquid-water path ($g\ m^{-2}$)	Planetary albedo (%)	Cirrus cloud emissivity (%)	Arctic sea ice extent ($10^6\ km^2$)	Antarctic sea ice extent ($10^6\ km^2$)
Observed	14.9	2.7	~50	—	30.0	—	11.3	11.8
Control experiment	14.7	2.5	53.4*	43.2	27.8	42.4	11.9	12.0
Perturbation − control	3.32	0.15	0.50*	4.52	0.31	17.4	−3.06	−6.04
250 hPa	5.53	—	1.56	1.17	—	—	—	—
550 hPa	4.30	—	−0.78	1.67	—	—	—	—
850 hPa	3.26	—	−1.00	1.68	—	—	—	—

The last three rows show in addition the vertical distribution of the difference (perturbation − control) of temperature, cloud cover, and cloud liquid-water path. Surface temperature data from ref. 16, precipitation data from ref. 17, albedo from ref. 18, Arctic ice extent from ref. 19 and Antarctic ice extent from ref. 20.
* Random overlap.

52

Table 2 Change of net radiation budget $\delta_x R$ due to changes of individual parameters x in the perturbation experiment

	x = solar constant	x = temperature	x = water vapour	x = clouds	x = surface albedo	$\sum_x \delta_x$	$\delta \sum_x x_i$
Planet							
$\delta_x R$	4.6	−12.4	4.5	4.5	0.6	1.7	2.1
$\delta_x S/-\delta_x F$	(4.6/0)	(0/−12.4)	(0.3/4.2)	(−2.2/6.7)	(0.6/0)	(3.3/−1.6)	(2.8/−0.7)
Atmosphere							
$\delta_x R$	1.5	−9.4	−0.4	6.5	−0.4	−2.2	−1.8
$\delta_x S/-\delta_x F$	(1.5/0)	(0.3/−9.7)	(0.7/−1.1)	(−0.3/6.8)	(−0.4/0)	(1.8/−4.0)	(1.7/−3.5)
Surface							
$\delta_x R$	3.1	−3.0	4.9	−2.0	1.0	4.0	3.9
$\delta_x S/-\delta_x F$	(3.1/0)	(−0.3/−2.7)	(−0.4/5.3)	(−1.9/−0.1)	(1.0/0)	(1.5/2.5)	(1.1/2.8)

The respective solar ($\delta_x S$) and terrestrial ($-\delta_x F$) radiation changes are given in brackets. The last two columns compare the sum over the individual changes and the change resulting from changing the parameters all at once. Positive (negative) values indicate warming (cooling). The values are obtained by global and time averaging the respective changes over the diurnal and annual cycles. Units are Wm^{-2}.

a global warming of 3.3 °C at the surface increasing with height. Evaporation and hence also precipitation increases due to the increase of the surface saturation mixing ratio with temperature according to the Clausius-Clapeyron relation. The increase in surface temperature causes part of the sea ice to melt, approximately 25% in the Arctic and 50% in the Antarctic regions. Total cloud cover is slightly larger due to an overall increase of high clouds and a high-latitude increase of low clouds. In the remaining areas cloudiness decreases. The total liquid-water path is larger by about 10% causing an increase of planetary albedo and cirrus cloud emissivity. The change in emissivity of middle and low clouds (not shown) is negligible because in the control run they are nearly black.

The most interesting aspect of the perturbation run is the increase of cloud liquid water with increasing temperature which is assumed in various radiative-convective model studies[4,5]. From aircraft soundings of cloud liquid water content L and temperature T made in the Soviet Union[13], Somerville and Remer[5] derived a value $f = 1/L\, dL/dT \approx 0.04\ K^{-1}$. Our model experiments suggest an increase of globally averaged f with height of (0.03/0.06/0.10) K^{-1} for (low/middle/high) clouds. Whether the rather large f for high clouds is realistic cannot be decided from the soundings mentioned above which end already at an altitude of 6–7 km. The main conclusion of Somerville and Remer[5] is that the temperature dependence of cloud liquid-water content causes a negative feedback which could reduce the CO_2-induced warming by as much as 50%. This result is obtained with a model which does not allow for changes of cloud cover and cloud emissivity. In our experiments both parameters vary as does cloud albedo so that the sign of the net cloud feedback may be negative or positive.

To evaluate the cloud feedbacks the equilibrium climate states evolving from the control and perturbation experiments are analysed in terms of the global radiation budget[14]. This procedure involves two idealizations. First, the time mean radiative flux is represented by the flux computed from the equilibrium climate of the control and perturbation run, respectively. Second, the net solar and terrestrial flux differences between perturbation and control, δS and δF, are approximated by a sum of partial differentials each of which represents a flux difference, $\delta_x S$ and $\delta_x F$, due to a change of a relevant climate parameter x, such as solar constant, temperature, water vapour mixing ratio, cloud parameters and surface albedo. The globally averaged results are shown in Table 2, separately for the planet, the atmosphere and for the Earth's surface. The change of clouds induces a substantial greenhouse warming in the atmosphere but a cooling of the surface caused by a reduced solar radiation input at the surface. The resulting cloud feedback for the planet is positive, just as large as the water vapour feedback and the direct solar forcing. Summation over the individual changes approximately equals the total change (last column) computed from the perturbation experiment. Unfortunately, the net planetary radiation budget is not zero. The residual is probably caused by inconsistencies due to interpolations of, for example, temperature, fluxes between the dynamic part and the radiation part of the model. At the surface the residuals are balanced by increased turbulent fluxes of sensible and latent heat.

For a closer inspection of the cloud feedbacks we subdivide the total cloud change into four parts representing the changes of cloud cover and cloud liquid water separately for high clouds and middle/low clouds (Table 3). Again, summation over the individual changes gives approximately the correct net change (last column) so that the splitting seems to be justified. The liquid-water increase of high clouds and the resulting increased infrared emissivity (Table 1) produce a substantial greenhouse warming of the atmosphere. At the surface, however, the increased albedo of all types of clouds causes a net cooling, as anticipated[4,5], which overcompensates the heating induced by the low-latitude reduction of low and middle cloud cover. Thus, the sign and the magnitude of the net cloud feedback are essentially governed by the cloud optical depth feedback.

The redistribution of cloud amount and the increase of cloud liquid-water content in the perturbation climate are in correspondence with previous conjectures[1-5]; however, the

Table 3 Change of net global radiation budget $\delta_x R$ due to changes of individual cloud parameters x in the perturbation experiment

	x = high cloud cover	x = middle and low cloud cover	x = high cloud liquid water	x = middle and low cloud liquid water	$\sum_x \delta_x$	$\delta \sum_x x_i$
Planet						
$\delta_x R$	0.5	1.3	3.6	−1.2	4.2	4.5
$\delta_x S/-\delta_x F$	(−0.4/0.9)	(1.9/−0.6)	(−2.3/5.9)	(−1.2/0)	(−2.0/6.2)	(−2.2/6.7)
Atmosphere						
$\delta_x R$	0.9	−0.3	5.1	0.2	5.9	6.5
$\delta_x S/-\delta_x F$	(0.1/0.8)	(−0.7/0.4)	(−0.2/5.3)	(0.1/0.1)	(−0.7/6.6)	(−0.3/6.8)
Surface						
$\delta_x R$	−0.4	1.6	−1.5	−1.4	−1.7	−2.0
$\delta_x S/-\delta_x F$	(−0.5/0.1)	(2.6/−1.0)	(−2.1/0.6)	(−1.3/−0.1)	(−1.3/−1.4)	(−1.9/−0.1)

The respective changes of solar ($\delta_x S$) and terrestrial ($-\delta_x F$) radiation are given in brackets. Units are Wm^{-2}.

observational basis for validating these results is very poor. Moreover, although the cloud feedbacks analysed above seem plausible the question remains: are they realistic—will the real atmosphere respond to a radiative perturbation (induced by a CO_2 increase, for instance) in a similar way? We cannot answer this question but there is evidence that the cloud radiative forcing (the effect of clouds on the radiation budget) is realistic in the control climate. Our estimates based on the computation of the planetary radiation budget with and without clouds are in broad agreement with many estimates based on satellite observations[15]. In the global and annual mean the net cloud effect is a cooling of the planet because the albedo effect (54 $W m^{-2}$) dominates over the greenhouse effect (31 $W m^{-2}$) by 23 $W m^{-2}$.

Nevertheless, the results should be taken as preliminary because we used a coarse-resolution model with many simplifications, particularly in the cloud microphysical part. Much more theoretical and observational work seems to be necessary to develop and validate cloud prediction algorithms which are based on the governing physical principles.

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Southern oscillation simulated in a global climate model

K. R. Sperber, S. Hameed‡, W. L. Gates* & G. L. Potter†

Laboratory for Planetary Atmospheres Research, State University of New York, Stony Brook, New York 11794, USA
* Climatic Research Institute, Oregon State University, Corvallis, Oregon 97331, USA
† Lawrence Livermore National Laboratory, PO Box 808, L-262, Livermore, California 94550, USA

The Southern Oscillation is the dominant pattern of interannual climatic variation over the Earth. Climatic variance associated with this phenomenon is exceeded only by the annual cycle and the ice ages. Although there is general agreement among climatologists that the Southern Oscillation originates in the interaction between the atmosphere and the tropical ocean, the detailed mechanism(s) have remained elusive. In this report we present evidence that the essential aspects of the Southern Oscillation are simulated in a general circulation model (GCM) of the coupled atmosphere and upper ocean. This indicates that: (1) the physical basis of this global oscillation is present in the equations of motion underlying this model; (2) multi-year simulations of climate by GCMs, which have hitherto primarily been used to study equilibrium properties of climate, may also be useful in investigating time-dependent changes on the interannual timescale.

‡ To whom correspondence should be addressed

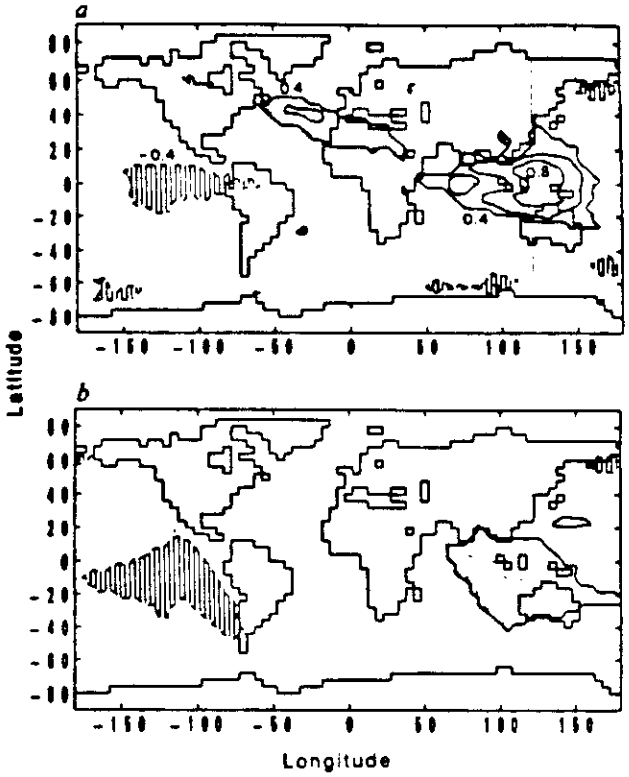

Fig. 1 *a*, Correlations of annual average sea-level pressure (SLP) with that at 130° E, 2° S from a 23-year simulation of the OSU coupled atmosphere-upper ocean GCM. Only those correlations significant at ≥95% confidence limit are shown. The contour spacing is 0.2. The spatially coherent anticorrelation between the Indonesia-Australia region and the eastern Pacific Ocean is a manifestation of the Southern Oscillation that is also found in the observed pressure field. *b*, Observed sea-level pressure isocorrelations with Darwin, Australia, after Wright[20].

It has been suggested that quasi-periodic variations of the trans-Pacific pressure gradient result in weakening (strengthening) of the trades causing easterly (westerly) migration of the zone of convergence and precipitation[1]. Wyrtki[2-6] hypothesized that the variations of wind stress on the ocean give rise to quasi-oscillatory behaviour of east-west water transport and temperature gradient in the eastern Pacific, which in turn redistributes large amounts of energy affecting global weather. Several models of the Southern Oscillation have been developed by simulating atmosphere-ocean interaction in the equatorial Pacific basin[7-12]. Cane and Zebiak[11] and Cane *et al.*[12] have reported a coupled atmosphere-ocean model of the equatorial Pacific region which reproduces major features of the Southern Oscillation, including interannual variations of sea surface temperature (SST). In their model, mean monthly conditions are specified from climatological data and deviations from the mean are calculated according to physical laws. Also, several authors have reproduced atmospheric characteristics of the Southern Oscillation in GCMs by prescribing anomalously high SSTs in the model eastern Pacific[13-17]. The results we report here are different in that a global atmosphere-ocean circulation model was integrated without any empirical constraints on the simulated interannual variations.

Walker and Bliss[18] characterized the Southern Oscillation as '... when pressure is high in the Pacific Ocean, it tends to be low in the Indian Ocean from Africa to Australia ...'. This large-scale swaying of pressure between the two oceans is the primary atmospheric signature of the Southern Oscillation. It results in sea-level air pressure near Indonesia and Australia to

BURNING FOSSIL FUELS PRODUCES CO/2
STOP ALL OFF-SHORE OIL DRILLING
FOR EMERGENCY CLIMATE STABILIZATION
WITH AN EARTH REGENERATION PROGRAM

INCREASED EARTHQUAKES AND TORNADOES
ATTRIBUTED TO CARBON DIOXIDE BUILDUP

Snow and ice buildup around the polar areas means pressure passing through the tectonic system and breaking out more in the middle regions of the earth.

Dr. Stephen Schneider, for example, raised this question at the Los Angeles meeting in May 1985 of the American Association for the Advancement of Science, in his presentation to the Climate Section.

Snow coverage reported November 1985 by the NOAA (National Oceanographic and Atmospheric Administration), from satellite photos, was 18% more in the northern hemisphere (North America, Europe, USSR, Asia) than the previous high point which was in November 1973.

More snow comes from more CO/2 in the atmosphere. The CO/2 causes warming in the lower latitudes ("greenhouse" effect), and more evaporation of water (which drops as snow higher up).

CO/2 has increased from about 280 parts per million in the atmosphere to 345 this century. The count at the turn around into the last glacial period was about 320 ppm approximately 120,000 years ago.

There have been over 17 glacial cycles of around 70,000 to 110,000 years each. Why? Soil minerals get used up; forests then start to die out; with diminished and dying forests, the CO/2 starts to increase; finally leading to climate change and the next glacial period.

CO_2 & CLIMATE

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Directors: Alden Bryant, Douglas W. Fryday, Dolores Huerta, Julianne M. Malveaux, PhD, Fred Bernard Wood, PhD. Editor: Barbara B. Logan

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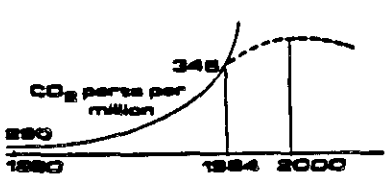
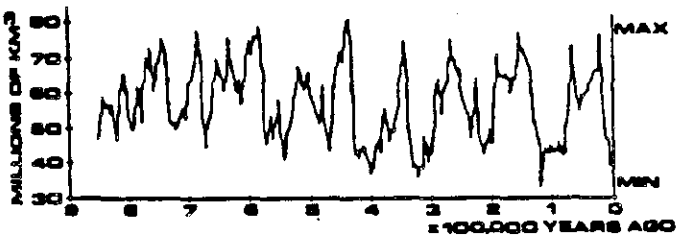
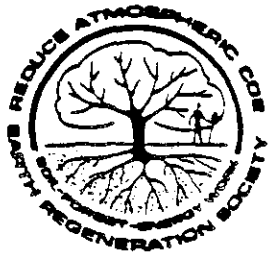
The following sources of increasing disturbance occur in the U.S. at different times and different locations, but need to be looked at all together as one general system accelerating us into technical breakdown and famine, to be followed by glaciation, unless the process is slowed and turned around: (1) storms, on both land and ocean; (2) landslides; (3) roads, utilities, buildings demolished; (4) wind storms, with various forms of damage; (5) blizzards; (6) floods; (7) tornadoes; (8) drought; (9) record heat spells; (10) record cold conditions; (11) cold fronts coming down from the arctic, as far as Florida; (12) snowstorms; (13) snow and ice buildup; (14) shorter growing seasons/changing storm and cold conditions; (15) forests dying out; (16) forest fires increasing in less resistent forests; (17) forest and agricultural infestation; (18) acid rain speeding the end of forests; (19) earthquakes; (20) volcanic action.



ATMOSPHERIC CARBON DIOXIDE INCREASE AND PROPOSED REDUCTION



VARIATION OF GLOBAL ICE VOLUME



A NEWSLETTER ABOUT CYCLES OF GLACIATION, THE NEGATIVE EFFECTS OF AN INTERGLACIAL/GLACIAL TRANSITION ON LIVING SPECIES, AND A COUNTER PROGRAM.

C. Bertrand Schultz

"'Mini-Ice Age' due, predicts scientist." Holdrege Citizen, 10-20-85. (Associated Press.)

"The director of the Nebraska Academy of Sciences believes the Northern Hemisphere is heading for a 'mini-Ice Age.' C. Bertrand Schultz.

"Schultz concurs with other geologists who say that by the year 2010 an Ice Age will engulf the Northern Hemisphere, resulting in Canada's inability to grow grain and the Soviet Union's inability to feed itself.

"Even now, he says, parts of Alberta, once rich in wheat, do not have the necessary 41 frost-free days in the growing season needed for a harvest.

"'The mean annual temperature of the Northern Hemisphere has continued to fall,' he said. 'It has been dropping since 1947, at least as far as we've been able to determine.'

Kenneth E.F. Watt

Abstract. The appearance of a century-long climatic warming trend results from the placement of most thermometers in cities, which warm relative to the countryside as they grow. The pattern revealed by rural thermometers in the United States is a significant cooling trend since 1941, except in some far western and north central regions.

Victor Kovda

Victor Kovda heads the Scientific Council on Problems of Soil Science and Reclamation of Soils at the USSR Academy of Sciences. He wrote to an American correspondent on December 10, 1985, as follows: "As a soil scientist, I am much involved in both ecological studies and problems concerning current climatic trends.

"I am fully informed concerning the existing prognosis of global warming influenced by a growing CO/2 concentration in the atmosphere.

"Observations by Soviet soil scientists in the USSR have compelled me to believe that, on the contrary, it is cooling which has taken place over the most recent period, 15-20 years.

"The signs of permafrost shifting southward, some shortening of the growing season and the increased severity of winters as well as the freezing of northern seas are the valid arguments for me.

"It may be a question of a periodic fluctuation (like those that have taken place in the past) or it may be the beginning of the next glaciation. This is a matter for research and discussion.

"But there are no signs of a forecasted warming and that is definite. This statement of mine has been published in Russian and English several times, namely that cooling goes hand in hand with an increase in arid lands as can be now observed practically everywhere.

"Discord about this problem still exists and studies about it will be prolonged."

A counter program to reduce CO/2, and try for climate stabilization, means remineralize the soil with a broad spectrum of minerals and trace minerals (reasonably good gravel and rock dust), reforestation, conservation and alternative energy technology development.

Replace fossil fuels. STOP ALL OFF-SHORE OIL DRILLING. END COAL USE. The Earth Regeneration Society put forward a 20 million job program for the U.S. to carry out an earth regeneration program.

Gramm-Rudman and star wars will be washed out by the immensity of the climate and glaciation problem. A counter program will take all we've got.

This means a full employment program, backed up with a full service support effort (food, health, education, training, child care, housing), in order to carry through climate stabilization in time — a worldwide envolvement. 1986 is the year of final public realization of what is happening. We have a massive and immediate survival problem.

If you want our Newsletter, other reports, or to assist in this citizen-science effort, you can become a Subscribing Member ($25) or a Sustaining Member ($100 or more). Tax deductible. Make checks out to "Earth Regeneration Society, Inc."

Big Storm Roars Through Rockies

Cheyenne, Wyo.

A snowstorm buried Colorado and Wyoming with up to 17 inches of snow yesterday, closing schools, delaying flights and shutting down Wyoming's state government in Cheyenne before blustering eastward into the Plains.

The storm closed down the northern Colorado college town of Fort Collins, where students took the day off. Many got around campus on cross-country skis.

State authorities in Wyoming told all 4500 government workers to stay home, closing state offices for the day. All schools were also closed.

Cheyenne was socked with seven inches of snow overnight. The central part of the state, where blizzard warnings were posted, was hit with over a foot of snow. Snow continued to fall throughout the day.

Cheyenne was socked with seven inches of snow overnight. The central part of the state, where blizzard warnings were posted, was hit with more than a foot of snow. Snow continued to fall throughout the day.

The Cheyenne Municipal Airport closed yesterday morning because two snowplows broke down. "We couldn't keep up with it (drifting snow)," airport manager John Wood said.

Many highways in Wyoming were closed, and use of chains were required for Interstate 80 between Lyman and Evanston.

The storm dumped up to 17 inches of snow on Fort Collins in northern Colorado and six inches in downtown Denver, snarling morning rush-hour traffic and giving thousands of school children the day off. Denver is expected to get another eight inches by today, forecasters said.

United Press

Record Snow Covers U.S., Europe, Asia

Washington

Snow cover set a record for November in North America, Europe and Asia last month, the National Oceanic and Atmospheric Administration announced yesterday.

Last month, snow covered 6 million square miles of North America, topping the 5.1 million record set in 1973, the agency said. Satellite photos showed snow covering 9.2 million square miles of Europe and Asia, breaking the record of 7.8 million, also set in November 1973.

) + 18%

) + 18%

"This is the most snow on the ground in November, as far as total coverage, we've seen since we started using satellite data to measure the phenomenon in 1966," reported Michael Matson of NOAA's National Environmental Satellite, Data and Information Service.

The unusually extensive snow cover does not necessarily indicate that winter will be more severe than normal, Matson cautioned.

"Weather brings the snow, not the other way around," he said. "There may be some long-range effects, but no forecaster would predict a white Christmas based on November observations."

Associated Press

SAN FRANCISCO CHRON CLE

Tuesday, December 10, 1985

By Associated Press

Pedestrians crossed a street during the snowstorm in Denver

MCMURDO AREA OF THE ANTARCTIC. The antenna are 120 feet tall, built during the 1965-68 period. Approximately 15 feet of the towers are now showing, which means four to five feet of ice increase per year average. (SEE MAP BELOW)

This crane was caught by an early snow storm. They never got it out. You see only the tip of the boom — and 7 to 10 stories of ice build up since the 1960s.

ANTARCTICA

AZIMUTHAL EQUIDISTANT PROJECTION

EARTH REGENERATION SOCIETY, INC.
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Notes From the Field

Workers returning from Antarctica, and workers in California, have reported on conditions they observed. The Earth Regeneration Society is passing on this information for those concerned with saving the areas, in case the information can be of assistance in finding out what is going on and taking corrective measures.

Antarctica

One large construction crane was caught in snow storms. It could not be moved out. It is almost entirely covered with ice and snow. Only the top of the boom is showing now. This was near the U.S. base in the McMurdo area. The Richard Byrd Surface Camp has been mentioned.

Use the figures of 95 foot increased snow and ice depth in a time period of 20 to 23 years: 95/23 = 4.1 Take this as four feet per year average increase in snow depth, with ice forming under the weight and cold.

Response by U.S. group: now putting up a 180 foot radar antenna.

The dome at the research center, located at the South Pole, is being crushed in with the weight of ice forming.

Similar conditions have been reported from Greenland. Workers described snow increase in the area of a US communications base, in which platforms for living and working facilities had to be raised about five feet each year because of the increasing snow buildup. This was in the late 1970s and early 1980s.

Efforts to save the area in its present condition There is a call to save Antarctica as a World Park. Green Peace is involved in this effort.

The general international orientation is that the world fresh water supply is reduced and polluted. Air quality is seriously polluted. The Antarctic is the most pure continent, one of the most beautiful places left on the earth. Leave it the way it is.

One worker, returning from work in the area three years ago, reported that the harbor they had been using became so filled with ice they could no longer bring ships in.

Atmospheric carbon dioxide increase from 270 parts per million to 350 ppm since 1900 produces more warming and evaportion in the lower latitudes; then this results in condensation in the higher latitudes — clouds, snow and ice. We are half way through the transition into the next glacial period. The climate change is moving fast.

Similar to the ice build up around construction is the ice impact on McMurdo Station trash. The San Francisco Examiner, January 8, 1989, "Big U.S. outpost is icy trash dump." "The No. 1 environmental disgrace in Antarctica is McMurdo Station, the main U.S. scientific base, critics say. ... An NSF special panel warned in June that McMurdo's three-decade accumulation of trash 'presents a health and safety hazard' to its personnel, which tops 1,000 during the Antarctic summer. ... Originally, McMurdo officials dumped trash on the ice shelf, which lies alongside the base. Come late summer, the ice broke up and drifted away, carrying the trash to sea. It melted, and the garbage sank into the drink. But beginning in the mid-1970s the ice didn't melt, and the garbage began piling up along the shore, right next to McMurdo. The result: a mountain of garbage, hideous to behold."

recognize that same face when presented in three-quarters profile.

PARES relies on the new technology of neural networks. Like the brain, it has many interconnected memory "cells," which work simultaneously rather than sequentially and thus greatly speed up the computation. And like a brain, a neural network can be trained to concentrate on essentials while ignoring irrelevant matters like angle of view—it can "learn" what's important and what isn't. But the training is tedious: an operator must patiently correct the computer's mistakes.

"It's a bit like pointing out your relatives to your three-year-old kid," says Peter Wohlmut, vice president of the PARES program. "It takes a while for him to figure out who's who." Eventually the computer, like the child, creates three-dimensional generalizations of all the people in its memory.

In the computer each generalization is mathematically derived from pictures of a person the system has been trained to recognize—ideally, pictures taken at different angles and under different lighting conditions. PARES converts the images into mathematical expressions containing up to 256 ratios of facial features, such as the ratio of a face's length to its width. Afterward, when a video camera scans a face or photograph, PARES will convert the video signal into a new mathematical expression and compare it with others in its memory. If the new one is sufficiently similar to one it has stored, it will declare a match. PARES needs only a tenth of a second to compare a face with up to 500 it has been trained to recognize. So far it has a false-alarm rate of half a percent—that is, of all the matches it declares, one in 200 will be incorrect. The error rate can change, however, depending on whether the operator sets wider or narrower limits for declaring a match.

Since the system does not depend on any one part of the face, it is not easily fooled by disguises like a wig or a mustache. "Obviously, someone wearing a ski mask will get through PARES," says Wohlmut, "but at that point you shouldn't need a computer to tell you something's going on."

Stuck south of their summer habitat because of late spring thaws, hordes of snow geese are turning newly sprouting marshes into desolate mud flats.

GEESE IN THE GLOBAL GREENHOUSE

Each year, as winter eases its chilly grip on the landscape, hundreds of thousands of snow geese leave their seasonal haunts in the southern United States and congregate for the long flight back to the Canadian north. Following the receding snow line, the huge column of birds migrates up the continent until reaching the northern end of the Hudson Bay. Once there the birds immediately fan out to establish their spring and summer habitats in the lush wetlands of the adjacent Northwest Territories. Or at least that's what used to happen.

Robert Jefferies, a botanist at the University of Toronto, has found that for most of the past decade heavy snowfall and sun-obscuring cloud cover have conspired to delay the Canadian snowmelt and interrupt the birds' migration. In the 1980s, Jefferies says, the snow line was 90 to 150 miles south of where it was in the 1970s on May 15, which typically marks the start of the nesting season. As a result, when the geese arrive, the northern shores of the bay are still under snow. Immense gaggles of geese accumulate at its southern shores and remain trapped there for up to several weeks. The birds feed voraciously on the local salt marshes, devouring the young spring plants and turning the marshes into barren mud flats.

"The geese," says Jefferies, "are changing the very nature of the landscape." Over the past four years marsh vegetation has decreased by a third in some of the areas he's studied, and by almost half in others. The diminished vegetation, in turn, hinders the migration of other birds following in the geese's flight path. Arctic wading birds, for example, which feed on insects and worms that normally thrive in the marshes, are turning up in lower numbers.

Climatologists are still debating if the recent changes in weather patterns are a temporary aberration or the beginning of a long-term trend. Jefferies notes that some computer models of the greenhouse effect for Canada suggest that dense cloud cover will continue to delay the springtime snowmelt. If that prediction proves right, disrupted migrations might become more common. "We can't say for certain that what we've seen this past decade is a direct result of the greenhouse effect," Jefferies says. "But if it is, then it suggests that some consequences would be so indirect that we could never begin to predict them all."

PHOTOGRAPH BY HANS LINDEMANN PETERSEN

THE ENVIRONMENTAL DILEMMA

DISCOVER

THE WORLD OF SCIENCE

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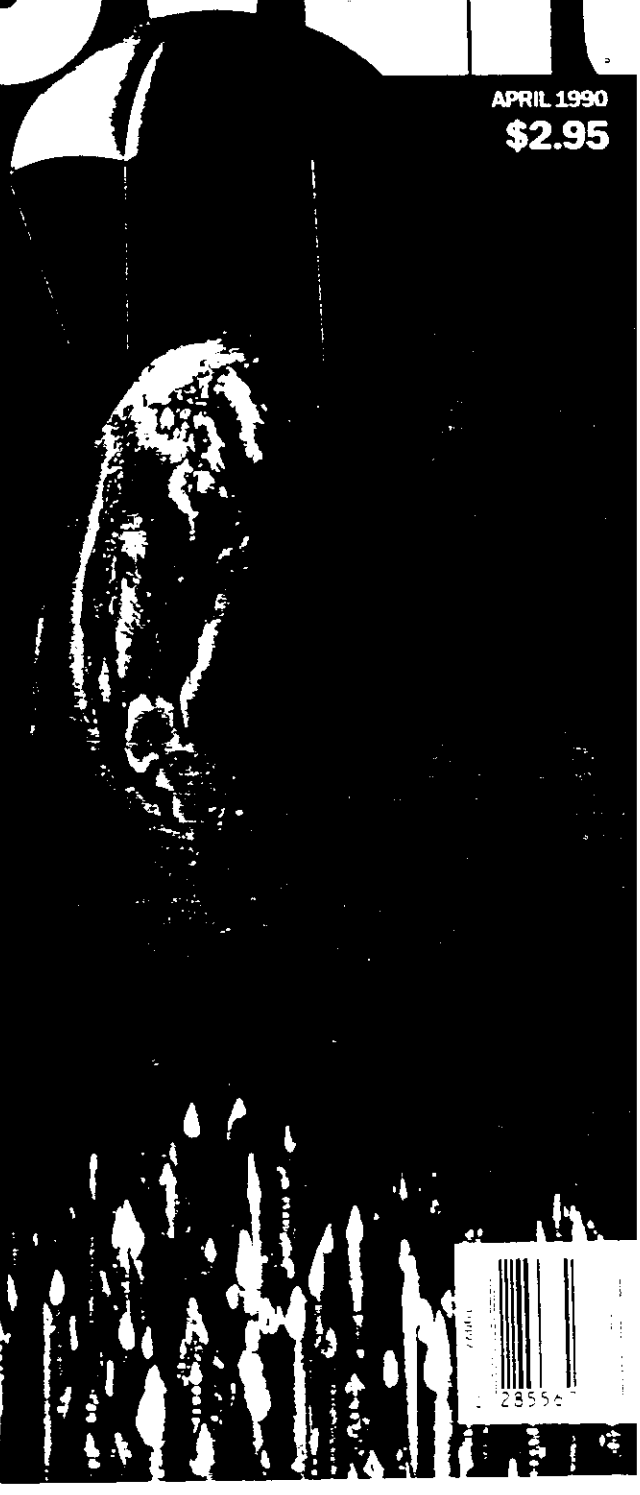

SPECIAL ISSUE

THE STRUGGLE TO SAVE OUR PLANET

PLUS:
Touchy Robots
Raindrop Physics
Sexual Perception

EARTH REGENERATION SOCIETY, INC.

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(415) 525-4877

June 6, 1990

Mr. Peter Petronek
Coordinator of Special Projects
Earth Day Canada
800 Yates Street
Victoria, B.C.
V8W 1L9, Canada

Dear Mr. Petronek:

We wish to extend our respect for the work you are doing, for your understanding of the realities we are all facing, and to offer you encouragement and support in our mutual efforts.

Your emphasis on soil remineralization as the basis for maximum forest growth, crop nutrition value, drought, heat and frost resistance and thereby also human health, is in line with the best work currently in numerous countries. This is an upcoming area of major investment, and will be highly beneficial to investment groups developing this new industry.

To us, it appears that you are carrying forward the message and intent of the programs reaching millions of people around the world during the months leading up to Earth Day, on Earth Day 1990, on World Environment Day June 5, and since then.

We are heartened by your concern that awareness of the full warming/cooling cycle of climate change is essential for public action and government response. Anything less will leave our countries open to continuing confusion and inadequate response through government channels. Our survival is at stake, and every year will produce greater losses as long as the CO/2 level is above the livable CO/2 level of about 280 parts per million. It is obvious that Canada and the United States can develop a significant involvement in an international climate stabilization effort through the United Nations.

Changes taking place in Canada

1. Permanent snow line moving south in Canada (90 to 150 miles, 1980s vs 1970s). One result has been migrating geese held back from traditional feeding areas, and having serious destructive effects on the ecology further south in substitute feeding areas.

2. Exceptionally deep snow in the winter of 1983 in a region 500 miles north of Winnipeg. Wolves were unable to find the normally available winter food and started coming to the edge of the city looking for garbage and scraps. The region included a mining city of approximately 16,000 people.

3. Moose die out in southern Alaska. An Alaska Fish and Game Department report was carried recently on a CNN program in the U.S. There has been the most serious die off of moose they have ever seen. The snow has become so deep in winter that the moose can no longer dig down for forage and are starving to death, with their carcasses showing up in the Spring. This is further evidence of significant ecological shift. It is an unprecedented event, one of many extreme events in recent years.

Behind this are the reports of unprecedented snow depth during the 1980s in Alaska by Maynard Miller, and Eastern Canada, Baffin Island and Greenland snow increase indicating movement into the next glacial period according to Gifford Miller.

4. 1984 wheat loss in Canada of about 75% due to heat and drought in the summer, following large scale crop destruction in the higher latitudes during the winter.

5. Farmers have been going bankrupt at the highest rate ever in Canada, primarily due to climate change intensities. Banks are foreclosing and having to take over farms.

6. You reported to us unprecedented low level snows in British Columbia June 1, together with unusual storms, flooding, and other extremes around Canada.

U.S. history on recognition of the full climate cycle, its growing effect on human life, and the direction of possible solution

1. Early 1970s statements referring to the end of the interglacial period: Alexis Dreimanis, George Kukla, C. Bertrand Schultz, and talk among people in neighborhoods in North Eastern U.S. (1980: "the next ice age is coming").

2. August 1974, CIA Research Dept. report on climate change.

3. 1982, California Democratic Council, state convention platform section.

4. April 1983, incorporation of the Earth Regeneration Society as a non-profit corporation in California. A number of the main participants had known each other in the International Society for General Systems Research for 15 to 20 years (current organization name: International Society for the Systems Sciences).

5. 1984, California Democratic Party platform first included section on climate change, reforestation, glaciation, and international cooperation.

6. AFL-CIO National Convention, starting in 1986, included climate change in its Environment section. It refers to climate, food and jobs, based on a resolution submitted from the Alameda County Central Labor Council describing the full warming/cooling climate cycle and the emergency nature of the problem. The resolution originated with the Peralta Federation of Teachers, Local 1603, AFT, AFL-CIO, and its Climate, Food and Jobs Committee.

7. Scientists in many fields have contributed according to their specialties, be it soil, forests, oceans, alternative energy, cloud, snow and ice buildup, and general systems approach to integrating the whole climate change process. Their work is included in the documents referred to in paragraph 5. below. Also note the references in my paper "The Role of CO/2 Budgets in Climate Stabilization" [797] to be issued July 9, 1990.

Necessity for a clear and complete statement of the problem, the process that is now accelerating, and the direction for solutions

1. We appreciate your awareness of the accelerating glaciation conditions which have been appearing in Canada, as indicated above, and your action and educational efforts in response to the problem.

2. We share your concern for increasing massive programs around soil remineralization, reforestation, alternative energy technology development, and ocean phytoplankton and kelp enhancement to reduce atmospheric CO/2. At the same time you are looking for appropriate transfer of investment and production activity by corporations, from present military, and less essential output, to new requirements.

3. In the near future, we will look forward to Canada developing its own working mechanism of national and local CO/2 Budgets.

4. We appreciate your understanding concerning the intensities of climate change. These conditions are forcing public and corporate awareness of the accelerating aspects of the glaciation process. Our mutual job is to put the problem clearly out in front of the public. This is not time for compromise with those trying to stop action on CO/2 reduction, and mislead the public.

5. We are glad that the Earth Regeneration Society three-volume set, including over 200 items relating to the science and institutional response to climate change, has been helpful to you in conferences and meetings with government and non-government groups in Canada.

6. We are looking forward to analysis by Canadians on CO/2 emissions within your country, by source and annual rates. It is now so timely for all countries to come forward with essential information relating to climate change and climate stabilization, and not be held back by those narrow interests trying to stop change.

7. We will keep you informed as to the progress of the proposed legislation in the U.S., "Emergency Climate Stabilization and Earth Regeneration Act of 1990." It is the first proposed legislation to state clearly the full global warming/cooling process, the magnitude of the CO/2 reduction job, and call for a national CO/2 Budget and related information on accelerating destruction from climate intensities in summer and winter.

In conclusion, you have our deepest admiration and respect for the job you are doing. Should Canada go, and the permanent snow line keep moving South, the United States would follow in destruction of agriculture, infrastructure and human life. In a way, you are our first line of defense against climate change, and partner to work for climate stabilization within the total international situation.

Sincerely yours,

Alden Bryant

Alden Bryant

President, Earth Regeneration Society

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CO_2 & CLIMATE

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Directors: Alden Bryant, Douglas W. Fryday, Dolores Huerta, Julianne M. Malveaux, PhD, Fred Bernard Wood, PhD.

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CANADA

Aspects of climate change and the glaciation process

1. Baffin Island. Professor Gifford Miller of Colorado. In a 1977 television program, he described how we are moving into the next glacial period with the rapid snow buildup in the northern latitudes.

2. There was much heavier 1983 winter snow buildup in the region 500 miles north of Winnipeg, with animals moving south more than usual and wolves therefore coming to the edge of towns looking for food. Snow lasted much longer into the Spring.

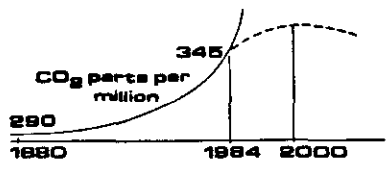
3. 1984 wheat production was down 76% (Statistics Canada. Christian Science Monitor, 9-25-84). They were hit by summer drought from the south and, in northern Saskatchewan, by late storms followed by early frosts which killed off more wheat. Professor C. Bertrand Schultz, Director of the Nebraska Academy of Science, pointed out that much of Canada no longer has 41 frost free days to raise wheat.

4. Northern hemisphere snow cover in November 1985 was 18% greater in North America, Europe and the USSR, than the previous peak which was in November 1973 (satellite readings).

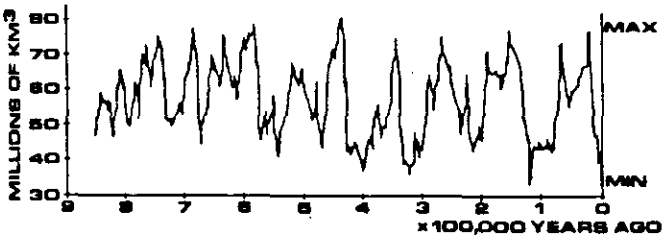
5. In the Great Lakes region, summer 1986 temperatures were not up in the usual 90s but in the 60s and 70s. (This same degree of cooling was taking place in Tbilisi, Georgia, USSR, in the 1983-1984 period.) The Great Lakes have been filling and becoming increasingly more destructive of property along the lake shores, particularly in Chicago (this results from the increasing CO/2, warming in the lower latitudes, and more cloud cover and rainfall in this region).

6. The 20 or more degrees (F) of cooling in the Great Lakes area extended throughout Canada In 1986 Canada had almost no summer.

7. Sugar maple trees in the Quebeque area. Over 30% were dead and dying in 1983, by aerial survey, and over 80% in 1986. When they are cut for sap, the cuts do not heal. It is our suggestion that this is mainly because the soil minerals are low (used up, washed to the sea) Remineralization with good rock dust as in Austria, Germany, Switzerland, Czechoslovakia, Australia, would probably bring the trees back to life. The offsetting factor would be the increasing cold fronts coming down from the growing snow cover to the north.



ATMOSPHERIC CARBON DIOXIDE INCREASE AND PROPOSED REDUCTION



VARIATION OF GLOBAL ICE VOLUME

A NEWSLETTER ABOUT CYCLES OF GLACIATION, THE NEGATIVE EFFECTS OF AN INTERGLACIAL/GLACIAL TRANSITION ON LIVING SPECIES, AND A COUNTER PROGRAM.

Arctic and Alpine Research, Vol. 20, No. 4, 1988, pp. 404–413

GLOBAL ALPINE GLACIER TRENDS, 1960s to 1980s*

FRED B. WOOD
Office of Technology Assessment
United States Congress, Washington, D.C. 20510, U.S.A.

ABSTRACT

Analysis of data compiled by the Permanent Service on the Fluctuations of Glaciers (now known as the World Glacier Monitoring Service) suggests that the alpine glaciers of the world as a group shifted during the 1960 to 1980 period from a regime strongly dominated by shrinking and receding glaciers to a mixed regime. Between 1960 and 1980, on the basis of data for about 400 to 450 glaciers observed each year, advancing glaciers are shown to have increased from about 6% of observed glaciers to 55%. During the 1960 to 1980 period, on the basis of data for about 50 glaciers observed each year, annual mass balance is shown to be, on the average, positive for about 57% of observed glaciers in the European Alps and for 40% of observed glaciers in the other monitored areas of the world. Preliminary data for 1981 to 1985 suggest that the mixed glacial regime is continuing. However, regularly monitored glaciers account for only a small percentage (probably less than 1%) of the total number of glaciers worldwide. More extensive research and monitoring are necessary to determine the pervasiveness and permanence of this shift, and to assess its climatic implications.

INTRODUCTION

The behavior of glaciers has been the subject of scientific research for more than a century, but has recently acquired a new sense of urgency with respect to the possible effects of trace gas-induced climatic change on glacier size and movement (see McBeath et al., 1984; U.S. DOE, 1985). Alpine (i.e., mountain) glaciers and small ice caps are thought to be particularly sensitive to significant changes in climate, that is, long-term trends in temperature and precipitation, and have been suggested as indicators of climatic change (see Meier, 1965; Untersteiner, 1984; Barry, 1985a).

This article examines and analyzes the comprehensive data on glacial change during the 1960 to 1980 time frame compiled by the Permanent Service on the Fluctuations of Glaciers (now known as the World Glacier Monitoring Service [WGMS]) located in Zürich, Switzerland (Kasser, 1967, 1973; Müller, 1977; Haeberli, 1985a). Preliminary 1981 to 1985 data for selected countries are also considered. The primary focus of this article is on identifying key trends in fluctuations of alpine glaciers (and a few ice caps). The article does not consider the Greenland and Antarctica ice sheets, for which empirical data are extremely limited (U.S. DOE, 1985). In addition, the gross geometry of the ice sheets is generally thought to respond to climatic change on the scale of centuries or millennia (although outlet glaciers and iceberg calving respond much faster), while the smaller alpine glaciers and ice caps generally respond on an annual to decadal time scale (Untersteiner, 1984; Gates, 1985; Williams, 1985; Haeberli et al., in press).

*The views expressed are those of the author and not necessarily those of the Office of Technology Assessment, Technology Assessment Board, or U.S. Congress. The article is based on independent research of the author and not on work conducted for the OTA.

MATERIALS AND METHODS

The most extensive glacial data are available for variations in the positions of glacier fronts. These data (as well as data on glacier mass balance, area, and volume) are compiled by the WGMS from information provided by correspondents in individual countries around the world. Generally, the data are submitted either in quantitative form (e.g., meters per year in change in the position of the glacier front) or qualitative form (e.g., the glacier front appears to be in advance, in retreat, or stationary) when numerical values are not available. There still is substantial disparity in the monitoring of glacier fronts, especially in terms of geographic coverage, ranging from extensive monitoring in the European Alps and Iceland to minimal monitoring in Canada and China. Glaciers monitored for variations in glacier fronts account for only a small percentage (probably less than 1%) of the total number and area of glaciers worldwide. For example, of the approximately 7500 glaciers in the United States, including 5900 in Alaska (see Brown, in press), as of 1980 only 101 were regularly monitored for changes in glacier fronts. The monitoring methods employed vary from aerial and terrestrial photogrammetry to ground surveys to combinations thereof. At present, satellite imagery is used only for special studies and not for large-scale monitoring.

Some data are available for glacier mass balance, that is, the net change in glacier mass in a given year or cumulative mass balance over time. Mass balance is important, because it is the variable that directly links the glacier to its climatic environment. Changes in mass balance over time drive changes in ice thickness, ice flow, and ultimately the positions of glacier fronts. However, mass balance data are very sketchy. The number of glaciers monitored for mass balance is only about one-tenth of the total number monitored for glacier front variations (or perhaps 0.1% or less of all glaciers). Net annual mass balance is generally estimated in meters or millimeters of water equivalent, either by calculating the difference between annual accumulation and ablation or the difference between mean specific winter balance and summer balance (see Haeberli, 1985a).

Limited data are available on changes in glacier area, that is, the surface area of a glacier usually measured in square kilometers, and another indicator of glacial extent. Also, very limited data are available on changes in glacial volume, usually measured in cubic kilometers or thousands of cubic meters. The data sets on changes in area and volume cover only subsets of the glaciers for which mass balance data are available, which in turn are a subset of glaciers for which glacial front data are available.

The published reports of the Permanent Service on the Fluctuations of Glaciers (now the WGMS) should be consulted for technical details on monitoring methods and the raw monitoring data (Kasser, 1967, 1973; Müller, 1977; Haeberli, 1985a).

In order to develop overall trends on the positions of glacier fronts, I reviewed the published WGMS data for all monitored glaciers, excluded glaciers in those years when no data were available or when snow covered the glacier front (and thus made measurement impossible), and calculated the number and percentage of glaciers that were reported to be in advance, stationary, or in retreat by year for each country, selected regions, and globally.

The number of observed glaciers increased gradually from 271 in 1959/60 to 446 in 1979/80, with Austria, Switzerland, Italy, Iceland, the United States, and the Soviet Union having the largest number. The country-by-country distribution of observed glaciers is shown in Table 1. Note that the total number of monitored glaciers was 625 in 1979/80, but that data were actually collected for only about 70% of these.

Next, in order to develop overall trends on glacier mass balance, I reviewed the published WGMS mass balance data for all monitored glaciers, excluded glaciers for which less than 10 yr of data were available (with two exceptions), and calculated the number and percentage of glaciers that were reported to have a positive or negative mass balance by year for each country, selected regions, and globally.

A total of 53 glaciers were included in the mass balance analysis, and these are summarized by country in Table 4. The specific glaciers are listed in Appendix A along with the years of data availability. In only two years, 1971/72 and 1973/74, were the data available on all 53 glaciers.

TABLE 1
Variations in glacier fronts: number of observed and monitored glaciers, by country

Country	Number of Observed Glaciers 1959/60	1969/70	1979/80	Monitored glaciers[a] 1979/80
Iceland	30	33	37	49
Norway	14	10	10	12
Sweden	3	3	6	15
Austria	58	92	108	118
France	2	18	6	6
Italy	101	111	47	59
Switzerland	63	98	105	114
Canada			6	25
United States		20	50	101
Soviet Union		27	43	75
Peru			5	5
Argentina[b]				
China			3	12
Kenya			4	6
Antarctica			16	28
Totals	271	412	446	625

[a]Includes glaciers for which no data were available in a given year or for which the glacier front was covered with snow, thus making measurement impossible.

[b]Data available for 1973/74 and 1974/75 only.

Finally, in order to develop overall trends on changes in glacier area, I reviewed the published WGMS data for the 53 glaciers used in the mass balance analysis and found that areal data were available for 49 of the 53. After excluding the Devon Ice Cap (due to its large size and distorting effect on overall trends), I calculated the net change in area for each of the 48 individual observed glaciers over the period for which data were available for each glacier, and then summed these changes by country and globally. The 48 included the glaciers listed in Appendix A with the exception of the Devon, Meighen, and South ice caps and Ram River Glacier in Canada and the St. Sorlin Glacier in France. I also calculated the number and percentage of glaciers the areas of which grew, shrank, or remained the same over the period of observation.

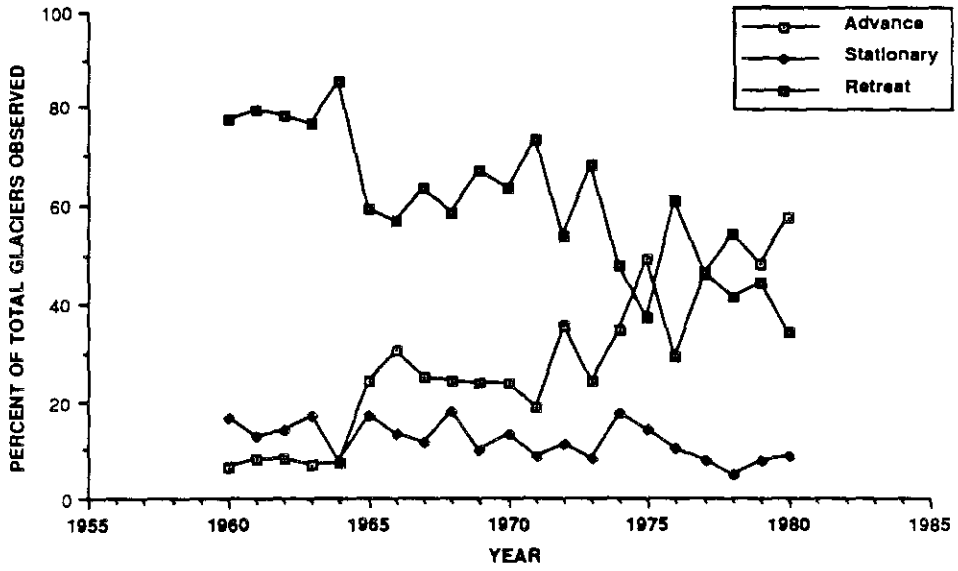


FIGURE 1. Variations in positions of glacier fronts in percent of total glaciers observed by year, 1960 to 1980.

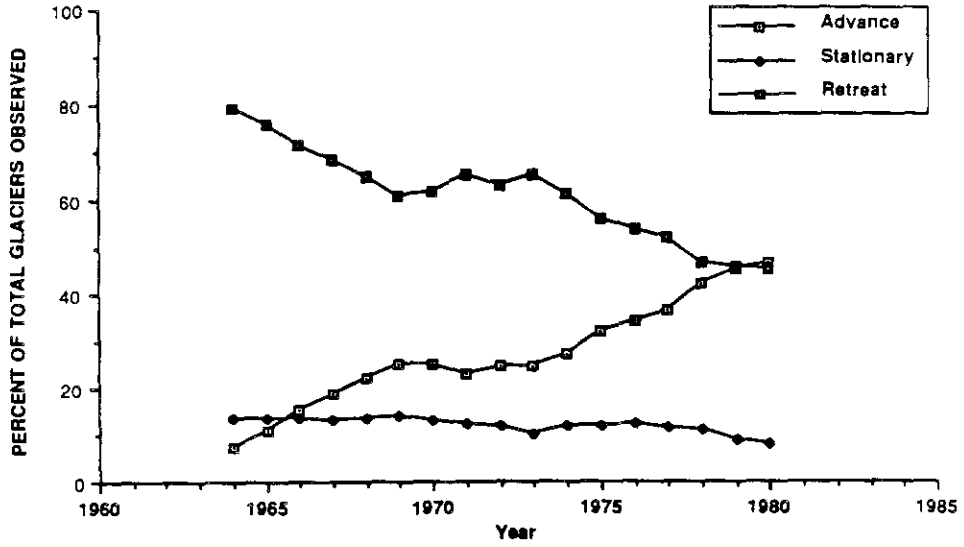


FIGURE 2. Variations in positions of glacier fronts in percent of total glaciers observed, 5-yr moving averages, 1965 to 1980.

RESULTS

Positions of Glacier Fronts

The 20-yr trends in the positions of glacier fronts are shown in Table 2 and Figure 1. The percentage of glaciers advancing increased from about 6% of observed glaciers in 1959/50 to more than 55% in 1979/80. During the same time period, the percentage of glaciers in recession declined from more than 75 to about 35%. And the percentage of stationary glaciers declined slightly. All three trends evidenced considerable interannual variability, as shown. Part of the variability is due to the changing yearly mix of observed glaciers. Not all glaciers are observed in all years. Indeed, many glaciers are observed only once every few years. When converted to a 5-yr moving average, as shown in Table 2 and Figure 2, the trends are clarified, with a cross-over point of 1979/80 when the percentage of advancing glaciers exceeded the percentage of receding glaciers.

As of 1980, 50% or more of the observed glaciers were advancing or stationary in the following countries: Italy, France, Austria, the United States, Switzerland, China, Iceland, and Norway. The 1980 percentages of advancing, stationary, and retreating glaciers for all reporting countries are shown in Table 3. The small number of observed glaciers for France, China, Canada, Peru, Sweden, and Kenya limits the confidence one should place in trends for these areas. Also, many of the observed glaciers for China, Canada, Peru, Kenya, and Antarctica have a very limited reporting history, likewise making it difficult to assess current trends.

Mass Balance

For the entire 20-yr period (1959/60 to 1979/80), the percentage of observed glaciers with positive mass balance is summarized by country, region, and overall in Table 4. For all observed glaciers, the global average is 45% positive mass balance, that is, on the average, 45% of observed glaciers had a positive mass balance in any given year. Most countries fell in the 39 to 44% range, with only Sweden lower (33%) and the Alps (with the exception of Italy) higher (50 to 60%).

The 20-yr mass balance trend showed even greater interannual variability than the glacier front trend. This is due in part to the changing number and mix of glaciers but also to the expected wide fluctuations in annual mass balance. For example, in 1962/63 and 1975/76, all four observed Swiss glaciers showed negative mass balances, but in the following years (1964/65 and 1976/77) all four glaciers showed positive mass balances. Mass balance reflects primarily the previous year's climate, whereas advances and retreats in glacier fronts reflect the cumulative effect of several (and sometimes many) years of climate.

The mass balance trends using 5-yr moving averages are shown in Table 5 and Figure 3. Significant variability is still evident, driven in part by wide swings in the mass

Table 2
Variations in positions of glacier fronts, 1960–1980, by year and by 5-yr moving average[a]

	Year by Year			5-yr Moving Average		
Year	Adv.	Stat.	Ret.	Adv.	Stat.	Ret.
1959/60	6.3	16.6	77.1			
1960/61	8.1	12.6	79.3			
1961/62	8.1	14.0	78.0			
1962/63	6.7	17.0	76.4			
1963/64	7.1	7.7	85.1	7.3	13.6	79.2
1964/65	24.2	16.7	59.1	10.8	13.6	75.6
1965/66	30.3	13.2	56.6	15.3	13.7	71.0
1966/67	25.1	11.6	63.3	18.7	13.2	68.1
1967/68	23.9	17.8	58.4	22.1	13.4	64.5
1968/69	23.8	9.5	66.7	25.5	13.8	60.8
1969/70	23.8	13.1	63.1	25.4	13.0	61.6
1970/71	18.5	8.4	73.1	23.0	12.1	64.9
1971/72	35.3	11.1	53.6	25.1	12.0	63.0
1972/73	24.0	8.0	68.0	25.1	10.0	64.9
1973/74	34.7	17.5	47.8	27.3	11.6	61.1
1974/75	48.9	13.8	37.3	32.3	11.8	56.0
1975/76	29.2	10.1	60.8	34.4	12.1	53.5
1976/77	46.1	7.6	46.3	36.6	11.4	52.0
1977/78	53.8	4.7	41.5	42.5	10.7	46.7
1978/79	48.1	7.7	44.3	45.2	8.7	46.0
1979/80	57.4	8.5	34.1	46.9	7.7	45.4

[a]Adv. – percentage of observed glaciers advancing; Stat. – percentage of observed glaciers stationary; Ret. – percentage of observed glaciers retreating.

Table 3
Summary of changes in positions of glacier fronts, by country, 1979/1980[a]

Country	Number of observed glaciers	Changes in Glacier Fronts		
		Adv.	Stat.	Ret.
France	6	83		17
Italy	47	81	9	11
Austria	108	72	3	25
Switzerland	105	70	3	28
Iceland	37	57	3	41
Norway	10	50		50
United States	50	46	28	26
China	3	33	33	33
Soviet Union	43	23	12	65
Peru	5	20		80
Canada	6	16	16	67
Antarctica	16		38	62
Sweden	6			100
Kenya	4			100

[a]Adv. – percentage of observed glaciers advancing; Stat. – percentage of observed glaciers stationary; Ret. – percentage of observed glaciers retreating.

balance of glaciers in the European Alps. For this group of glaciers, the percentage of glaciers with annual positive mass balances increased from about 29% in 1963/64 to 77% in 1968/69, then declined back to 24% in 1972/73, rose again to 79% in 1977/78, and remained relatively stable at a highly positive level through 1979/80. For all observed glaciers, the percentage with positive mass balance peaked at more than 50% in the late 1960s and mid-1970s and declined to just under 40% in 1979/80.

TABLE 4
Average percent of observed glaciers with positive mass balance, 1960–1980, by country and region

Country/Region	Number of observed glaciers	Average percent of observed glaciers
Canada	11	43
United States	4	41
North America	15	42
Norway	8	44
Sweden	1	33
Scandinavia	9	43
France	2	50
Switzerland	4	52
Austria	5	66
Italy	1	42
European Alps	12	57
Soviet Union	16	39
China	1	43
Asia	17	39
Totals	53	45

GLACIER AREA AND VOLUME

The results for glacier area and volume are summarized in Table 6 and show, overall, little significant change. For all 48 glaciers, the 1980 area of 458.2 km² reflected a net increase of 3.8 km² (or about 0.8%). This is probably within the range of measurement error. In terms of percentage change by country, only France, China, and Norway showed significant growth or shrinkage (5 to 6% range). But these are based on one observed glacier each for France and China and largely on the areal growth of

TABLE 5
Variations in glacier mass balance, 1963–1980, 5-yr moving average

Year	European Alps Pos. Bal.[a]	All Countries Pos. Bal.[a]
1963/64	29.3	34.1
1964/65	35.7	42.4
1965/66	43.9	43.9
1966/67	57.4	50.7
1967/68	71.7	58.1
1968/69	77.2	56.2
1969/70	64.5	49.7
1970/71	47.9	47.4
1971/72	35.4	45.0
1972/73	24.4	42.2
1973/74	32.5	43.8
1974/75	45.2	47.7
1975/76	48.5	49.5
1976/77	58.5	46.4
1977/78	78.5	46.2
1978/79	75.0	41.7
1979/80	73.2	38.1

[a]Pos. Bal. – percent of observed glaciers with positive mass balance for the year indicated.

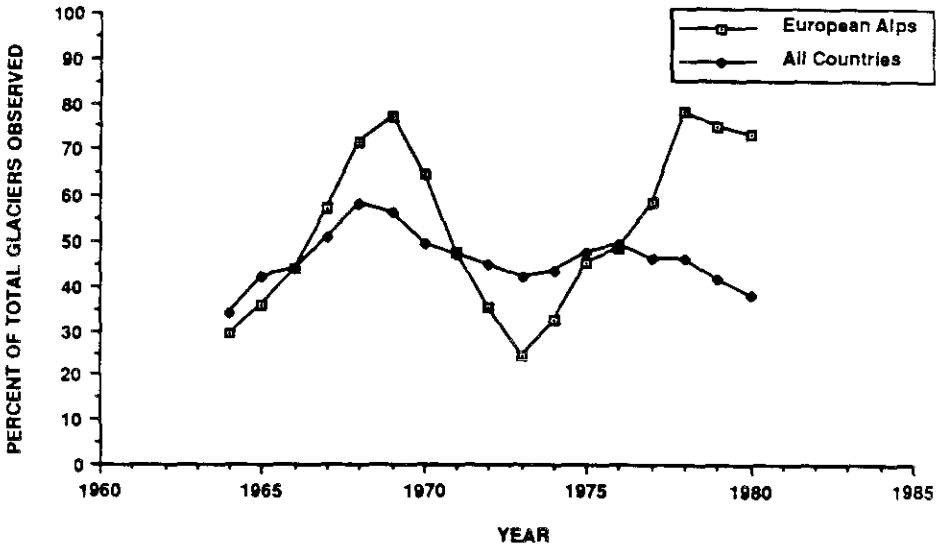


FIGURE 3. Variations in glacier mass balance as percent of observed glaciers with positive mass balance, 5-yr moving averages, 1963 to 1980.

one glacier (Nigardsbreen) in Norway, and thus should not be considered indicative of broader trends. Of the 48 observed glaciers, the data indicate that 12 grew, 19 shrank, and 17 remained the same in area.

Data on changes in glacier volume are extremely limited. The latest published volumetric data (Haebreli, 1985a) covers only 34 glaciers, with highly variable geographic coverage, years between measurements (ranging from 2 to frequently 10 or 20 yr), and measurement techniques. Analysis of the data found that, of the 34 glaciers, 16 increased in volume over the period of measurement and 18 decreased in volume. In general, observed glaciers in Austria and Germany increased in volume, while glaciers in Switzerland, the Soviet Union, and Canada decreased, although trends were somewhat mixed for the latter two countries.

TABLE 6
Net change in glacier area, 1960–1980

Country	Number of glaciers	Glacial area (km²)	Net Change in Area (km²)	(%)
Canada	7	64.25	+0.2	+0.3
United States	4	43.67	−0.13	−0.3
Norway	8	122.54	+5.95	+4.9
Sweden	1	3.1	0	0
France	1	0.83	+0.05	+6.0
Switzerland	4	140.2	−2.62[a]	−1.9[a]
Austria	5	24.98	+0.29[b]	+1.2[b]
Italy	1	4.68	−0.04	−0.9
Soviet Union	16	52.11	+0.79	+1.5
China	1	1.84	−0.11	−6.0
Totals	47	458.20	+3.80	+0.8

[a] −0.18 km² (−0.13%) during 1976–1980.
[b] +0.75 km² (+3.0%) during 1971–1980.

DISCUSSION

Synthesis of glacial trend data is difficult because of the uneven geographic coverage of glacier monitoring activities, and because of the complexities of glacial dynamics. Glacier monitoring is, in general, most extensive in Europe and Iceland. Even in these regions, monitoring of changes in glacier fronts receives most of the attention, since advances and retreats are relatively easy to measure. Monitoring of changes in glacier mass balance, area, and volume is severely limited. And for major portions of the world, especially Alaska, Canada, China, Antarctica, and the Andes and Himalayas, even monitoring of glacier fronts is rare when compared with the large number of unmonitored glaciers.

A further complicating factor is that change in the position of glacier fronts, the most commonly monitored glacial variable, is heavily affected by glacier dynamics. Thus interpretation of changes in frontal position (i.e., advance or retreat) as an indicator of climate change can be difficult and complex. For example, the Aletsch Glacier in the Alps has steadily retreated in length over the 1920 to 1980 period but has significantly increased in mass balance since the early 1960s, suggesting that changes in length can lag changes in mass balance by up to decades (Haeberli, 1985b). However, the specific time constants and relationships depend on each glacier's size, geometry, stability, and location (e.g., cirque, valley, or tidal; maritime, continental, or transitional), among other factors (see Meier, 1965, 1984, 1985; Haeberli et al., in press).

With these caveats in mind, the glacial trend results suggest the following:

(1) During the 1960 to 1980 period, glaciers in the European Alps (Austria, Switzerland, France, Italy) appear to have experienced a net growth. The percentage of advancing glaciers increased from an average of about 10% to more than 75%; the average percentage of glaciers with positive mass balances increased from about 30% to over 70%. These results are generally consistent with other published analyses for the Alps (see Barry, 1985a, 1985b; Patzelt, 1985, 1986).

(2) The strongest evidence for glacial growth is in Austria, especially during the 1971 to 1980 period when four of five observed glaciers showed positive mass balances in 8 of 10 yr (the fifth was positive in 4 of 10 yr), and five of five observed glaciers increased in area; also, the percentage of advancing glaciers (based on observation of about 90 to 100 glaciers) increased from roughly 14% in 1971 to 72% in 1980, and 9 of 10 observed glaciers increased in volume.

(3) Globally, glacial trends over the 1960 to 1980 period appear mixed. Outside of the European Alps, mass balances remained negative, but not overwhelmingly so, with about 40% of glaciers showing positive balances on the average. Likewise, in addition to the Alps, for the United States, China, Iceland, and Norway by 1980 more than half of the observed glaciers were advancing and/or stationary. On the other hand, more than half of the observed glaciers in Antarctica, the Soviet Union, Canada, Peru, Sweden, and Kenya were retreating. As noted earlier, the limited overall data on glacier area and volume were mixed.

(4) While long-term data are limited, the mixed glacial trends during the 1960 to 1980 period suggest a shift in the global alpine glacier regime that appears to have been previously dominated by retreating glacial fronts and negative mass balances. For example, long-term mass balance data for a French glacier (Sarennes) and a Swedish glacier (Folgefonni) indicate that mass balance increased from 1882 to 1920, decreased from 1920 to 1950, and in-

creased again since about 1960 (Reynaud, 1984). And Meier's (1984) analysis of 25 glaciers showed uniformly negative mass balance trends over the period 1900 to 1961. A detailed update of Meier's work is warranted but is beyond the scope of this article. However, I conducted a rough comparison for one region. For eight glaciers in the Alps and Pyrenees, Meier found an average net mass balance of -0.42 m water equivalent per year over the 1900 to 1961 period. My analysis of 12 glaciers in the Alps (based on data in Müller, 1977; Haeberli, 1985a) indicates an average net mass balance of +0.11 m water equivalent per year over the 1971 to 1980 period (and +0.31 m per year on average during 1976 to 1980). Any implications for even this one region must be qualified given the differences in the glacier mix and the methods used to calculate mass balance.

With respect to changes in positions of glacial fronts, extensive long-term data are available for glaciers in the European Alps. In general, over the last 200 yr, glaciers in the Alps were most advanced during the early 1800s, then retreated until the early 1900s, a period of partial readvance, and then retreated again until the recent period of partial readvance (see Porter, 1986). For the 1926 to 1960 period, most observed glaciers in Austria, Italy, and Switzerland (70 to 95%) were in recession and only a few (5 to 20%) were advancing. In this context, the shift in the Alps over the 1960 to 1980 period to a regime dominated by advancing glacier fronts appears to be even more significant. Data for 1981 to 1985 suggest some reversal of this trend in the Alps and a reduction in the percentage of advancing glaciers that appears to have stabilized at about 50% (see Patzelt, 1986; IGS, 1987). Long-term data for Icelandic glaciers also suggest a shift in glacial regime. Monitoring of the small "Ok" ice cap in western Iceland indicates significant retreat from 1910 to about 1950 after which the rate of retreat slowed appreciably such that by 1980 the ice cap appeared to be close to equilibrium. A similar pattern is apparent for the much larger Langjökull ice cap, with two of its major outlet glacier fronts actually showing significant readvance during the 1970s (Williams, 1986). Data for Iceland over the 1981 to 1985 period indicate that the percentage of advancing glaciers held constant at about 50% (Rist, 1982–1986).

Long-term data for glaciers in the United States likewise indicate a general retreat from 1920 to 1950, followed by slower recession and some readvances (Meier, 1965; also see Carrara, 1987). The 1960 to 1980 trends appear further to confirm a shift to a mixed glacial regime in North America that is continuing into the 1980s both in the United States (see Mayo et al., 1985; Clarke et al., 1985; Brown, pers. comm., 1987b; Armstrong, in press) and Canada (Ommanney, 1986). One area where the shift does not appear to be present is the Soviet Union, at least based on glacier data reported to the WGMS (see Makaverich, 1987).

(5) Interpreting the climatic implications of glacier changes is difficult. For example, there appear to be several climatic conditions under which glacial growth can occur. One is a decrease in summer temperature (and thus reduced summer melt), all other things being equal. A second is an increase in winter precipitation (in the form of snowfall), all other things being equal. A third is a combination of reduced summer temperature and increased winter snowfall. This is the combination that is thought to explain the generally positive mass balances and advancing glacial fronts during the 1960s and 1970s in the Swiss and Austrian Alps (Patzelt, 1985). Conversely, an increase in summer temperature and decrease in winter precipitation is thought to explain the declining percentage of advancing Swiss and Austrian glaciers during the early 1980s.

A fourth possibility is increased winter temperature accompanied by increased precipitation that falls as snow, not rain. Empirical research evidence from the Wolverine Glacier in southern Alaska for 1967 to 1985 indicates that, contrary to common perception, rising temperature can lead to glacier growth so long as it is still cold enough for snowfall (Mayo and Trabant, 1984; Mayo et al., 1985). Similar research is needed on other glaciers in this and other glaciated areas of the world.

(6) Overall, based on this analysis of WGMS data, it appears that the alpine glaciers of the world as a group shifted during the 1960 to 1980 period from a regime strongly dominated by shrinking and receding glaciers to a mixed regime. This shift was most evident for glaciers in the European Alps and Iceland, where the majority of observed glaciers were advancing and growing as of 1980, and where glacier monitoring is the most extensive (as a percent of total glaciers) and consistent (in terms of a relatively unchanging set of monitored glaciers). This trend is weaker in other parts of the world, but, on average over the 1960 to 1980 period, the annual mass balance was positive for about 40% of the observed glaciers. The comparable figure for the Alps was 57%. Put differently, all of the available glacier trend data (variations in glacial fronts, mass balance, area, volume) either support the shift to a mixed glacial regime during the 1960 to 1980 period or at least are not inconsistent with a mixed regime.

However, any conclusions about overall trends must be qualified because regularly monitored glaciers account for only a small percentage of all glaciers. Further research and monitoring are necessary to determine the pervasiveness and permanence of this shift in the global alpine glacial regime, and to assess the climatic implications. In doing so, it is important to increase the geographic coverage of monitored glaciers, with special attention to glaciers in areas such as Canada, China, the Himalayas, the Andes, and the United States, especially Alaska, that are currently seriously underrepresented. Greater use of satellite imagery should be helpful in this regard (see Swithinbank, 1985; Williams, 1985, 1987), as a complement to ground surveys and photogrammetry. Also, increased monitoring of temperature and precipitation at glacier sites is needed in order to facilitate research on the relationships between climatic and gla-

cier change. Finally, glacial and related climatological trends need to be reported by geographic region, climatic zone, and hydrologic basin as well as by country and hemisphere (see Haeberli et al., in press), in order to provide the basis for broader climatic interpretations.

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APPENDIX A
Glaciers Included in Mass Balance Trend Analysis

Name of glacier grouped by country	Location of Glacier[a]			Years of Data Available	
	Lat.	Long.	Elev.	Dates	Total years
Canada (11)					
Baby	79 26N	90 58W	1170	1959/60 – 1976/77	18
Devon Ice Cap	75 25N	83 15W	1890	1960/61 – 1979/80	20
White	79 27N	90 40W	1780	1959/60 – 1978/79	20
Peyto	51 40N	116 32W	3185	1964/65 – 1979/80	16
Woolsey	51 07N	118 03W	2670	1964/65 – 1974/75	10[b]
Ram River	51 51N	116 11W	3020	1965/66 – 1974/75	10
Ward Hunt Ice Shelf	83 05N	73 45W	10	1965/66 – 1974/75	7[c]
Sentinel	49 54N	122 59W	2100	1965/66 – 1979/80	15
Meighen Ice Cap	79 57N	99 08W	1267	1959/60 – 1979/80	20[b]
South Ice Cap	75 25N	115 01W	715	1962/63 – 1974/75	13
Place	50 26N	122 36W	2610	1970/71 – 1979/80	10
United States (4)					
Gulkana	63 15N	143 25W	2460	1965/66 – 1979/80	15
Wolverine	60 24N	148 55W	1700	1965/66 – 1979/80	15
Blue	47 49N	123 41W	2377	1959/60 – 1973/74	15
South Cascade	48 22N	121 03W	2085	1959/60 – 1979/80	20
Norway (8)					
Engabreen	66 39N	13 51E	1594	1970/71 – 1979/80	10
Hoegtuvbreen	66 27N	13 39E	1160	1970/71 – 1976/77	7
Alfotbreen	61 45N	5 39E	1380	1962/63 – 1979/80	18
Nigardsbreen	61 43N	7 08E	1960	1961/61 – 1979/80	19
Grasubreen	61 39N	8 36E	2300	1962/63 – 1979/80	18
Storbreen	61 34N	8 08E	2070	1959/60 – 1979/80	21
Hellstugubreen	61 34N	8 26E	2200	1962/63 – 1979/80	18
Hardagerjoekulen	60 32N	7 22E	1860	1962/63 – 1979/80	18
Sweden (1)					
Storglaciaeren	67 54N	18 34E	1828	1959/60 – 1979/80	21
France (2)					
Sarennes	45 07N	6 10E	3190	1959/60 – 1979/80	21
St. Sorlin	45 11N	6 10E	3463	1965/66 – 1979/80	15
Switzerland (4)					
Aletsch	46 30N	8 02E	4158	1959/60 – 1979/80	21
Gries	46 26N	8 20E	3373	1961/62 – 1979/80	19
Limmern	46 49N	8 59E	3421	1959/60 – 1979/80	21
Silvaretta	46 51N	10 05E	3160	1959/60 – 1979/80	21
Austria (5)					
Hintereis	46 48N	10 46E	3710	1959/60 – 1979/80	21
Vernagt	46 53N	10 49E	3633	1965/66 – 1979/80	15
Kesselwand	46 50N	10 48E	3490	1959/60 – 1979/80	21
Sonnblick	47 08N	12 36E	3030	1963/64 – 1979/80	17
Filleck	47 08N	12 36E	2920	1963/64 – 1979/80	17
Italy (1)					
Careser	46 27N	10 42E	3350	1966/67 – 1978/79	12

APPENDIX A (cont.)

Name of glacier grouped by country	Location of Glacier[a]			Years of Data Available	
	Lat.	Long.	Elev.	Dates	Total years
Soviet Union (16)					
Tsentralny Tuyuksu	n.a.	n.a.	4219	1964/65 – 1979/80	16
Obrucheva	n.a.	n.a.	650	1965/66 – 1976/77	12
Igan	n.a.	n.a.	1180	1965/66 – 1977/78	13
Dzhankuat	n.a.	n.a.	4018	1967/68 – 1979/80	13
Karabatkak	n.a.	n.a.	4280	1965/66 – 1979/80	15
Abramova	n.a.	n.a.	4960	1967/68 – 1979/80	13
Golubina	n.a.	n.a.	4420	1968/69 – 1978/79	11
Igli Tuyuksu	n.a.	n.a.	4220	1964/65 – 1979/80	16
Molodezhnyy	n.a.	n.a.	4150	1964/65 – 1979/80	16
Mametovoy	n.a.	n.a.	4190	1964/65 – 1979/80	16
Kosmodemyanskoy	n.a.	n.a.	4070	1964/65 – 1979/80	16
Ordzhonikidze	n.a.	n.a.	4120	1964/65 – 1979/80	16
Mayakovskogo	n.a.	n.a.	4000	1964/65 – 1979/80	16
Partizan	n.a.	n.a.	4370	1964/65 – 1979/80	16
Visyachi	n.a.	n.a.	3850	1964/65 – 1979/80	16
Malyy Aktru	n.a.	n.a.	3714	1969/70 – 1979/80	10[b]
China (1)					
Urumqihe	43 07N	86 49E	4476	1959/60 – 1979/80	21

[a]Lat. – latitude of glacier in degrees and minutes north; Long. – longitude of glacier in degrees and minutes east or west; Elev. – maximum elevation of glacier in meters for the last year of data available.
[b]Excludes 1 yr with no data.
[c]Excludes 3 yr with no data.
[d]n.a. – no data available.

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ENGINEERING PHILOSOPHY OF COMBINING TOP-DOWN AND BOTTOM-UP SYSTEMS ANALYSES OF CLIMATE CHANGE.

FRED B. WOOD, Sr. (or III)
2346 Lansford Ave.
San Jose, CA 95125 USA
(408) 723-7818

Abstract

The problem is what is happening to the climate, and what can we do about it to preserve the food supply for the five billion people who inhabit the Earth?

Philosophy. Using both a top-down and a bottom-up approach to the climate change problem, we predict that the elapsed time to solve the problems of climate change could be reduced by breaking the problems up into six section.

Science. From the Science perspective, we review the structure of cycles of ICE ERA's, ICE EPOCH's, ICE AGE CYCLES, INTERGLACIAL WARM PERIODS, and LITTLE ICE AGES. We identify numerically which ERA, EPOCH, CYCLE, and PERIOD we are in, and translate both the simple greenhouse warming thesis and the soil nutrition glacial cycle thesis into terms of where are we on the levels of glaciation time charts.

Decision & Strategy. This discussion leads to the need for people concerned over the environment and climate change to develop three types of consciousness: Individual, Social and Geophysical. These form a triple pentagon for coevolution with the biosphere.

Engineering. This section includes a comparison of present temperature data with trends predicted by the nutrition-glacial cycle thesis.

Production. This discussion accounts for the materials needed for reforestation and remineralization such as seedlings and rock dust, and the equipment needed such as tree planting machines and rock grinders plus alternative energy technologies.

Emergency Action. This discussion relates to calculations of the rate of reforestation needed to reduce the CO/2 level fast enough to prevent world-wide crop losses that would bring massive starvation to our planet.

Philosophy

Using both a top-down and a bottom-up approach to the climate change problem, we predict that the elapsed time to solve the problems of climate change could be reduced by breaking the problems up into six sections described above. From the Philosophy perspective, we review thirteen different hypotheses on climate change, not just the simple greenhouse warming thesis. These alternative hypotheses and the forty-five experiments against which they should be checked are listed in the 1987 ISGSR Conference Proceedings [19].

Science.

Glaciation History

What does science tell us about the current climate change? The history of ice ages on planet Earth is summarized in Fig. 1, which is based on an illustration in the Time-Life Series [4]. In terms of Glaciation Cycles:

> We are near Year 10,800 of
> the 23-rd Inter-Glacial WARM PERIOD of 10,000-12,500 years of
> the 23-rd 70,000-120,000 year ICE AGE cycle in
> the 6-th ICE EPOCH of 2 million-4 million years of
> the 7-th ICE ERA of 65 million-100 million years in
> the 4.6 billion years of Planet Earth.

Top-Down

From the Science perspective, we review a Top-Down approach to understanding the structure of the ice age cycles. Even if one believes that the greenhouse warming will cancel out the ice age cycles, one needs to show a functional diagram and/or sample calculations of the process. The cycles of ICE ERA's are shown with more scientific details in the Cambridge Encyclopedia [11].

The next step in developing a more comprehensive top-down analysis would be to develop a one-dimensional simulation of the climate system starting with the block diagram suggested by Fred B. Wood, Jr. [17]

Bottom-Up

The Bottom-Up approach starts with physical properties such as the gas molecules of the atmosphere, the water in the oceans, and the land masses. The computer simulations of climate have progressed from energy balance climate models to one dimensional radiative-convective climate models to two-dimensional climate models to three-dimensional general circulation climate models. Then computer simulation programs are written to connect everything together and to make computer runs of the simulation programs to see what happens as the atmospheric carbon dioxide quantity is increased [9].

American Society for Cybernetics Criterion

For a number of years the American Society for Cybernetics has maintained a rule that a reliable computer simulation of a system should have at least two different types of simulation models to compare before one can consider either one of them reliable. What is lacking in the simulation of climate change is existence of two sufficiently different simulation approaches to meet this criterion. A simple one-dimensional top-down simulation of the climate system including the soil minerals, trees, and other vegetation would be an important step toward testing the current models against this criterion.

Decision & Strategy.

This discussion leads to the need for people concerned over the

environment and climate change to develop three types of consciousness: Individual, Social and Geophysical. These form a triple pentagon for coevolution with the biosphere as shown in Fig. 2.

Individual Consciousness

For the individual to be effective, either doing research on climate change, or as a political activist taking emergency action, he or she must review a number of areas within the scope of his or her individual consciousness: Ethics; Sub-Conscious Script [10]; Nutrition & Exercise; Psychological Awakening; Resolution of Codependency.

Social Consciousness

For groups of people to develop a successful political action plan for the protection of the environment, for climate stabilization, or for a more narrow sphere of interest such as women's rights, they need to understand a group of social concepts such as: The Partnership Way [5,6] (Male & Female Cooperative decision Making); Business Decision Theory including the Regret Matrix [21]; Reconstructive Knowledge [22]; Cooperation between Nations through the UN and UNEP; and the Perception of Tools of Production.

It is particularly important for special groups such as those working for women's rights develop a Geophysical Consciousness to enable them to understand how climate change could disturb the social institutions that protect their rights.

Geophysical Consciousness

Alden Bryant has defined the "Environmental Pentagon" [3] as the five major components of climate change: Soil, Forests, CO/2, Oceans and Ice.

Engineering.

There has been discussion as to whether the Hamaker Thesis on Soil-Nutrition Driven Glacial Cycles should go in the science or engineering sections. It now appears that it should be treated in both sections. The Hamaker Thesis is a science hypothesis in which parts are still in the qualitative stage of development that makes it difficult to apply the usual quantitative tests in testing scientific hypotheses. However the Hamaker Thesis is valuable as an engineering guide in estimating possible future states of nature to use in business management type decision theory under uncertainty.

This section includes a comparison of present temperature data with trends predicted by the nutrition-glacial cycle thesis. In Fig. 3 the top right square (D) shows that we have ten years of satellite microwave sounding unit measurements of the Earth's surface temperature [8]. Since there is an irregular cyclic variation of varying period from ten to fifteen years it may take thirty years of data to obtain

proof of whether it is warming or cooling directly from surface temperatures.

Even though there are questions about the proper placing of thermometers, the 100-year temperature data can help us see where are. In Fig. 3 for Northern (A), Tropic (B), and Southern (C) latitudes the solid curves are the five-year running means of surface temperature anomaly. For the recent part of curve A the annual mean values are plotted as dots.

Examining the dots for the last thirty years shows that the annual mean temperatures are becoming very irregular, while in 1955-1960 the annual and the five-year running mean values were very close. It is known that many records for hottest and coldest temperatures in 100 years have been broken in the last few years. There are signs that the greenhouse warming effect is storing more energy in the atmosphere which may be leading to more non-linear chaotic processes not predictable by our present computer simulation programs.

The long straight lines are straight line approximations to the five-year running mean lines. The long dash lines are predictions made by Hamaker in 1983 [7] on the basis of the Hamaker Thesis. The scatter of the annual mean dots tend to show a slight warming, but this warming is still within the ten to fifteen year variation in temperature from unidentified sources. In twenty years we should have accurate data on where the earth surface temperature is going.

Research by Woillard in France has shown that the previous transition from interglacial warm zone vegetation to arctic vegetation occurred in less than twenty years [14]. If we wait for verification of the cooling associated with glaciation, we may wait until it is too late to stop the glaciation and two or three billion people could die of starvation on our planet.

Therefor I recommend that we move at full speed to reforest the earth, remineralize the soil, reduce the burning of fossil fuels, and convert to alternative energy sources such at thermal electric power plants.

Production.

This discussion accounts for the materials needed for reforestation and remineralization such as seedlings and rock dust, and the equipment needed such as tree planting machines and rock grinders plus alternative energy technologies. Potential sources of rock grinders and other materials are reported in the newsletter: Soil Remineralization [12].

Emergency Action.

This discussion relates to calculations of the rate of reforestation needed to reduce the CO/2 level fast enough to prevent world-wide crop losses that would bring massive starvation to our planet. Alden Bryant has prepared reports on possible rates of

reforestation and compared the results with the rate of which the CO/2 is rising [2,3].

Conclusions

Engineering, Production, and Emergency Action components of the program lead to the conclusion that even the opposing groups of environmentalists can agreed on a common plan of reforestation, stopping the logging of tropical and temperate rain forests, stopping the burning of fossil fuels, developing of alternative energy sources, remineralization of the soil, etc.

References: A very abridged reference list is printed below. The full reference list is available from the author.

[1] Bryant(1987) [8] Hansen(1988) [15] Wood,Jr(1988)
[2] Bryant(1989) [9] Henderson-Sellers(87) [16] Wood,Jr(1988)
[3] Bryant(1990) [10] Kappas [17] Wood,Jr(1989)
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[5] Eisler(1987) [12] SR [19] Wood,Sr(1987)
[6] Eisler(1990) [13] Spencer(1990) [20] Wood,Sr(1990)
[7] Hamaker(1983) [14] Woillard(1979) [21] Lial(1974)
[22] Raskin(1987)

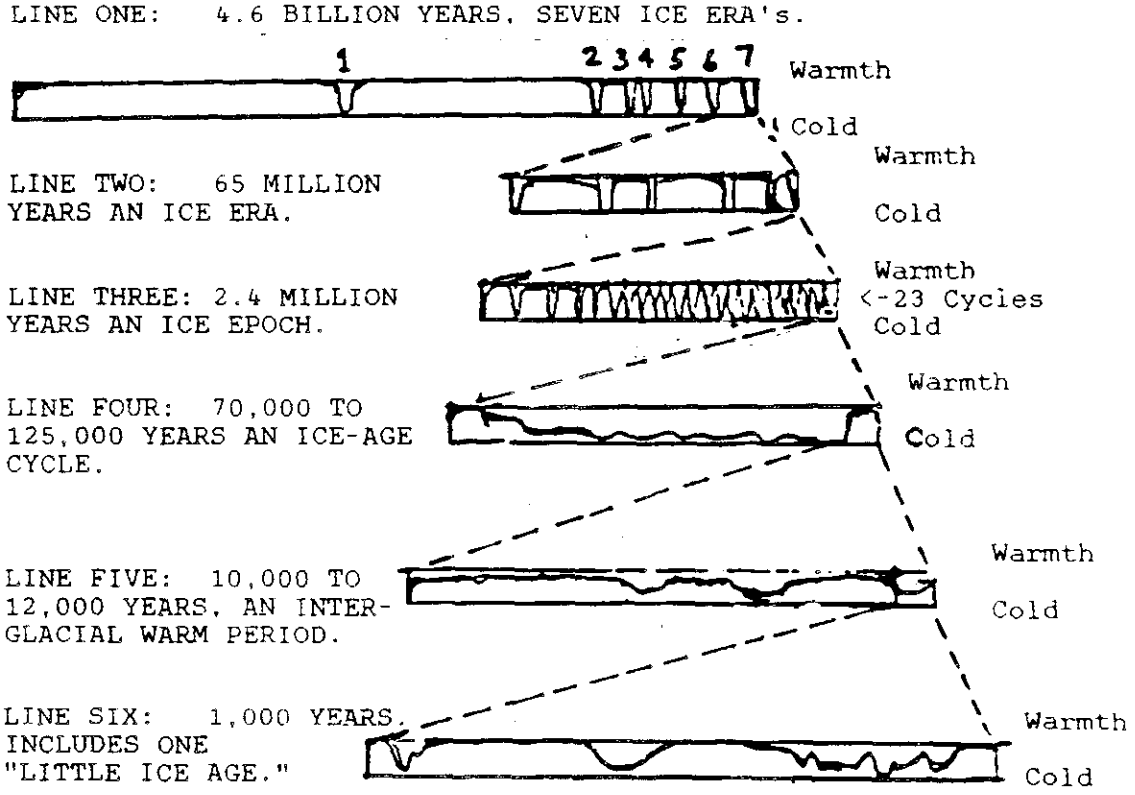
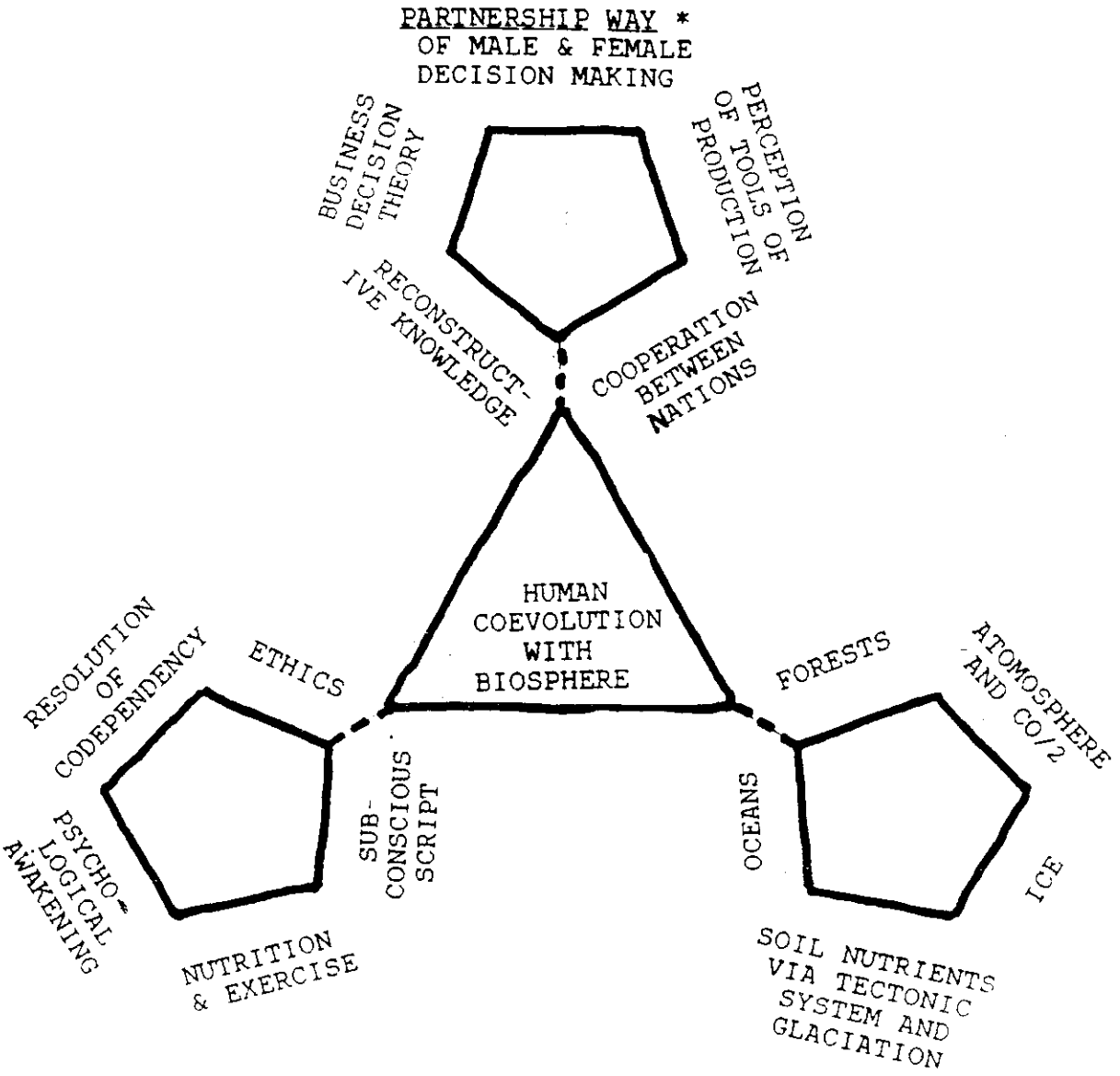


Fig. 1. A series of time charts, each one embracing a fraction of the one above, depicts the swings between cold and warmth that have characterized the climate of the earth for billions of years. Adapted from Chorlton and Editors of Time-Life Books [ ].

SOCIAL CONSCIOUSNESS



INDIVIDUAL CONSCIOUSNESS GEOPHYSICAL CONSCIOUSNESS

* Riane Eisler, The Chalice and the Blade (1987)
Riane Eisler & David Loye, The Partnership Way (1990)

Fig. 2. Triple Pentagon for Human Coevolution with the Biosphere.

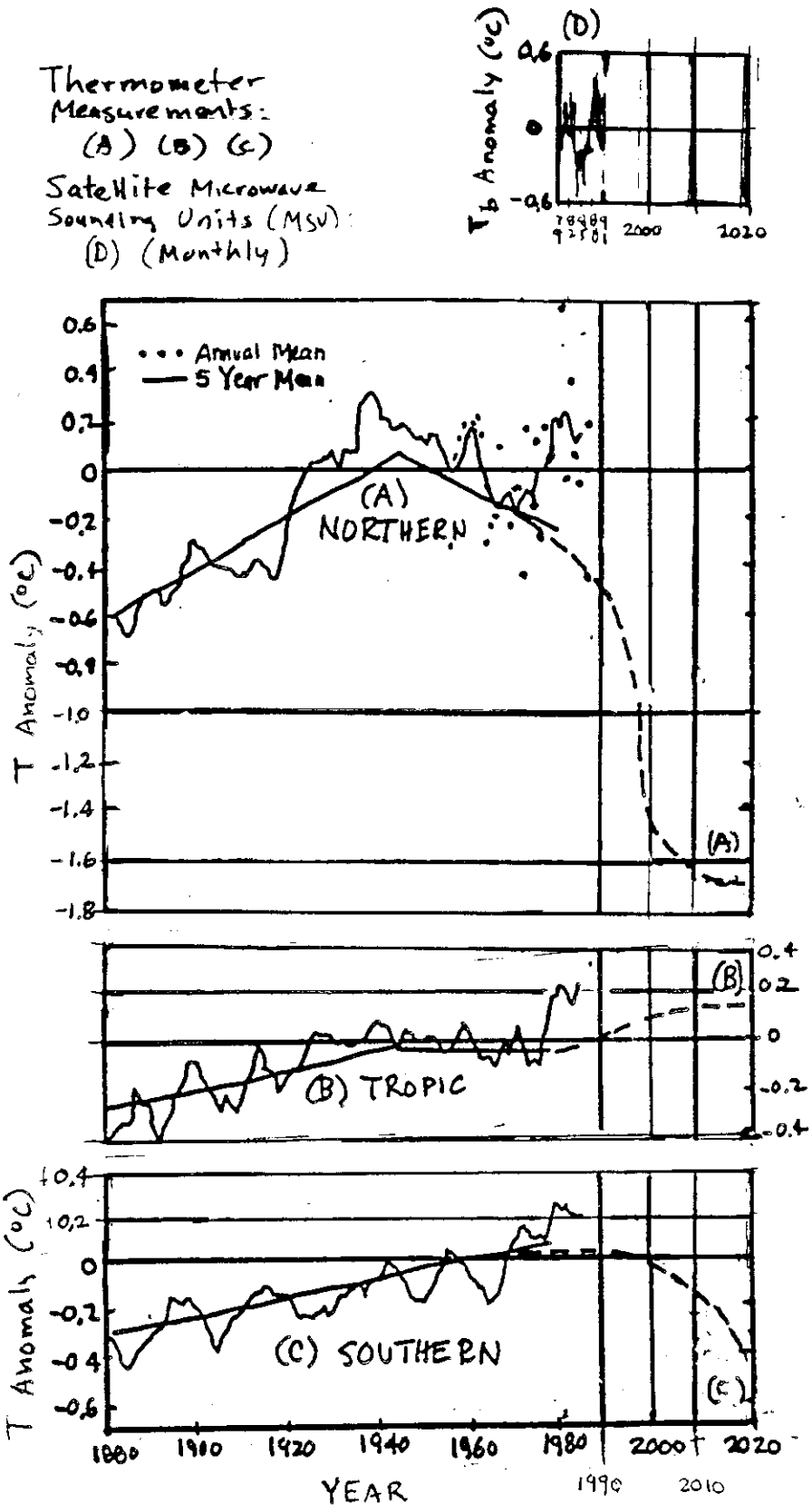


Fig. 3. Hansen's data [8] on Temperature Anomaly from 1880 to 1987: (A) for Northern Latitudes (90 N 23.6 N), (B) for Tropic Latitudes (23.6 N to 23.6 S), (C) for Southern Latitudes (23.6 S to 90 S). Hamaker's projections [7] of these temperatures for 1970 to 2020 shown in dashed lines. Spenser and Christy's satellite microwave sounding unit data [13] for 1979 to 1989 added at top.

EARTH REGENERATION SOCIETY, INC.
470 VASSAR AVENUE, BERKELEY, CALIFORNIA 94708 U.S.A.
(415) 525-4877

93

August 6, 1984

Dr. Fred Bernard Wood
2346 Lansford Ave.
San Jose, CA 95125

Dear Dr. Wood:

Since we in ERS have recently been discussing the question of growth rate of forests, it is appropriate to develop general guidelines on this subject because of the need to reduce atmospheric carbon dioxide on a global basis.

In a recent discussion with Dr. Paul Zinke, Department of Forestry, University of California, Berkeley, he suggested that we keep in mind the very approximate figures for forest net growth rate as follows:

Near the equator —	15 cubic meters per hectare per year
High latitudes, such as Finland —	2 cubic meters per hectare per year
Working average for a global reforestation program in appropriate areas —	10 cubic meters per hectare per year

I intend to use these guideline figures in a first cut estimate of the amount of forest growth to reduce CO/2 from 345 parts per million back to 280 ppm.

This is, of course, a matter of soil remineralization both for new tree planting and for more rapid growth of existing forests.

As regards soil conditions, keep in mind that we have estimates suggesting that minerals and trace minerals are down in the range of 25% to 40% in a number of countries. One source of information is Brookside Farms Laboratory Association, Inc., New Knoxville, OH, where they process as many as a million soil samples a year.

The questions of past maximum fertility, present mineral levels, other soil conditions, and desirable future goals, are essential aspects of what we now refer to as an "earth regeneration program."

Yours,

Alden Bryant

Alden Bryant

504

OAKLAND TRIBUNE, CALIFORNIA USA

Soviet blaze may add to China's fire woes

The Associated Press

BEIJING – Chinese firefighters in Daxinganling forest, combating the worst fire in Communist China's history, face a new threat — a major blaze approaching from the Soviet Union, the official news agency Xinhua said yesterday.

In a report from Hohhot, capital of China's Inner Mongolia, Xinhua said northwesterly winds pushed the Soviet fire more than one additional mile toward the Chinese frontier. It was now only 5 miles from the border.

It said low temperatures and light showers slowed the fire somewhat, but if winds picked up it was likely to cross the nearly 500-foot-wide Ergun River dividing the two countries.

A contingent of 1,200 firefighters was put on alert to keep the fire out of Inner Mongolia.

The Soviet fire has been burning in the Baikal region since the beginning of April. It was not clear how far this fire was from the huge fire in China's northeast Heilongjiang province, which is also advancing on Inner Mongolia.

More than 18,000 Chinese firefighters have been moved to the west side of the fire in China to hack out firebreaks and keep the flames from spreading farther south and west, Xinhua said.

The agency said the 18-day-old fire in Daxinganling forest near the Chinese-Soviet border continued to head west and south toward Inner Mongolia.

The blaze has killed more than 200 people, injured at least 221, burned villages, left 51,000 people homeless and charred about 1.48 million acres of forest.

Firefighters already have built a 100-mile-long firebreak around the Gulian Forest Farm in the southwest part of the fire area, Xinhua said.

A Chinese representative said he did not know exactly how far the Daxinganling forest blaze was from Inner Mongolia, but it still was "quite far away."

A U-shaped firebreak that kept the fire from spreading to the east for several days has been extended to 180 miles, he said.

SAN FRANCISCO Sunday, May 10, 1987 A-9
★★★ Sunday Examiner & Chronicle

Winds fuel huge fire in China

100-mile wall of flame guts town, nears second

By James Miles
UNITED PRESS INTERNATIONAL

BEIJING — Thousands of soldiers battled high winds and a wall of flames more than 100 miles long, trying to stop a raging forest fire — which already has killed 114 people and gutted a town — from advancing toward another community, officials said.

The inferno, which erupted Wednesday in northeastern China, also has been blamed for 96 serious injuries.

Some 50,000 people have fled the flames in the forest-covered Daxingan Mountain range in Heilongjiang Province, about 800 miles northeast of Beijing near the Soviet border, according to an official at the Beijing office of the state-run China News Service.

An estimated 3,000 troops were fighting to control the blaze spreading southeast in a wall of flames 110 miles long and 25 miles deep, the spokesman said, quoting official reports from the area.

The cause of the fire, which began simultaneously in several areas of the forest, has not been determined but a Forestry Ministry spokesman said it likely was caused by human carelessness.

Official media reports said the fire had begun to die out when fierce winds suddenly sent flames roaring through the town of Xilinji. Most of the buildings in the town of 20,000 inhabitants were burned.

Railway lines at the settlements of Xilinji, Tuqiang and A Er Mu as well as 280,000 cubic yards of trees were destroyed, the news agency official said.

A Foreign ministry official said the blaze threatened the town of Tahe, just southeast of the fire's reported location Saturday morning.

The official said the road to Tahe, which lies in a gully, has formed a wind tunnel through which the flames are roaring toward the town.

Soldiers were unable to approach the blaze, he said, and have been able only to dig a fire-prevention ditch at the edge of the disaster region.

The disaster is not over, he said, adding that some 10,000 additional troops were on standby.

China News Service said the air force had dropped 94 tons of food, clothing and medical supplies to people "trapped by the blaze. All road, railway and wire links have been severed with the affected area."

The New China News Agency said Daxingan Forest Bureau officials Friday flew to investigate the fire but their plane was unable to land because of the smoke. Vice Minister of Forestry Xu Youfang has flown to the region to help coordinate rescue efforts, it said.

Floods kill 4

BELGRADE — Four people drowned and five were injured in widespread flooding caused by two days of rain, Belgrade newspapers said Friday.

F4

85

[78-1 12-4-89]

MINERAL RESEARCH & DEVELOPMENT PTY. LTD.
36 Bowyer Road
Wingfield 5013, South Australia
Australia

Phone: 011 61 8 268 8065

Outside of Adelaid

Contact: Dr. Hooshing Massary

The following is a retyping of information, apparently collected in the early 1970s and received by ERS in the early 1980s.

DO NATURAL MINERAL FERTILIZERS GET RESULTS?

"THERE IS NO EVIDENCE TO ENCOURAGE FARMERS TO EXTENSIVELY USE INSOLUBLE CRUSHED ROCK AS FERTILIZER." (Dr. D.S. Wishart, Director of Agriculture)

NOW READ WHAT THE USERS HAVE TO SAY.

The following comments have been offered spontaneously by our clients and represent honest unbiassed opinions. Although we have refrained from publishing their names, any further information required will be gladly supplied to genuine enquiries upon request.

CHANDADA (West Coast S.A.)
Used minerals on 3,000 acres of crop last year, and my neighbour thought I was mad carting fertilizer 400 miles. All crops in the district were affected by a disease, but there wasn't a sign of it on the 3,000 acres seeded with minerals. My yields are easily the best in the district, and my barley all went malting grade. Crops grown with minerals seem to hang on a lot longer. The dung beetles came like magic.

ORANGE (N.S.W.)
Ewes in lamb, especially received the hardest time with pregnancy toxaemia being the biggest problems. As soon as these problems were recognised stock minerals were put out and the ewes wasted no time in consuming it. Their quick response was almost immediate and since then not one ewe has had any complications whatsoever in lambing. After seeing the benefit upon the ewes I see no reason for not continuing upon a permanent basis with them. Using stock minerals with the rest of the stock looks very favourable.

HYNAM (S.A.)
This year we spread a trial quantity of 120 tons on our property. The results in this one year have been quite dramatic. There is a difference of 6 inches in clover height where the minerals were concentrated behind the spreaders. P.S. I suggest you contact Mr. —— of Naracoorte for one of the most incredible success stories I have ever heard using minerals on lucerne.

NUMURKAH (VIC.)
Please send me about 50 soil sample kits as I seem to be the one who everyone in the Numurkah are come to when they want the soil kits and information on the

Dolomite. I must say I am very happy with my own results from the Dolomite and I mention it to everyone I meet and more and more people are using it on this area and if I have my way I won't rest until everyone in my area is using it.

MISSOURI UNIVERSITY (U.S.A.)
You are to be commended for using as your criterion of quality the choice of the grazing animal. Congratulations on your faith in working from the ground up in cooperation with Nature's Laws. (Professor William A. Albrecht.)

MURRAY BRIDGE (S.A.)
Our first application of mineral fertilizers in 1969 produced double the 1968 yield on the same glasshouse area. In 1968 the crop produced 2,000 cases. By January 1970, the one year old plants had produced 3,000 cases and were still setting fruit after 6 seeks without water in mid January 1970. A further estimated 1,000 cases had to be pulled and dumped with the vines. My neighbour was probably the only grower in Murray Bridge who did not see any Botrytis disease in 1969 and he reports that fruit picked dark red-ripe will keep for up to 10 days. This quality has not been experienced at any time on the recommended chemical fertilizers used in the past.

LEETON (N.S.W.)
We have been subjected to all kinds of pressure to prevent our business from progressing. I told you in our previous letter of our stock being poisoned — this was subsequently found to be deliberate! .....I would if time permitted give you a report on the very successful use of your pdocucts on this property. This has however attracted a lot of opposition from certain quarters. I can only say that the use of Dolomite and Phosphate used through our compost heaps have worked beautifully, especially on maize.

WALCHA (N.S.W.)
I am delighted to say that everything is falling into place. My lambs are the best they have been, and there is practically no scouring (usually by this age I am busy with the drench gun). The dung beetles have been very active, and even though I epeccted things to happen, I didn't expect it so quickly. I had an expert down from New England University, and you could see the mineral aspects ticking over in his mind. It is amazing now they appeared. The whole process is most exciting.

MUNDALLA (S.A.)
Now approaching the end of second year exclusively on mineral fertilizers. Has completely restored earthworm and dung beetl population, wiped out all weed problems without weedicides, trebled the stocking rate from 4 sheep per acre to 12 sheep per acre. Wiped out scours 100%. Cut 16 1/2 lbs. of wool average off every beast on the property with not a single dag, three months after crutching when running at times 22 sheep per acre on lush pasture for weeks at at a time.

BORDERTOWN (S.A.)
Now entering third year on mineral fertilizers. After 21 consecutive years of total failure to establish any type of crop on areas of water repellent sands, has, in one season, established wheat throughout the whole area and in the wheat, sub clovers, the vigour of which would be the envy of any farmer. My neighbour has had equal success in both 1968 and 1969 and reports a very substantial increase in his wool clip with drenching down to his all time mimimum. And he produced top weight in Demeter Fescue seed this year with 80 lbs. per bag compared with other small seed growers in the area who were pleased with up to 60 lbs. per bag.

SCOTT'S CREEK (VIC.)
I put a ton to the acre over my property in a three year programme starting 12 years ago. In that time I have not hd a single case of milk fever or tetany, nor have I had the vet. My butter fat has gone from 7,000 lb. to 25,000 lb. in the

same period.

NURIOOTPA (S.A.)
You may recall the Department diagnosed a disease in our carrot field. This has been cured by applying your fertilizer. Under the old system of manuring we were obliged to top-dress every fortnight. This has all changed, and we find it unnecessary to top-dress after applying your prescription fertilizer. So far the results have been very pleasing and have been giving us a feeling of delight.

BELL BLOCK (N.Z.)
The terrific results I have achieved after a short time of using your minerals on my pastures are little short of a miracle.

PAPAKURA (N.Z.)
This season, since using minerals, I have reared 52 calves with 5 lbs. of whole milk twice a day from 25 cows and I have sent over 500 lbs of milk to the factory. At night I hold my cows in the mineral paddocks and during the day they are on the ordinary grass. The morning milking is always 200 lbs. ahead of the night milking. As for bloat, not a sign, mammitis, just a small curd one milking, but the cow's resistance is so good she can combat it without the help of penicillin. The whole general health and appearance of the herd is vastly improved to that of previous years.

STAWELL (VIC.)
A crop of oats (Avon) on shares on my property considered the best around the area has gone nearly 3 tons an acre on light sandy ground. It has super as well as Dolomite. On observations the last 2 seasons, the crops need a little Super to boost in the early stages and then the Dolomite takes over in the spring to really finish if off to a good crop.

MACCLESFIELD (S.A.)
We are now entering fifth year of exclusive mineral fertilizer use and showing enormous increase in production. Animal health problems and vet bills now are almost nil. In early January we cut 200 bales of mixed pasture hay per acre.

TOOMA (N.S.W.)
Black mastitis was a problem but seemed to stop when I started giving them your stock lick.

BRANXHOLME (VIC.)
The reduction of barley grass mainly and capeweed is most reassuring. The promotion of grass in some paddocks is not so noticeable, but the health and condition of both sheep and cattle is apparent. Every year the dung beetles are increasing rapidly, even in this adverse season, their results are amazing.

We have noted a decrease in red legged earth mite, lucerne flea, cockchafer and increase in earthworms dung beetles and ladybirds.

MOONTA (S.A.)
Regarding natural mineral fertilizers. I have been a user for the last four years and have had remarkable results. I am going to take some photos of the green feed in barley stubbles tomorrow of mine on minerals and my neighbour on super-phosphate and if you would like to publish them .....I have been trying for two years to get the Department of Agriculture to do trials at my property without success .....I would like this letter published in your paper if you are allowed to do so and also that if anybody would like to see my green feed at this time of year you are welcome, but I very much doubt if there is anybody this interested in seeing what can be done with natural mineral fertilizers. If I am wrong then America and South Africa are wrong as America has been analysing soil for 40 years and South Africa

for some considerable time and in my opinion it is about time the Department kept up with the times and if any trials are done, in the future that are done by somebody that knows what they are doing so that the farming community are not falsely led into believing that natural minerals are no good.

NORTH DORRIGO (N.S.W.)
I have been very satisfied with the mineral fertilizer and mineral lick. Production increased last season, the cows came in in excellent condition. Last Christmas one got up to 62 lbs. of milk for the day — a couple of weeks ago the top cow did 74 lbs of milk and 3.11 lb. of butterfat, this being the second to do over 3 lb. butterfat this season and a few more came close to it and 50 to 60 lb. of milk is now common. The cows being A.I.S. Neighbours are still in disbelief that it is the minerals! This season's calves have done the best ever and young stocks have grown better than ever. Mastitis has decreased, also blot and scours, which was common among the cows. Dung beetles returned within a couple of weeks of first application. My farm is only 100 acres and I did it all with 21 tons last year and intend to put on 15 tons this year. Have not used any other fertilizer and do not intend to again.

MILMERRAN (OLD.)
The area that received mineral treatment last year will again receive further treatment this year. If the improvement is again continuous then I'll be more than happy.

TALLYGAROOPNA (VIC.)
I have had good success with the minerals I put on 18 months ago. The cows are milking well, and I have never seen them in better condition in my 30 years on the farm here. Mastitis was with me every year, and in some years up to half the heed was sffected at different periods. Since I put the minerlas on, I have had only two cases in two seasons, and they were very mild cases. The pastures are grazed into the ground now, and previously I was slashing the feed to try to keep it short so the cows would graze it. I think one of the greatest benefits from your minerals is the prevention of bloat, as this is one of the worst areas for bloat in Victoria, in some years this distsrict loses 1,000 cows in one year. You may use this letter in any way you want.

NARACOORTE (S.A.)
I thought you may be interested to know that I topped the State with lucerne yields per acre last season, this was my first year in applying minerals on irrigated ground.

Since 1964 my yields have been deteriorating, and it was good to see a seed set like old times.

My wheat yielded 15 bags per acre this year, sewn with one bag of minerals, and the crop of Demeter Fescue went 500 lbs. first grade seed per acre.

MUMBANNAR (VIC.)
I had 2,000 sheep affected with Barber's Pole Worm (Bottlejaw). I didn't have time to drench them, so I put minerals in troughs in the paddock. In three days, when I rounded them up to drench them, there wasn't a sign of bottle jaw in the whole mob, but they ate a lot of minerals.

ADELAIDE HILLS (S.A.)
Conception rate in our stud beef enterprise went from 60% over 12 months to 100% in 6 weeks since we treated our whole property with minerals according to your recommendations at 1 bag to the acre. In the whole history of our stud, we have never seen our cattle in better condition, and this is on paddock feed.

WONYIP (VIC.)
Since I started using minerals on my dairy property just over two years ago, I have not needed to call the vet to my farm.

MILLMERRAN (QLD.)
I wish to advise that the 15 tons of minerals arrived in good order and condition. I wish to report on my trials as follows:

Sunflower struck early, grew rapidly, very healthy, and just commencing flowering, crop very even, with additional rain it will be the best I've ever grown — a definite response to minerals in my first year.

RIVERTON (S.A.)
After 6 years on minerals, I grew the best wheat yet this year, equal to the best Manitoba red wheat. Many bags were 220 lbs. My best crops went 30 bags to the acre, which is not bad for hard heavy grain in 18 inch annual rainfall country.

SALISBURY (S.A.)
We were experiencing a very high percentage of "no take" when budding on recommenced chemical fertilizers. Now, after complete soil analysis and the subsequent application of "prescription" minerals, we have planted over half a million rose trees in the nursery ths year and claim at least 95% "take" of buds; ours is probably the biggest rose nursery in the Southern Hemisphere and supplies all over Australia.

STRATHALBYN (S.A.)
Increased response of clovers, lucerne, reduction of dandelions, soursobs, barley grass.

Velt grass seems to grow better with mineral fertilizers, and we see more of mature plants.

I have not sprayed our irrigation plot since 1967 and we have little trouble with wags.

Our sheafed hay this year is very heavy and so are the bales of hay, they seem to be like lead.

MOUNT GAMBIER (S.A.)
Have not used Super since 1967. Applied Dolomite-copper-zinc following year. Pasture improved considerably. Heavy loss of still-born lambs almost eliminated. No worm or pulpy kidney trouble. Drenched once this year as precaution only time since applying Dolomite.

Still-born lambs at approximately 25 per cent previously: have fallen to 1 per cent. Drenching now almost a thing of the past. 100% fertility in cattle.

MELTON (VIC.)
Increased response of clovers, lucerne, grasses. Self seeded and very healthy.

LORQUON (VIC.)
Haven't sprayed lucerne for mite since using Dolomite.

Decrease in red legged earth mite, lucerne flea, ellworms.

We run 30 breeding cows and calves on 30 acres of irrigation. This has been top dressed at 2 bags per acre for the last three years. Have no trouble with bloat on the 16 acres lucerne balance mixed pasture.

Reduction in milk fever, mastitis, chewing bark, eating soil.

RAYWOOD (VIC.)
Increased number of bushels of wheat per acre.

MOUNT GAMBIER (S.A.)
Big reduction in milk fever. From $100 the last year I used super to $7.50 the first year I used mineral.

Improvement in milk production docility. Reduction in milk fever, eating soil.

Increased response of clovers and lucerne. Reduction of dandelions and barley grass.

SPRINGTON (S.A.)
Improvement in weight gains, fertility, milk production, survival of young, wool production, vigour, docility.

Lameness in front legs of sheep very severe in the months Oct./Nov. 15-20 in the 100, since using your minerals no sign of lameness.

Reduction in tetany, milk fever, scours, mastitis, worms, excessive appetite, calving or lambing difficulties.

MARUNGI (VIC.)
Improvement in weight gains, milk production, docility.

Old cows improved quickly. Cracked and sore teats which have been a regular occurrence each spring have not occurred this year.

Reduction in milk fever, mastitis, worms, excessive appetite.

Grasses and clovers responded better. Ryegrass and cocksfoot thickened.

Bleat which has been very severe on my property for 7 years since it was first sown down in pasture was not so severe this spring, and controlling measures e.g. pasture spraying — painting cows with bloat oil ceased approximately 5 weeks earlier than usual.

NORTH DORRIGO (N.S.W.)
The only problem is the cost of freight to get it here which over doubles the price, but if some response continues it will be worth it.

WAAIA (VIC.)
Cows in very good condition. No health problems since mineral fertilizers applied last 12 months. (Oct. 1972)

FROM THE BURNLEY HORTICULTURAL COLLEGE

PRESS INFORMATION DATA

SOIL REMINERALISATION FOR

HORTICULTURAL/AGRICULTURAL/FORESTRY APPLICATIONS

EARTH REGENERATION SOCIETY
470 Vassar Ave.
Berkeley, California 94708
(415) 525-4877

IV-15-88

699

HISTORY & OVERVIEW

1.1 THE ORIGIN OF SOILS

The soils of the world have been derived from rocks that have been crushed/ground by glaciers, or expelled by volcanoes, and subsequently subjected to the weathering action of climate by wind, water, variation in temperature or by modern day mechanical crushing.

1.2 THE AVERAGE AGE OF SOILS

Most of our soils are over 10,000 years old. This time frame coincides with the last period of glaciation. There are exceptions where glaciers are still actively grinding rock and releasing the fine particles into rivers which flood low lying areas regularly.

The most dramatic demonstration is the Alluvial valleys in the Hunza region of the Himalayas where two modern day phenomena occur -

firstly, the natural fertility of the soil, and secondly, the age to which the population live (up to 140 years of age).

The linkage between these two situations is related to the freshly ground rock which forms the Alluvial soil in as much that silt is slowly releasing a balanced range of minerals which in turn stimulate the multiplication of micro organisms which in turn recycle essential plant nutrients. This culminates in the establishment of a fertile environment for plants to grow vigorously and healthily with the ability to be more resistant to disease.

1.3 THE DEGENERATION OF SOILS

Since their formation, soils have been losing their inherent fertility (demineralisation) by natural processes (percolating rainfall leaching nutrients to the drainage system and wind and water erosion removing topsoil) and man's cultivation which results in the removal of soil nutrients in crops for human consumption.

Today most soils have lost many of the essential nutrients and are unbalanced. Nutrient levels have declined in most areas of the world with many tragic examples of total degradation - the deserts of North Africa and the Middle East and recent examples of rapidly declining soil fertility - the Murray River area in Australia. This unbalanced soil situation is known as "demineralised soil" where because of the lack or imbalance of minerals being released, micro organisms are less active with little or no nutrient recycling occurring. Therefore, the soil fertility chain is destroyed resulting in undernourished and disease susceptible plants.

Soil demineralisation occurs through natural processes:

a/ The percolating rainfall leaching nutrients to the drainage systems (streams/rivers/oceans).

b/ Wind erosion removes the soil to other areas. Again we have seen dramatic examples in recent times of increased damage by wind erosion. Accelerated by the breakdown in soil fertility (demineralisation) one such example is the wheat land in the Mallee in Victoria.

c/ Water erosion removes top soil and depending on the state of demineralisation, water erosion will accelerate the more an area is demineralised. For example, in poorly mineralised soils, where the micro organisms are less effective, there will be less fibreous material to hold the soil.

Soil is demineralised through the artificial means of:

a/ Man's cultivation of the soil for food crops. The historical effects of cultivation in this manner are covered later.

b/ Irrigation practices on poorly structured and demineralised soils have lead to salination - the biggest soil problem in Australia today.

c/ Industrialised man has created pollution in various forms, but as related to demineralisation of the soil, acid rain is the best example.

1.4 ACCELERATION AND RETARDATION OF SOIL DEMINERALISTION

Soils known to be fertile and actively cultivated 10,000 years ago are now invariably deserts as a result of nutrient removal and subsequent topsoil erosion.

Although demineralisation is a natural process there are many examples of when man's influence has accelerated or retarded this process.

a/ The deserts of North Africa were once fertile, producing healthy crops. Man's harvesting of the forest and subsequent cultivation has caused a decline in rainfall with increased wind activity resulting in erosion of the top soil. Further acceleration resulted from continual cropping with little or no return of nutrients to the cropped soil.

b/ Soils in China that were derived from wind blowing glacial flour (high in natural nutrient sources) were cultivated by the Chinese, under a system of organic recycling thus slowing down the process of demineralisation.

c/ The Murray River region is a good example of modern day practices leading to rapid demineralisation of soil. At the turn of the century such soils were already poor (highly demineralised). With tree removal, excessive application of water (flood irrigation) and artifical fertilisers, we have successfully accelerated a situation which will be very difficult, but not impossible to retrieve.

1.5 THE INTRODUCTION OF ARTIFICAL FERTILISERS

For the past two hundred years, man has been able to exploit soils that had become nutrient deficient (by natural processes) by the application of chemical fertilisers. To date we have concentrated on supplying those nutrients required in relatively large amounts (Nitrogen, Phosphorus and Potassium) with some notable examples of trace element (those required in relatively small amounts) use in specific soil types, for example, zinc and copper in the pastoral "deserts" of South Australia and Victoria and Molybdemum in the high rainfall pastoral soils of Eastern Australia.

1.6 THE PLANT DENIAL EFFECT

As we cultivate more intensively (e.g. vegetables and other irrigated crops) so we find the need to add additional nutrient elements to the soil. Such addition of individual nutrients can upset the balance and often renders the dwindling supply of inherent nutrients unavailable to soil micro organisms and plants, thus the expected yield responses are not always achieved.

Many foliage sprays of 'balanced' nutrients are on the market to attempt to improve vegetable yields. Such meaures are only temporary, for the life of the crop, and can often produce tasteless, soft, pest susceptible crops.

The cost of growing crops in unbalanced soils are:

a/ Having to combat pests and diseases.

b/ The excessive water requirements (up to 4 times of those required for well balanced soils)

c/ The dissipation of costly human resources.

d/ The cost to human/animal health with crops not taking up sufficient minerals to meet human and animal nutritional needs.

1.7 THE ELEMENTS OF BALANCED SOIL

Rocks (e.g. basalt, lava, granite, shale, slate) supply the nutrients necessary for plant (and animal) growth. A soil derived from a nutrient "balanced" rock is said to be fertile. Soil supplied plant nutrients (at least 13) are required in specific proportions. Plants take up additional elements that are essential for animal and human health (at least 8).

TABLE OF ESSENTIAL PLANT NUTRIENTS

Essential nutrients used in relatively large amounts				Essential nutrients used in relatively small amounts	
Macro-nutrients				Micro-nutrients (previously known as trace elements)	
Supplied from Air and Water		Supplied from Soil Solids		Supplied from Soil Solids	
Carbon	(C)	Nitrogen	(N)	Iron	(Fe)
Hydrogen	(H)	Phosphorus	(P)	Manganese	(Mn)
Oxygen	(O)	Potassium	(K)	Zinc	(Zn)
		Calcium	(Ca)	Copper	(Cu)
		Magnesium	(Mg)	Boron	(B)
		Sulphur	(S)	Molybdenum	(Mc)
				Chlorine	(Cl)

Plants in turn take up additional elements that are essential to human and animal health: Sodium, Selenium, Iodine and Cobalt. As well, although not essential, some elements appear to have beneficial effects on some plants eg. Silcon, Vanadiuim, Chromium and Alumium. But excesses of any other than the essential beneficial elements can have a toxic effect on plants, rendering a lesser abundance of nutrients.

REMINERALISATION OF SOIL/PROCESS/APPLICATIONS

2.1 REMINERALISATION OF SOIL - PROCESS

Remineralisation is the incorporation of original rock (finely ground) to the growing zone of nutrient exhausted and eroded soils.

In order to rebuild fertility as stated in the History and Overview, we in theory could spread rocks on to our soils. However the more practical way to achieve successful remineralisation is to further mill rock dust, as found in our commercial quarries, to an estimated size of 200# mesh fineness. This product, applied at various rates to the plant growing zone of nutrient exhausted and eroded soils, should provide us with the basis of developing a remineralised balanced soil.

2.2 THE PURPOSE OF APPLYING GROUND ROCK

Ground rock applications are aimed at restoring the original balanced fertility that existed in the soil when it was formed 10,000 or more years ago, thus duplicating the environment to as near its original state. Once achieved, food production increases will improve economic returns to the treated land. Perhaps more importantly, further decline can be arrested.

2.3 REMINERALISATION LOWERS COSTS

Remineralisation will provide a balanced environment for plants to grow efficiently, resist the ravages of pests and diseases and produce high yields (many times that on exhausted soils). The direct benefit lowers cost of total production. In Australia's case this will enhance the country's ability to be export competitive.

2.4 QUALITY BENEFITS

Crops grown in remineralised soils will provide the necessary nutrient balance for human requirements and be attractive in taste as well as appearance. From a quality aspect, commercially higher prices will result. In addition, a wider range of markets become available.

Because the crops are of a higher quality in the total sense, stock will conserve energy, the health of both humans and animals will show a marked improvement due to more minerals being made available (as recalled in the Overview, people in the Himalayas live up to 140 years of age).

2.5 BENEFITS OF SLOW RELEASE GROUND ROCK

Once remineralised (i.e. finely ground rock incorporated in the top 10 to 30cm) a soil may produce high and palatable yields for many years before a subsequent treatment is required. Dependent on rate of application, the cost can be a once only situation, with a multiplying effect on resultant years. More importantly, if no action

is taken, one must take into account the loss of production and income with further soil deterioration.

2.6 RATE OF APPLICATION OF GROUND ROCK

This is where we start to identify potential market segments:

a/ Broad acres/Forestry - significant responses can be achieved from as little as 500kg/ha. for broad area crops (wheat, barley, sunflowers, sorghum, field peas).

b/ Vegetable and Irrigated Crops - desirable application rates for vegetable and other irrigated crops are 2000 to 5000 kg/ha. The lower rate may need to be annually for a few years.

c/ Home landscape - home gardens which have invariably been constructed out of subsoil fill will respond remarkably to remineralisation. Application rates of 2kg per sq. metre, incorporated to a depth of 30 cm will produce vibrant lawn, ornamental and vegetable gardens and fruit trees for years. The gardens will be established much more quickly and use much less water than the conventional methods of establishment. To further address the environmental effects for new home landscape development in the future, will be the need to supplement the current practice of transporting soil from more fertile areas. In the not too distant future soil extraction permits will cease due to new legislation being drafted. Therefore, the need to compile heavy doses of ground rock thoroughly mixed with subsoils will be necessary to achieve a balanced soil.

2.7 REMINERALISATION THROUGH THE COMBINING OF GROUND ROCK ORGANIC AND INORGANIC MATERIAL

Changing social and habitat situations have led to the development of new products for the growth of plants - the development of soiless potting mixes which offer high moisture retention/balanced nutrients/ long life and are disease free when sold is one example - a futher refinement of this product would be the addition of 10-15% rock flour to provide a nutritionally stable and balanced media.

Other components in this combining process could be composted manures (fowl manure) and by-products of industry, the most compatible being Kiln Dust from cement/lime works.

As an example of the rapid development in soiless potting mixes, commercial nurseries 2 years ago used approximately 10% soiless mixes. Today this figure is 50% of total Victorian market and estimated to be as high as 90% within 18 months (nursery industry has a predictable growth rate averaging 10% - 14% over the next 10 year cycle.

SOURCES OF REMINERALISATION MATERIAL

3.1 GROUND ROCK

In former years it has been said that Australia rides on the sheep's back (the author still holds this basic view). The economists more recently tag Australia as potentially the world's quarry for the purposes of soil remineralisation - undoubtedly, a true statement.

a/ Our commercial quarry system is well placed to benefit from further reducing existing quarry rock dust (3mm - 150# mesh) to a standard of 200# mesh.

b/ Over burden, currently a major negative cost component to commercial quarrying operations, is potentially a viable prime source of ground rock for remineralisation of soil.

c/ Agricultural areas with loose surface rock could be treated with a portable crushing plant which would directly return the ground rock to the soil.

d/ Kiln Dust when combined with ground rock is one of the best artificial remineralisation agents. Because the potential percentage of kiln dust is relatively low, ground rock acts as a convenient carrier.

MARKET POTENTIAL

4.1 PRELIMINARY MARKET POTENTIAL VICTORIA

Estimates to date are for a total market in excess of 13 milltion tonnes in Victoria, with an annual tonnage of 300-400,000 tonnes per annum in Victoria going into the following market sectors:

Home Garden
Market Gardens
Orchards/Vineyards
Nurseries
Corporate/Public Landscaping
Remineralisation Saline Areas/Irrigation
Forestry/Pastoral/Cropping Land

Cost effective applications can be justified from $15 - $50 per tonne depending on the market segment.

Particularly in the Forestry and Horticultural industries there is a an improved opportunity to agglomerate rock dust with other products such as kiln dust and other industry by-products. This also has the benefit of allowing product to be distributed by a variety of techniques.

RESEARCH & DEVELOPMENT REQUIREMENTS TO CONFIRM COMMERCIAL VIABILITY

Market potential is based on overseas experience, research and development needs to be carried out to determine Victorian and Australian commercial market.

The Australian Institute of Re-Vegetation has been formed and will be based at V.C.A.H. Burnley as a joint venture project between Government agencies and private investors.

106

АКАДЕМИЯ НАУК СССР
ИНСТИТУТ ПОЧВОВЕДЕНИЯ И ФОТОСИНТЕЗА

ACADEMY OF SCIENCES OF THE USSR
INSTITUTE OF SOIL SCIENCE AND PHOTOSYNTHESIS

СССР. Московская обл
г. Пущино
Телефон 223-35-58

Pushchino
Moscow Region, USSR
Tel. 223-35-58

Ref._____
Date July 8, 1987

RECEIVED 8-12-87

Dr. Alden Bryant
Earth Regeneration Society, Inc.
470 Vassar Avenue
Berkeley, California 94708

Dear Dr. Bryant,

I have received a set of the documents of the "Earth Regeneration Society" including the proposed program of actions and the draft of possible governemntal acts.

I appreciate very much the proposed actions embracing soil cover-vegetation(forest as the most important factor)-man activity (maximal return to soils of all the organic by-products and manure) -remineralization of leached acid soils.

Humic horizons of a hectare of fertile fields may contain as much as hundreds and thousands tons of organic matter and carbon dioxide. Now practically everywhere, the organic by-products and waste are neglected and become fully mineralized emitting considerable amounts of CO_2 to the atmosphere.

If organic materials are collected, composted and regularly inserted in arable soils, the soil fertility will be upgraded/stabilized, and a considerable quantity of CO_2 from the atmosphere will be annually fixed in the form of humus and fresh photosynthetic organic material.

Composting of organic by-products for production of the organic fertilizers can be combined with biogas production for citizen's consumption.

So, I am certain that global reafforestation of mountainous regions and tropics, regular rehumification of arable soils, control

of soil erosion, remineralization of acid soils, and reasonable fertilization of all arable soils will very much improve the planetarian balance of CO_2 in the biosphere.

Of course, every continent, natural region and particular country requires its own concrete program and sequence of actions. But general theoretical principles and technology must be coordinated to be complementary to each other.

I am very much impressed with your own and your colleagues' intention to suggest the "Problem of Earth Regeneration" as the global super problem to the governments and scientific circles, as a vital subject of peaceful international cooperation in the interests of humanity of the XXIst century.

Best regards and wishes,

V. Kovda

Victor Kovda

P.S. Sorry, I was unable to attend the meeting of 1-5 June.

108

Stoned in Sonoma

Bob Cannard's innovative rocky fertilizer produces smooth results.

PHOTO BY ERIC GIBSON

Bob Cannard fertilizes with a layer of crushed river rock followed by manure.

by Eric Gibson

Bob Cannard's farming practices—particularly using raw, crushed river rock as the basis of his fertilizer program and letting weeds grow freely between rows of his vegetable crops—have members of the scientific community scratching their heads.

Bill Liebhardt, director of UC's sustainable agriculture program, puts it this way: "Not many farmers would be willing to do things the way Bob Cannard does. His system appears to work for him, but I'm not sure it would work for others. We need to study it a lot more closely."

Though Cannard's methods may be questionable, no one can question his results—his produce is superb. In addition to having developed a hefty, repeat-customer clientele in several Sonoma County farmers markets, Cannard also grows most of the produce used at the internationally renowned Chez Panisse restaurant in Berkeley. That restaurant's owner, Alice Waters, is credited with having started the California cuisine cooking style, which emphasizes the freshest produce, simply prepared.

Pat Waters, Alice's father, conducted a farm survey of 20 of the finest farms in the area to choose the restaurant garden for Chez Panisse. He says of Cannard's produce: "It really meets Alice's criteria of being 'the freshest and the finest'... he's right out there on the cutting edge of quality."

"It has more flavor, even compared to the other organic produce we get," says Paul Bertolli, head chef at Chez Panisse. "It has a very genuine taste, a taste of the soil. The lettuce, in particular, has an herbaceous quality, which I think proves Bob's point that plants share the aroma of surrounding plants. It's a

Bread from Stone

The practice of using granite powder as a soil additive dates back at least to the late 19th century when a German chemist, Julius Hensel, wrote the book *Bread from Stones*. Hensel maintained that much of the earth's surface, which has been depleted of minerals by erosion and farming, could be restored by the addition of granite powder—what he called the "primordial rock."

The views of one of Hensel's contemporaries, German chemist Justus Von Liebig, also were widespread at the time. Von Liebig identified three main plant requirements as NPK (nitrogen, potassium, and phosphorous). Give plants these three chemicals, and you've supplied most of their nutrient requirements, he believed. Hensel, on the contrary, asserted that a broad, balanced spectrum of natural substances is required for healthy plant growth; these substances cannot be found in any man-made formula, he said.

He also discouraged using manure. Like NPK, he said, manure contains large amounts of nitrogen, which "act as an unnatural stimulant to plant growth."

The ideas of Von Liebig gained predominance, however, and as the NPK formulas are familiar to almost every commercial farmer, today Von Liebig is recognized as the father of modern chemical-fertilizer theory.

—*Eric Gibson*

wild taste that perhaps everyone won't like, but compared to the washed-out, supermarket taste, I welcome it."

Cannard's 20-acre farm snuggles on a hillside slope about 5 miles south of Glen Ellen in the Sonoma Valley. He grows a variety of annual crops, including vegetables and herbs, as well as berries, grapes, and mixed tree crops. The farm yields about 30,000 produce boxes a year, about 40 percent of which goes to Chez Panisse. He sells the rest at farmers markets in the area.

A college dropout after four semesters in agricultural science, Cannard says he discovered his unusual method of fertilization 12 years ago when he owned a nursery. He was trying to make a clear space for container plants so he spread a layer of crushed river rock over his lot, "but the weeds shot up like crazy," he says.

When he began farming shortly thereafter, Cannard began putting a thin layer of crushed river rock around each plant, followed by a layer of compost, and then wetting it. The wet manure creates an acid condition, he says, which breaks down the rock powder so that the plant can absorb the nutrients.

Spreading the compost or manure on top of the crushed rock is vital for another reason: Living microbial organisms are introduced, that, in addition to the acidity, are vital to breaking down the rock's nutrients. "If you just add crushed rock to a dead soil," Cannard says, "it's just like adding cement. You need the living action of the microbial flora to assimilate the nutrients."

To supplement the common compost ingredients of manure and straw, Cannard adds the Chez Panisse kitchen wastes, which the restaurant truck delivers as it comes to pick up the day's produce.

"My fertilizer costs $15 a ton, and my plants are so healthy that I don't have any pest problems," Cannard says. Cannard purchases his river rock from local rock crushers on the Russian River who supply crushed stone to the asphalt industry. He adds about 400 pounds of rock per acre to the soil. Cannard is now constructing his own rock crusher from old iron tractor wheels to break down the powder even more finely, for greater surface-area coverage and quicker absorption.

Cannard claims he uses only crushed rock, oyster shells, and compost on his crops, yet he is no organic purist. "If you get good results with urea," he says, "use it. Sometimes such products are needed to help revitalize a dead soil."

But he pursues his point that the full range of nutrients needed by plant life, especially in what he calls our depleted, mineral-deficient soils, can be supplied by only one fertilizer: crushed river rock. Cannard calls river rock the "parent rock." Derived from rivers' sedimentary deposits, it provides the full range of mineral elements, including the infinite number of trace minerals lacking in any narrow-spectrum fertilizer.

His philosophy is that adding a more narrow-range fertilizer provides only a slice of the pie, which is "like telling the plant what it needs. Plants have evolved under natural growing conditions," he maintains, "which might provide only a few parts-per-million of some micronutrient such as gold. Artificial additives don't contain these micronutrients, yet who knows if the plants need them?"

On this point, Cannard feels he goes a step beyond the organic school of farming. "If you add only manure compost in mineral-deficient soils," he says, "you'll still get aphids." He claims that since adding crushed river rock to his soil, he's never had a pest or disease problem.

Cannard calls rivers "nature's rock crushers," and says that crushed rock from them is bound to have a rich spectrum of nutrients. "Rivers carry a tremendous organic load," he says, "everything from leaves to granite to basalt to dead insects. They mix it up and deposit it in the valleys."

As if adding rocks to his garden weren't enough, Cannard cultivates another farmer's enemy: weeds. He calls weeds a "low-life cover crop" that yields the benefits of traditional cover crops: conserving soil moisture, preventing leach loss due to sun and water, providing an environment for beneficial insects, lessening compaction, and recycling nutrients.

In addition, the soil cover and support provided by the weeds growing between rows allows Cannard to pick in the rain or immediately following irrigation. Leaving weeds also allows him to plant more densely, since no tractor is needed for cultivating.

The key is not to let the weeds overpower productive plants, and Cannard goes in with a hand scythe when the weed foliage threatens the cash crop. He leaves about 3–6 inches of clean space around each plant. Time spent suppressing the weeds is about an hour per acre.

If quick weed growth forces him to scythe before the weeds re-seed, he plants cover crops such as vetch or clover, mixing them with lettuce seed, for instance. When the lettuce is picked several months later, the cover crop is left to grow for a winter cover.

"Most farmers feel the way to control [soil] competition is to kill all the weeds, but the downside is a dead soil as well," says Cannard. "It's much easier merely to suppress the weeds, as long as their foliage is not crowding out the productive crop."

Rocks and weeds may not be every farmer's cup of tea, but they're something to think about. UC Extension vegetable specialist Ron Voss comments, "We need to know what parts of Bob Cannard's [methods] are working and why, before we can really recommend them to others." ■

EARTH REGENERATION SOCIETY, INC.
1442A Walnut Street #57, Berkeley, California 94709
(415) 525-4877

February 18, 1989

Dr. Fred Bernard Wood
2346 Lansford Avenue
San Jose, CA 95125

Dear Dr. Wood:

I have just talked at length by phone with Bob Cannard of Sonoma, California, who has twenty acres in vegetables, including some 200 fruit trees which are partly citrus and partly avocado.

You are familiar with his work through the recent Eric Gibson article in the California Farmer.

Bob tells of winter temperatures going down to 15 degrees F and no damage to his fruit trees. This is the result of remineralizing the soil as he has done for 12 years with gravel dust and steer manure. The surrounding farms sustained considerable damage from the freezing.

We have heard for years about remineralizing soil with reasonable good rock dust and thereby raising healthier crops that are pest resistant as well as more resistant to heat, cold and drought. The Cannard farm is an excellent example.

One of the best restaurants in Berkeley currently sends a truck to the Cannard farm daily for vegetables, as they consider these vegetables to be the most tasty and nutritious in the area.

Sincerely yours,

Alden Bryant

Alden Bryant

752A

111

LEVEL 1 - 1 OF 4 STORIES

October 4, 1989, Wednesday, Late Edition - Final

SECTION: Section D; Page 9, Column 1; Financial Desk

LENGTH: 1280 words

HEADLINE: BUSINESS TECHNOLOGY;
A Cheaper Road to Solar Power: It's Done With Mirrors

BYLINE: By MATTHEW L. WALD

BODY:

For years the quest for economical solar power has centered on photovoltaic cells that turn sunlight directly into electricity. The cost of the cells is so high, however, that their use has been limited.

But a more prosaic and less costly method of harnessing the sun, using mirrors to gather energy, is being expanded in the California desert northeast of Los Angeles. It now feeds 194 megawatts of power into Southern California

Edison's distribution system, which is enough to serve 270,000 people.

With tax breaks those ''solar thermal'' plants make electricity at a price that competes with that of power made from oil or gas, and the cost appears likely to be competitive soon even without a subsidy.

The system, commercialized by Luz International Ltd., makes large quantities of steam by using miles of curved, movable mirrors that focus the sun's heat on pipes filled with a liquid. The liquid is heated by the sun and then pumped through pipes immersed in water. That water is boiled into steam, which is fed through a turbine that turns a generator.

Only the method of generating the steam is different; the rest of the system is the same as an electric plant that gets its energy from burning oil, coal or gas or from splitting uranium atoms.

But making electricity from the sun's rays has several advantages over conventional means. The use of expensive, nonrenewable fossil fuels is greatly reduced, although a backup system is required for periods without sun. And emissions of toxic gases and gases contributing to the greenhouse effect are cut back.

762

Luz is an American company, based in Los Angeles, that has an Israeli subsidiary that makes the mirrors. It is named for the spot where Jacob dreamed he saw the angels ascending and descending a ladder. The company is already the largest generator of solar electricity in the United States.

Last year the company added 60 megawatts of solar thermal capacity, compared with world shipments of photovoltaic cells with a capacity of about 35 megawatts. Both numbers are modest - a large nuclear plant can generate 1,000 megawatts - but executives at Luz think their technology is much closer than photovoltaic cells to becoming popular in the electric-utility market.

The electric-utility grid is the prime use, in fact, for solar thermal stations. By contrast, photovoltaic cells are so costly that they are now practical only where grid power is not available. They were initially developed for the space program and are most familiar in pocket calculators. They have already established an important market niche at remote sites, for use in navigation buoys and mountaintop telecommunications repeater stations, for example.

While photovoltaic cells are still not cost-competitive with conventional power sources for bulk power generation, engineers and scientists at laboratories around the world are trying new ingredients to lower costs.

(c) 1989 The New York Times, October 4, 1989

Larry L. Sherwood, director of the American Solar Energy Society, said: ''Photovoltaics clearly has the potential to come down in price. Semiconductor-type technology, just by its nature, tends to come down.''

Luz officials say their solar thermal installations are already cost-competitive with the expensive sources of electricity used at peak hours, producing power for about 8 cents a kilowatt-hour. Energy analysts say both solar technologies will have applications in replacing fossil fuels.

Luz has built its operations with the help of Federal and state tax credits, the last of which are scheduled to expire this year. But the company says the system will become commercially viable without subsidies. It has raised more than $750 million in capital from investors like Potomac Electric Power, Baltimore Gas and Electric and Prudential Insurance.

The Luz energy collection system is based on curved mirrors about six feet high, which concentrate the sun's rays to make them 80 times more powerful. These rays are focused on a black steel pipe filled with a heat-transfer fluid.

''It's no different from what you tried as a child, when you burned holes in a piece of paper with a lens,'' said Michael Lotker, a vice president of the company. It is considerably hotter, though. The heat-transfer fluid reaches

735 degrees Fahrenheit, which is about 200 degrees hotter than the water used to make steam in most nuclear plants. To hold in the heat, the pipe is surrounded in thermos bottle fashion by a glass tube and a vacuum.

The plant heats up less than an hour after dawn. As the sun moves across the sky, the motorized, shaft-mounted mirrors rotate to follow, keeping within a tenth of a degree of the sun's position.

Sunshine, even in the desert, is variable, but so is demand for electricity. In fact, in most of the United States the sun's heat is what determines the peak in electricity demand, because of the air-conditioning load. This allows Luz to provide power almost exactly when it is needed most.

Luz has added a refinement to cope with demand on cloudy days and after nightfall. It supplements the solar heat supply with a boiler fueled by natural gas.

To qualify for favorable power purchase terms under Federal law, a solar plant built by an independent power producer must get 75 percent of its heat from the sun. Luz uses natural gas for up to 25 percent, to assure steady output, but a utility that owned such a plant outright could use the natural gas portion without constraint, the company noted.

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In this solar-fossil hybrid, the solar collectors could be thought of as a system for saving natural gas, or fuel oil, the other fossil fuel most often used for small plants that provide electricity to meet peak demand. Each square meter of solar collector will save about a barrel of oil, or 6,000 cubic feet of gas, each year for its 30-year life, Mr. Lotker said.

The fuel savings from a square meter of mirror would be about $600 over 30 years, assuming current oil prices of about $20 a barrel. One square meter gathers enough energy to light two lightbulbs of 100 watts each; an 80-megawatt plant requires 464,000 square meters, so the total fuel savings could be $278 million.

Whether such an investment compares favorably with other investments depends on the future price of oil and the price of money. Many analysts are predicting increases in gas prices soon, and over time, oil prices are also likely to rise.

The value of the technology may also be measured by how much importance society puts on reducing the output of carbon dioxide, the gas most linked to global warming.

When the system operates in only its solar mode, no carbon dioxide is emitted. Luz officials say the hybrid system produces 0.27 pound of carbon

dioxide for every kilowatt generated, compared with 1.1 pounds for plants fueled solely with natural gas, 1.7 pounds for oil and 2 pounds for coal.

Nitrogen oxides, another pollutant, are 20 times lower than in a conventional gas-fired plant, the company says, and almost three times lower than in a gas plant with advanced pollution-control equipment.

Luz officials say the cost of land is not a big factor in solar economics. In the desert northeast of Los Angeles where Luz has 194 megawatts in operation and 80 under construction, ''there are thousands of square kilometers serving no useful purpose,'' Mr. Lotker said.

Following the Sun

Luz solar collectors track the sun's daily path across the sky. The collectors focus sunlight onto steel pipes mounted inside vacuum tubes. The pipes contain a heat-transfer fluid that is heated to 735 degrees Fahrenheit. This fluid is pumped through a conventional heat-exchange system to create steam to generate electricity.

GRAPHIC: Diagram; photo of miles of curved, movable mirrors at Kramer Junction, Calif which focus' the sun's heat on liquid-filled pipes to make steam to spin

(c) 1989 The New York Times, October 4, 1989

a power-generating turbine.

SUBJECT: SOLAR ENERGY

NAME: WALD, MATTHEW L

GEOGRAPHIC: CALIFORNIA

TITLE: BUSINESS TECHNOLOGY PAGE (NYT)

255286891004

Solar thermal electric power for the United States
Notes for energy lecture, January 15, 1989

Otto J.M. Smith Berkeley, California

ENERGY UNITS

1 Exajoule	=	$1.0 * 10^{18}$	Joules (Watt-second)
	=	$27.778 * 10^{7}$	MWH (Megawatt-Hours)
	=	$27.778 * 10^{10}$	KWH (Kilowatt-Hours)
	=	$0.94845 * 10^{15}$	BTU (British Thermal Units)
	=	0.94845	Quads (Quadrillion BTU)
	=	$0.94845 * 10^{10}$	Therms
1 Quad	=	$1.0 * 10^{15}$	BTU
	=	$1.0 * 10^{10}$	Therms
	=	1.0544	Exajoules
	=	$1.0544 * 10^{18}$	Joules
	=	$29.288 * 10^{7}$	MWH
	=	$29.288 * 10^{10}$	KWH
1 MWH	=	$1.0 * 10^{3}$	KWH
	=	$3.600 * 10^{-9}$	Exajoules.
	=	$3.600 * 10^{9}$	Joules.
	=	$3.414 * 10^{-9}$	Quads.
	=	$3.414 * 10^{6}$	BTU
	=	34.14	Therms
	=	$8.593 * 10^{8}$	Calories
1 BTU	=	$1.0 * 10^{-5}$	Therms.
	=	$1.0 * 10^{-15}$	Quads.
	=	$1.0544 * 10^{-15}$	Exajoules.
	=	$1.0544 * 10^{3}$	Joules.
	=	$2.9288 * 10^{-7}$	MWH
	=	$2.9288 * 10^{-4}$	KWH
	=	251.996	Calories
1 Calorie	=	4.1840	Joules.
	=	3.08596	Foot-Pounds.
	=	0.003968	BTU
	=	0.0011622_{-6}	Watt-Hours.
	=	$1.559 * 10^{-6}$	Horsepower-Hours.

APPROXIMATE RELATIONS

Solar Intensity, (Insolation),
Clear Day, Summer Noon, Normal Angle:

1 ^{4}KW per Square Meter.
10^{4} KW per$_{3}$Hectare,
$29.2 * 10^{3}$ MWH/Hectare/Year.
$12.98 * 10^{3}$ MWH/Acre/Year.

1 Hectare = 10^4 Square Meters
= 2.25 Acres.

1 Barrel = 42 U. S. Gallons
= 158.987 Liters.

Heat of Combustion per barrel of fuel:

	10^6 BTU	MWH thermal
Ethane	3.082	0.90266
Propane	3.836	1.123
Butane	4.326	1.267
Motor Gasoline	5.253	1.538
Fuel Oil	5.825	1.706
Crude Oil	5.829	1.707

Methane Combustion: = 1035. BTU/(cubic foot of gas)
= 36.55 BTU/(liter gas)
= 0.01070 KWH_t /(liter gas)

USA Total Consumption of Energy

Year	Quads	Exajoules
1985	73.94	77.96
1986	74.26	78.30
1987	76.01	80.14

USA Net Electrical Generation, 1987 Year = $2.861 * 10^9$ MWH_e.
= 8.38 $Quads_e$ = 8.836 $Exajoules_e$.

All USA Energy except Electrical: 1987 Year
= $1.6544 * 10^{10}$ MWH_t
= 48.46 $Quads_t$
= 5.783 times net electrical.

LUZ SOLAR POWER PLANTS

Land Area = 3 times Mirror Area.
Annual Production from Solar Power = 420 MWH_e / Acre.
= 945 MWH_e / Hectare.
= $2.69 * 10^5$ MWH_e / (Square Mile)

To supply all USA annual electrical needs from solar of $2.861 * 10^9$ MWH_e = $6.81 * 10^6$ acres = $1.06 * 10^4$ Square Miles.

This is a square of land 103 miles on a side.

To supply all USA energy needs from solar electricity would require $6.78 * 1.06 * 10^4$ square miles = $7.19 * 10^4$ sq. mi. = a square of land 268 miles on a side.

E N E R G Y I N D E X

Annual energy bill of the United States: $420 billion

Annual savings attributable to energy efficiency improvements made since 1973: $130+ billion

Percent growth in the U.S. economy, 1973-1986: 33+ percent

Percent growth in U.S. energy consumption, 1973-1986: 0

Barrels of oil imported to the U.S.: 6.8 million per day

Barrels of oil saved by energy efficiency improvements made since 1973: 13 million per day

Market price of Middle East oil, January, 1988: $18 per barrel

Price of Middle East oil, if U.S. military costs incurred there are included: $170 per barrel

Average generating cost for nuclear power, per kilowatt hour: 10-13 cents

For electricity in general: six cents

For energy conservation programs: one to four cents

Price of oil, at the rate paid for nuclear power: $240 per barrel

Amount the U.S. Treasury spent in 1987 on energy conservation research and development: $200 million

Amount the U.S. Treasury spends each year on subsidies to the nuclear power industry: $15 billion

Value of U.S. nuclear power plants that have been abandoned: $15 billion

Contribution of new coal and nuclear power to U.S. capacity, 1985-1986: 0.7 quadrillion BTUs

Contribution of energy efficiency to total U.S. capacity, 1985-1986: 5.1 quadrillion BTUs

Countries ranking above the United States in percentage of GNP devoted to energy conservation R&D: Italy, Japan, Canada, West Germany, United Kingdom, and Sweden

Year in which the joint DOE-industry research program on compact fluorescent high efficiency lamps was halted: 1981

Year in which General Electric began distributing Japanese-made compact fluorescent high efficiency lamps: 1985

Amount saved in one year if the U.S. converted to best available lighting technology: $30 billion

Cost of upgrading energy efficiency of World Bank headquarters lighting: $100,000

Amount World Bank headquarters saved in electricity costs in 1984: $500,000

Price of a photovoltaic solar cell in 1954: $600/peak watt; 1976: $44/peak watt; 1986: $5.25/peak watt

Amount of oil the U.S. would have to import, to meet present demand, if the average MPG of all cars in the U.S. was 42 MPG: none

Average MPG of all cars in use in the U.S. in 1973: 13, in 1985: 25

MPG of the prototype Toyota AXV: 98

MPG of 1987 Mustang V-8: 14

Barrels of oil saved between 1975-1985 because of efficiency improvements in cars and light trucks: 2,400,000/day

Barrels of oil produced by the entire state of Alaska: 1,500,000 per day

Amount of time it takes for the average American car to pollute the atmosphere with its own weight in carbon: 1 year

Compiled by Judy Christrup

SOURCES: Safe Energy Communication Council, Charles Komanoff, World Resources Institute, Worldwatch Institute, Rocky Mountain Institute, American Council for an Energy Efficient Economy, Office of Rep. Claudine Schneider, American Petroleum Institute, Christopher C. Swann (and a tip of the hat to Harper's Magazine)

TRANSPORTATION

* A transport fuel tax of $1.00 per gallon could yield 160 billion dollars per year.

* Increasing fleet average Miles Per Gallon (MPG) to 30 mpg without a tax increase would save annually 2.3 billion barrels of oil or 42 billion dollars per year.

OR A total fuel tax on heating and transport fuel of $1.00 per gallon plus a fleet average increase to 30 MPG could yield 183 billion dollars per year plus saving 42 billion dollars in imports for a total annual benefit of 225 billion dollars. This is more than the federal government annual deficit, and this would encourage conservation.

SOLAR

A Bureau of Reclamation investment of 86 billion dollars per year for 10 years in parabolic trough solar-thermal electric power plants in the desert in 80 megawatt modules could save 3.6 billion barrels of oil per year, or yield an annual benefit of 65 billion dollars to society.

WIND

Each 200 million dollars invested in wind farms of 100-kilowatt electric generation units yields the same annual energy as one offshore oil-drilling platform.

UTILITY-SPONSORED CONSERVATION

For each dollar of subsidized conservation, the utility was saved the necessity of investing seven dollars in new capacity.

EFFICIENCY

The USA spends 84 % more energy per unit of GNP than Germany and Japan.
Transport alone in the USA costs 160 billion dollars per year.

15 January 1989
Otto J. M. Smith
612 Euclid Avenue,
Berkeley, California, 94708

R. 7-11-89

119

UP IN ARMS

As a lifelong resident of Nevada, I read with a great deal of interest "A Nuclear Dump: The Experiment Begins," by Dan Grossman and Seth Shulman, in the March issue.

The very idea of a nuclear dump site in Nevada is absurd and reprehensible. Nevada is not and should never be an "experiment" or a test tube. Nevadans are not guinea pigs. We already know firsthand the tragedy of radiation poisoning because of our experience with atomic fallout from the Nevada Test Site. We're not about to get fooled again by the glib assurances of "experts."

DISCOVER and Grossman and Shulman are to be commended for alerting their readers to this issue. Stay tuned, because you haven't heard the last from this Nevadan.

Sen. Harry Reid (Nev.)
Washington, D.C.

A SECOND OPINION

Elisabeth Rosenthal's article "The Wolf at the Door," [Vital Signs, February] is an articulate, accurate, even elegant evocation of some of the events that took place at our hospital. I had the pleasure of working with Dr. Rosenthal at that time, and I am prompted to make a few comments to provide perspective.

The nature of a specialty hospital such as ours is that its in-patients represent the worst end of the spectrum. I hope that other lupus patients are not unduly frightened by what she portrayed, since most patients are much less ill and lead normal or near normal lives.

There are happy points to the story, too. "Ms. Johnson" is now an outpatient, smiles spontaneously, speaks short sentences, and calls me by name. I am optimistic about her eventual recovery. The "potato chip" girl is now a normal, articulate woman with no trace of her prior neurological deficits. The "cheerleader" is eagerly looking forward to a kidney transplant. I don't comment on the other patients because I know them less well, but their physicians tell me they are also recovering.

We all wish that lupus did not exist. But when it does, all is not grim.

Michael D. Lockshin, M.D.

MICRO MADNESS

The juxtaposition of the two articles "Microbots" and "March of the Fire Ants" [March] suggests the following scenario: Why not have the Bell Labs people whip up a macroarmy of microbots and ship them off to Florida and points west to wage a Lilliputian war against the fire ants? Surely the little demons would be wiped out in no time.

Patricia F. Lamb
New Wilmington, Pa.

■

Sure it may be a good idea to insert skillions of microscopic mechanical mice into the bloodstream to eat up all the bad bugs, cholesterol, and other trash. But how do you get every last one of the hungry little buggers out?

D. R. Lane
Vallejo, Calif.

PAPER CHASE

I've known Steve and Sylvia Czerkas ["Skinning the Dinosaur," by Don Lessem, March] for many years. In fact, they were with me on a dinosaur dig about ten years ago. They are both very talented people who are dedicated to their work.

Eighteen years ago I published an article called "Hobbyists, Amateurs, and Professionals," in which I pointed out the importance of scientists without advanced degrees. One of our late outstanding paleontologists with positions at Harvard University's Field Museum had no degrees at all, and I know a number of nondegree holders who are doing or have done outstanding paleontological work in California, Nebraska, and Montana. I consider my own Ph.D. in paleontology (Berkeley, 1949) simply a passport that got me into academia.

That degree alone doesn't always make a good scientist. And when it comes to *Stegosaurus* plates or dinosaur skins, a trained artist's eye may well be more authoritative than that of one who works only with bones. People like the Czerkases should be appreciated and aided by professionals.

James Reid Macdonald
Rapid City, S. Dak.

A NEW IRON AGE

In addition to the ways mentioned for "Cooling Off the Greenhouse" [by Andrew C. Revkin, January], you should also consider oceanic fertilization with iron.

We are pursuing the hypothesis that the reason for the nonuse of the abundant nitrate and phosphate in Antarctic surface waters is that the plants do not have enough iron to make chlorophyll and hence are growth-limited. Oceanic iron for phytoplankton is provided by the fallout of atmospheric dust. During the ice ages, when carbon dioxide levels were low, iron-rich atmosphere dust loads were markedly higher. In contrast, dust loads have been very low during present and previous interglacial periods.

If all of the major nutrients were used in the present-day Antarctic ocean, the growth could result in the removal of 1 billion to 3 billion tons of carbon each year. These are large numbers in comparison to the estimated fossil fuel carbon input of 5 billion tons. The iron required to stimulate this growth would be on the order of 200,000 to 400,000 tons. Our largest ships have a capacity of 550,000 tons; thus, iron fertilization is feasible. Applying small amounts of iron to a large surface area is another matter, however. Nevertheless, this scheme is much more feasible than reforestation or sulfur addition.

We have an expedition to the Antarctic next month, and we will seek additional evidence for our iron hypothesis. If all goes well, it may be another step toward cooling off the greenhouse.

John H. Martin
Moss Landing Marine Laboratories
Moss Landing, Calif.

Address letters to: DISCOVER, 3 Park Ave., New York, N.Y. 10016. Please include a daytime telephone number. Letters may be edited for length and clarity. We regret that we cannot accept responsibility for unsolicited manuscripts or art.

777

120

INTERNATIONAL UNION FOR QUATERNARY RESEARCH
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The National Research Council of Canada
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with
the active participation of
the Geological Survey of Canada

CONGRESS CENTRE, OTTAWA, CANADA
JULY 31 – AUGUST 9, 1987

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PROGRAMME AND ABSTRACTS
~~PROGRAMME ET RESUMES~~

1987

p. 274
275

THE "GULF OF MEXICO" SEA LEVEL CURVE

Tanner, W. F., and S. Demirpolat, Geol. Dept., Florida State Univ., Tallahassee, Fla. 32306 U.S.A.; and Luis Alvarez, History Dept., Universidad Nacional Autonoma de Mexico, Mexico D.F., Mex.

Beach ridge plains on four sides of the Gulf of Mexico produced a new, better sea level history for Late Holocene time: St. Vincent Island and Sanibel Island, Fla., Mesa del Gavilan, Tex. and Isla del Carmen, Mex. On St. Vincent Island there are 400 data points, which can be grouped in sets, some high, some low; set boundaries mark rises and drops of sea level. Relative moment measures show the same changes: three rises and two drops since 7000 B.P. Vertical uncertainty is 1.0 m, time uncertainty under 50-to-100 yrs. High stands exceeded present level by 1-2 m, and low stands were below it by 1-3 m. The last change, about 800 B.P., was a rise.

The three other areas were compared with St. Vincent I. The fit is almost perfect, as far back as the record goes in each area. Published data from beach ridge plains in southern Louisiana, away from the Mississippi River delta, also fit. Submerged beaches along the zero energy coast of Florida provide positive evidence for 2 or 3 low positions at about -2 or -3 m. Although not dated directly, these fragile features must be late Holocene in age.

Late Holocene sea level did NOT approach present position asymptotically, but fluctuated both above and below it, with a period of about 1000 yrs. The rate of short-term change was 5-to-20 cm/yr. Small changes (< 40 cm) and slow changes (<one cm/yr) are not visible in our data.

FORECAST: WARMER CLIMATE, SEA LEVEL FALL

Tanner, William F., Geology Dept., Fla. State Univ., Tallahassee, Fla. 32306-3026 U. S. A.

Work on beach ridge sets on St. Vincent Island, Fla., produced a detailed late Holocene sea level history. This included planetable profiling, air photo analysis, granulometry, and other work. There were three rises, about 6000, 2700-2800 and 800 B.P., and two falls, about 4500 and 1700-1800 B.P. (the last four, 1-to-4 m). Each change took less than 50-to-100 yrs. Key sediment parameters also shift sharply in this short time interval. About 400 data points, some 10 years apart, were used.

The St. Vincent curve was the basis for more work elsewhere around the Gulf of Mexico: Sanibel Island, Fla., Isla del Carmen, Mex., and Brownsville, Tex. The four areas agree in timing and direction of change, as far back as the record goes in each case. The history obtained from all four is here designated the "Gulf of Mexico" sea level curve. It cannot be attributed to local causes.

The climate record from the same time interval (Dansgard et al 1969, Wendland, 1972; Yoshino, 1986) is almost precisely the inverse of the Gulf of Mexico curve. The latter shows low sea level (-2 to -4 m) where the climate curves indicate a warm interval. Therefore we should re-examine the concept that "cold climate" and "low sea level" MUST go together, for changes of only 1-to-5 m. There appears to have been a shift, about 5000-6000 B.P., from a direct relationship to the inverse scheme that operated since then. A warming trend DOES indeed indicate a drop, under present conditions. With a warmer climate, sea level may fall 1-to-3 m, rather than rise.

4

On peut se procurer des exemplaires supplémentaires à (au) :

778

EARTH REGENERATION SOCIETY, INC.

470 VASSAR AVENUE, BERKELEY, CALIFORNIA 94708 U.S.A.
(415) 525-4877

May 7, 1988

To whom it may concern:

Subject: Atmospheric carbon dioxide, climate change, and ocean level.

First, we wish to point out the well known. In the course of recent glacial periods (varying in the neighborhood of 70,000 to 120,000 years) global ocean level drops 300 to 350 feet as the global ice volume increases from around 35 to 70 or 80 million cubic kilometers.

Second, there has been talk about oceans rising due to CO/2 effect. This has been in the context of CO/2 increase and reference to "warming" only, without sufficient reference to what is happening in the full dynamics of climate change by latitude and by season. The accelerating destructive realities, of warming in the lower latitudes and cooling in the higher latitudes, are forcing attention to the full climate situation, to climate stabilization efforts, and attempts at protection against natural disasters due to climate change.

Third, a group within the National Academy of Sciences has spent time on the question of ocean rising due to CO/2 effects. They are satisfied that this is not the case; and statements about oceans rising due to CO/2 should now be laid to rest.

For guidance on who to refer to in the National Academy of Sciences on this matter, we suggest:

Dr. Stephen Rattien
Deputy Executive Director
Commission on Engineering and Technical Assistance
National Academy of Sciences
MH280
2101 Constitution Avenue, NW
Washington, D.C. 20418
(202) 334-2189

Fourth, we recommend that the few studies, based on an arbitrary question "if the ocean should rise a certain number of feet where will the water go?" should also be laid aside. Unfortunately some public funds have already been spent on this type of study and subsequent media reporting.

[60-33 5-6-88]

April 23, 1990

SONOMA EARTHWEEK

Darwin Hall
Sonoma State University
California

Talk by Alden Bryant
President, Earth Regeneration Society

This year Earth Day is receiving broad international consideration.

Earth Day must be viewed as protection of the environment and human life. The environment is being transformed from natural processes (climate change), and human processes (toxic pollution, resource destruction and speeding climate change).

Climate Stabilization is the order of the day. From now on, Climate Stabilization must become a main focus of our government from the President of the United States on down to every city council person, to every mayor.

Climate Stabilization is the re-establishment of the balance of nature as we have known it for over 10,000 years, which is the duration of the present interglacial period.

Climate Stabilization means that it is necessary to bring up the conditions of life of all the people — their food, housing, health, education, child care and peace — or there will not be the workers and the working conditions to stabilize climate in time.

Climate Stabilization means the development of a massive jobs and environment program for our country — and similar programs in every country — established in the form of a CO/2 Budget. A CO/2 Budget is the measure of the production of CO/2 in a region (fossil fuels) and the reduction (soil, forest and ocean action) or offset (alternatives to fossil fuel). Such a plan should include pollution abatement and clean up. State and local CO/2 Budgets can lay out work, its CO/2 impact, and tie into a national plan.

Submission of preliminary national CO/2 Budgets to the United Nations by the end of 1989 was urged in a paper presented at the July 2 to 7, 1989, meeting of the International Society for Systems Sciences, Edinburgh, Scotland ("CO/2 Budget Approach to Climate Stabilization", Alden Bryant). The original call for CO/2 Budgets was made in Budapest, Hungary, at the June, 1987, meeting of the Society ("Economics of Climate Stabilization" by Bryant, Malveaux, Fryday). Hungary was the first country to start a CO/2 Budget.

By Climate Stabilization we mean the establishment of a clear focus on specific goals. Reduce atmospheric carbon dioxide on a worldwide basis, with the United States doing its part, from the current 350 parts per million back down to the 280 ppm or less which is where it has been for over 120,000 years, or since the last transition from interglacial to glacial conditions.

The primary instrument for stabilization of climate is the Emergency Climate Stabilization and Earth Regeneration Act of 1989, submitted for review by Representative Ronald V. Dellums, and printed in the U.S. Congressional Record of November 21, 1989, Part III, Page E 4034-36.

This proposed legislation is the first in the U.S. — or any country — to place the problem of climate change in its full context of growing intensities of heat and drought in the lower latitudes, and clouds, snow, ice and freezing in the higher latitudes. This is legislation that calls attention to the full cycle of climate change, its effect on our food supplies, and the extent and timing of the necessary solution.

This legislation is in the sense of the United Nations Resolution, submitted by Malta and passed by the General Assembly on December 6, 1988, entitled "Conservation of Climate as Part of the Common Heritage of Mankind." This legislative proposal is fully supportive of the body of working governments, "International Panel on Climate Change," with its three working groups chaired respectively by Great Britain, the USSR, and the USA.

This legislative proposal defines the structure of the problem: reduction of CO/2 from 350 ppm to 280 ppm in 15 years. The timing is a statement of the rate of increase of climate intensities: heat, drought, freezing, storms, floods, tornadoes, hurricanes, clouds, snow and ice, earthquakes and volcanoes; shorter growing seasons; and destruction of agriculture and technology. The framework of what we see around us in the world, and what we know, is described in the term "Environmental Pentagon." A pentagon is a five-sided figure. We know about the military pentagon in Washington, D.C.

An "environmental pentagon" refers to what is known about climate change and the solution for climate stabilization. The five sides of our Pentagon are: soil, forests, CO/2, oceans (phytoplankton), and ice (clouds, snow and ice). The solution is: work on soil remineralization, reforestation, ocean phytoplankton expansion, energy conservation, and alternative energy technology development. This comprises the soil, forest, ocean and energy work to reduce CO/2.

Stress is on the soil/forest connection. The world's forests are dying, primarily from demineralized soils, and are being brought back by remineralizing the soil with adequate rockdust plus organic material. Effective results are being obtained by Gernot Graefe of Austria, and there are application programs in a number of other countries.

Look at what is known — our Environmental Pentagon. How many glacial cycles have we had? Our science information indicates 20 to 25, over two million years. Now, however, is the first time that literate human species is facing the transition from interglacial to glacial conditions. Some peoples, still close to nature, have legends of past great changes. The Hopi people have such. One of our earliest known written records, going back about 6,000 years, is in Sumerian pottery records -- the myth of Inanna, death and resurrection through the goddess. The point here is to ask what we are up against when we as an entire society are facing something we have never experienced before in our lives. This is our first such transition. We are well into it.

There are those in science, industry, labor, political and numerous citizen groups involved with the full cycle and the full range of actions necessary for Climate Stabilization. At the same time we still have those consciously playing with jumbled and incomplete evidence and confusing the public -- distorting science. As a society we have progressed from junk food, to junk bonds to junk science (warming only, poles melting).

There are increasing forces working hard for Climate Stabilization. There are also those who talk environment and do the opposite. They push Congress to reduce the federal budget for forest, soil and alternative energy technology development. They work hard to maintain military-industrial expenditures of over 300 billion

dollars by building satellites and spy planes (Aurora, around 5600 miles per hour) at about one billion dollars each. This reconnaissance, together with nuclear weapons production, is their objective. These, too, are forces that must be brought into the drive for Climate Stabilization.

For 150 years there has been a concentrating of wealth based on the premise of infinite natural resources. Now we are facing the reality of the need for a total shift to living in harmony with nature. This means replacing the natural resources we continue to use and need, so as to achieve the stabilization of climate and ensure a livable environment. The natural resources that we must rebuild and protect include our soil, forests, water supplies and food.

Reducing atmospheric CO/2 in time is essential to maintaining our crops and functioning technological society. The destruction of soil, forest and water resources is leading rapidly into economic and now environmental collapse.

For all of these 150 years, men and women have struggled for equitable distribution of goods and services, striving to bring up the standard of living of all people. In the mid-1940s this was included in the United Nations Charter and the Declaration of Human Rights.

Now it is becoming increasingly clear that climate stabilization is related to an equitable human society and an economic life brought into balance with the ecosystem in each region. From a world of wealth created by labor, we are moving toward a world of survival based on the balance of labor and natural resources.

Contributions to the scientific understanding of the full cycle of climate change are noted as follows.

Heat and drought increase in the lower latitudes is leading into clouds, snow and increased freezing in the higher latitudes, a continuous warming and cooling process — Kenneth E.F. Watt (USA), Victor Kovda (USSR).

The heat and drought, as well as the more intense freezing and shorter growing seasons, are destroying crops in the U.S. (as well as many other countries). The U.S. is faced with cutting back on exports — U.S. Department of Agriculture, Statistics Office.

Cloud cover is increasing and contributing to cooling — E. Roeckner, U.Schlese, J. Biercamp, P. Loewe (Federal Republic of Germany), V. Ramanathan (USA), Hubert H. Lamb (Great Britain).

Over the last 20 years, the majority of the world's glaciers which are monitored are advancing — Fred Bruce Wood (USA).

Snow has been increasing significantly in depth in Alaska and Tibet — Maynard Miller (USA); in Eastern Canada and Baffin Island — Gifford Miller (USA); in Antarctica — reported by returning workers. Ice depth has been increasing in parts of the Antarctic an average of four to five feet per year for 25 years.

The snow line in parts of Canada is now 150 miles further south than at this time in previous years. Parts of Canada have not had enough frost free days to grow wheat — stated by C. Bertrand Schultz (USA) in Philadelphia in 1986 at the AAAS (American Association for the Advancement of Science), at the meeting of the member association ISGSR (International Society for General Systems Research), and now common knowledge in Canada according to Peter Petronek, Coordinator of Special Projects for Earthday Canada.

The increase of snow and ice over the last 20 years in the Antarctic, on the

glaciers of Alaska, Eastern Canada, Baffin Island, Greenland, the USSR, are the rough equivalent of an inch or two drop in ocean level -- it has been recommended that this whole question be given more analytical attention.

We are in transition into the next glacial period — C. Bertrand Schultz (USA), Alexis Dreimanis (Canada), Gifford Miller (USA), Fred Bernard Wood (USA).

Remineralization of forests with rockdust plus organic material is bringing them back to life — Gernot Graefe (Austria); and other countries. Large areas of the USA and other countries have mineral and trace mineral depletion in the range of 25% to 40% — Mark A. Flock, Agronomist (Brookside Farms Laboratory, New Knoxville, Ohio, testing approximately a million soil samples per year, from various countries).

Ocean remineralization to increase phytoplankton, and significantly add to atmospheric CO/2 reduction — John H. Martin (USA). Oceans can be remineralized with iron particles in areas primarily lacking this mineral; but further research and investigation into environmental implications is necessary. This may produce as much as one fifth of global CO/2 reduction over the next 15 years.

We are entering the final period of recognition of climate change and the transformation of human society in an effort to maintain itself. Our losses will become greater every year until the atmospheric CO/2 concentration is back to around 280 ppm. Other greenhouse gasses are an additional problem. The race is to reduce CO/2 before it is too late — even in the face of increasing destruction of crops, livestock, utilities, transportation, housing and human life. These are two simultaneous processes "going critical."

We who care about survival must come together to make our greatest effort. Groups, all across the country, from local to national -- to international -- must come together to integrate this work into their daily lives and to demand appropriate action by all those in elected office.

[82-2]

126

ALDEN BRYANT
470 Vassar Avenue, Berkeley, California 94708
(415) 525-4877

Comparison of:

Dellum007 Emergency Climate Stabilization and Earth Regeneration Act of 1989

with previous legislation on climate change

Previous legislation, in some cases, presents a good range of work that needs to be done. It covers most of the main areas of activity, providing objectives, plan, administration, and funding for each.

With that basic observation made, the following points will present the additional material in Dellum007.

(1) The earth is going through a natural cycle. We are in the transition from interglacial to glacial conditions, human activity is speeding up the process, primarily by cutting forests, reducing swamp, marsh land and wet lands, and burning fossil fuel. See paragraph (17) for further explanation.

(2) Earlier bills set forth a substantial range of activities in the context of least cost, new technologies becoming commercial, marketable, and relying on the private market system. The problem of global climate stabilization raises additional questions. There are quantity and time requirements, quantity of CO/2 to remove from the atmosphere, and the time in which we have to do it.

(3) This means a finite job to do in an approximate time period. The finite job is to reduce carbon dioxide from the present 350 parts per million (ppm) in the earth's atmosphere back to approximately 270 ppm, in order to keep the world's climate within the range of fluctuation we have known for the last 6000 years or more. CO/2 has been below this level of 270 ppm for over 120,000 years.

(4) The CO/2 reduction from 350 to 270 ppm translates into approximately 170 Gt (gigatons, billions of tons) of carbon. The time period has to be within approximately 15 years considering the rate at which heat, drought and freezing are knocking out food supplies and climate extremes are exerting pressure on human society.

(5) Earlier bills present programs that are moving toward the primary goal of CO/2 reduction. Dellum007, however, defines the structure, i.e., natural cycle plus human effects, the quantity and time requirements for climate stabilization, and thereby the far greater priority which must be given to climate related programs. It is now up to humans to stabilize, solve the problem of balance between the earth and its atmosphere within the time frame.

(6) The USA share of the world quantity and time goals will set the context for the mix of public and private activity in the USA, and along with that the mix of CO/2-effective programs.

(7) Dellum007 calls for a working document which will serve to integrate all activities related to climate stabilization, increases and decreases year by year, and that is the "CO/2 Budget". It calls for Federal, State and local CO/2 Budgets.

(8) Submission of preliminary national CO/2 Budgets to the United Nations by the end of 1989 has been urged in a paper presented at the July 2 to 7, 1989, meeting of the International Society for Systems Sciences, Edinburgh, Scotland ("CO/2 Budget Approach to Climate Stabilization", Alden Bryant). The original call for CO/2 Budgets was made in Budapest, Hungary, at the June, 1987, meeting of the Society ("Economics of Climate Stabilization", Alden Bryant).

(9) A CO/2 Budget is an integrated jobs and environment plan, including pollution abatement and clean up. State and local CO/2 Budgets can lay out work, and effect of work, and tie into the national plan.

(10) Soil remineralization with appropriate rockdust. Soil work is included in HR 1078 but there is no mention of bringing back up the mineral and trace mineral quality of the soil in older soils. This is needed for crops and for forest areas, in some parts of the country more than others, less in the areas which have been glaciated and much more so in areas which are further south and have not been glaciated in the past.

(11) Dellum007 stresses the soil/forest connection. The world's forests are dying primarily from demineralized soils and are being brought back by remineralizing the soil with adequate rockdust plus organic material -- Gernot Graefe (Austria), and application programs in a number of other countries.

(12) Dellum007 specifies ocean phytoplankton increase. Other bills do not specifically refer to this potential program. Oceans can be remineralized with iron in areas primarily lacking this mineral; but further research and investigation into environmental implications is necessary. This may produce as much as one fifth of global CO/2 reduction over the next 15 years.

(13) Dellum007 calls for careful evaluation of losses due to environmental conditions, the intensities of climate change that are increasingly destructive of food, lives and property. It calls for such analysis of losses over the last ten years, to help show the magnitude of the problem we are facing.

(14) Other bills include international cooperation in various ways, but do not refer to the quantity/time structure — which means not only our food supply along the way, as well as functioning of our technological society, but a race to achieve balance of the earth and atmosphere before it is too late to stop the glaciation process.

(15) Corporate tax surcharge: start with 5%. Others propose a little less, but from other tax approaches rather than from a specific corporate tax, and a Climate Stabilization Trust Fund, as in Dellum007. We note that corporate taxes are now about 12% of IRS income, whereas at the end of the 1940s the figure was close to 50%.

(16) The 5% may be reduced during Congressional discussion and negotiations. There will be future bills on funding; the immediate problem is to get large scale physical work started. This is the essence of Dellum007 and our survival.

---

(17) Primary scientists of reference:

Heat and drought increase in the lower latitudes is leading into clouds, snow and increased freezing in the higher latitudes, a continuous warming and cooling process — Kenneth E.F. Watt (USA), Victor Kovda (USSR).

Cloud cover is increasing and contributing to cooling — E. Roeckner, U.Schlese, J. Biercamp, P. Loewe (Federal Republic of Germany), V. Ramanathan (USA), Hubert H. Lamb (Great Britain).

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We are in transition into the next glacial period -- C. Bertrand Schultz (USA), Alexis Dreimanis (Canada), Gifford Miller (USA), Fred Bernard Wood (USA).

The increase of snow and ice over the last 20 years in the Antaractic, on the glaciers of Alaska, Eastern Canada, Baffin Island, Greenland, the USSR, are the rough equivalent of an inch or two drop in ocean level -- it has been recommended that this whole question be given more analytical attention.

Remineralization of forests with rockdust plus organic material is bringing them back to life — Gernot Graefe (Austria); and other countries. Large areas of the USA and other countries have mineral and trace mineral depletion in the range of 25% to 40% — Mark A. Flock, Agronomist (Brookside Farms Laboratory, New Knoxville, Ohio, testing approximately a million soil samples per year, from various countries).

Ocean remineralization to increase phytoplankton, and significantly add to atmospheric CO/2 reduction — John H. Martin (USA).

[74-22 7-21-89]

120

EARTH REGENERATION SOCIETY, INC.
1442A Walnut Street #57, Berkeley, California 94709
(415) 525-4877

February 3, 1990

Mr. Andrew Card fax: 202-456-2397
Office of John Sununu
The White House
Washington, D.C. 20500

Dear Mr. Card:

I have been asked to send you critical and essential material for the President's speech on climate change. Here is my suggestion.

It is time to broaden out the issue from talk about warming to a call for full investigation of the warming and cooling conditions.

The problem is obvious from the changing natural conditions: heat and drought in the summers and greater freezing in the winters. Everyone can see this.

People from agri-business executives, to utility people, to local governments and citizen organizations are being hit by climate extremes. Don't let the President lag behind the mounting wave of awareness and call for action to stabilize climate -- action on reforestation, soil improvement to support tree growth, conservation and energy programs.

Professor Kenneth E.F. Watt, University of California, Davis, one of the foremost world figures in the area of the biosphere (and climate within that), will be presenting the fuller picture to the California Energy Comission later this month. This will be a major turning point from the limited "warming only" to a fuller response to the warming and cooling conditions. It is well that you take advantage of knowing of this in advance and open up the approach in the President's speech.

I am also sending you a copy of the discussion draft of a legislative initiative entered by Representative Dellums to the Congressional Record, November 21, 1989, noted as global warming and cooling -- title "Emergency Climate Stabilization and Earth Regeneration Act of 1989."

What I cannot fax to you are the photographs showing four to five feet per year ice buildup in a good part of the Antarctic since the mid 1960s.

The enclosures give you some of the picture.

My concern is that the President doesn't end up looking like the back end of the train, unaware of the full scope and emergency nature of what we all are facing.

Could he refer to the U.S. preparing its CO/2 Budget as part of a world program? Hungary is the first country working on a CO/2 Budget. (I initiated the term in a paper to the International Society for General Systems Research, Budapest, Hungary, June 1987, and urged that all countries prepare preliminary CO/2 Budgets, in my paper to the same Society in Edinburgh, Scotland, 1989. It is called for in the draft submitted by Dellums.)

Sincerely yours,

Alden Bryant

President, Earth Regeneration Society

79-V4

THE WHITE HOUSE 2.5.90

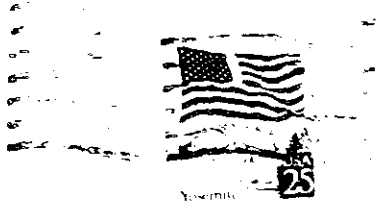
Dear Dr. Bryant:

Thank you for your correspondence FAXed following my telephone conversations with John McConnell on Saturday. Your interest is appreciated.

I have shared the information you sent with the appropriate White House Officials. Please keep in touch.

Sincerely, Andy Card

Andy Card
THE WHITE HOUSE
WASHINGTON



Dr. Allen Bryant
Earth Regeneration Society, Inc.
1442A Walnut Street #57
Berkeley, California 94709

7-2-44

Paper for the Annual Meeting, International Society for the Systems Sciences,
Portland, Oregon. July 9-13, 1990.

THE ROLE OF CO/2 BUDGETS IN CLIMATE STABILIZATION

Alden Bryant
President, Earth Regeneration Society, Inc.
1442A Walnut Street #57
Berkeley, California 94709, USA
415-525-4877

Abstract: A CO/2 Budget is a statement of the increases and decreases of atmospheric carbon dioxide (CO/2), shown in units of carbon, in a region over the short and long run (one year and ten years respectively are recommended). It is presented as a working tool to measure the changes required for stabilization of climate. The biospheric conditions must be stabilized before reaching a point of no return in snow buildup, and climate intensities in summer and winter, knocking out food supplies in the temperate latitudes. The world is well into the transition from interglacial to glacial conditions; and it is questionable to what extent human society can carry out a sufficient soil, forest, ocean and energy program to stabilize climate conditions in time.

Climate change will increasingly impact all social and economic problems and conflicts.

The move toward climate stabilization potentially can become the world's greatest unifying force.

Work programs to carry out the necessary soil, forest and energy programs can be expressed in an integrated and comprehensive fashion through CO/2 Budgets — planned increases and decreases of CO/2 in a given region. CO/2 is specified here since the excess CO/2 above approximately 280 parts per million in the world's atmosphere is the main driving force in climate change.

We are living in times of increasing evaporation, heat and drought in the lower latitudes, resultant freezing, snow and ice formation in higher latitudes, plus storms, hurricanes, shorter growing seasons and irregular destructive temperature extremes in both summer and winter. Crop destruction is accelerating; and worldwide food surplus is approaching zero.

The basis in law to develop necessary programs and international cooperation exists in the United Nations Charter, in regional treaties, and within nations. Preparation of additional legal structure is in process to help implement essential food, labor, technology, financial and educational exchanges [26, 9].

This paper asks that we get the entire soil, forest and energy process going in the most extensive and rapid manner possible.

Human society is now required to look at the balance of the earth and the atmosphere, and to develop a more comprehensive and total view of life [27].

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The dynamic for progress on climate stabilization can be stated as actions bouncing off of each other. An achievement by one group can be an impetus for action by other groups, or in economic development terms, "demonstration effect." Consider molecular action in gas. Heat up a gas and the molecules move all the faster, giving impetus to each other. In such a manner we are approaching a far greater confluence of the social and physical sciences.

In a general systems approach one can list social groupings and view them as interfacing with a set of functions. Groupings: science, academic, trade unions, corporations, political parties, and other citizen organizations. Functions: education, elections, laws, funding, administration, work (by individuals, groups and whole populations). The objective is to get the work going [24, 14].

Change and turbulence

Human society is facing conditions of turbulence at the changeover from one mode to another, from the interglacial to glacial conditions [16, 15]. New processes are now set in motion that are going on in spite of human activity: snow and ice increase [28]; cooling of northern forests (less CO/2 storage) and oceans, more burning of some forest areas under heat and drought increase.

Major ecological conditions have been going critical which is part of the transition from interglacial to glacial conditions: (1) soil demineralization, (2) forest death, burning and infestation, (3) CO/2 increase (above 300 ppm), (4) amphibians disappearing, and (5) cloud [13], snow and ice buildup. We are in the final transition, from around the 1940s or 1950s, with heavy snow and ice buildup in the Antarctic starting in the 1960s [22, 8].

"We presently live in an interglacial, approaching a transition to the next glacial interval." [7] In 1985 there was an 18% increase in peak snow cover (November) in the northern hemisphere compared to last peak which was in 1973 [2]. In parts of Canada the snow line (May) was 90 to 150 miles further south in the 1980s compared to the 1970s, causing disruption of bird migrations, vegetation and insect life [10]. Over 30,000 sheep were frozen to death by a freezing storm near Melbourne, Australia, in their summer (December 1987) [25]. Cooling now from cloud increase is greater than warming from CO/2 increase [18]. "The director of the Nebraska Academy of Sciences believes the Northern Hemisphere is at least heading for a 'mini'Ice Age" [20, 1].

We are looking at regional ecological interactions, not just the aggregation of CO/2-reducing activities. This requires separate types of analysis and records. CO/2 is an indicator. Temperatures are indicators. The driving force comes basically from the soil, then through the global vegetation, to the CO/2 level, and its pivotal force in climate intensities, and finally the cloud, snow and ice changes.

One example is the cutting of vegetation in the high parts of the Himalayas, changes in the watershed conditions, and the increased

flooding in the low lands. Here is the cluster of CO/2 Budgets for a region which includes several countries.

Every CO/2 Budget, both regional and global, requires a multiple approach: show impact on quantity of atmospheric CO/2 and the qualitative impact on the ecosystem as a whole. This is a highly complex and sensitive process, for which we have the people and the tools, but are only beginning to respond to the need.

Adding up regional carbon data gives a numerical result. It does not bring forward the qualitative aspects of global system change such as (1) CO/2 reaching 300 around 1950s and the cooling mode taking over, (2) some ocean areas cooling, (3) less evaporation, more drought on the land, (4) forests in higher latitudes being colder, less taking in of CO/2, hence more CO/2 in the atmosphere, and (5) more forest fires and dying trees resulting in CO/2 increase.

The legislation proposed by United States Representative Ronald V. Dellums calls for compiling the record of maximum climate intensities, in the summer and in the winter, that are causing accelerating damage to crops, utilities, houses, transportation, some industrial facilities, and human life [6].

The concept and call for CO/2 Budgets was first described at the International Society for General Systems Research (ISGSR) Annual Meeting, Budapest, Hungary, June 1987, Climate section [5]. A further call, for all countries to complete preliminary CO/2 Budgets and forward them to the United Nations, was made at the Annual Meeting of ISGSR, now renamed International Society for Systems Sciences, Edinburgh, Scotland, July 1989 [4].

Considerations for developing a CO/2 Budget

1. The world's forests, swamps, deltas, and grasslands are a major source of taking in carbon dioxide (CO/2) from the atmosphere. The oceans are also a CO/2 sink, but they change relatively slowly — except for the potential phytoplankton expansion in mid-Pacific and Antarctic Ocean areas with the addition of iron particles [17]. The forests and swamps, and the soil they grow in, together with the oceans, are the key to our efforts to stabilize climate.

2. CO/2 is the main driving force in the climate change. The increase (from less than 280 parts per million [ppm] in the atmosphere for about 120,000 years since the last change from interglacial to glacial conditions, to 350 ppm now) means an increased "greenhouse" effect. This increase produces more heat, drought, moisture evaporating in the lower latitudes, and more condensing, clouds, snow, and freezing in the higher latitudes, resulting in all-time record cold moving down from the north in the winter and sporadically in the summer as well.

3. A CO/2 Budget means analysis of the changes in agriculture, industrial production, services and individual living patterns required to bring about the necessary changes in soil, forest, and energy conditions.

4. In California, one farmer has for twelve years undertaken soil remineralization with gravel dust and steer manure to produce the best crops in the area, and no pesticides or chemical fertilizers [11]. In Austria, under the Academy of Sciences, forest areas are being brought back to life with rock dust remineralization plus organic material [12].

5. Numerous early calculations have been made on CO/2 increase and decrease. One approach to forest sequestering of carbon is taken from Paul Zinke at the University of California, Berkeley: global averages for net growth rate of forests — tropical forests fifteen cubic meters per hectare per year, temperate zones ten, and northern zones (like Finland) two [23].

6. One interesting problem for the short run is to show how much fossil fuel will be necessary to produce alternative energy technology, and to carry out soil, forest and ocean work. Solar thermal electric power is available. LUZ Corporation is now serving over 400,000 people in Southern California, and their recent 80 megawatta plant came in at near eight cents per kilowatt hour (life cycle basis) — better now than oil and nuclear power plants [3, 21].

7. We need to evaluate elements and sub-elements for the CO/2 Budget. This will require input from groups in the region involved with the activities included in the CO/2 Budget, such as mass transit and reforestation. Show how these groups see the changes; and show what their part will be in implementing the CO/2 Budget.

8. Projections of future work and results must, to the extent possible, be tied to the qualitative changes taking place as the earth goes further into glacial conditions. The earth went from primarily warming mode up to the 1940s, and from then on into a primarily cooling mode (with more cloud, snow and ice buildup and record cold in the winter).

9. The goal of a CO/2 Budget is to develop a sufficiently thorough base for information, and out of this a comprehensive integrated jobs and environment program for a region. The assumptions and calculations must have the broadest possible assistance from specialists in different disciplines, from public and private agencies, and citizen response throughout the areas concerned.

10. The international goal for a CO/2 Budget, coordinated through the United Nations, is the combining of data from actual regional work programs and providing an effective process for planning and keeping track of CO/2 reduction on a word-wide basis.

Conclusion

"Whether we control technology by directing its evolution, by choosing when and how to use it, or by deciding what significance it should have in our lives, we shall succed only if we are able to accept what at first appears to be an impossible shift in our point of view: different as people and machines are, they exist not in two different

worlds, but at two ends of the same continuum. Just as we have discovered that we are a part of the natural environment, and not just surrounded by it, so also we will find that we are an intimate part of the environment of technology. The auxiliary "organs" that extend our sight, our hearing, and our thinking really are an extension of our physical bodies. When we are able to accept this, we shall discover that the struggle to control technology has all along been a struggle to control ourselves" [19].

In order to compile the most effective CO/2 Budget possible, a clear picture is necessary of the conflicting forces, the people involved, and the possibilities of transforming present productive activity into new forms for human survival. Rybczynski provides history and a more integrated approach to technology, social impact and impact on the natural environment. Numerous publications provide the same for sectors of industry with a special role to play: oil, coal, timber, chemical, fertilizer, agriculture, mining, utilities and the military/industrial. Finally, and with the changes taking place in other countries, the role of government and the transformation of government is increasingly the order of the day.

The dynamics of government, in response to climate change, include the range of participants from elected officials to corporate clusters and their CEOs, to citizen groups, some organized around mass direct conflict situations, like trade union members, struggling to achieve or to maintain a decent standard of living.

Reflecting all of these conflicting forces is the range of government bodies from local to national. Through them, as long as we can still function as societies with government processes, we are now searching for a new balance with the ecological forcs of which we are a part, with the technology we have created within our ecological boundaries, and with the human struggle for food, jobs and a sufficient quality of life.

All of this is being more rapidly determined by climate change and our reponse. The CO/2 Budget is the main working tool within this setting. It is the collecting device for delineating the transformation of human society within the ecological forces now so intensely in motion. It is the measuring statement for the parts and for the whole in the coming years. These are the years we will struggle for survival in a new balance with nature — a regenerated earth and stabilized climate.

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TABLE I FORMAT AND DESCRIPTION FOR A CO/2 BUDGET
Earth Regeneration Society CO/2 Budget — soil, forest, energy work

Increase of CO/2	Grams of carbon input to the atmosphere	
	Current 12 month period	Future period 10 years
gasoline use	xxx	xxx
oil use	xxx	xxx
coal use	xxx	xxx
natural gas use	xxx	xxx
cutting trees	xxx	xxx
soil deterioration	xxx	xxx
natural disasters (1)	xxx	xxx
Total	xxx	xxx
Reduction of CO/2	**Grams of carbon removed from the atmosphere**	
Plant life		
forests (based on net growth rate)	xxx	xxx
swamps " "	xxx	xxx
grass lands " "	xxx	xxx
oceans - phytoplankton	xxx	xxx
Soil		
soil remineralization, resulting in renewed and faster plant growth	xxx	xxx
Energy		
conservation (equivalent CO/2 reduction) [Range of energy conservation and fossil fuel offset activities]	xxx	xxx
alternative technology (equivalent CO/2 reduction) [Range of energy activities that will result in reduction of CO/2 output]	xxx	xxx
Total	xxx	xxx
Net effect on CO/2	xxx	xxx
Portion of global reduction of CO/2 required (This figure is more significant in the case of a state or country CO/2 Budget)		xxx

(1) Combination of effects throughout the regional economy — from heat, drought, fires, infestation, floods, hurricanes, tornadoes, storms, feezing, and shorter growing seasons. Translate into terms of increase in CO/2 (direct and indirect) — fossil fuel use to recover from the disaster, loss of tree cover and loss of alternative energy facilities.

(2) Each country, state, county, or other region, will have its own numbers to put in place of xxx for the one-year or 10-year column.

EARTH REGENERATION SOCIETY, INC.
470 VASSAR AVENUE, BERKELEY, CALIFORNIA 94708 U.S.A.
(415) 525-4877

U. S. EMPLOYMENT PLAN — EARTH REGENERATION PROGRAM
Employment by Industry Group

	Employment, Thousands of Jobs				
	(1) 1984 Actual	(2) 1989 Estimate	(3) Trans-fer	(4) New Jobs	(5) Total Cols. (2) to (5)
Agriculture	2 958	2 920		540	3 460
Remineralization			1 000	5 000	6 000
Forestry, and fisheries	80	90			90
Reforestation			500	2 400	2 900
Mining	657	650	<300>		350
Rock for remineralization			100	50	150
Manufacturing	19 962	20 290	500	1 130	21 920
Durable manufacturing	11 858	12 050	500	690	13 240
Nondurable manufacturing	8 104	8 240		440	8 680
Transportation, communication and utilities	5 636	5 720		420	6 140
Transportation	3 209	3 230		180	3 410
Communications	1 397	1 440		170	1 610
Public Utilities	1 030	1 050		70	1 120
Wholesale and retail trade	23 976	24 200		1 330	25 530
Finance, insurance, and real estate	6 291	6 400	<100>	340	6 640
Services	24 296	24 920	<600>	1 320	25 640
Construction	5 927	6 100	1 000	4 820	11 920
Government enterprises	1 485	1 510		80	1 590
Special industries	1 615	1 700		90	1 790
Sub-Total	92 883	94 500	2 100	17 520	114 120
Government (federal, state and local)	15 760	16 400	<100>	1 890	18 190
Foreign participation				500	500
Military	2 100	2 100	<2 000>	90	190
Total	110 743	113 000	——	20 000	133 000

1984 Actuals (down to Sub-Total) are taken from the Bureau of Labor Statistics, June 1985, 155 sector tab run "Time-series date for input-output industries — output, price, and employment (1972-SIC definitions). The estimates are those of the author.

The above U.S. employment plan is proposed to become part of an emergency international effort to halt the rise in atmospheric carbon dioxide and slowly bring it back to an equilibrium level (from 345 parts per million to around 280 ppm in the earth's atmosphere) and maintain a livable earth-atmosphere balance. We have the numbers, the technology and the education to handle the problem this time. We did not have these assets over 100,000 years ago at the last turn around into glaciation conditions.

1. New employment of 20 million jobs includes 2m to repair damage from increasing weather intensity, 12m to be employed on soil, forest and energy work within approximately four years from now, and 6m necessary supportive indirect labor throughout the rest of the economy.

2. Transfer of workers from less to more essential jobs means reduction in coal mining and petroleum (fossil fuel), services, military and government (federal, state and local) sectors offset by increases in remineralization of forests and agricultural land, reforestation, stone quarrying (for remineralization), durable manufacturing, and construction. Estimate: 3.1 million jobs.

3. Remineralization means gathering or grinding, storage (as necessary), loading, transporting, spreading, plowing in (for some agricultural uses). This refers to a very large number of big and small sources of rock for rock dust and widespread forest and agricultural application. This is highly labor intensive. 6 million jobs.

4. Reforestation , the rebuilding of forests, is now taken to mean the planting of many species of trees most natural to the habitat in each region (not just one species for lumber), with the goal of fast growing trees to take carbon out of the atmosphere. It means planting a combination of trees, shrubs, grasses to best develop the whole region. It means careful analysis of the conditions of each region. It means widespread involvement in federal lands, state lands, each county and every part of every city as both possible and practical. 2.9 million jobs.

5. Construction includes large scale damage repair from storms, hurricanes, flooding, fires, and earthquakes. 1 million jobs.

Energy conservation and development of alternative energy technology (solar heating and thermal electric plants, biomass for alcohol fuel and power plant operation, wind electric, hydrogen, and other -- not nuclear, no addition to radioactive contamination). 4.8 million jobs.

6. Foreign participation means working through the United Nations channels, as part of international teams, to expedite and help bring about the most effective earth regeneration in every region of the world. Regional regeneration plans are required. Above all, this means maximizing reforestation in temperate and tropical zones. Industrialized countries will be working more effectively with third world countries or we are all at risk. They regrow their forests or we too are out. The benefits of earth regeneration in its broadest sense far outweigh the short run returns to military-industrial corporations or companies involved in undesirable fossil fuel burning and destructive forest and soil practices.

7. Military. Reassignment of resources and duties as part of a basic and essential international arrangement.

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Alden Bryant, Earth Regeneration Society, Inc.

EARTH REGENERATION SOCIETY, INC.
1442A Walnut Street #57, Berkeley, California 94709, USA
(415) 525-4877

P R E S S R E L E A S E January 5, 1989

The world's population is increasingly at risk due to accelerating climatic disasters, according to Alden Bryant, president of the Berkeley, California-based Earth Regeneration Society.

Bryant recently concluded a European tour during which he exchanged data on the climate emergency with scientists and environmentalists in Moscow, Hamburg and London.

This was followed by participation in a United Nations conference on "Earth Regeneration and the Environment" held December 9 in New York in honor of the 40th anniversary of the UN Declaration of Human Rights. Bryant's paper on "Human Rights, Environment and Climate Stabilization" emphasized that emergency measures beyond anything imagined in the past must be taken to protect human societies.

The conference was co-sponsored by the Government of Malta and the Earth Regeneration Society (ERS) with Non-Governmental Organization (NGO) assistance. Addressing climate change for the first time in its history, the UN General Assembly on December 6 unanimously adopted a resolution calling for a comprehensive review of climate change, its economic and social impact, and response strategies to "delay, limit or mitigate" its adverse effects.

The historic resolution was in response to a resolution first presented in October by Malta calling for "conservation of climate as part of the common heritage of mankind."

Bryant's summing-up paper at the conference called for development of a "common international understanding" on removal of carbon dioxide (CO/2) from the earth's atmosphere, replanting and saving of the world's forests, soil remineralization, and "financial and resource transfers between developed and lesser developed countries to expedite climate stabilization programs."

The implementation of physical work on soil, forests and energy to reduce CO/2, Bryant said, can come about through use of a "CO/2 budget." Such a plan envisions CO/2 reduction goals set for all global areas, taking into consideration each region's "specific conditions of soil, trees, ground cover, food production, people, their culture and history."

It is time, he said, "when much of the best science, technical and social talent must be brought together to work out carbon-reducing activities beyond any previous plans."

Among UN conference speakers were Malta UN Ambassador Alexander Borg-Olivier; Gregory C. Watson, Executive Director, Massachusetts Office of Science and Technology; Dr. Kenneth E.F. Watt, professor of Environmental Studies, University of California at Davis; Dr. Elias Habte-Selassie, Institute for Social Studies at the Hague; and Ann Fagan Ginger, professor of Peace Law, University of California, Berkeley.

Watson said that climate changes "that run the spectrum of extremes from blistering heat and bitter cold to periods of severe drought and massive flooding" are the "most challenging problems that will confront humanity during the next decade."

He called upon governments to give this problem "immediate and serious attention." Climate stability and a sustainable future, he said, depend upon stopping the wreckless destruction of the world's tropical forests, initiating world-wide tree

67-8

planting and soil mineralization programs and stepping up "research and development of alternatives to fossil fuel energy sources."

The November 7-10 Hamburg, Federal Republic of Germany, World Congress on "Climate and Development: Climatic Change and Variability and the Resulting Social, Economic and Technological Implications" saw more than 400 scientists and environmentalists, including Bryant, exchange views on strategies to address global climate change.

Participants from Third World countries posed the dilemma caused by the industrialized nations being the major contributors to accelerating climate change while the developing world feels the consequences most drastically.

UN Secretary General Javier Perez de Cueller told the Congress that developing as well as developed nations must "launch major worldwide sustained initiatives to understand the phenomenon (of climate change) and to incorporate viable measures within their development strategies to combat it."

One UN role, it was announced, will be the involvement of all social groups in the political decision-making process on climate change because of its economic and social impact on these social groups, "especially the socially and economically disadvantaged."

Bryant's Hamburg paper called for "closing the gap" between (a) the threat to human life from rapidly increasing climate intensities (10 to 15 years), since we are now in the transition from interglacial to glacial conditions, and (b) a maximum global climate stabilization program to remove excess CO/2 from the atmosphere through acceleration of soil-forest-energy work to protect human life (25 or more years).

Istvan Lang, Secretary-General of the Hungarian Academy of Sciences, announced at Hamburg that his country will develop a CO/2 budget. It is the first country to do so.

In Moscow, Bryant met with members of the USSR Academy of Sciences, and with the International Department of the All-Union Central Council of Trade Unions, on climate stabilization as well as with members of "Travels for Peace and Environment," a non-governmental organization devoted to preventing the degradation of nature through "citizens' environmental diplomacy."

Bryant's meetings in London included two in the House of Commons — one with the environmental head of the Labour Party, and the second as speaker for the first organizational meeting of the "Tory Green Initiative," a new group of MPs and others established to bring environmental and climate issues into the work of the Tory Party.

143

EARTH REGENERATION SOCIETY, INC.
1442A Walnut Street #57, Berkeley, California 94709, USA
(415) 525-4877

January 5, 1989

Dr. Alexander Borg Olivier
Ambassador, Permanent Representative
of Malta to the United Nations
249 East 35th Street
New York, N.Y. 10016

Dear Ambassador Borg Olivier:

We are taking this opportunity to express our profound gratitude for the initiative of the Government of Malta and your personal contribution in taking leadership in the new arena of climate stabilization.

Not only do we offer our appreciation for your sponsorship of the December 9, 1988 conference on "Earth Regeneration and the Environment," held in the Dag Hammarskjold Auditorium — but behind that, the entire process of placing the subject on the agenda of the United Nations General Assembly and obtaining passage on December 6 was critical to putting the urgency of this problem before the world.

Recognition of great events in human history often comes through to the general public slowly and quietly. In this case there is such a story waiting to be written! You placed the subject "Conservation of Climate as Part of the Common Heritage of Mankind" on the U.N. agenda starting October 24, United Nations Day 1988. Based on your determination, and clarity of understanding of the nature of our times, the final resolution passed the General Assembly on Tuesday, December 6 "without a vote," the highest form of unanimity.

We are so well aware that behind this rapid movement lies at least fifteen years of mounting climate-induced catastrophies, accelerating human tragedy around the world. In response, the U.S. Congress has now undertaken initial legislative proposals.

Your action in the U.N. opens the door to implementation of climate stabilization programs as required on an emergency basis in every part of the world. Between October 24 and December 6 several interesting events took place.

1. In Moscow November 7, during the parade in Red Square, Moscow television featured live interviews, one being with the President of the Club "Travels for Peace and Environment." I was told that he called on political leaders of the USSR to speak out specifically for climate stabilization on an emergency basis.

2. Prime Minister Margaret Thatcher gave a talk on environment and climate to the British Academy of Sciences. A month or so later, on November 24 there was the inaugural meeting of the new organization "Tory Green Initiative" designed to help bring environment and climate issues up front in the Tory program.

It is our understanding that your actions in the U.N. have already had direct and indirect effects in many places. The above are but two examples, concerning which we have specific knowledge and input. It is our hope that we will have many years in which to express our gratitude for your pioneering work in the U.N.

Respectfully,

Alden Bryant

Alden Bryant, President

67-9

EARTH REGENERATION SOCIETY, INC.
470 Vassar Avenue, Berkeley, California 94708
(415) 525-4877

Comments on adequacy of "climate" computer models (started in the 1970s)

Primary focus:

Temperature data — a great part from urban areas. According to Professor Kenneth E.F. Watt the early models are so composed of data including "urban heat island effect" that their main finding is essentially that cities are getting bigger (and the urban areas are therefore getting warmer).

Aspects not included significantly (or not at all) in "climate" models:

1. Total global forest, swamp and grass cover — effect on reducing CO/2: (a) effect from reducing forest areas, and (b) effect from remineralizing soil and bringing forests back to living, growing conditions (as in Austria, Germany Australia, and other places).

2. Global soil conditions — depletion of minerals and trace minerals (from leeching and erosion), which, at the end of the 10,000+ years of the present interglacial period, is the primary basis for forest death, burning and greater pest infestation.

3. Cloud cover — net increase of reflection of heat away from the earth.

4. Snow cover — greater depth of snow in many higher latitude areas and higher elevations; sporadic greater total coverage during the winter, particularly in North America, Europe and Asia; and lasting longer into the spring (limiting crop growth).

5. Ice increase — harbors in the Antarctic now iced in; ice masses in the Antarctic that no longer break up and drift out as sea ice; sea ice areas in the Antarctic that are now more solid ice and less open sea areas between ice bodies; less access time in the summer for shipping to take supplies up to the north coast of Alaska; glaciers advancing (of the approximately 1% of the world's glaciers that are monitored: "Between 1960 and 1980, on the basis of data for about 400 to 450 glaciers observed each year, advancing glaciers are shown to have increased from about 6% of observed glaciers to 55%." Fred Bruce Wood, "Global Alpine Glacier Trends, 1960s to 1980s," Arctic and Alpine Research, Vol. 20, No. 4, 1988, pp. 404-413).

6. Shorter growing seasons — with later storms and irregular warm and freezing spells in the spring, and earlier frosts and freezing, there are fewer days for crops to come to maturity; field and orchard produce is being destroyed at increasing rates over the last ten to fifteen years.

7. Heat and drought — wiping out more crops during the summers, from Africa, starting in the 1970s, to the U.S. for the last two and three years.

8. Cold conditions — already necessitating farmers in some areas to change the crops they are growing.

9. History of maximum heat in the summer, maximum cold in the winter , and major differences around the world — for example, during the 1980s, Japan and Scandinavian areas reported colder summer conditions while there were hotter summer periods in the U.S.

It is the increasing extremes of hot and cold (all time record hot and cold periods) that destroy food and property, and are also taking human life in many ways. "Annual average" temperature figures (including urban heat island effects) bury and obscure the extremes, thus diverting attention from the rapid climate changes we are now living through.

Such presentations (of annual average temperatures) have contributed to a loss of 15 years which could have been spent in massive climate stabilization work — soil, forest and energy programs for CO/2 reduction.

10. Transition into glacial conditions — loss of food crops is part of the transition. If, as

appears to be the situation, the U.S. is out of surplus food, from the five major crops, in two or three years from now, due to heat, drought, and freezing, what is the prognosis for the next ten years? It is imperative that the public as a whole be made aware of the extent to which we have entered the transition into the next glacial period.

Limts to CO/2 increase:

Some people using inadequate climate models write about CO/2 increasing to 600 ppm; the following factors, however, provide limits to the increase of CO/2 in the world's atmosphere.

Limit 1. Fossil fuel. The rate at which growing climate intensities will be destroying or obstructing fossil fuel burning activities. Greater snow storms, flooding and wind storms mean less traffic movement of all kinds and more utilities knocked out, even more temporary closing of factories and offices. These conditions limit the increase of atmospheric CO/2. Combine this with human organization for transition into alternative energy technology development to reduce the use of fossil fuel.

Limit 2. Forests. The moves to stop destroying forests, and the moves into reforestation, will limit the future increase of CO/2. Far greater Federal funding, and assignment of military units, has become necessary to fight the increasing forest fires. Remineralization of forest soils will increase forest net growth rates and also help to remove CO/2.

Estimate: CO/2 may not rise more than 40 or 50 more parts per million. The increase over the next ten years depends on human earth regeneration programs.

Talk about doubling CO/2 to 600 ppm, and average annual temperatures rising 10 degrees F., is at best useless arithmatic speculation, and at worst purposeful misleading information which could seriously weaken mobilization to avoid full glaciation conditions. We may be facing elimination of most of the world's food supplies, and most of the human species with it.

The nature of climate change which needs further clarification in the media:

The basic process we see around us is the transition from interglacial to glacial conditions. This relates to soil deterioration, forest death, CO/2 increase, cloud and snow increase, and destruction of food supplies.

Human activities reducing forests and burning fossil fuels speed up the process -- whereas the basic process is the climate cycle going into glaciation (unless we stop it).

We have lived for over 10,000 years with CO/2 at or less than about 270 ppm. The job is to get it back to that level. Humans must do the soil, forest and CO/2 reduction work, on an emergency international basis starting now (as compared to the 70,000 to 120,000 years of a next glacial period with very little human life remaining).

Note that "greenhouse effect" is not automatically a problem. It is part of the natural balance between the earth and atmosphere. Humans breathe in oxygen and breathe out CO/2. Plants take CO/2 in and give off oxygen (the trunks and branches of trees are approximately 45% carbon). Evaporation in the warmer latitudes means rain and snow in the colder latitudes — this is part of winter snow build up. Then the snow melts back in the spring and summer.

During the interglacial period the CO/2 level has been at or below 270 ppm. It is the increased greenhouse effect (CO/2 now at 350 ppm) that is a problem as it is driving us into glacial conditions. The additional warming coming from the lower latitudes means additonal snow and freezing in the higher latitudes — it is not melting back each summer. The snow is building up, is deeper, lasts longer into the spring, and is sending us increasing freezing weather in the winter, and even some in the summer.

This is the first time that literate human society (a period of around 6000 years) faces the problem of an end of an interglacial period and the transition into the next glacial period. Stabilizing climate, cleaning up toxic wastes, eliminating acid rain, protecting human life and health, are emergencies that are now enjoined in one great challenge.

[68-20 2-15-89]

EARTH REGENERATION SOCIETY, INC.
470 Vassar Avenue, Berkeley, California 94708
(415) 525-4877

Interview with Dr. Irving Kaplan
By Barbara Logan and Alden Bryant
January 18, 1984, at the home of Dr. Kaplan in San Diego.
(Condensed and edited transcript)

MR. BRYANT: This afternoon we're going to have a discussion around carbon dioxide and climate problems.

On my right is Dr. Irving Kaplan. On the far side of the table is Barbara Logan, member of the Earth Regeneration Society. My name is Alden Bryant. I'm the President of the Earth Regeneration Society (ERS).

We'll start by giving you a little of our background. ERS is the sponsor for this discussion. We are a private non-profit corporation founded in April of 1983. Our concerns are with educational and science programs to bring forward a very broad aproach to the problem of carbon dioxide buildup. The broad approach deals all the way from (a) soil conditions and forests, (b) the science, technology and politics of CO/2, (c) the climatic changes, (d) food losses, and clear on into (e) glaciation. We are concerned with the emergency nature of this. We're concerned that people look at this from the point of view of a very intensive soil/forest/alternative energy program to bring down the carbon dioxide level. In the course of our efforts, we have turned to people such as Dr. Irving Kaplan to help fill in some of the very important aspects of this problem.

First let us introduce Barbara Logan, who is an architect, and has for many years shown a deep concern for environmental and nutrition problems. She is going to give you more of an introduction now for Dr. Irving Kaplan.

MS. LOGAN: Dr. Kaplan is a psychologist. In 1960 he was a civilian researcher for the Navy where he melded the human portion into weapon systems and the naval organization, and organized the first governmental group to do futurism. He is the man who coined the phrase "human ecology." He has published many predictions. He predicted micro-electronics, the cheapness and reliability of electronic circuitry, and the consequent changes which are occurring in industry. He published predictions concerning the computer age and its implications for work, the military, and economics.

During this time, in the 1960's, he became aware that things were not working out economically very well anymore. Being one of the first futurists, he turned from prediction into planning for the future. At this time he left the Navy, which was not particularly interested in the economics and the social ramifications of the future.

In 1972 Dr. Kaplan's work drew him to the climate problem and its implications for society. People like David Brower, and other environmentalists, said that advanced technology, capital intensive solutions to these problems, would stress the planet beyond its ability to bear and would alter the climate.

Dr. Kaplan began asking himself the question, "How can we solve the social and climate problems?" Perhaps, Dr. Kaplan, you would begin by telling us a little of the history of the perception of the carbon dioxide problem and the associated climate changes.

DR. KAPLAN: I'd like to. In 1955, Cesare Emiliani, who was a geologist, brought forward what we would consider the modern contribution to deep climate research. And Emiliani predicted the onset of ice ages. He discussed ice ages of the past, and from them, was able to predict what was happening now. And so, beginning in '55, we find the start of serious modern climatology, with a number of researchers all of a sudden entering the area and becoming very interested in what was happening to climate. All of them--just about all of them--stressing the cooling aspects going down into the next ice age.

In 1957 the counter-theory was brought to the fore, and this was the "carbon dioxide warming theory", born from Dr. Roger R. Revelle and Dr. H. Suess, both of the Scripps Institution of Oceanography. And in 1957 began the controversy between two major theories of climate--one cooling, one warming.

The contention grew. The lay population, I noticed, began to take sides. Certain of them enjoyed warming theories, certain of them enjoyed cooling theory, but in essence, the interested population was being split up into two active viewpoints, very strongly opposed to each other.

MS. LOGAN: Yes. I believe that's what we were discussing earlier, your perception of the development of the problem. You were telling me also that you spoke before the Law of the Sea. Perhaps you'd like to tell us about that.

DR. KAPLAN: Well, in 1970 we began working on the economic use of the oceans. And directly out of this grew a design for the production of goods -- and the design grows from the chemistry of the ocean itself, and from automation and from new technology. And the design became a challenge to some of our environmentally involved people, who said that, "No, we could not, under any circumstances, have any type of large world industrialization, because it would warm the climate, this as the physical by-product of expanded industry.

And so we had to go into a study of climate at this point. And we found essentially that it was cooling. We found that despite the fact that we were doubling our carbon dioxide production every 10 or 12 years from industry, despite that fact, it was cooling. The more carbon dioxide we produced, the colder it got. And this became obvious, at least to me, in the early 70's. And so, you had to begin to wonder why.

Nevertheless, my mind was still associated with warming theory, and saying that if we are going into an ice age, perhaps the answer is world industrialization, which would stave off the ice age.

So it occurred to me that if we were to fall into a climatic abyss, if we were to become very cold, perhaps the answer could be in what I call "the human ferment", and that humanity, by industrializing, could perhaps be the answer to the cooling climate. Here I ran into lots of static, and it seemed that this came mainly from the warming theory people. So at any rate, in the early 70's, I was left with an involvement with climate, and I found myself saying that my idea wasn't working--the human ferment was not working--the more carbon dioxide we produced, the more industry we went into, the colder it got. And I had to begin to wonder why.

So in 1976, I was speaking to George Kukla, a climatologist of the first order, and George was wondering about the same thing -- why, if we produce more carbon dioxide, is it getting colder -- the opposite of what is predicted by warming theory!

In 1979, Dr. Kukla published a paper by which he said that carbon dioxide is a two-way problem--not only does it work from the ground up (not only does it capture infrared, which rises from the surface of the earth), but it also does something to the solar

energy coming down from the sun; and that it filters out the near infrareds coming from the sun, therefore filtering out energy. But more important, that carbon dioxide was filtering out those specific bands of energy which melted snow and ice.

That being the case, the more snow and ice you have, the more it is preserved by the carbon dioxide, the longer is the snow and ice season. The cold is manufactured over a longer period, and the earth becomes colder where there is snow and ice. In the Southern Hemisphere there is less snow and ice, and it was found that this mechanism was not working as strongly in the Southern Hemisphere; but certainly, it was working very strongly in the Northern Hemisphere, and temperatures were dropping in the period between 1938 and the present--we've lost two degrees Celsius, at least, due to carbon dioxide.

Now, this is one theory. More recently we have another, which is John Hamaker's theory. John is an environmentalist, an engineer, a synthesis-tic mind, a man who is beyond analysis -- who is quite creative, who has sprung a theory of genius which simply states that carbon dioxide, in warming up the tropical zone, produces a world system by which water vapor is brought to the northern and southern zones, and deposited as snow and ice; and therefore that carbon dioxode directly speaking again, is a cooling agent rather than a warming agent.

Now, the Hamaker Theory is a long one and a complex one, and I'm not going to get into it.

MR. BRYANT: Could I say a little on behalf of why we've all come together this way, through the Earth Regeneration Society. We want to bring out publically as fully as possible the relation between the mineral quality of the soil and forests. When the soil is deteriorating, the forests deteriorate--and it is the forests that we need to bring down the carbon dioxide count in the atmosphere. We find that so many people who are in climate work never dealt with problems of forest and soil condition; and that maybe the 50 major computer models of the atmosphere in no way deal with the forest quality and soil quality. So this seems an appropriate time to mention that that's where our effort is coming into the picture.

DR. KAPLAN: My efforts have been rather narrow following along climate, and I find Mr. Hamaker, very refreshing with his broad viewpoint -- chemical/biological/geological viewpoint -- all of which dovetails, all of which comes together. I'm not going to attempt that. I'm better off letting Mr. Hamaker tell you that.

MR. BRYANT: But you saw the meetings that actually took place in the early 70's around the climate problems.

DR. KAPLAN: Oh yes.

MR. BRYANT: You saw the emergency nature, the breadth of the analysis, and then how that went through phases, and went through changes. That is what we're looking forward to discussing.

DR. KAPLAN: I can provide us with what I was exposed to in 1970 or 1972. They began in a meeting at Malta during which I presented the design for the Law of the Sea, the industrial design, and during which, it was brought out that the world was cooling; that perhaps such a design could aid in a warming. Later on I found that this does not work. We found that the more we seemed to work at producing goods via the burning of fossil fuels, the colder it gets. And now we have the reasons. We have the Hamaker reasons and we have the reasons that were put out by the climatologist George Kukla.

So we have good reasons, very good reasons, by which we understand why carbon dioxide is causing cooling rather than warming.

MS. LOGAN: Dr. Kaplan, excuse me. We hear so much recently about the global warming theory, but very little about the global cooling theory. Could you tell us why you think that is.

DR. KAPLAN: Well, I'm going to enjoy this, I hope. Beginning in 1972, it appeared that there was a strong bias on the part of some people toward warming theory. Cooling people were still doing research, they were publishing, they were being rather prolific, turning out awfully good work. Nevertheless, the stuff that hit the media was ten to one at least, warming theory.

As much good cooling theory, as much good science as came out, we kept hearing over and over and over again that it was going to warm. And this, despite the fact that we now know it's not warming -- we are losing warmth, the drought is increasing, hundreds or thousands of millions of people are now threatened by drought or dying of drought, and drought is due to cooling, it's not due to warming.

And so we had to wonder, in the early 70's, why such an emphasis on warming theory when the cooling theory was already proving itself out; when in the mid-50's people were dying of drought; in the late 60's people were dying of drought; in the mid-70's they were dying of drought. In 1976,'77,'78, etc., the drought increased remarkably -- and drought can only happen when the world is cooling. It's a rather simple mechanism, which is that as the top of the world cools, as the polar regions cool, the cold heavy air slides off the continent onto the oceans; the oceans become cooler.

If, whereas, the world cools, we have a cooling ocean surface. And the ocean surface is distributed by the major ocean currents. And using these, we can actually predict drought and when and how it happens.

So I have been able to predict drought for perhaps the last eight or ten years now. And finding that as we have a cold ocean in certain parts of the Pacific, we will have drought in the North American continent, in Africa, in Mexico and the Caribbean, even in India, other parts of Asia, the major islands of the Pacific, and certainly in Europe. We are able to predict where, pretty much, and how this drought will happen.

Simply put, as the water becomes cooler it evaporates at a slower rate; we get fewer clouds; we get less rain; there is less shading from the clouds. There is therefore more sun hitting the land; the water moisture evaporates from the soil; you get less of that refrigeration effect from the land surface of the planet; and you get not only drought, but you get extreme summer heat. And, for instance, in 1980, we find the loss of 2,000 people through the middle of our country, all of them to heat prostration.

In 1976 I found a correlation between earthquakes and cold. The colder it got, the more earthquakes we had. It turned out simply that the colder the northern part of the planet became (North America for instance), the larger was the snow and ice region and it pressed down on the tectonic surface. And in pressing onto the planet, produced a pressure which was distributed through the planet, the planet acting like a balloon and bulging outwards. And when it bulged outward the pre-stressed earthquake faults may be triggered into slipping, and we get earthquakes.

At the time, I was not discussing, was not talking about, volcanism. But it turns out that the same goes for volcanoes. The colder it gets, the more volcanoes act up. Dr. Reid Bryson has been very concerned with the effects of volcanoes on climate. Dr. Bryson's concern is that these volcanoes will produce sufficient dust and aerosols so that they will sufficiently obscure the sun. When this happens we may drop precipitously into the cold regime, into the ice age. During this last decade there has been a sufficient increase in volcanic actrivity so that the correlation between snow cover and volcanism has become visible.

So, we're able to show that, accompanying the cooling we get both volcanoes and earthquakes. What's interesting here is what has occurred to me in the last year -- that volcanoes and earthquakes don't all happen on the surface of the continent where we can see them. Some happen under water. For instance, one place where we found volcanism is just offshore of Northern California and Oregon, where scientists discovered a number of fissures in the bottom of the ocean. Seemingly over this last year, these fissures have heated up and the California current, passing over them, became warm. And we've been calling that the El Nino effect. Actually, it's just a heating from the bottom of the ocean, the release of geological heat through the water.

We can expect similar events all over the world. We can expect other so called El Nino events, perhaps this coming year also. Such an event produces clouds, it produces rain, produces floods; and over the last year, over the beginning, over the first half of this last summer, the "El Nino" produced in the way which we've just guessed at, saved us from half a year of drought.

The so called El Nino ended in July. Immediately, we fell into drought. It was the most severe drought we've experienced in this century. It lasted perhaps three months in many places and through the winter in other places. During this period, some tens of millions of people died in Africa, in India, Mexico, the Caribbean, and other places. And at that point, as I was so deeply involved, I began to feel what I suspected were muscle spasms in my back. These related to my stress, and all of this due to what I could see as the buildup of drought, and the acceleration of the drought curve to where we would perhaps not be able to do anything about it to the best of our science, the best of our technology. Perhaps we were on the losing end, and skidding down into the next ice age.

At this point I found myself having lost a lot of biological resistance. X-rays were taken, and it turned out that "you have cancer!"

Well, this is just a small part of the problem. The problem is growing. We have a very severe winter. The cold is pouring off onto the ocean, and the ocean is already dedicated to drought. There seems no way we can avoid a next spring, a next summer, a next fall of crop losses with the involvement of every major continent, and many millions of people, perhaps billions, in famine. Personal problems take on a new perspective now and they can't be enjoyed as they once were.

MS. LOGAN: Excuse me, Doctor Kaplan. What you say sounds so very reasonable. Yet a very prominent scientist, Dr. Roger Revelle, still supports the global warming theory and does not anticipate severe climate disturbances in the future. And nor do a number of other scientists who are also prominent in these fields. Can you explain that for us?

DR. KAPLAN: Well, I suppose I should not to try to explain it all myself. I should throw some of this back onto the rest of the climatological community. The majority of this community still says it's cooling. The rest of the community is a cooling theory community. And it talks ice ages; and it talks drought; and it talks very

strongly. It is obvious to the climatological community by now that warming theory and the great public relations effort accompanying it are rooted in something other than science.

In 1974 the CIA published two well-written reports, one on climate, which described the cooling psition held by the climatological community. It discussed most of what science had said to that point, came to the conclusion that we were cooling very quickly; and that the United States was facing a world of chaos. A second report was written on food, and the CIA said that we're facing an immense shortfall of food, starting in the Third World, but perhaps to be found on our continent also, in the United States.

Now, the CIA did come up with some statement as to what this would do for us politically. Politically, if we are a food provider, if other countries are short in food, why, our star rises and we become more important. This is pretty much what the CIA said. But on the other hand, it said also that we could also face a food shortfall. 1976 has demonstrated that we could. We lost some 20% of our wheat; some 50% of our corn; just about all of our soybeans.

In 1977 we began again into drought, but this time the country put 60 million extra acres of land into production. We came out with a very large crop of wheat and corn. But the per acre yield was some of the smallest in the history of agriculture. So, what we are facing this year is a shortfall of food, as predicted by the CIA, as predicted by just about every cooling climatologist; but not discussed by the warming theory.

The warming theory says we are not going to discuss what happens in the next few years, we're going to begin our discussion with what happens, say, in the first quarter of the next century, say in the year 2025. And thereby the warming theory has avoided a discussion of the present, what is actually happening now. It nevertheless comes across in such a way that many people are given to believe we're warming now; many people are given to believe that there is no food problem. Others come away believing tht the drought is caused by warming, an impossibility. And despite the facts of drougnt, despite the facts of extreme winters, somehow or another, thin theory has its effect and is able, so often, to override actual events. This is surprising, perhaps, but we find that with our species we are able to do that.

MS. LOGAN: Doctor, you think then, that in the case of Dr. Revelle and others, that this is just an honest difference of opinion?

DR. KAPLAN: All this is maybe getting out on a limb. And perhaps it's time we got out on a limb. I may be wrong, but we do not have the science to support the warming theory. That science is now gone. We have very strong evidence that says carbon dioxide causes cooling--it is cooling. The evidence is too strong to overlook. If that evidence is as strong as it appears -- certainly it is, and the majority of climatologists agree with it -- why is it that we keep getting a replay of warming theory every few months, every few weeks, in the media? Is it possible that it's being done for the purpose of national morale? Are they trying to keep a dying population from dying a little earlier by rioting, by stealing food or by causing social chaos? Are we to die by the numbers and pleasantly? Or can we have a little riot about dying? Can we discuss it a little? Can we make it part of the social world and bring it into consciousness, bring it into the world consciousness? Seemingly not. For some reason we go on and on with warming theory. And one has to wonder, with a demonstration of death which we've just gone through this last summer, with the one which we are already dedicated to next summer, and which we will not escape.

Consider the conditions of economics which say we have an overpopulation; we have automation; we have a situation which is no longer economically feasible; a situation in which economics can no longer exist. And perhaps in order to maintain an economic world, we have to depopulate it. Perhaps to maintain the privileged positions of certain people in this world we have to depopulate a great deal of the world. This may be a thin hypothesis but others are simply too psychotic.

MS. LOGAN: So then these scientists are working, really, on behalf of the wealthy movers of society.

MR. BRYANT: Did you see changes around 1976, a year or two after the CIA reports, in certain meetings, that help illustrate these thougnts?

DR. KAPLAN: I'm glad you're refreshing me here. Yes. In 1976 I was privileged to be at a meeting in North Africa. My friend Roger Revelle was there also. In fact, I had given a presentation on climate to the Pacem in Maribus group and the Club of Rome. Roger and some other people got themselves ready to leave and left, went to a very important meeting in Washington, D.C., of the National Acadamy of Sciences and of the deeper government than that, I should say -- the security aspect of government also. In this meeting it appears that the warming theory became the "non-official" policy of the government -- and of the very wealthy few who pull the wires of government.

I was again privileged to be at a meeting in Washington in May of '77, just a few months later, of the American Geophysical Union. The Union was addressed -- the scientists were addressed -- by two people, one a scientist, the other a member of the President's economic advisors. And they made it rather clear that should one wish to study climate in the United States, the preferred position was warming theory. Scientific effort given to cooling might not get very far because the "unofficial" position of the United States was warming theory. It was made very clear. And despite the fact that the majority of the world's climatologists were not warming theorists. We found after this meeting, very little expression -- very little public expression of what was happening, in reality, to the climate. Very little about the findings were published, were brought out to the media, and in fact, certain findings were published in the scientific press but in such way that they were not easily understood by lay people, and had to be more than closely read if you were to understand that they were saying that it's getting colder.

MS. LOGAN: Many of these scientists in prominent organizations, such as the Club of Rome and the Tri-Lateral Commission, are dedicated to the advancement, I believe, to the disinterested advancement, of science. Yet, you are saying that they are taking a particular view for political reasons. Why would they compromise themselves, their integrity as scientists, in this way?

DR. KAPLAN: Well, we are all economically controlled. We all have jobs, we all have positions. I find that some scientists, Dr. Schneider, for instance, who, with his wife, had written a book which says that drought is coming on quickly, found himself very actively contributing to warming theory. He was part and parcel of meetings held by the AAAS (American Association for the Advancement of Science), the Aspen Institute for Humanistic Studies, and other such meetings, to which lay people were invited from all over the world. People from every country were invited. This was a big public relations effort and it went on for years.

MR. BRYANT: Who paid for all that?

DR. KAPLAN: The warming theorists took their show to the Congress for CO/2 research and education money. Some went to the national Academy of Sciences study group on climate and energy. Most of the money was probably administered through the National

ience Foundation. It was all tax money.

. BRYANT: It looks like we've had approximately seven years of holding back serious rk around the cooling part of the cycle.

. KAPLAN: We've had seven years in which true discussion of a science has been oked off. The First Amendment has been trampled through intrigue and the raw use of wer. Even the data on tornadoes and hurricanes was deleted from the World Almanac ter 1980, because it had shown the relationship between these phenomena and cooling. evertheless we find that there are still a few heroes around. There are some people England, in France, and Germany, who resoundingly back the cooling theory. We just on't hear about them here. We find that people working for the government in the nited States, for NOAA (National Oceanic and Atmospheric Administration), for nstance, or for any of the NOAA laboratories become warming theorists if they're alled upon to contribute to a warming theory meeting, to a meeting oriented toward ay people rather than scientists -- and there has been a large number of these eetings to which important people are invited, and in which they participate. And I eet people in India, in Mexico -- all over the world -- who have been to these eetings, who carry warming theory with them into their countries. They are lay eople; they are not scientists, but they are important in their countries.

MR. BRYANT: Even some members of the U.S. Congress have been on television in the last few months, and they are particularly into this mold that you're describing.

There is a growing understanding that we have very few years left to reach some level of survival. And as you and I have discussed at times in the past, it is the role of the artists and the people in psychology, in the social end, in looking for a total, total coming together of human life. We have never had such a challenge to our economic system, and have never been in this position before.

Here is what is so hard for the Earth Regeneration Society effort. The U.S. has never been in the position where the major thrust is that we must share food with the Third World countries so that they can survive, and re-grow their forests so the world's balances remain supportive of human life. Help them or we are gone!. We've never faced such a thing before. It's unknown to us: a symbol of sharing in the world that we have never had to face. And now we face it, or the crisis will mount geometrically every year. We're at a temporary loss. We've no standards, and we have to learn how to deal with something this immense.

DR. KAPLAN: Yes. We find quite possibly that warming theory is motivated by our insanity, by our economic motive. We find that the resistance to the ERS program is an economic one. Now, should we be able to see ourselves clear and beyond economics, why, perhaps we will be able to find an answer. Rational thinking will settle on our species only after the "economic problem," this powerful fear is solved.

Certainly, we have on our technological shelf the capacity, at the very moment, to lift ourselves out of the economic world--we have every chemical required in sea water, including fresh water which we need desperately now. We have just broken through in very cheap solar energy; we can use that. We have cheap automation. We are capable of producing our requirements and comforts at very low cost and at an environmental gain.

MR. BRYANT: We have received considerable inspiration from your discussions of the past, about the nature of those meetings in 1976 and 1977 that stopped a lot of the necessary discussion of planning and program to reduce astmospheric CO/2. Now we are getting some new signs on the horizon, such as actions by Southern Cal Edison.

Take this point about Southern Cal Edison. We want to bring out how they're one of the first utilities to consider using wood on a large-scale to fuel power plants. There are plans now by other companies to develop large pine reserves/tree plantations, part of them in California, Hawaiian islands, Arizona, New Mexico and elsewhere, to use as fuel for power plants. This is just an opener.

Another kind of opener is the decision by the California Democratic Party -- their Platform Committee has officially put in a section on carbon dioxide, the control problems, the climate problems, and a review of the full cycle of the heating and of the cooling and the glaciation aspects. This is the first time that a political party has put this in as part of a proposed plank. (Subsequently a section was approved by the full Convention in the final platform.)

Now, these are signs of the times. And also to us, this means, in effect, ringing the bell on the oil industry — that it is incumbent on them to look to a major transformation, out of coal and oil and gas, into alternatives, primarily tree plantation work, and the whole range of alternative energy sources. So we see these things as on the horizon for really major treatment, now. And that's why we're throwing our efforts into this educational work.

DR. KAPLAN: Well, this is a hot concern for life, and I would like to think of what you just said in terms of concern for survival, and primarily that; and there is no shortage of technology here. If we're going to save lives, the technology which you've just mentioned is the ultimate environmental technology required. There are some fast technologies involved also. We can save millions of lives, almost immediately through the use of microbial foods, and halophytes which are very easily produced, and which, by the way, will also decrease atmospheric carbon dioxide, just as you would like (taking it out of the atmosphere, converting it to food; and, at that, the most nutritious food). I know that people can eat and make very cheap mass produced food. It can be done all over the world. A billion or so lives are threatened this summer, and a substantial portion of these lives may be saved by this type of technology. (Food base produced via a symbiosis of algae and yeast.)

The second technology is: how do we quite simply and very quickly stop the degradation of temperature? How do we just keep it from falling as fast as it is falling? There is a rather simple space technology here which was discussed at a space meeting (the UNISPACE meeting in 1982) and came out looking rather favorable. It's simply a method of reflecting more solar energy down onto the earth by orbiting in certain positions, certain amounts of very thin film plastic mirrors up in near space (1600 miles). This system can provide early temporary assistance toward saving our environment and allow the environmental work to get started, the work which you are discussing.

MR. BRYANT: All right. The sense of urgency is a major point here. A number of large groups in the U.S. have already called for emergency joint sessions in Congress around a counter program to bring down the CO/2 level. Now, I'd like to ask you, Dr. Kaplan, your thoughts about this question of emergency hearings in Congress and the physical action to start reducing the output of CO/2.

DR. KAPLAN: Yes. It has been the fashion in some of climatology to call what is happening "variability". We called it "climatic variability". We're saying the climate is becoming more variable, and that we're going back to a regime of the last 6,000 years, which has been a cooling regime. But nevertheless, they called it not "cooling", but "variability". I believe that's hiding behind something. We have an accelerated cooling occurring right now. It has brought around an accelerated

drought--we find tens of millions of people losing their lives in just two months in 1983. We find no way out, in fact this is going to be worse in 1984.

Now, this is more than just variability. This is of extreme concern. This is of the greatest global concern humans have ever known. And I would like to stress everything be opened up in Congress, all of the stops must be pulled, both in the Congress and in every political organization throughout the world -- whether it's a world organization, another country, or the United States Congress -- which should be at the center of the problem right now.

MS. LOGAN: We appreciate your explanation of the other point of view, and a reminder to us that it exists. I imagine you have been very seriously concerned about these problems over the years and have been thinking rather deeply about how we can enhance human life instead of destroy it, and save the planet instead of destroy it. Is that so?

DR. KAPLAN: Very much so. I'm hoping that the ERS will become a forefront organization here. I'm hoping it will find a way to prevail. Not to perish, but to prevail.

I'm hoping ERS will be able to use the realities which have been happening, the experiences which we're undergoing right now — this cold winter; next year's drought; last year's drought; the increasing drought curve which has demonstrated itself so clearly; and of course, the two or more degrees of Celsius which we lost since 1938.

I'm hoping that the ERS and perhaps other organizations like it can bring some reality and sanity back into the social disussion.

MR. BRYANT: We want to thank you, Dr. Kaplan, for what you have contributed today, out of your own experience, and Ms. Barbara Logan. We consider this interview to be a new effort in public discussion, around some of the key events within recent history, where these problems (a) were at first falling into focus, (b) then greatly distorted, and (c) are now coming back into full focus.

We have correspondence from top scientists who were pressured heavily in the late '70s and the '80s to stop their work on the cooling part of the cycle.

If we carry through a U.S. and global expansion program in soil remineralization, reforestation and alternative energy source development during the next four years, followed by five or six years maximum effort in the face of accelerating weather change conditions, it will become clear whether or not we will be able to stabilize the climate. We're going to make our best effort, and that's the reason for this discussion.

[11-2 to 4, 5-24-84]