International Society for General Systems Research, Meeting, June 1-5, 1987, Budapest, Hungary, Symposium: Climatic Change and Evolution of the Biosphere

---

A LOGICAL DIVISION OF THE DEVELOPMENT OF COEVOLUTION WITH THE BIOSPHERE INTO PHILOSOPHICAL, SCIENTIFIC, ENGINEERING, EDUCATIONAL, DECISION AND ACTION COMPONENTS

Fred Bernard Wood, Ph.D.,
Computer Social Impact Research Institute, Inc,
2346 Lansford Ave., San Jose, CA 95125

Keywords:

action	biosphere
carbon dioxide	coevolution
climate	crisis
decision	education
engineering	glaciation
philosophy	science
soil	world problems

Abstract

There is a danger that during the next ten years, while the earth scientists are developing a better understanding of the biosphere, irreversible climatic change may take place. For example, processes of climate change such as the greenhouse warming or glaciation may reach some key threshold after which effective human intervention would be difficult or impossible. The impact of such irreversible climatic change could be a major disruption of the world's climate with altered patterns of precipitation and drought, leading in turn to shortened crop growing seasons in many parts of the world. This could then lead to widespread starvation and pressures for mass migration to the remaining areas of the world where climate remained adequate for food production.

The pressures for mass migration could severely aggravate relations among nations and diminish prospects for stability and world peace. Thus, the climate problem is not just a science problem, it involves the following segments: Scientific Research, Engineering Synthesis, Philosophical Oversight, Educational Development, Decision Facilitators, and Emergency Action.

GRADE OF PROBLEM VS. TIME TO GO CRITICAL

Platt's 1969 table of world problems (10) is updated and reviewed in Table I to find the status of the most important world problems. Second after the dangers of Nuclear War and the Nuclear Winter problems, we have a cluster of climate related problems including greenhouse gases, glaciation, drought, crop failures and world hunger. These related problems are enclosed by a heavy line in Table I. The projections of different scientists and science committees show a considerable divergence. The earlier reports of paleoclimatologists discussed the question of when will the transition to the next glacial period come. (5, 6, 14) The engineering analysis by Hamaker developed a qualitative theory of the glacial cycle. (2, 3, 4) Then the U.S. NRC and the U.S. EPA came out with reports emphasizing warming and possible melting of polar ice. (1, 9)

There is a question as to whether the 100,000-year glaciation cycle will predominate, or whether the rising atmospheric carbon dioxide will override the glacial processes and move our planet to a new equilibrium point of warmer climate. The resolution of this CO/2-climate problem is essential, if we are to make progress in establishing the coevolution with the biosphere proposed by Moiseev in 1984. (8)

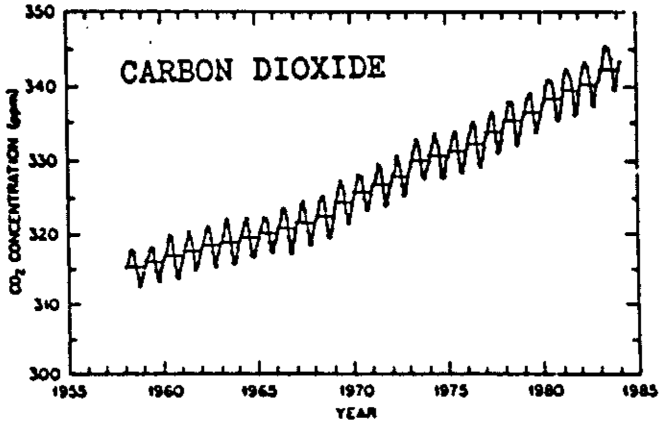
RISING CARBON DIOXIDE AND 100,000-YEAR GLACIAL CYCLE

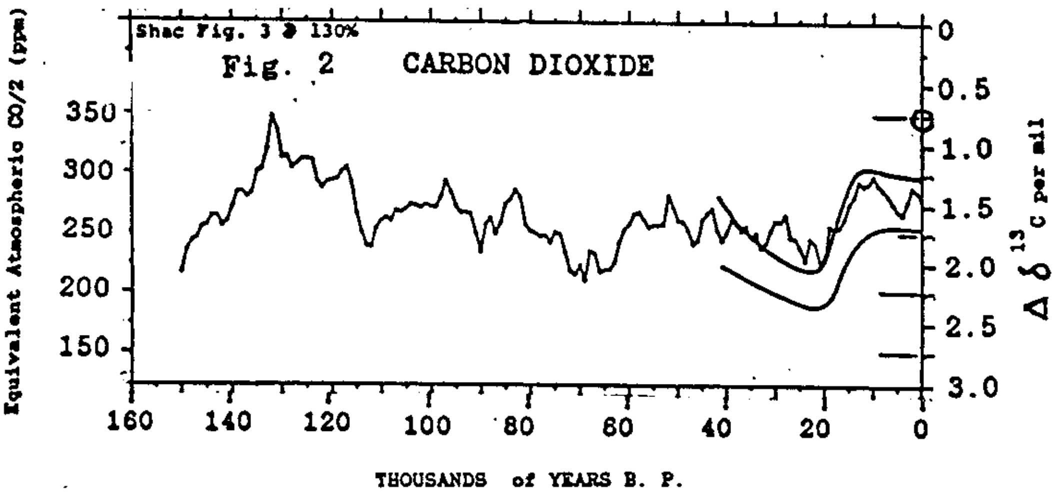
The recent rapid rise of the amount of carbon dioxide in the atmosphere is shown in Fig. 1. The CO/2 level has risen from 315 parts per million in 1958 to 345 ppm in 1985. (Ref. 12, p.5) Prior to 1900 the CO/2 level fluctuated around 290 ppm. The CO/2 level for the last 150,000 years is plotted in Fig. 2. (Ref. 11 & 12, p. 32) Points in Fig. 2 are based on isotope measurements in surface and sea-floor formanifera in slices of ocean bottom cores, where each slice represents about 500 years. Each point plotted is an average of two slices, giving a point every one thousand years. The current spike of CO/2 of +30 ppm in 27 years would hardly be visible when averaged over 1000 years for comparison with the data in Fig. 2. Making thinner slices of the ocean cores may not yield any more precision, because of the stirring of the ocean bottom sediments before they are compacted. We don't know if there were other fast rises of CO/2 at critical times in the past, such as the transition from interglacial to glacial at 120,000 years ago.

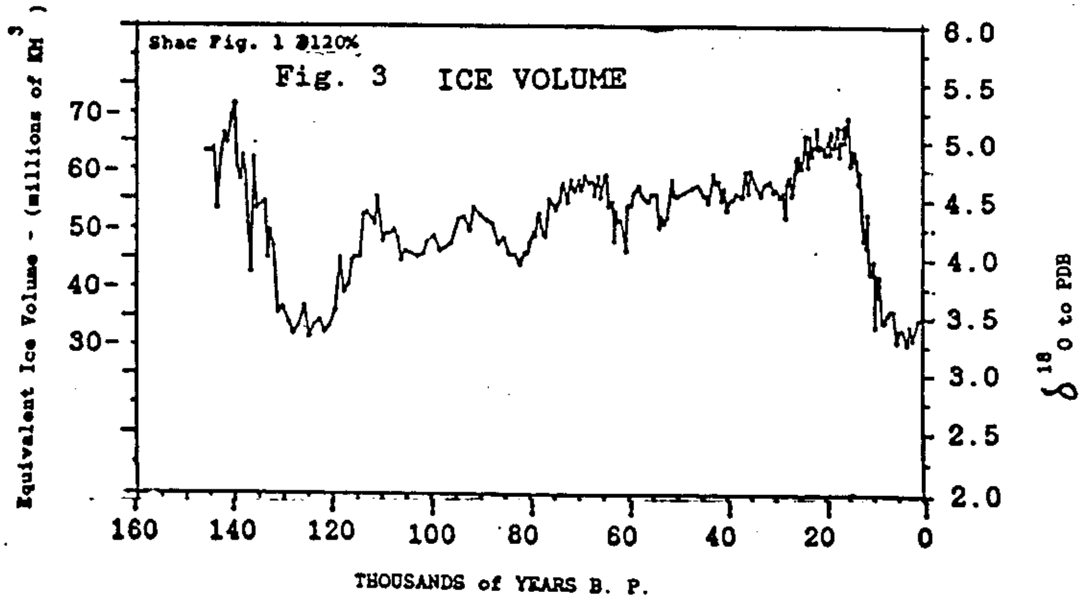
TABLE I : MAJOR WORLD PROBLEMS.
Classification of problems and crises by estimated time and intensity.

Grade	Estimated crisis intensity: Numerical (number affected times degree of effect)	Descriptive (word description)	Estimated time to crisis: -5 to 0 years...	1 to 5 years....	Estimated time to crisis: 5 to 20 years...	20 to 50 years.	50 to 2000 years	Grade
1.	10^{10}	Total annihilation		Nuclear or RCBW escalation	NUCLEAR OR RCBW ESCALATION	*(solved or dead)		1.
2.	10^{9}	Great destruction or change (physical, biological, or political)	ENG('85) Hamaker Drought, famine & death in Africa. We can still influence cycle with remineralization & reforestation.	NUCLEAR WINTER ENG('82) Hamaker Critical point of glaciation process 1984. ACID RAIN	NUCLEAR WINTER Famines Ecological balance Development failures Local wars CARBON DIOXIDE, GLACIATION, DEFORESTATION, FOOD SHORTAGE, HUNGER &DEATH ENG(84) Hamaker Temperate zone gone in 1990, few people alive in 1995. Rich-poor gap	Economic structure and political theory Population and ecological balance Patterns of living SCI('77):Kukla et al: New cooling data. SCI('79): Woillard Abrupt end of last interglacial (20 y). Universal education Communications-Integration Management of world Integrative philosophy	SCI('72) Kukla et al: End of interglacial a few 100 yr.	2.
3.	10^{8}	Widespread almost unbearable tension		Administrative management Need for participation Group & racial conflict Poverty-rising expectations Environmental degradation	Poverty Pollution Racial wars Political rigidity Strong dictatorships	COMPUTERIZED DESTRUCTION OF WESTERN CIVILIZATION		3.
4.	10^{7}	Large scale distress		Transportation Diseases Loss of old cultures WOMEN'S RIGHTS	Housing Education Independence of big powers Communications gap NEED FOR GENERAL SYSTEMS LEARNING AT ALL LEVELS	CARBON DIOXIDE, CLIMATE WARMING, SEA LEVEL RISE, (NRC'83) (EPA'83)		4.
5.	10^{6}	Tension producing responsive change		Regional organization Water supplies OCEAN FLOOR MINING UNDER UNITED NATIONS LAW OF THE SEA				5.
6.		Other problems--important, but adequately researched		Technical development design Intelligent monetary design				6.
7.		Exaggerated dangers and hopes				Eugenics		7.
8.		Noncrisis problems being "overstudied"		Man in space Most basic science				8.
			-5 to 0 years	1 to 5 years	5 to 20 years	20 to 50 years	50to 2000 years	

Fig. 1


CARBON DIOXIDE
CO2 CONCENTRATION (ppm)
YEAR
350
340
330
320
310
300
1955
1960
1965
1970
1975
1980
1985


Shac Fig. 3 @ 130%
Fig. 2 CARBON DIOXIDE
Equivalent Atmospheric CO/2 (ppm)
350
300
250
200
150
Δ δ 13 C per mil
0
0.5
1.0
1.5
2.0
2.5
3.0
160
140
120
100
80
60
40
20
0
THOUSANDS of YEARS B. P.


Shac Fig. 1 @120%
Fig. 3 ICE VOLUME
Equivalent Ice Volume - (millions of KM 3)
70
60
50
40
30
δ 18 O to PDB
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
160
140
120
100
80
60
40
20
0
THOUSANDS of YEARS B. P.

The ice volume derived from isotopic ocean bottom core measurements is plotted for the last 150,000 years in Fig. 3 (11). The plot has been rotated 180 degrees to obtain a graph with time going from left to right and for the ice volume increasing from bottom to top. Two sections of the ice volume curve are similar, the period from 135,000 to 120,000 years before present and the period 15,000 ybp to 0. Looking at these similar sections of the glacial ice volume curves, one would deduce that we are moving into the next glacial period. The resolution of the data is 1000 years giving a probable error range of +/- 500 years, so we can't say with precision where we are in the glacial cycle.

The time lines for research by U.S. Dept. of Energy and the International Geosphere-Biosphere Project have been discussed in a previous paper. (16)

DIVISION OF PROBLEM INTO PARALLEL SEGMENTS

To carry out a range of activities in regard to climate problems it is proposed that the following six steps be overlapped to gain time, so we won't be overtaken by the glacial cycle conditions unprepared: Scientific Research; Engineering Synthesis; Philosophical Oversight; Educational Development; Decision Facilitators; and Emergency Action. Each step is defined in Table II. An example of the use of decision theory under uncertainty has been proposed by Wood (15). A proposed emergency action program has been developed by Malveaux and Bryant (7).

CONCLUSIONS

Although reports of major science organizations and the U.S. EPA assume that the rising atmospheric carbon dioxide will make the earth warmer and lead to melting of polar ice, there is insufficient evidence to support the simple warming theory. The studies by Watt showing a cooling trend in U.S. rural temperatures indicate a serious look should made of the Hamaker Thesis on glaciation. Since the U.S. DOE and the IGBP program don't expect conclusive results until after the date of predicted severe crop losses by the Hamaker Thesis, we need to develop an action program in parallel with the scheduled scientific research to prevent a severe destabilization of civilization.

TABLE II: LIST OF KEY STEPS IN DEVELOPMENT OF COEVOLUTION WITH THE BIOSPHERE

SCIENTIFIC RESEARCH: Accelerated implementation of basic interdisciplinary research in the approximately 25 fields of science involved in understanding the climate and biosphere, and including better communication be established between the different fields of science.

ENGINEERING SYNTHESIS: Development of an adequate synthesis of concepts from over 25 fields of science and development of conceptual models and computer mathematical models of the climate and glaciation processes. The philosophy of general systems theory can help organize the material from the different fields of science provided there is cooperation between the specialists in the different fields and the generalists.

PHILOSOPHICAL OVERSIGHT: Application of the philosophy of science and systems to check the completeness and validity of methods used to verify the computer simulation models used in climate research.

EDUCATIONAL DEVELOPMENT: Education of the public and their governmental representatives with respect to climate changes and the biosphere including major components such as the tectonic system, the oceans, the land, soil minerals, forest nutrition functions, photosynthesis, the atmosphere, the carbon cycle in the biosphere and general tectonic-biospheric-atmospheric interconnections.

DECISION FACILITATORS: Development of people with skills in aiding decisionmaking under uncertainty where incomplete data is available. Development of techniques to estimate the risk of waiting for complete scientific proof.

EMERGENCY ACTION: Development and carrying out emergency programs such as remineralization and reforestation to stabilize climate.

REFERENCES

1. Environmental Protection Agency (1983) Can We Delay a Greenhouse Warming? September 1983, Strategic Studies Staff, Office of Policy and Resources Management, EPA, Washington, D.C.
2. Hamaker, John D. and Weaver, Don (1982) The Survival of Civilization , Burlingame, CA:

Hamaker-Weaver Publishers. 218 pp.
3. Hamaker, John D. (1984) Notes, Solar Age or Ice Age? Bulletin , No. 6/7, August 1984.
4. Hamaker, John D. (1985) Notes, Solar Age or Ice Age? Bulletin , No. 8, July 1985, Hamaker-Weaver Publishers, Box 1961, Burlingame, CA.
5. Kukla, G.J. and Matthews, R. K. (1972) When Will the Present Interglacial End? Science , Oct 23, 1972. 190:191
6. Kukla, G. J. and eight others. (1977) New Data on Climatic Trends, Nature, 270 , 573-580.
7. Malveaux, Julianne and Bryant, Alden (1986) A plan for social action in reduction of atmospheric carbon dioxide and climate stabilization . In: Proceedings of the International Conference on Mental Images, Values, & Reality. (John A. Dillon, Jr., ed.) Society for General Systems Research, Louisville, KY, V. II, pp. L-60 to L-75.
8. Moiseev, N. N. (1984) Coevolution: Some Propositions . USSR Acad. Sci. Preprint for International Seminar on Nuclear War, Erice, Sicily, Italy, 19-24 August 1984.
9. National Research Council (1983) Changing Climate , Report of the Carbon Dioxide Assessment Committee, Nat. Acad. Press, Washington, D.C.
10. Platt, John (1969) What We Must Do?, Science , 28 Nov 1969: 1115-1121.
11. Shackleton, N.J., Hall, M.A., Line, J. & Chuxi, C. (1983) Carbon isotope data on core V19-30 confirms reduced carbon dioxide concentration in ice ages. Nature, 306 , 319-322.
12. Trabalka, John R., Editor. (1985) Atmospheric Carbon Dioxide and the Global Carbon Cycle . Washington, D.C.: U.S. Department of Energy, Report DOE/ER-0239.
13. Watt, Kenneth E. F. (1985) The effect of local influences on perception of climate trends. Unpublished report, U.C. Davis.
14. Woillard, Genevieve (1979) Abrupt End of the last Interglacial s.s. in North-East France, Nature , Oct 18, 1979.
15. Wood, Fred Bernard (1986) Values in Decision Making on World Problems. In: Same SGSR Proceedings cited in Ref. 7, pp. L-16 to L-18.
16. Wood, Fred Bernard (1986) A Hypothesis on Geophysical Cycles, techno-Sociological Evolution and World Peace . In: Same SGSR Proceedings cited in Ref. 7, pp. L-76 to L-79.