

POST-COLD WAR GLOBAL ENVIRONMENT AND SECURITY

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The events of 1989 suddenly accelerated the erosion of the Cold War security system and its associated military-oriented concept of security. The pace of change in military postures of the Soviet Union and the North Atlantic Treaty Organization (NATO) countries still lags behind the political upheavals. Nevertheless, the trend toward the downgrading of traditional security threats and power competition will continue in the 1990s.

A second fundamental trend in world politics has accompanied the decline of the Cold War security system: the emergence of global environmental issues, once considered a diplomatic backwater. Underlying this trend is humankind's growing awareness of common threats to the biosphere. Human life can only continue on earth if there is a sufficient level of ozone in the upper atmosphere to prevent ultraviolet rays from the sun from reaching the earth's surface, and the future of that ozone layer is now in doubt for the first time. Accelerated global warming because of the emission of "greenhouse gases" over the next several decades also confronts the human species with serious biological and socioeconomic consequences: a decline of rain forests, a major increase in air pollution and species extinction over the present rapid rate, the northward movement of agricultural production, an increase in tropical diseases and a rise in the sea level by as much as 1.5 meters by mid-century (about eight times faster than the rise during the last century). The rising sea level in turn would threaten coastal areas where one-third to one-half of the global population resides, increase the frequency of severe flooding, cause the loss of drinking water and agricultural water supplies from salt penetration and imperil the world's wetlands and wildlife habitat.¹

The convergence of these two trends is creating a new phenomenon in world politics: the redefinition of national and international security primarily in terms of environmental threats rather than in terms of political-military threats from national or ideological rivals. Viewing environmental issues as "security" issues has troubled some environmentalists because the term has been associated closely with power politics and narrowly with national interests. They fear that its use will either lessen the impact of environmental threats or justify traditional security responses to them.² Students and prac-

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1. Jill Jaeger, *Developing Policies for Responding to Climatic Change*, WMO/TD-No. 225, April 1988 (World Meteorological Organization and UN Environment Programme), iii-iv.
2. See *Environmental Problems: A Global Security Threat*, Report of the Twenty-Fourth United Nations of the Next Decade Conference, June 18-23, 1989 (Muscatine, Iowa: Stanley Foundation), 15.

tioners of "narrow" national security, on the other hand, view equating the notion of environmental threats with security threats as merely a clever device to obtain increased funding.³

The concept of environmental security, however, is not simply a matter of redefining security in broader terms but represents an incipient transformation of thinking about world politics. The threats to the well-being of industrialized states from ideological or national enemies have already become inconsequential when compared with the disruption of the biosphere on which humankind depends. Whatever abuses have been and still are committed in the name of "security," the concept certainly has real meaning when applied to a state's physical environment.

The conflict between environmentally-based and traditional power-based conceptions of security operates on three levels: first, environmental security requires a degree of cooperation and interdependence with erstwhile enemies that further undermines the case for political-military competition; second, environmental and military conceptions of security are in competition for the same budgetary resources; third, nuclear deterrence, which has been at the heart of the traditional definition of national security since World War II, requires weapons whose very manufacture represents serious threats to environmental security.

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A rapidly increasing consciousness of national and global interests in environmental protection, abetted by economic forces, is undermining the traditional dominance of military power as a measure of national security. For most major powers, concern with economic growth and competitiveness in the world economy has already displaced concern about military power. But national leaders are also beginning to realize that economic growth must not come at the expense of the global environment. In the coming decade the complex linkages between maintaining a healthy world economy and protecting the global environment are likely to top the agenda in world politics.

General Secretary Mikhail Gorbachev has given a powerful impetus to this trend. His support for the transformation of all the Eastern European Communist regimes, including the Soviet regime itself, into pluralist systems, and his initiatives on conventional force reductions have transformed the political-military atmosphere of East-West relations, and reduced the "Soviet

3. Quote from a former Assistant Secretary of Defense, *U.S. News and World Report*, 25 December 1989, 51.

threat" as a justification for Western military deployments.⁴ The main motivation for these radical shifts in national security policy has been the Soviet Union's economic crisis, which required drastic military budget cuts aimed at reducing the military expenditure share of national income by as much as 50 percent and cutting the \$200 billion Soviet budget deficit by one-half by 1991.⁵ But Gorbachev publicly has recast Soviet national security policy in terms of interdependence on global issues that demands a new level of East-West cooperation.⁶ According to his "new thinking," in light of common environmental threats, "the dividing lines of the bipolar ideological world are receding."⁷ Moreover, as Soviet Foreign Minister Eduward Shevardnadze has declared, the traditional view that national security is based primarily on military power "is now totally obsolete and must be urgently revised."⁸

The United States has been more reluctant to downgrade the role of military power because of entrenched bureaucratic and economic interests. For decades, it could afford to ignore the "opportunity costs" of its high levels of peacetime military spending. But under current conditions of keen competition in the world market, those costs have begun to contribute to the erosion of prospects for future economic growth and even of US influence abroad.⁹ Even before the collapse of Eastern European Communism, the radical diminution of the Soviet threat was producing anomalies in the US posture, such as the remark by Admiral William Crowe, then chairman of the Joint Chiefs of Staff, after an historic ten day tour of Soviet military installations that he no longer considered the Soviet Union to be his enemy.¹⁰

US public opinion also had begun a momentous shift in its view of threats to national well-being, as traditional concerns about the Soviet Union was replaced by concerns about Japanese economic power and the global environment. While more than half of those polled in 1989 felt that the Soviet Union

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4. David Ignatius, "Yes, It's Real: How Gorby is Cutting the Soviet Threat," *The Washington Post* "Outlook Section," 5 November 1989; Randall Forsberg et al., *Cutting Conventional Forces 1* (Brookline, Mass.: Institute for Defense and Disarmament Studies, 1989), 70-71; Jeffrey Smith and Patrick E. Tyler, "Warsaw Pact Losing its Edge, Sources Say," *Washington Post*, 2 December 1989, A21-22; Jonathan Dean, "Conventional Talks: A Good First Round," *The Bulletin of Atomic Scientists*, (October 1989): 26-31.
 5. Letter to the editor from Yuri Lebedev, Major-general in the Soviet army, *Washington Post*, 2 December 1989.
 6. Bruce Parrott, "Soviet National Security under Gorbachev," *Problems of Communism* (November-December 1988): 1-36.
 7. Excerpts from Soviet Foreign Minister Eduward Shevardnadze's speech to the UN General Assembly, September 28, 1988, *Surviving Together: A Journal on Soviet-American Relations* (Washington, D.C., Fall/Winter 1988): 5.
 8. Address by Shevardnadze, *Surviving Together* (Fall/Winter 1988); Parrott, "Soviet National Security under Gorbachev," 10.
 9. See Kenneth A. Oye, "International Systems Structure and American Foreign Policy," in Oye, Robert J. Lieber and Donald Rothchild, eds., *Eagle Defiant: United States Foreign Policy in the 1980s* (Boston: Little, Brown, 1983), 7-16; Walter Goldstein, "The Opportunity Costs of Acting as a Super Power: U.S. Military Strategy in the 1980s," *Journal of Peace Research*, Vol. 18, No. 3 (1981): 241-260; Penelope Hartland-Thunberg, "From Guns and Butter to Guns v. Butter: The Relation between Economics and Security in the United States," *The Washington Quarterly* (Autumn 1988): 47-54; Andrew Mack, "The Political Economy of Global Decline: America in the 1980s," *Australian Outlook*, Vol. 40, No. 1 (April 1986): 11-20.
 10. Michael Dobbs, "U.S. Military Chief Praises Soviet Cuts but Advises Vigilance," *The Washington Post*, 14 June 1989, A25.

was either a minor threat or no threat at all to the United States, nearly 80 percent of the American public felt that environmental pollution had become a threat to the nation and that it should be addressed "regardless of cost."¹¹

In Western Europe, meanwhile, the process of redefining security in terms of protecting the environment has advanced much further. As early as 1982, before the depletion of the ozone layer and global climate change had been recognized as serious global environmental threats, a survey of citizens in ten states of the European Economic Community (EEC) showed that 60 percent felt that protecting the environment was more important than economic growth or controlling price inflation.¹²

In the late 1980s, this European environmental consciousness was being translated into an historic shift in states' understanding of national security: West German Chancellor Helmut Kohl declared that environmental issues would become "the most important question" in the next century.¹³ A study in 1989 by the Social and Economic Council, a joint labor-business group in the Netherlands, concluded that the environment was the country's biggest single concern.¹⁴ Meanwhile, Norway's Foreign Ministry views Britain's failure to address its export of acid rain as important to Norway as any trade or defense issue. And West Germany provided free sulfur dioxide scrubbers for Czechoslovakian power plants whose pollution is carried across the border to the Federal Republic of Germany.¹⁵

The most dramatic evidence of the transformation of traditional statecraft by environmental concerns was the support of seven Western European states for the initiative by the prime ministers of Norway, France and the Netherlands calling for the creation of a new authority within the United Nations to impose policies for the protection of the global environment.¹⁶ By proposing that nation states give up their unlimited sovereignty over policies affecting the global environment, these states were challenging one of the pillars of the old system of national security.¹⁷

While economic issues may have occupied the center of global politics as political-military rivalry receded in the 1980s, it is clear that those issues can no longer be separated from global environmental problems. In a major shift of focus, one-third of the communiqué of the "Group of Seven" economic summit in July 1989 was devoted to environmental issues. Even more striking,

11. See Thomas B. Edsell, "Public's View Could Aid Democrats," *The Washington Post*, 9 March 1989, A6; see also *A Series of Surveys of American Voters Attitudes Concerning National Security Issues*, National Survey No. 9, American Use of Force, (Detroit: Market Opinion Research, 1988), 38-42.

12. *The Europeans and Their Environment* (Strasbourg: Commission of the European Communities, 1983).

13. *Christian Science Monitor*, 12 December 1986.

14. Edward Cody, "Dutch Outline Proposal to Protect Environment," *The Washington Post*, 26 May 1989, A33.

15. Michael G. Renner, "Forging Environmental Alliances," *Worldwatch* (November-December 1989): 11, 13.

16. *The Washington Post*, 12 March 1989.

17. While this proposal represents a giant step toward a new concept of international security, it must also be noted that some of the same states that backed it (France and West Germany) also rejected a Dutch proposal for international inspection of suspected pollution sites on the Rhine on the ground of national sovereignty. See Renner, "Forging Environmental Alliances," 11-12.

at the global energy conference held in Montreal in September 1989, the predominant concern was not the security of energy supplies or energy prices but the connection between fossil fuel use and global climate change.¹⁸

The fact of global environmental interdependence in itself does not lead nations necessarily to cooperate in meeting global environmental threats. Not all global environmental threats affect all countries equally, nor are all states equally preoccupied with global environmental threats. Those conditions create the potential for states to attempt to maximize their gains in negotiating on global environmental issues. Moreover, states must not only be conscious of their own stake in international cooperation but also have the political, economic and technical means of participating effectively.

The socioeconomic impacts of global climate change probably will not be distributed equally between the West and the Soviet Union, given their different latitudes, topology, and demographic patterns. Global warming might well confer a net benefit on the Soviet Union, while imposing significant burdens on the United States and most Western European states. Although the Soviet breadbasket in the Ukraine would suffer a loss of productive land, agriculture in the Soviet Union might benefit, on balance, since so much of Soviet wheat-growing land is now too far north to enjoy favorable climate. Gains in cultivated acreage in the northern United States, meanwhile, would probably be more than offset by losses in the southern Great Plains, Southeast and Appalachia.¹⁹ Equally important, about 75 percent of the American population now lives on or near a coast, and the low-lying coasts of Northern Europe would be particularly vulnerable to a climate-induced rise in sea level. Leningrad, on the other hand, is the only major Soviet city close to sea level.²⁰

Moreover Soviet and Western capabilities for responding to environmental threats are vastly unequal. While the United States, Canada and Western Europe generally have strong capabilities for carrying out environmental protection policies, the Soviet Union's ailing economy and its technological backwardness have been powerful drags on the emergence of a global environmental policy. Given the apparent asymmetry of Western and Soviet vulnerabilities to the global climate change as well as of economic capabilities, it is not surprising that Western industrialized states have generally shown greater alacrity in moving toward commitments for reducing ozone-depleting and greenhouse gas emissions than the Soviets. The United States and the EEC nations were the leaders in the negotiation of the 1987 Montreal Convention on ozone layer.²¹ As negotiations on a framework convention on global climate similar to the 1987 Montreal Convention begin in 1990, most of the indus-

18. "Key Sections of the Paris Communiqué by the Group of Seven," *The New York Times*, 17 July 1989, A7.

19. *The Potential Effects of Global Climate Change on the United States*, Draft Report to Congress: United States Environmental Protection Agency, Office of Policy, Planning and Evaluation and the Office of Research and Development. October 1988.

20. Soviets attending international conferences have been quoted as referring privately to possible Soviet relative advantage from global warming. See Frank E. Loy, "The Environment and Foreign Policy: The Challenge for the Foreign Policy Professional," Address to the Mid-Atlantic Club, Washington, D.C., 25 May 1989.

21. See David D. Doniger, "Politics of the Ozone Layer," *Issues in Science and Technology*, Vol. 4, No. 3 (Spring 1988): 86-92.

trialized countries are prepared to commit themselves to the goal of cutting carbon dioxide emissions by 20 percent of the present level by the year 2000.²²

Thus far, high-level political opposition has prevented a US commitment to negotiate specific emission targets, based on fears that it would slow domestic and international economic growth.²³ But the US scientific community and environmental organizations are a potent political force; they were able to pressure Washington to taking the lead on the negotiation of an ozone treaty, despite the fact that the Reagan administration had come to office with a strong ideological bias against government regulation as a means of protecting the environment.²⁴ Global warming only emerged as a significant political issue in the United States in 1988, and the Bush administration is under strong domestic pressures to accept a framework convention on global climate change with specific emission cuts as targets.²⁵

Although Soviet scientists realized the significance of the ozone issue by the mid-1980s, the Soviet government was brought into the 1987 Montreal Protocol only reluctantly, as it feared that Soviet industry would be at a competitive disadvantage in developing new technologies to replace chlorofluorocarbons (CFCs).²⁶ Soviet delegates to the Montreal Conference demanded a special provision allowing it more time to implement the freeze on CFC production.²⁷ The Soviets would not endorse the US-Western European call for the elimination of CFC production by the year 2000 at the 1989 Helsinki Conference.²⁸ Similarly the Soviets (along with the United States and Japan) opposed any commitment to cutbacks on carbon dioxide emissions at an international conference on global warming last year.²⁹

Despite the asymmetry of vulnerabilities and the inequality of capabilities, the environmental interests of the West and of the Soviet Union are interdependent, because each needs the cooperation of the other in dealing with environmental threats that are high priority interests. Western states need Soviet help in addressing the threats of ozone depletion and global climate change, while the Soviet Union needs the help of the West in addressing its domestic environmental as well as economic crisis. Growing Soviet concern with cleaning up the domestic Soviet environment is the result not only of

22. Glen Frankel, "U.S. Moves to Block Pact on Emissions," *The Washington Post*, 7 November 1989, A1, A21.

23. Rochelle L. Stanfield, "Greenhouse Diplomacy," *National Journal*, 4 March 1989, 510-513; Marshall Ingwerson, "White House Gears Up for Assault on Global Warming," *The Christian Science Monitor*, 3 November 1989; Glenn Frankel, "U.S. Moves to Block Pact on Emissions," *The Washington Post*, 7 November 1989.

24. Doneger, "Politics of Ozone."

25. Glenn Frankel, "Nations Pass Resolution on Environment," *The Washington Post*, 8 November 1989, A6.

26. Rene Tarusko, "Cooperation in Climate Research: An Evaluation of the Activities Conducted Under the US-USSR Agreement for Environmental Protection Since 1974," National Oceanic and Atmospheric Administration, National Climate Program Office, 1989 (draft), 87.

27. Diane M. Doolittle, "Underestimating Ozone Depletion: The Meandering Road to the Montreal Protocol and Beyond," *Ecology Law Quarterly* Vol. 16 (1989): 424.

28. *International Environmental Reporter*, April 1989, 168-169. Soviet officials report that the production of alternatives to CFCs will not begin on an industrial scale until 1992-1993 (A. Boldinyuk, "The Ozone Hole—A Signal From the Future?" *Pravda*, 9 May 1989, FBIS-SOV-89-096, 19 May 1989, 8).

29. Glenn Frankel, "U.S. Moves to Block Pact on Emissions."

shifts in elite priorities but of growing mass political pressures on state environmental policy. Under Mikhail Gorbachev, the Soviet leadership has acknowledged officially an internal environmental disaster that has been apparent to Soviet citizens for many years. In 102 major Soviet cities, with a collective population of 50 million people, air pollution levels are several times higher than the official allowable standard. Leningrad's tap water has the rotten smell and taste of sulfur dioxide and is contaminated by amoebic dysentery bacteria. The Baltic, Aral and Black Seas are so polluted that beaches had to be closed in 1988 after typhoid and dysentery were reported in their waters. Chemical factories cause a high incidence of asthma, bronchitis and nasal problems, especially among children, and in the worst towns, the number of mentally ill and retarded children reportedly has increased by 3-4 percent annually during the past decade.³⁰

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Public outrage at water and air pollution, combined with the new freedom under Gorbachev, has inspired a Soviet grassroots environmental movement that is on the cutting edge of democratization. The demand for information on the health consequences of pollution has been more important than any other single factor in creating pressure from below for opening up the political system. In the Baltic republics strong "green" movements have emerged in response to conflicts over polluting industries centrally run from Moscow.³¹ Tens of thousands of citizens have openly protested against industrial pollution, nuclear power plants and starting new polluting chemical plants. The protests have forced the government to close polluting plants and shelve plans

30. Stefan Hedlund, "Environmental Ruin: A Swede's Perspective on the USSR," *Surviving Together* (Fall/Winter 1988): 2-3; Hilary French, "The Greening of the Soviet Union," *Worldwatch* (May-June 1989): 21-29; Judith Perera, "Where Glasnost Meets the Greens," *New Scientist*, 8 October 1988.

31. Ingrid Lipea, "Environmental Concerns Fuel Baltic Nationalism," *Alternatives*, Vol. 16, No. 2 (1989): 10; Arthur H. Westing, "The Greening of Estonia," *Environmental Conservation*, Vol. 15, No. 4 (Winter 1988): 300. The clash between the Baltic republics and Moscow over environmental issues is rooted in the fact that control over industrial activities of all-union importance, such as oil shale extraction and phosphate mining found in Estonia, are under central government control, while environmental protection and health are in the hands of the republics. Before Gorbachev, central government policies prevailed when there were conflicts between the two, despite ambiguity in the statutes on the matter.

for opening new ones, to set up its first environmental protection agency and to pledge a comprehensive program of environmental clean-up.

The environment is well on its way to becoming a central domestic political issue, ranking alongside improvement in the Soviet standard of living. Not only has it mobilized broad segments of the Soviet population into political activism for the first time, it has provided the most compelling and coherent basis for an emerging independent political force in Soviet politics. Soviet environmentalists already have gained footholds in the power structures on both regional and national levels.³² Environmental issues figured prominently in the first genuinely contested parliamentary election in 1989, and many newly elected deputies to the Congress of People's Deputies cited environmental problems as the country's primary problem when it met in June 1989.³³

But Soviet economic and technological weaknesses jeopardize Soviet ability to make good on its domestic environmental promises. There is still not a single sulfur dioxide or nitrogen dioxide purification device, for example, in the Soviet Union. The technology needed by the Soviets to address pressing environmental issues is very capital intensive. One estimate places the minimum immediate investment in environmental protection needed to avoid catastrophe at 100 billion rubles—ten times the present annual budget for environmental programs, which is only about 1.3 percent of GNP. And the Soviet budget deficit is already three times the size of the US deficit as a percentage of GNP.³⁴ Even if the Soviet leadership multiplies its environmental spending through draconian reductions in military budget, the USSR may be unable to fulfill commitments on either a phase out of CFCs or drastic reductions in greenhouse gases over the next decade without Western financial and technical assistance.

The Soviet Union is two decades behind the West in dealing with its environmental problems. It is one of the least energy-efficient economies in the world, using 40 percent more energy than the United States and nearly four times more than Sweden or France per unit of industrial production.³⁵ Moreover, Soviet "energy intensity" (energy consumption per unit of GNP) was thirty-seven times higher than that of the United States in 1985, and had actually risen by 17 percent since 1960, while other industrialized countries were reducing their ratios.³⁶

32. Randy Kritkauskay, "The Perestroika TV Doesn't See," *The Christian Science Monitor*, 15 November 1989, 19.

33. Perera, "Where Glasnost Meets the Greens"; Hilary French, "The Greening of the Soviet Union," 26-27; Robert S. Greenberger, "U.S., Soviets to Discuss the Environment This Week in Pristine Mountain Setting," *Wall Street Journal*, 18 September 1989, A12.

34. "Russia's Greens: The Poisoned Giant Wakes Up," *The Economist*, 4 November 1989, 26; Eric Green, "The Political Economy of Environmental Protection in the Soviet Union," 10-11.

35. Anthony Cortese, "Glasnost, Perestroika and the Environment," unpublished paper, 31 July 1989, 4-6; Hal Harvey and Amory Lovins, "Energy Efficiency: A Key to Soviet Reform," *Surviving Together* (Fall/Winter 1988): 8.

36. Albina Tretyakova and Matthew J. Sagers, "Trends in Fuel and Energy Use and Programs for Energy Conservation by Economic Sector in the USSR," unpublished paper, 1989, 2.

Soviet energy inefficiency is due in large part to the lack of economic incentives for energy conservation in the Soviet economic system. But it is also related to outmoded Soviet technology in industry, transportation and home heating. Improving Soviet energy efficiency will require the replacement or rebuilding of capital equipment in many of its economic sectors.³⁷

The Soviets need a relaxation of the Western allies' restrictions on technology sales to the USSR. Much of the technology the Soviets need for environmental protection and energy efficiency will have to be acquired with hard currency that is increasingly in short supply, so Moscow will have to seek additional loans from the West. The capacity of the Soviet Union to address its own environmental crisis will thus depend heavily in the post-Cold War era on the cooperation of the West.

The Western nations, on the other hand, will need Soviet help to achieve its interest in global environmental conventions. The Soviet Union is responsible for 10 percent of the world's CFC production and 21 percent of its fossil fuel consumption, the single most important source of greenhouse gases.³⁸ It is also responsible for the emission of nearly one-third more sulphur dioxide—another greenhouse gas—than all of the EEC countries combined.³⁹

The West will also need Soviet help in obtaining the knowledge on the ozone layer and greenhouse gas emissions. Since the Soviet Union occupies about one-sixth of the earth's landmass, it would be virtually impossible to set up a global monitoring system for the atmosphere without full Soviet cooperation. The Soviets have a large fleet of oceanographic research vessels capable of doing mid-ocean monitoring—something the United States lacks—as well as a research base in Antarctica that is well positioned for the study of stratospheric ozone depletion.⁴⁰ The United States and the Soviet Union have the most advanced scientific capabilities in the world for studying the world's atmosphere, and strengths of the two scientific communities complement one another: while the United States is superior to the Soviets technologically, it lacks data; the Soviets, on the other hand, have relatively poor technology but mountains of data and sophistication in designing monitoring systems.⁴¹ Moreover, the Soviets are strong in the theoretical mathematical models of climate change and paleoclimate analysis, but they lack the computers necessary to be able to make contributions to the joint Soviet-American endeavor.⁴²

To insure that the Soviets comply with global environmental conventions and contribute to the full extent of their capability to climate research, the West needs to help the Soviets on a wide technological front: substitute

37. *Ibid.*, 4.

38. Tatusko, "Cooperation in Climate Research," 86.

39. Eric Green, *The Political Economy of Environmental Protection in the Soviet Union* (Washington, D.C.: American Committee on U.S.-Soviet Relations, 1989), 4.

40. Rene Tatusko, "Cooperation in Climate Research," 89-90.

41. Terry F. Yosie, "Environmental Perestroika," *The Environmental Forum* (May/June 1988): 12; B. W. Hall, "Soviet Perceptions of Global Ecological Problems: An Analysis Based on Simulated Interviewing," unpublished Ph.D. dissertation, Ohio State University, 1987, 241.

42. Tatusko, "Cooperation in Climate Research," 69.

technology for CFCs to be phased out under a modified global agreement on ozone depletion, computer technology to boost Soviet capabilities for global climate modelling; modern technology, such as gas turbines for assisting in the modernization of the Soviet system of energy use. And since the ability of the Soviets to purchase high technology has been hard hit by the fall in the prices of Soviet oil and gas exports and the decline in the value of the dollar, Western states will have to make increased credits available to the Soviet Union for purchase of this technology.⁴³

In the longer run, the threat of climate change cannot be addressed without a systematic, global transition from fossil fuels to renewable energy sources. Such a transition would take decades and tens of billions of dollars invested in research and development to complete. In the meantime, a shift from coal and oil to natural gas, which emits one-third less carbon dioxide per unit than oil and almost half that of coal, would be an important element in a global warming mitigation strategy.⁴⁴

The political implications of such an energy transition would include an end to the role of the Persian Gulf as a crisis area for US foreign policy and a significant increase in economic interdependence between the West and the Soviet Union.

The political implications of such an energy transition would include an end to the role of the Persian Gulf as a crisis area for US foreign policy and a significant increase in economic interdependence between the West and the Soviet Union. Once the industrialized world begins to shift away from reliance on petroleum for its energy system, a major justification for military deployments and the possible use of major military force, which is already in decline, will finally dissolve.

The Soviet Union has the largest explored reserves of natural gas in the world—about 34 trillion cubic meters, or about 40 percent of the world's total. Its natural gas reserves are sufficient to sustain rapid growth in both

43. Committee to study International Developments in Computer Science and Technology, *Global Trends in Computer Technology and Their Impact on Export Control* (Washington, D.C.: National Academy Press, 1988), 206-208.

44. Jaeger, *Developing Policies*, 24. For one projection of an energy transition mix in which natural gas use would be equal to that of coal by 2020 but less than half the aggregate total primary use levels projected in other studies, see Jose Goldemberg et al., *Energy for a Sustainable World* (Washington, D.C.: World Resources Institute, 1987), 24, 32.

production and export for several decades into the future.⁴⁵ Moreover, the pipeline system linking Soviet natural gas sources and consumer markets in Western Europe was already completed in 1987.

If Western Europe were to shift from oil to natural gas as its primary energy resource until renewable energy sources are ready for commercial use, it would rely more heavily on the Soviet Union for its natural gas supply than it already does. When the Soviets reached an agreement with Western European states in the early 1980s to provide natural gas, the United States had opposed such increased interdependence regarding natural gas strongly, on the grounds that it would give the Soviets additional hard currency and even provide potential political leverage on Western European states in a political crisis.⁴⁶ But in a post-Cold War world in which fears of political military crisis have faded and the threat of global warming looms increasingly large, the United States should no longer object to mutual dependence that will bind the two parts of Europe closer together.

In the 1990s and beyond, environmental and traditional conceptions of security will be in competition for scarce capital resources. Minimizing global climate change and ozone depletion, preventing the destruction of the world's rain forests and maintaining the earth's biological diversity are massive and complex undertakings that will require heavy financial commitments from the advanced industrialized countries. The capital costs of needed energy improvements in the United States alone would be in the hundreds of billions of dollars over twenty years.⁴⁷ In addition, one must add the costs of research and development of renewable forms of energy; the costs of a fund to finance technological improvements in the developing countries' energy efficiency and energy transition, without which major energy-users such as China and Brazil will not join any global climate convention, and finally the costs of a fund for financing sustainable development. The World Resources Institute estimated in a 1989 report that these costs could add up to as much as \$50 billion annually.⁴⁸

These costs clearly would be borne by several industrialized countries in concert, and Japan might be expected to bear a larger share of the burden. Furthermore, some of the costs could be financed from a "CFC tax" on emissions of gases that threaten the ozone layer as well as a "carbon tax" levied on fuels in proportion to their contribution to emission of carbon dioxide. Nevertheless, a serious response to global environmental threats must entail rearranging budgetary priorities, and the only major source of funds in the

45. Central Intelligence Agency, *USSR Energy Atlas* (Washington, D.C.: CIA, 1985), 15.

46. See Robert J. Lieber, "Energy Policy and National Security, Invisible Hand or Guiding Hand?" in Kenneth Oye et al., eds., *Eagle Defiant: United States Foreign Policy in the 1980s* (Boston: Little Brown, 1983), 176-177; Donald J. Goldstein, "East-West Trade, Technology Transfer and Western Security," in Gordon B. Smith, ed., *The Politics of East-West Trade* (Boulder, Col.: Westview, 1984).

47. In 1981, the National Audubon Society estimated the capital costs for energy improvements over a twenty-year period to be between \$425 billion and \$925 billion in 1980 dollars (National Audubon Society, *Technical Report on the Audubon Energy Plan*, April 1981, 24, 31).

48. World Resources Institute, *Natural Endowments: Financing Resource Conservation for Development*

US budget will be the military budget, which has already been rendered vulnerable to deep cuts by international developments and massive shifts in public opinion. The 1990s will probably bring a significant redistribution of budgetary sources from military spending to environmental programs.

The new environmental consciousness impinges on the traditional concept of national security in yet another way: the objections of environmentalists to the production of nuclear weapons on environmental grounds. Nuclear weapons production has been a central element in US national security strategy for more than three decades, but it is now recognized that the mere production of these weapons has enormous "externalities" in the form of nuclear wastes that present long-term threats to the environment. Plutonium, the material from which nuclear bombs are made, is so toxic that inhaling one millionth of an ounce can cause cancer, and it remains radioactive for thousands of years. The US government has acknowledged officially the need to reduce the environmental damage already done by thirty years of dumping nuclear wastes into the environment.

It is now estimated that in the complexes for manufacture of nuclear weapons there are over 3,000 waste sites that involve threats to the environment, primarily from the contamination of groundwater by nuclear wastes. Cleaning them up could cost up to \$150 billion and take thirty years to complete. The radioactive wastes generated by weapons plants are so dangerous that Idaho has refused to continue storing them temporarily, pending the building of a permanent waste site which has yet to be devised. Every method tried thus far to dispose of these nuclear wastes, including one completed in 1987, has failed. The date for opening the permanent site in Nevada's Yucca Mountain already has been postponed from 1998 to 2010, because of Nevada's refusal to issue the environmental permit. If and when it does open, the site would hold only a fraction of the total high level nuclear waste, which would have to be transported in trucks on the nation's highways. Meanwhile weapons plants at Savannah River, South Carolina and Rocky Flats, Colorado had to be closed down in 1988 and 1989 because of safety and environmental concerns.⁴⁹

The massive difficulties and dangers associated with storing the radioactive wastes of past weapons production raise serious questions about plans for opening five new production reactors for nuclear weapons and relocating two more. At a time when the Soviet Union is no longer regarded as militarily hostile and is proposing to close down all remaining reactors by the year 2000, the environmental hazards of nuclear weapons production weigh far more heavily than any justification for its continuation.⁵⁰

49. Bruce Piasecki and Peter Asmus, "Radioactive Challenge to Nature's Resilience," *Christian Science Monitor*, 15 November 1988; Environmental and Energy Study Conference, "Environmental, Energy and Natural Resource Issues," 22 December 1989, 39-42; "Defending the Environment? The Record of the U.S. Military," *The Defense Monitor*, Vol. 18, No. 6 (1989): 2-3.

50. Barry Kelman, "Ban the Bomb Factories: The Risks are too Great," *The Christian Science Monitor*, 18 October 1989, 19.

The trend for environmental security to supplant military security is still only in its early stages. Furthermore, politically powerful figures and economic interests that profit from the status quo can slow the trend. But it is a transformation of international relations that cannot be reversed because it involves not only the reality of environmental deterioration but an historic shift in popular political consciousness.