

SOCIALISM AND ENVIRONMENTAL DISRUPTION: IMPLICATIONS FOR CUBA

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All societies and economic systems—industrialized or developing, market economy or socialist—must deal with environmental disruption. In market economies, environmental disruption has been the subject of considerable economic analysis. Environmental disruption is associated with “failure” of the market mechanism in the face of externalities and public goods. Much less attention has been paid to environmental disruption under socialism, in part because of theoretical arguments that environmental disruption would not arise in socialist societies. A former Soviet Minister of Public Health found environmental disruption in market economies perfectly understandable: “The capitalist system by its very essence is incapable of taking radical measures to ensure the efficient conservation of nature (Goldman 1970, p. 37).” The implication is that the Soviet Union and other socialist countries could take, and had taken, such measures.

The environmental devastation in Eastern Europe and the former Soviet Union that became evident upon the fall of socialism and the lifting of the information curtain enveloping these countries, makes it clear that the theoretical arguments about the incompatibility between socialism and environmental disruption had very little to do with reality. We fear that the environmental situation in Cuba, an eager implementer of the socialist economic model, may be similar in many respects to that which prevailed in Eastern Europe and the former Soviet Union.

This paper reviews the literature on the theory and practice of environmental disruption under social-

ism. It discusses specific features of centrally planned economies that make these economies prone to environmental disruption, with special emphasis on the socialist model of agricultural development. The paper concludes with a discussion of some of the features of socialism in Cuba that have shaped the island’s environmental situation and prospects.

SOCIALIST ECONOMIES AND THE ENVIRONMENT

Advocates of socialism argued, on theoretical grounds, that environmental disruption could not occur in a socialist society. Environmental disruption occurs in market economies, they argued, because economic decisions are made by individuals whose own interests—rather than those of society—are paramount. In centrally planned economies, decisions are centralized and the objective function for the economy that is maximized by central planners includes environmental quality. Under socialist organization, therefore, there can be no environmental externalities since environmental issues are not external to decisionmaking by central planners (Gregory and Stuart 1974, p. 407). The following quote from a Soviet economic journal captures the essence of the perceived superiority of socialism:

The effective management of the economy is incompatible with the capitalist system. This is manifested most clearly by the vast amount of environmental degradation in most capitalist countries. It is clear that within the framework of a capitalist economy there is no point in even raising the question of management of the environment on a nationwide scale.

But such a formulation is logical and necessary in conditions of a planned socialist economy (Kramer 1974, p. 886).

The argument for the superiority of socialism over market economies with respect to environmental quality has also been posed in terms of property rights. Public ownership of the means of production under socialism eliminates the structural cause of excessive pollution that exists in market economies arising from private ownership of capital and land. The incomplete specification of property rights in market economies permits an important share of the costs of production and consumption to fall on individuals external to realized market transactions. In a socialist economy, where all productive assets are owned by “society,” property rights are fully assigned and correctly specified; external costs by definition do not exist, and every economic decisionmaker has direct material reasons to recognize the full economic costs of his or her actions (McIntyre and Thornton 1978, p. 187).

Several other theoretical arguments regarding the compatibility of socialism with environmental quality have also been put forward. Oskar Lange, for instance, argued that socialist central planners would place a high value upon a clean environment, ensuring that economic growth is accompanied by environmental quality. In Lange's view, a socialist economy would be better able to construct the set of remedial taxes to internalize external costs because it would not be confronted by the political difficulties and managerial resistance that result from the incomplete specification of property rights in market economies (McIntyre and Thornton 1978, p. 188). Maurice Dobb suggested that in the real world, central planners might have some difficulty in obtaining and processing information; nevertheless they would make economic decisions with maximum global vision and keeping in mind their environmental impact. Jan Tinbergen endorsed the notion that, in general, decisions made at the higher possible levels minimize the problem of externalities (Gregory and Stuart 1974, p. 408).

Finally, the case has been made (McIntyre and Thornton 1978, pp. 189-190) that decisionmakers

in a Soviet-type centrally planned economy have an advantage over a market-type economy in obtaining the required information to make meaningful analyses of the benefits and costs of pollution abatement systems. Due to their position, central planners have access to three types of information that are critical for cost-benefit analyses: (1) the specific production processes used by enterprises; (2) the locational circumstances of enterprises; and (3) the relative merits of centralized or decentralized abatement strategies. That is, should Soviet political decisionmakers at the highest party and government levels embrace a commitment to environmental quality, planners would have access to the technical information required to make efficient environmental choices (McIntyre and Thornton 1981, p. 147).

The Reality of Environmental Disruption Under Socialism

However, “many of the theoretical advantages that a socialist society would seem to have for coping with the problem [of environmental disruption] have proven to be illusory in practice” (Goldman 1972, p. 326). The reality of environmental disruption in socialist countries—amply demonstrated by the severe environmental degradation observed in the former Soviet Union and socialist countries of Eastern Europe—contradicts the theoretical propositions:

One of the ironies of the former centrally planned economies, we have come to learn, is how little they cared about protecting their environments. Such rapacious behavior should not be so prevalent in societies whose purported objectives were defined in terms of the social rather than the private good. Nevertheless, virtually every one of the countries of Central and Eastern Europe is confronting a Herculean task in slowing down the rate of pollution and cleaning up decades of environmental neglect (Bohi 1994, p. vii).

It was well known to Western scholars that by the 1960s and 1970s, the Soviet Union and the former socialist countries of Eastern Europe already faced serious environmental problems (e.g., Bush 1972, 1974; Goldman 1970, 1972, 1973; Volgyes 1974). Industrial pollution threatening pristine Lake Baikal, a fire in the Iset River in Sverdlslok, the gradual disappearance of the Aral and Caspian Seas because of the

diversion of the rivers that fed them, smog and polluted air in Central Europe from low-quality coal, had all been documented in the literature.

Nevertheless, the lack of official statistics and reports made it difficult to appreciate the breadth and depth of environmental disruption in socialist countries. The information barriers began to break down in the late 1980s with the implementation by the Soviet Union of a policy of openness (“glasnost”) that brought about the publication in 1989 of the first-ever official reports on the state of the environment (Altshuler and Golubchikov 1990; Yablokov 1990).

The magnitude of the environmental disaster in the Soviet Union and the Eastern European socialist countries that became apparent upon the fall of socialism surpassed the expectations of even the most pessimistic observers. As Feshbach and Friendly (1992, p. 1) put it with regard to the Soviet Union:

When historians finally conduct an autopsy of the Soviet Union and Soviet Communism, they may reach the verdict of death by ecocide. ... No other great industrial civilization so systematically and so long poisoned its land, air, water, and people. None so loudly proclaiming its efforts to improve public health and protect nature so degraded both. And no advanced society faced such a bleak political and economic reckoning with so few resources to invest toward recovery.

The situation in Eastern Europe, and the diagnosis of its cause, were very similar:

The legacy of our polluted continent [Europe] can partly be blamed on the policies adopted by the socialist Communist states over the last four decades. The Eastern bloc countries never admitted to pollution problems during the first two decades of the post Second World War era. In spite of Stalinist and post-Stalinist heavy industrialization policies, pollution of any kind was, according to their propaganda, only to be found in the West where capitalist profit motive was the cause of their environmental degradation problems. Hindsight has now proved the fallacy of such claims, but does not solve the way forward in these countries (Carter and Turnock 1993, p. 189).

The recent literature on the “environmental disaster” in the former Soviet Union and the socialist coun-

tries of Central and Eastern Europe is vast. Some of the most salient examples of environmental disruption in the former Soviet Union and the socialist countries of Eastern Europe include:

Air: The industrial sector was the most important source of air pollution in the former Soviet Union. Coal-fired power and heating plants, steelworks, and chemical plants emitting high levels of pollutants were located across the nation. Emissions of air pollutants exceeded established health norms in all industrial areas. In 103 industrial cities—with combined population of over 50 million people—emissions exceeded normal standards by ten-fold or more; during 1988, pollution reached 50 times the standard in 16 cities. Heavy air pollution was responsible for a high incidence of lung disease in several areas of the country and also for forest die-back in Lithuania, the Urals, the Ukraine, and Siberia (Satre Ahlander 1994, pp. 7-9).

Eastern Europe suffered from more severe air pollution problems than the former Soviet Union (Ziegler 1991, p. 89). Air pollution arose primarily from the heavy reliance on lignite, or brown coal, as an energy source: over three-quarters of Poland’s energy consumption and two-thirds of Czechoslovakia’s and the former East Germany. Coal’s noxious fumes damaged many buildings and forests and caused serious health problems throughout the region (Carter and Turnock 1993, p. 189).

Water: Highly polluted surface waters—those with concentrations of pollutants about 10 times the permitted maximum—in the former Soviet Union included the Western Bug, the Dnestr, Danube, and Don rivers, and the rivers of Sakhalin Island; the Volga and the Irtysh and the Amur river basins also had high levels of pollutants and impurities (Feshbach 1991, p. 231). In some areas, the main culprits of such pollution were the pulp and paper industries, steelworks, and the chemical industry. In others, agriculture was the main source of water pollution because of the intensive use of mineral fertilizers and pesticides (Satre Ahlander 1994, p. 14). In 1988, the Soviet Union was able to treat only 30 percent of its sewage to meet established sanitary norms; 50 percent of the sewage was improperly treated, while the

remaining 20 percent was dumped into the water untreated (Satre Ahlander 1994, p. 15).

One of the most poignant examples of environmental disaster in the former Soviet Union was the desiccation of the Aral Sea. An ill-conceived plan initiated in the 1950s to increase cotton acreage in Central Asia by massive irrigation of marginal lands and intensive use of fertilizers diverted water that normally fed the Aral Sea; in 1989, only one-eighth as much water as in 1960 reached the Aral Sea from its two main feeders, the Syr Darya and the Amu Darya (Feshbach 1992, pp. 73-75). The Aral Sea itself, formerly the fourth largest inland sea in the world, has lost over one-third of its area, the surface level has dropped by 13 meters, and the volume reduced by 790 cubic kilometers. Moreover, whatever water reached the Aral was heavily contaminated with phosphates, ammonia, nitrites, nitrates, and chlorinated hydrocarbons from agricultural runoff. Major storms of dust, salt, and toxic residues from the exposed seabed of the Aral have contaminated the surrounding region, turning once-fertile pastures into a desert and severely affecting the health of the population. Ironically, it is estimated that over one-half of the water drawn off from the Aral Sea Basin is wasted because of highly inefficient irrigation systems, evaporation, and carelessness and incompetence. Excessive application of water to crops coupled with inadequate drainage have turned large tracts of land into saline swamps (Akiner 1993, pp. 256-257).

Direct and indirect pollution of surface water resulted in the poisoning of lakes and rivers in Eastern Europe through acid deposition from refineries, mining operations, and other industrial activities. In Poland, both the Vistula and Oder rivers are virtually ecologically dead as a result of pollution from mining operations in Silesia. The Baltic Sea is heavily polluted with waterborne sewage, industrial effluents, and agricultural chemical waste. The Black Sea is on the verge of a catastrophe because of extremely high pollution levels, with some reports suggesting that all life could disappear from the Black Sea; much of the pollution entering the Black Sea is carried by the Danube, along whose banks are located paper mills, iron and steelworks, petroleum and sugar refineries,

chemical plants, cement plants, coal and minerals-processing plants, breweries, and canneries (Carter and Turnock 1993, pp. 191-192).

Land/Vegetation: There is a large literature that documents the adverse results on the environment of the implementation of the Soviet agricultural model, which relied heavily on large-scale farming, chemical inputs and mechanization. According to official sources, 58 percent of total agricultural land of the former Soviet Union was affected by salinization, erosion, acidity, or waterlogging. Despite a ban, DDT continued to be used. A survey conducted in 1989 of 841 farms producing grain, rice, wine, tea, fruit, and vegetables found DDT in 35.5 percent of 250 agricultural products; 16.6 percent of the soil had been polluted by DDT (Feshbach 1991, pp. 229-230). In 1988, one-fifth of the Soviet population lived in regions where the ecological situation was deemed to be unsatisfactory; agricultural lands affected by overgrazing, intensive cultivation, deforestation, changed chemical composition of the soil, wind erosion, desertification, and compacting of the topsoil, accounted for a significant share of these lands deemed unsatisfactory (Satre Ahlander 1994, p. 6).

Farming, although itself suffering from air pollution, was one of the main polluters of land in Eastern Europe. Tillable land suffered also from open air mining methods and deposition of municipal and industrial waste. Further, poor agricultural practices led to water and wind erosion and soil degradation (Satre Ahlander 1993, p. 193).

One of the most visible signs of environmental disruption in the region is the destruction of forests; vegetation, especially from forests, suffers from raised contamination by industrial waste emissions and other pollutants. Damage to forests in the former Czechoslovakia has been attributed to emissions from the Polish copper refining town of Legnica in Silesia. The region from Cracow in southern Poland to the Tatra Mountains in the former Czechoslovakia is covered by a semi-permanent pall of sulphur, nitrogen, and other pollutants emitted from negligent enterprises in both countries (Carter and Turnock 1993, p. 194).

Nuclear contamination: The April 1986 accident at the Chernobyl Nuclear Power Plant in the Ukraine is without parallel as a technological disaster. It exposed 400 million persons to radiation and caused 31 directly attributable deaths, as many as 28,000 delayed cancer fatalities, evacuation of 116,000 people, and polluted ground water deposits throughout Europe (Lofstedt and White 1990, p. 2).

Nuclear radioactivity in the former Soviet Union is a much broader environmental hazard, however. The magnitude of the network of “atomic cities” (atomgrad) that carried out the development and production of nuclear weapons in the former Soviet Union is still not known with certainty, but as many as 90 locations have been identified; not known with certainty either are the level of radioactive contamination of the areas, the stocks of nuclear materials that are stored, or the condition of the storage facilities. The same is true for nuclear waste dumps in the Barents, Kara, and White Seas of the Arctic, the Sea of Japan, and locations in the Far East. It was revealed in 1992 that in the city of Moscow alone there were 636 radioactive toxic waste sites, 1,500 in St. Petersburg, 1,000 in Penza, and 200 in Omsk (Feshbach 1993, pp. 233-234).

The use of nuclear power for commercial power generation in the former Soviet Union and Eastern Europe has been a source of radioactive contamination and has the potential for a nuclear catastrophe. Antiquated methods of uranium mining in the former Czechoslovakia and processing in Bulgaria have affected local health; disposal of nuclear wastes accumulated in power plants is problematic for Eastern European nations given that the former Soviet Union no longer takes back spent fuel rods and reprocessing service costs in the open market are very high (Carter and Turnock 1993, p. 196). In the Soviet Union, a radiation leak occurred at the nuclear power plant at Sosnovy Bor in March 1992 and a radiation explosion at the Tomsk-7 reactor in April 1993 (Greenblatt 1993, p. 245).

The safety of the 58 Soviet-designed commercial power reactors in operation in the former Soviet Union and Eastern European nations is a matter of serious concern. Experts agree that these reactors do

not meet international safety standards and pose significant safety risks because of deficiencies in their design and in their operation by plant managers and personnel who lack adequate training in many of the safety procedures practiced by operators in Western Europe, Japan, and the United States. Twenty-five of the reactors—including 15 of the model that was involved in the Chernobyl accident—are considered to be the least safe because of the lack of a containment structure and other inherent design deficiencies and cannot be economically upgraded (U.S. General Accounting Office 1994, pp. 1-3).

Explanations of Environmental Disruption Under Socialism

Three general explanations of environmental disruption in the Soviet Union have been presented in the literature. These three explanations, which are also applicable to environmental disruption in Cuba and other centrally planned economies (CPEs), are: (1) failure of the system; (2) conscious neglect; and (3) central planning implementation problems.

System Failure: The thrust of this line of argument is that environmental disruption occurs in CPEs because the economic organizational model in fact does not incorporate the environment into the planning process. The central planning mechanism fails to generate appropriate resource valuations, including the costs of environmental disruption and of the use of natural resources. Unaware of appropriate resource valuations, planners cannot allocate resources rationally even if they wished to do so (Gregory and Stuart 1974, p. 411).

In reality, allocation of environmental expenditures in CPEs tends to be made by the central authorities on the basis of the “branch principle,” whereby resources are distributed through the hierarchy of ministries rather than directly to regions or cities where environmental protection expenditures could be most effective. Ministries, in turn, assign such resources to their own priorities, not necessarily the ones that would be best for the environment on a national scale. The emphasis in CPEs on quantity information and direct commands—rather than on the flow of price information among economic agents—in resource allocation decisions have given

rise to situations in which harmful, yet potentially useful, waste products of an enterprise may have been discarded into convenient waterways rather than used as an input into a complementary production process, even where enterprises were located physically close to each other (Satre Ahlander 1994, p. 26).

The valuation problem is further complicated by Marxist theory, which is prejudiced against charging for natural resources (Gregory and Stuart 1974, p. 411). Central planners tended to use natural resources as free goods or assign them a very low valuation, thereby creating an incentive for the extensive use of natural resources. An example related to the mining sector is instructive:

... after a Soviet mine operator has extracted the richest ore, his marginal costs and average variable costs begin to rise. As it takes more units of labor and machinery to extract one unit of ore or oil, the mine director begins to look for another, more easily exploited mine or oil deposit. This is a natural reaction since in the slang of the economist, “bygones are bygones,” that is the mine operator does not have to worry about recovering his old fixed costs (Goldman 1972, p. 315).

Moreover, enterprise managers tended to be rewarded on the basis of fulfillment of output goals, rather than prudent use of resources (Satre Ahlander 1994, p. 27).

Finally, fines imposed on enterprises that violated environmental rules were insignificant compared to bonuses for overfulfillment of production plans (Goldman 1972, p. 322).

Conscious Neglect: Another general explanation of environmental disruption in the former Soviet Union is that environmental concerns were consciously discarded, as they were considered as one of the costs of rapid economic growth and industrialization. Czarist Russia was a backward, developing country at the turn of the century. Although not the highest priority, conservation of the environment was important during Lenin's tenure at the helm of the Soviet Union, at least in terms of legislation adopted. However, even before Lenin's death, rapid economic growth and industrialization became para-

mount and other economic objectives, including conservation, set aside (Goldman 1973, p. 57).

The policy of rapid economic growth and industrialization pursued by the Soviet Union since the rise of Stalin emphasized the development of gigantic heavy industry enterprises. These enterprises used huge amounts of natural resources and generated vast amounts of pollution. Another element of this policy was to increase output in the short run, neglecting “non-productive” activities such as pollution abatement. During this period, then, the Soviet leadership deliberately traded off environmental protection for short-term rapid growth; it did not recognize the real costs of growth and postponed some of the costs (e.g., environmental clean up) by letting them accumulate in the form of a stock of pollution (Gregory and Stuart 1974, p. 410).

Implementation of Central Planning: Perhaps the most powerful explanation of environmental disruption in the Soviet Union and other CPEs is that the perfectly-centralized system of decisionmaking foreseen in the socialist economic model has not proven to be practical in the real world (Gregory and Stuart 1974, p. 411). First, contrary to central planning myth, most crucial economic decisions are not made by a small group of planners at the apex of the planning hierarchy with a broad view of the economy. In reality, they are made by ministerial and regional authorities and by plant managers none of whom can—or cares to—see the entire economy and the effects of a given decision on different aspects of the economy (Gregory and Stuart 1974, p. 411).

Second, ministries and other organizations with decisionmaking power in charge of managing a given industry and promoting its growth also have responsibility for preventing environmental damage by that industry (Kelley 1972, p. 571). Opponents of projects find themselves in the awkward position of having to lobby against national ministries or regional organizations on projects they believe create environmental disruption; these same organizations, in theory, are responsible for preventing environmental disruption (Gregory and Stuart 1974, pp. 411-412). According to Kramer (1974, p. 887), the reality of the Soviet system differs substantially from the theo-

ry of a centrally-planned monolith state that pursues the true interests of society. Instead, “government bureaucracies in the Soviet Union appear to be the functional equivalent of the capitalist entrepreneur who greedily pursues his private gains to society's detriment.”

Third, central planning has relied almost exclusively on fulfilling output goals. Less quantifiable goals—such as cost reductions, innovations, and environmental quality—have played a very limited role in decisionmaking (Gregory and Stuart 1974, p. 411).

And fourth, investment planning has tended to favor industrialization through the creation of new production capacities rather than through retrofitting of existing ones. Investment policies promoted the building of new plants rather than modernizing existing heavy industry enterprises—gigantic plants that were technologically obsolete and generated large amounts of pollution. The emphasis on quantitative targets meant that older plants were kept in production as long as they met output plans, without regard to the pollution they generated (Satre Ahlander 1994, pp. 30-31).

SYSTEMIC REASONS FOR ENVIRONMENTAL DISRUPTION UNDER SOCIALISM

There are certain characteristics of CPEs—mostly arising from the pervasive role of government in the economy—that generate pressures resulting in environmental disruption. According to an analyst,

It is possible, at one extreme, to inflict great damage [to the environment] whilst generating very little economic welfare; on the other hand, it is possible to generate significantly more welfare with relatively little environmental disruption. It is now clear that the communist economic and political systems are the worst embodiment of the former extreme. The East European countries, currently in transition from communism, are incomparably less prosperous, while being more environmentally damaged, than the industrialized Western nations. A cynic might say that industrial effluent and atmospheric pollution per unit of national product was the only field where the ... [Eastern Europe] ... has secured a decisive lead over the Western nations (Sobell 1990, p. 47).

Some of these systemic characteristics—what Goldman (1970, p. 41) calls “incentives to pollute under socialism”—have been mentioned earlier, but they are discussed briefly below for the sake of providing a fuller presentation.

Marxist theory of value and pricing of natural resources: Unless some specific exception is made, resources under the Marxist labor theory of value are treated as free goods. For many years, the Soviet Union treated natural resources in this fashion in its planning system. Thus, whenever mine operators or oil drillers had exploited the most accessible ore or oil deposits, they moved to a new site where average variable costs were lower, wasting valuable ores and multiplying environmental disruption (Goldman 1970, p. 41). In the 1970s, resource valuation was raised to a priority economic task because of rising extraction costs for a number of mineral and other natural resources, and low rates of nominal rate of return to capital in extractive industries (Thornton 1978). Despite these efforts, the proper valuation of natural resources continues to be an intractable problem for socialist economies.

Central planning's emphasis on quantitative goals: Managers and state officials in CPEs were judged almost entirely on the extent to which they fulfilled quantitative production goals (Goldman 1970, p. 41). Given this virtually single evaluation criterion, there is no incentive for managers or state officials to divert productive resources from output-generating applications in order to preserve the environment.

Unbalanced growth: The emphasis on economic growth through industrialization created an industrial structure in CPEs biased toward heavy industry. Heavy industries tended to be prominent users of energy and raw materials; CPEs consumed about twice as much energy (and even more raw materials) to produce one unit of gross domestic product than the advanced capitalist countries, and they used less efficient and more ecologically offensive fuels such as coal and lignites in doing so (Sobell 1970, p. 47). The priority assigned to heavy industry, a major contributor to pollution, coupled with the low level of environmental technology, explains why industrial

pollution of the atmosphere was substantial in the former Soviet Union and Eastern and Central European socialist nations (Satre Ahlander 1994, p. 7).

Another example of unbalanced growth and its impact on the environment is the experience of the chemical industry of the Soviet Union. In the early 1960s, Khrushchev ordered that the Soviet Union should have a large chemical industry, and in response, numerous plants sprung up throughout the country. The decision to enlarge the chemical industry, and its implementation, were so sudden, that there was not sufficient time to consider the environmental disruption that would be caused (Goldman 1970, p. 41).

Failure to use potential economies of scale arising from state ownership of resources: In the Soviet Union and other CPEs, economies of scale were used against the environment: “rather than mobilizing resources to protect the environment, they were mobilized to combat the environment and change it in order to facilitate the fulfillment of politically determined production targets” (Satre Ahlander 1994, p. 21). Contrary to what was argued on theoretical grounds by supporters of socialism, state-owned companies have been no different from privately owned companies in the extent to which they have damaged the environment (Dahmén 1971, pp. 44-45). The lack of private property in CPEs means that these economies are also unable to measure private costs, as there are no private property owners to complain about decisions that affect their holdings or estimates of the value of the damage (Goldman 1970, p. 41).

Land tenure and extensive agricultural cultivation techniques: In most CPEs, land was in the hands of the state, typically organized in large enterprises and relying heavily on tractors and other mechanized equipment. Increases in production were based on bringing additional land under cultivation or introducing additional productive inputs (extensive cultivation). This agricultural production model was very disruptive of the environment: the pressure for additional agricultural land required massive irrigation projects and threatened water resources, heavy tractors compacted the soil and added to erosion prob-

lems, generous application of fertilizers and pesticides polluted water resources and affected the quality of food and public health (Satre Ahlander 1994, pp. 18-19). Agriculture was the heaviest polluter of water and soils in the former Soviet Union (Danilov-Danilian 1993, p. 33).

More broadly, collectivization created serious problems related to the stewardship of natural resources, which was most evident in the agricultural sector. Agricultural workers, who did not own the land they farmed, had little incentive to conserve resources. Relatively simple soil conservation techniques, such as crop rotation, were abandoned in the Soviet Union as input-intensive agriculture was embraced. This was less of a problem in other CPEs—such as Poland—where a significant portion of agricultural land remained in private hands.

Ineffective regulation: In theory, CPEs are a regulator's paradise: nearly all productive resources are owned by the state and the central plan, with its very detailed input and output targets, provides a very powerful instrument for regulators to influence production processes. The reality is very different. Hungarian economist Kornai (1992, pp. 140-145) has observed that enterprises in CPEs operate under a “soft budget constraint,” meaning that if they overspend their financial plan, they can turn to the state for additional financial resources. Losses are financed by the state because drastic actions such as insolvency, bankruptcy, and plant closure create worker dislocations and are avoided at all costs.

Monetary penalties (fines) for violations of environmental standards, one of the strongest instruments available to regulators, are meaningless in the presence of soft budget constraints and do not create incentives for managers to comply. When they are used, fines tend to be very low in comparison with environmental disruption being done or alternative ways to remedy it. Goldman (1970, p. 39) relates the case of paper and pulp mills operating near Lake Baikal and threatening its ecosystem. A technological solution to the effluent problem caused by the mills was to build a sewage conduit to transport the effluents to another location where they could be properly disposed. Construction of the bypass was estimated

to cost \$40 million, while the mills were assessed fines of \$55 for each violation. This disparity may be responsible for what Goldman calls the “lack of enthusiasm” on the part of mill managers to pursue the technological solution. Because fines are paid out of enterprise funds, this is tantamount to the state paying itself, and guilty managers in practice suffer no effective penalty when rules designed to stop pollution are ignored (Nove 1980, p. 79).

Fragmentation of decisionmaking: The ministerial system of economic decisionmaking that prevails in CPEs creates coordination problems and barriers to the efficient use of resources. The problems associated with the ministerial system of economic decisionmaking, and its ability to generate environmental disruptions, are most evident in large projects and in instances where the sequencing of activities is critical. Because responsibility in large projects is shared by several agencies, it is easy to shift blame to another organization and no one is answerable for environmental disruption. For example, eight different departments or ministries had responsibility for the development of a timber complex in Siberia where the potential for environmental damage was considerable (Nove 1980, p. 80). Different ministries have responsibility for the extraction of various types of minerals, wasting valuable natural resources and harming the promoting environment:

... many ores in nature appear in complex compounds intermingled with other minerals. Thus iron ore may also contain copper and lead and apatite may be combined with nepheline, a valuable mineral used in the production of aluminum. Unfortunately, the Ministry of Ferrous Metallurgy is usually unauthorized to process non-ferrous metals, and has no funds to handle such materials. As a result, it frequently happens that the spoils that are discarded are more valuable than the basic product that is extracted (Goldman 1973, p. 63).

The bureaucratic fragmentation of administrative responsibility has a more direct effect on the environment since each ministry or organization is responsible for setting standards for the area of the economy over which it exerts responsibility. The bureaucratic fragmentation for setting pollution standards and en-

forcing them leads to confusion and raises potential conflicts between regulatory agencies and the industries and municipalities they regulate. Environmental control is next to impossible when there are numerous ministries involved and each is charged with regulating its own particular sector. The multiplicity of agencies and ministries with some control means that ultimately no single agency is assigned overall responsibility (Goldman 1973, p. 59).

Lack of central environmental authorities: CPEs traditionally charged sectoral ministries with the simultaneous use and protection of natural resources. Each ministry established environmental standards with regard to the sector under its competence, made administrative decisions that affected the use of resources and protection of the environment, and received complaints from the public regarding environmental disruption. Agencies charged with using natural resources tend to be less than forceful in enforcing environmental mandates (Kelley 1976, p. 571).

Scarcity of capital: Pursuit of rapid growth and industrialization created a chronic shortage of capital in the Soviet Union. One of the strategies pursued by the government to deal with this shortage was to stretch available capital as far as possible. Inevitably, this meant that expenditures for non-productive construction and equipment (e.g., electrostatic precipitators for air treatment, water treatment systems, tertiary treatment plants for sewage control) were systematically dropped from investment projects in order to permit the financing of other projects that increased production (Goldman 1973, p. 58).

Lack of political accountability: The absence of political accountability in CPEs aggravated their inability to respond effectively to signals of environmental distress. Political and economic power rested with the communist party, which granted freedom to economic sectors to pursue their activities—including the freedom to pollute—so long as they produced the goods (Kabala 1992, p. 10).

Weak environmental movement: Environmental citizen lobbies in CPEs tended to be weak, and their ability to influence government actions was very lim-

ited. In the Soviet Union, environmental citizen lobbies, whether semi-official public conservation organizations or informal coalitions of environmentalists formed on certain key issues (such as the preservation of Lake Baikal), lacked extensive organizational base and the direct links with important party and state agencies that characterized their opponents in industry (Kelley 1976, p. 578). The weakness of environmental citizen lobbies in the former Soviet Union is consistent with the “atomization” of society that characterizes CPEs (Rev 1993, p. 12). Officials who make decisions that affect the environment in CPEs are not politically accountable; they typically “do not have to face a voting constituency which might reflect the conservation point of view, such as the League of Women Voters or the Sierra Club” in the United States (Goldman 1970, p. 41).

Control of information: One of the reasons for the weakness of environmental movements in CPEs was the control of information by the central government. The very limited amount of information that was disseminated placed the public at a disadvantage in challenging government action. In particular, “access to information on pollution—the principal weapon of citizens’ groups in any country—was frustrated by the predilection toward secrecy in communist systems. For a long time, secrecy limited the degree of public pressure that could be brought to bear on the government to force environmental quality” (Kabala 1992, p. 11).

THE SOCIALIST AGRICULTURAL DEVELOPMENT MODEL

While the specific features of the socialist agricultural development model embraced by socialist countries varied from place to place according to political, cultural and national circumstances, the basic blueprint was inspired by the Soviet Union’s historical experience. The features of this model are central to a study of the Cuban environmental situation and prospects given Cuba’s predominant agricultural character and the fervor with which the ruling socialist elite replicated it in the island.

The essential characteristics of the agricultural organizational model that emerged in the former Soviet Union and was later adopted by other socialist coun-

tries were: 1) large-scale production units; 2) extensive cultivation; 3) mechanization; 4) technological interventions; and 5) heavy use of agricultural inputs such as chemical fertilizers and pesticides. They shaped Soviet agricultural policies and practices, and resulted in chronic agricultural shortages and environmental degradation. In the 1960s and 1970s, Cuba adopted the Soviet agricultural organizational model and, not surprisingly, replicated that country’s negative record on agricultural production and preservation of the environment.

One of the first actions of the Bolshevik regime in 1917 was to confiscate large estates and to distribute land among the peasants. This change in land tenure meant that Russian peasants were no longer obligated to deliver a predetermined share of their output to landlords (as rental fees) or to the state (as taxes or principal payments) and for the first time had the freedom to make decisions regarding production of agricultural output and its marketing. A year later, as part of the regime of war communism, the Bolshevik leadership under Lenin introduced a system of requisitioning of agricultural surpluses from peasants, with the police serving as enforcers. However, the New Economic Policy (NEP) that began to be implemented in 1921 reversed the latter policy and allowed peasants to retain control over their land. It has been estimated that in the late 1920s, individual peasants farmed over 95 percent of the land; the Soviet government’s role in agriculture during this period was primarily as a purchaser of grain from individual producers (Pryor 1992, p. 15).

In 1929, the Communist Party under Stalin’s leadership began a ruthless drive to collectivize agriculture. By the mid-1930s, the collectivization process was essentially completed. It has been estimated that in 1938, 93.5 percent of peasant households were in collective farms (Gregory and Stuart 1974, pp. 106-107). In the late 1920s, Stalin argued on a number of occasions that simply combining farms would lead to increases in agricultural production; a further economic rationale for collectivization he often used was that small peasant farming produces the smallest marketable surplus, intimating that large-scale pro-

duction units would benefit from economies of scale (Pryor 1992, p. 46).

The predominant form of collective production organization in the former Soviet Union was the collective farm or *kolkhoz*, in theory a cooperative organization in which the peasants voluntarily joined to till the soil using means of production contributed initially by those who joined. Another important form of collective organization was the state farm or *sovkhos*, essentially “a factory in the countryside” (Gregory and Stuart 1974, pp. 232-233) owned by the government where workers were wage earners. Although ideologically the state farm was considered a superior type of economic organization—or a higher type of “socialist property”—than the collective farm, the two forms of organization coexisted in the Soviet Union. State farms gained in importance in the 1940s and 1950s, however, as collective farms were consolidated into larger state farms and new lands brought under cultivation were organized as state farms (Gregory and Stuart 1974, p. 244; Volin 1962, pp. 252-253).

Large-scale production units: Farm size is a function of many variables, including population density, quality of the soil, climatic conditions, kind of crop grown or animals raised, etc. Even after accounting for differences in these variables, farming units in the Soviet Union tended to be very large. Among the economic reasons that have been given in the literature for large farm sizes in the Soviet Union are (Thiesenhusen 1995, p. 32):

- modern production techniques can be introduced much more quickly in large-scale farming than in family farms because of centralized management—instead of training millions of individual farmers only some thousand have to be trained;
- large-scale farming is more efficient because full advantage can be taken of mechanization;
- capital and credit are more accessible at more favorable terms;
- marketing and quality control can be achieved more efficiently; and

- planning can be executed more skillfully.

In Nove’s view, the economic arguments in favor of large farm units in the Soviet Union can be reduced to one: administrative convenience (Nove 1965, p. 3).

In addition to economic reasons for large-scale agricultural production units, the ruling ideology also justified such pattern of land concentration. Volin (1962, p. 254) identifies “farm giantism” as a distinctive trait of Soviet agricultural organization. He states:

The cult of bigness, a feature of Soviet policy, has its ideological roots ... in the orthodox Marxist doctrine of economic concentration, which stresses the similarity, as far as large-scale methods of production are concerned, between agriculture and manufacturing. This doctrine, which makes no distinction between the large and the optimum size of an enterprise, was further reinforced by the unbounded enthusiasm of Lenin and his disciples for farm mechanization, modeled on the American pattern. It was one of the motivating forces in the collectivization of small peasant agriculture and establishment of huge state farms.

The Soviet proclivity toward large-scale operations in industry has also been referred to as “gigantomania” (Gregory and Stuart 1974, 246). According to Laird (1965, p. 149):

From the beginning of Bolshevik rule, traditional Russian gigantomania, arising largely out of a sense of the vastness of the land, was wedded to the Marxist-Leninist conviction that large industrial enterprises are superior organization forms. Therefore it has almost always been assumed that the larger Soviet farms are better.

Nove (1965, p. 2-3) reports that the average size of a Soviet *kolkhoz* increased five-fold between 1949 and 1961; the average size of *sovkhoses* increased as well, although at a slower pace.

Extensive cultivation: Another feature of the Soviet agricultural model was extensive cultivation. With no rent charged for land, it was sound economic decisionmaking by farm managers to increase production by expanding the size of the farm units rather than by

more intensive cultivation of existing units (Raup 1990, p. 101).

For example, to address the chronic problem of shortfalls in agricultural production—especially of grains—the Soviet Union under Khrushchev engaged in a campaign to expand cultivation to lands that theretofore had not been used for agricultural purposes. The so-called “virgin lands program,” which began in 1954, brought large tracts of land in Siberia and Kazakhstan under cultivation. By 1960, 42 million hectares of land had been reclaimed and seeded, roughly 20 percent of all sown land in that year (Gregory and Stuart, 1974, p. 243). Between 1953 and 1961, total cropland expanded by 30 percent in the Soviet Union as a whole (Zoerb 1965, p. 29).

Although the virgin lands program was a great success in terms of land brought under cultivation, and agricultural output rose in the short term, long-term results were poor. Allocations of agricultural machinery to the virgin lands program were large and were made at the expense of other agricultural areas. Much of the new virgin lands brought under cultivation were marginal in terms of quality of the soil and, more important, subject to hazardous climate—dry, hot winds that blew into the virgin lands from the Central Asian deserts coupled with Arctic winds that brought snow as early as August, and uneven rainfall (Willett 1962, p. 101).

Massive crop failures in the 1960s ushered changes in farming methods and agricultural management aimed at overcoming inefficiencies. The emphasis of these changes was on more intensive exploitation of areas already under cultivation instead of further extension of the sown areas (Novak-Decker 1965, p. 193). Nearly two decades later, increases in agricultural productivity through intensification of farming on existing agricultural farmland was one of the objectives of Gorbachev’s *perestroika* in the agricultural sector (Laird and Laird 1990, pp. 109-110).

Mechanization: As noted above, Lenin’s “unbounded enthusiasm” for American-style farm mechanization was instrumental in shaping the Soviet Union’s

collectivist agricultural model. Volin (1962, p. 250) writes:

In developing agriculture along new collectivist lines, the Communist rulers were guided by the Marxist orthodox doctrine of the absolute superiority of large-scale production in agriculture as in industry. Lenin added to this doctrine the enthusiasm for that American invention, the tractor, as a vehicle for collectivist transformation of small peasant agriculture. As far back as 1918 he thought that if the Russian peasants were given 100,000 tractors and supplies needed to operate them, they would plump for communism, which he recognized was merely a fantasy in those days.

To make agricultural mechanization services available to small peasant farmers too poor to afford their own machinery, the Soviet authorities created state machine tractor stations (MTS). These were special units that brought together tractors, combines and other large farm machinery together with facilities for operating machinery and repairing and supervising personnel. After collectivization, farm sizes increased greatly and the importance of mechanization rose: “he who controlled the tractor—the new form of farm power—controlled agriculture” (Volin 1962, p. 258). Since collective farms were not allowed to own machinery, MTS wielded enormous power and decisions made by MTS managers had tremendous impact on agricultural output. The MTS were scrapped in 1958 and henceforth collective farms were allowed to own and operate agricultural machinery.

The drive toward more intensive and efficient agricultural exploitation undertaken in the late 1950s and early 1960s relied heavily on mechanization. A very large share of investment in the agricultural sector was devoted to the procurement of agricultural machinery and equipment, assigned mainly to state farms, but also to collective enterprises. Despite the large investments in agricultural machinery and equipment, mechanization imbalances were commonplace: some operations, like harvesting grain, were highly mechanized, while others, such as cleaning and drying grain, were still largely carried out inefficiently by hand labor (Volin 1962, p. 269).

Technological interventions: Soviet authorities had a proclivity to rely on “campaigns” from above to try to resolve the chronic agricultural problems of the country. These campaigns often involved grandiose schemes that relied on scientific and technological solutions to bottlenecks arising from limitations on cultivable land resources. The view that science and technology could conquer the problems of soil quality and unsuitable climate spread the myth of the unlimited agricultural resources of the Soviet Union and diverted attention from the management and incentives problems that were at the center of the agricultural production quagmire.

Among the best documented of these agricultural campaigns based on technological interventions are:

- The so-called “Stalin Plan for the Transformation of Nature,” introduced in the 1940s, and consisting of: 1) a plan for planting shelter belts and reforestation; 2) a plan for introducing crop rotations with perennial grasses; and 3) a plan for building ponds and other reservoirs for storing water from local sources for the purpose of limited irrigation and water supply (Timoshenko 1953, p. 254).
- A massive project to turn semi-arid lands of several Central Asian republics into a cotton producing area. This required technological intervention in the form of a massive irrigation scheme in the Aral Sea basin that drew water from the Syr Darya and Amu Darya rivers, two of the main feeders of the Aral Sea (Akiner 1993, p. 256).

As Nove (1980, pp. 131-132) has said about these campaigns:

Some [of the campaigns] were built around much-publicized projects, or methods. The list is a long one. The introduction of an alleged rubber-substitute plant, *kok-sagyz*, occupied space in the press in the thirties, as did the raising of rabbits, and the *travopolye* (ley grass) crop rotation scheme. Then after the war came Stalin’s “plan for the transformation of nature.” ... More recently, under Khrushchev, there was a whole series of campaigns: the ploughing up of virgin and fallow lands, expansion of acreage under

maize, “overtake America in the production of meat and milk,” reduction in the area under sown grasses, the introduction of two-stage harvesting, the use of “peat-compost pods” (*torfo-peregnoynye gorshochki*).

At another level, the “campaign” mentality had perverse impacts on agricultural production. For example, sowing had to be completed and reported to the central authorities by a certain date whether or not the soil and climate conditions called for such activity; often, the method of sowing (e.g., sowing corn in squares rather than rows) was dictated by the central authorities as part of a campaign. The same held for harvesting. In the Soviet Union in the 1950s, the Party prescribed a campaign to engage in “two-stage” harvesting of grain, where the grain was cut at one date and it was picked up for threshing at another, regardless of the ripeness of the grain and whether the delay in threshing would affect yields and quality of the grain. The priority of the local authorities was to report fulfillment of plans related to the use of the “advanced” two-stage harvesting method rather than grain output (Nove 1965, pp. 10-11).

Use of agricultural inputs: Faced with stagnation of production by the agricultural sector, Khrushchev coined a new version of Lenin’s slogan by declaring that “Communism is Soviet rule, plus electrification of the whole country, plus ‘chemicalization’ of the economy” (Novak-Decker, 1965, p. 193).

Demand for fertilizers and pesticides grew rapidly in the 1950s as a result of the expansion of land under cultivation pursuant to the virgin lands program. Chemical fertilizer production increased rapidly as well, with the expansion of chemical plants and facilities to mine large deposits. The drive to cultivate land more intensively and efficiently resulted in even higher usage of fertilizers and pesticides in collective and state farms.

Poland, where agriculture remained largely in private hands during the socialist period, provides an interesting contrast to the Soviet agricultural model with regard to use of fertilizers and pesticides. Cook (1988, pp. 136-137) makes the point that fertilizer use in Poland declined in the 1980s and that Poland ranked near the bottom in Europe in the use of plant

protection chemicals, such as herbicides and pesticides.

THE ENVIRONMENT AND SOCIALISM IN CUBA: INSTITUTIONS AND PRACTICE

In the early 1960s, the Cuban government adopted socialism and began to replicate in the island the institutions and practices that (mis)managed the economy in the Soviet Union and Eastern Europe. As was the case in the latter countries, socialism in Cuba engendered environmental degradation. Specific instances of such environmental degradation have been documented in numerous official publications (e.g., Ministerio de Ciencia, Tecnología y Medio Ambiente 1995, 1997) and unofficial sources (e.g., Oro 1992; Wotzkow 1998). Rather than covering this same ground, this section of the paper describes selected features of socialism in Cuba that illustrate how closely it paralleled institutions and practice in the former Soviet Union and Eastern Europe and raise concern about the environmental implications for the island.

Centralized decision making: As in other socialist countries, political and economic decision making in Cuba is invested in the Communist Party. All government officials in leadership positions are also members of the Communist Party. In practice, key political and economic decision making rests within a small group of Communist Party officials dominated by President Fidel Castro. Alternative political parties to the Cuban Communist Party are not allowed and public expressions of dissidence from Party views are severely punished. Popular elections for the top leadership positions have not been held in the island for the nearly 40 years that the Castro regime has been in power.

Collectivization: Although data to make precise comparisons of the degree of collectivization across socialist countries are not available, fragmentary information suggest that at the end of the 1980s, state ownership of the means of production in Cuba was as significant, if not more so, than state ownership in other socialist countries. In the late 1980s, Cuba was among the socialist states with the highest percentage of agricultural land in state farms. Similarly, the share of national output generated by the state sector in

Cuba in 1989 (96 percent) was comparable to East Germany's and higher than the share produced by the state sector in Hungary, Poland, and Vietnam (Pérez-López 1995, pp. 38-44). Structural changes made in the 1990s, for example the break-up of state farms and the creation of Basic Units of Cooperative Production (*Unidades Básicas de Producción Cooperativa*, UBPCs) as well as the promotion of joint ventures with foreign investors, have reduced somewhat the share of the state's ownership of productive resources, but it remains very high.

Central planning: By the 1970s, Cuba had adopted full fledged physical central planning mechanisms to manage its economy. These mechanisms paralleled very closely those in place in the Soviet Union and Eastern Europe and were established with technical assistance from the latter countries. Cuban government planners drew up very detailed annual plans which covered imports, investments, domestic production, exports, and so on. Once adopted by the Communist Party/government, these plans carried the force of law. Cuban planners also developed longer-term plans, typically five-year plans, which were coordinated with other socialist countries. As in the Soviet Union, there were many instances in which central directives were implemented within the framework of national campaigns; the best known instance was the national mobilization to produce a ten million-ton sugar harvest in 1970.

Industrialization: Imbued by industrial prowess of the socialist countries, the Cuban leadership embarked in the 1960s on a rapid industrialization path that foresaw the establishment of heavy industries in the island. Plans called for the construction of integrated steel mills, metalworking complexes, and even automobile production plants. These plans were set aside when it became apparent that Cuba did not have the natural resource base to support these industries, but the fascination with industrial gigantism remained. Manifestations of industrial gigantism are the very large plant to produce sugarcane combines in Holguín and the incredibly ambitious nuclear power program conceived in the 1970s that would have built three nuclear power plant complexes—with as many as 12 nuclear reactors—across the is-

land. Industrial plants imported from the Soviet Union and Eastern Europe—to refine metals, to manufacture chemicals, cement, and paper products—embodied the same environmentally unfriendly technology that caused environmental damage in these countries.

Large-scale agriculture: In 1963, the Cuban government redefined its development strategy to give agriculture—and sugar in particular—a central role. The new agricultural strategy, inspired by the Soviet agricultural model of gigantism and extensive agricultural production, included significant expansion in the area devoted to sugarcane cultivation, increase in the use of chemical inputs, intensive use of irrigation, and mechanization of sugarcane cultivation and harvesting. Sugar cane lands that had been nationalized and turned into cooperatives were converted into large state farms to reap economies of scale in mechanization, irrigation, fertilizer application, etc. Progressively, private farmers were coopted to give up their land and to turn it over to the state to increase the size of state farms and other forms of collective farming. Large-scale farming in state-owned land was the predominant form of agricultural production in Cuban until the 1990s, when UBPCs were established.

Institutions: To manage its socialist economy, Cuba built institutions that mirrored very closely those in the Soviet Union and Eastern Europe. This was, in part, a practical necessity: as Cuba deepened its ties with the socialist community and domestic organizations had to be created to interact with foreign counterparts. Cuba's central planning institutions resembled very closely those of other socialist countries; they were built with technical assistance from the socialist countries, and these countries provided classroom and hands-on training for key personnel.

One form of institutional development inspired by the Soviet Union and Eastern Europe that had an adverse impact on the Cuban environment was the creation of industry-specific ministries which had responsibilities for both industry promotion as well as pollution control and conservation of resources. Examples are the Ministry of the Sugar Industry (*Ministerio de la Industria Azucarera*), the Ministry of

the Steelworking Industry (*Ministerio de la Industria Sidero-Mecánica*), and the Ministry of the Construction Industry (*Ministerio de la Industria de la Construcción*). Environmental protection agencies were empowered to investigate violations of environmental laws and regulations by state enterprises, but enforcement was reserved for the corresponding Ministry responsible for the industry.

Environmental information: Socialist Cuba has emulated the Soviet Union and the socialist countries of Eastern Europe with regard to the lack of public access to environmental information. The Cuban government controls all forms of media and exercises very strict controls over the form and amount of environmental information made available to the public. On occasion, specific instances of environmental degradation (e.g., environmental damage caused by open pit mining, garbage that pollutes beaches, wastes dumped illegally in streams and rivers) is featured in the official media, but generally with a political purpose, such as building support for a government-led economic initiative or singling out officials who may become victims in power struggles within the Communist Party. Statistical yearbooks and other official sources do not provide time series data on environmental indicators.

Lack of environmental NGOs: Cuba has the dubious achievement among socialist countries of not permitting independent environmental non-governmental organizations (NGOs) to operate openly. This is so despite the fact that the Cuban Constitution of 1976 recognizes the freedom of Cuban citizens to associate freely and allows the formation of mass and social organizations; the Constitution also guarantees the right of mass organizations to exist and to own property. In 1988, the Cuban government dissolved the Life Naturist Association (*Asociación Naturista Vida*), an organization established in the 1930s that brought together individuals interested in environmental matters (Alfonso 1991); it also arrested the leaders of the Green Path Ecopacifist Movement (*Movimiento Ecopacifista Sendero Verde*), a group created in 1998 with the objective of restructuring the Cuban political system to enhance ecological principles and spoused returning land to

farmers and using solar rather than nuclear energy for electricity generation (Santana 1992).

SUMMARY AND IMPLICATIONS

The environmental devastation in the former Soviet Union and in Eastern Europe that became evident upon the fall of socialism in 1989-90 and the lifting of the information curtain enveloping these countries makes it abundantly clear that the theoretical arguments about the compatibility between socialism and environmental preservation had very little to do with reality. In fact, the breadth and depth of environmental disruption in these countries surpassed the expectations of even the most pessimistic observers. Environmental degradation was generalized, affecting air, water, and land/vegetation.

Certain characteristics of centrally planned economies—mostly arising from the pervasive role of government in the economy—make them prone to environmental disruption. These characteristics include the emphasis of central planning on quantitative goals, unbalanced growth that favored the heavy industry sector, lack of political accountability,

weak environmental movement, close control over information, land tenure and extensive agricultural techniques, ineffective regulations, etc.

In the early 1960s, Cuba embraced political and economic relations with the Soviet Union and the socialist countries of Eastern Europe. These countries became Cuba's principal economic partners, purchasing the bulk of Cuba's exports and providing most of the island's imports, including its industrial plant and equipment. Industrial plants imported from the Soviet Union and Eastern Europe embodied the same environmentally unfriendly technology that caused significant environmental damage in these countries.

Over nearly four decades, Cuba has been an avid practitioner of socialism, replicating the range of institutions and policies implemented in the Soviet Union and the Eastern European socialist countries. Unfortunately for Cuba, it would not be surprising if the legacy of socialism in Cuba is environmental disruption in the island mirroring that experienced by the Soviet Union and Eastern Europe.

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