PART VIII

Consumption and the Environment

Overview Essay

by Jonathan Harris

The consumption of the average U.S. citizen requires eighteen tons of natural resources per person per year and generates an even higher volume of wastes (including household, industrial, mining, and agricultural wastes). Some of these wastes are released to the atmosphere, rivers, and oceans; others are landfilled or incinerated; a small proportion are recycled. The standard conception of economic development envisions the rest of the world's population as moving steadily up the ladder of mass consumption, eventually achieving levels similar to those achieved by the United States and some European economies. Clearly, the environmental implications of the global spread of mass consumption for resource use and environmental waste absorption are staggering. Should not this promote some rethinking of economic theories of consumption, which for the most part have ignored resource and environmental implications?

The articles in Part VIII address both theoretical and practical aspects of this question. We have already become familiar with critiques of the simple economic theory of utility maximization through consumption of goods. The hypothetical consumer at the center of this theory is devoid of social relationships, ethical principles, or any relationship to the natural world. His or her satisfaction is measured only in terms of quantities of goods and services consumed, and the science of utility maximization is concerned primarily with the choice of how to balance consumption among various alternatives offered in the marketplace. The individual's role as consumer is independent of involvement in the productive process, in which capacity his or her labor is sold in the market for the best possible wage. The only link between the two activities is that the money earned through work provides a budget for consumption. Income may also be saved, but savings serve ultimately to support future consumption via the increased production that results from investment.

The limitations of this abstract perspective in explaining the real-world growth of mass consumption have been extensively explored in earlier parts of this volume. In this part we will find that there is a significant overlap between the socially oriented critique of consumption theory and the ecologically oriented analysis of the impact of mass consumption on the natural world.

One of the few economists to draw attention to this overlap at an early stage was John Kenneth Galbraith, whose prescient article "How Much Should a Country Consume?" appeared in 1958. Galbraith called for an investigation into resource and environmental problems that might be posed by ever-growing consumption; he argued for a reorientation from consumption patterns "which have a high materials requirement to those which have a much lower requirement [such as] education, health services, sanitary services, good parks and playgrounds, orchestras, effective local government, a clean countryside." He deplored the economic forces that promote "an inordinate concentration of our consumption on what may loosely be termed consumer hardware."[1] In this short article, Galbraith prefigured by several decades themes that have more recently been developed in detail, motivated by a sharper awareness that the resource and environmental problems of consumption are now not hypothetical but well advanced and continuing to grow exponentially.

The Social and Environmental Implications of Market Consumption

The initial article summarized here, by Mark Sagoff, focuses on one such essential theme in the overlap between social and ecological critiques of consumption theory. Sagoff distinguishes between the individual as consumer and the individual as citizen. In the arena of public policy, we may make choices that are significantly different from those related to individual consumption. In particular, Sagoff envisions an individual who participates in mass-consumption patterns while supporting an environmentally oriented public policy. At one level, this might be taken simply as evidence of hypocrisy—being prepared to advocate collective sacrifice in a good cause, but at the same time being unwilling to give up personal comforts. But this would be to oversimplify, ignoring the essential role of institutional change. Faced with a crumbling public transit system and highways unsafe for bicycling, people will naturally drive. Given a well-run and convenient public transit system, and safe bicycle paths, many more "individual" choices will be made in favor of nonautomotive transportation. (U.S. citizens who believe that "a well-run and efficient public transportation system" is an oxymoron might consider the systems of many European cities.)

This brings up the issue of what we mean by an "individual" choice. Almost any seemingly "individual" decision to purchase a good is tied to a web of public policy choices. An economic textbook example might present the consumer making a choice to purchase a pound of butter. But behind that simple choice lie many institutional factors. Is the butter local or has it been shipped from a long distance? That may depend on whether the state has a policy of preserving farmland, taking into account environmental and aesthetic externalities. It also depends on whether the national government taxes or subsidizes energy production, affecting long-distance hauling costs. Is the butter produced with artificial chemicals and hormones? This depends on agricultural and environmental policies. Does the consumer know whether or not artificial chemicals and hormones are used in production? That depends on food labeling laws. Will a cholesterol-conscious consumer aim at cutting down butter consumption? This may depend on public health policies and information. Has the butter been produced under humane conditions on the farm? That will depend on agricultural regulations and public sentiment. Has the butter been adequately refrigerated and is it free from contaminants? Those will depend on food inspection laws. In even the simplest consumption decision, a multitude of factors are involved; only a small portion of the information relating to these issues can be conveyed to the consumer through the economic "information carrier" of market price.

The economic doctrine of "consumer sovereignty" is thus put in a different light. Consumers can exercise their power through the market by selecting purchases based on price and other information easily available to them. But to affect the multitude of other factors shaping the market itself, they must be involved in public policy issues. This reality is especially evident in the area of environmental policy, as Sagoff emphasizes. The environmental issue is thus linked to a broader critique of the economist's concept of a "utility function," which somehow balances all of an individual's needs and desires. It has been well established in economic theory that it is impossible to derive a "social welfare function" that somehow adds up all of the individual preferences of consumers.[2] The area of social relations and public policy has, so to speak, a life of its own, which cannot be reduced to individual preference functions. The ethical values that provide the basis for social cohesion cannot, therefore, be excluded from any theory of consumption in the pursuit of a "value-free" science. Sagoff clearly makes this point by using examples concerning consumption and the environment, but its implications must extend to all aspects of consumption theory and of economic theory in general. Once the myth of the sovereign individual consumer falls to the ground, the many "free market" policies that it serves to justify are thrown into question.

This line of thought is developed further by Mario Cogoy. He introduces

the idea of a "boundary" between market and nonmarket aspects of consumption that can be generalized to apply to the boundary between market and nonmarket elements of human life. The overextension of the market sphere, he argues, has negative implications both for social life and for the environment. But it is very difficult for the individual to resist the institutional forces promoting excessive marketization. Thus the individual purchases and relies on an automobile for transportation, depends on the utility company to deliver home energy, and relies on prepackaged foods from the supermarket. The implications of these choices (such as excessive fuel use, generation of carbon emissions or nuclear waste, energy used in processing, and increased waste from packaging material) are remote from the individual purchasing the products. Were he or she instead to walk or bicycle, spend time insulating the house, and cook meals from basic ingredients, the environmental impacts would be lessened—but the time pressures of work make such a lifestyle impossible for many people.

In accepting increasing marketization as normal, and recommending it strongly to developing nations as a route out of poverty, we tend to ignore such negative correlates. Again, the effects on resource consumption and the environment are especially evident, but the insidious effects of the shifting boundary are more general. The undermining of community and family, as well as the replacement of spiritual values with commercial ones (effects discussed extensively in other parts of this volume) are now joined by the distancing of the individual from the natural world, with attendant environmental degradation.

It is, of course, possible to think of counter examples, in which increased marketization benefits the environment through the spread of resource-saving technology. Most such examples, however, involve the replacement of one set of environmental problems with another. "Modernized" agriculture may help limit conversion of forest and savannah by making possible higher yields on existing acreage, but the trade-off involves increased fertilizer and pesticide pollution. Modern sawmills waste less wood, but may increase overall timber exports by raising their profitability. The replacement of wood and dung fuels with oil-based fuels limits pressure on agro-ecosystems, but increases carbon emissions. Overall, the more common tendency is for marketization to promote increased resource use.

Macroeconomic Perspectives on Consumption

Herman Daly puts the microeconomic rethinking of consumption into a macroeconomic perspective. He draws on Alfred Marshall, who unlike most modern economic theorists emphasized the physical nature of the

process of production and consumption. This provides a link to the ecological approach to economics, which Daly has pioneered.[3] Rather than focusing only on the value added to matter or energy by human labor and the use of human-made capital, he emphasizes the inherent limits on low-entropy matter or energy resources to which value is added in the economic process. This suggests that some limits to consumption are advisable and eventually inescapable. If, as Daly argues, the scale of the macroeconomy has expanded to the point where natural resources and environmental waste absorption, rather than human-made capital, are the scarce factors, then consumption itself needs to be rethought.[4] Rather than maximize consumption in the pursuit of welfare, we need to seek ways to maximize welfare with minimum consumption. Hitherto the market system has been better at the former goal than the latter, and economic theory has measured success primarily in terms of greater consumption (or greater investment today in the cause of increased consumption tomorrow). This does not mean that the market system is not up to the new challenges; but it does suggest that it needs new direction. Daly proposes a shift to resource and energy taxes, rather than taxes on labor and capital, to encourage resource-conserving development. He also clearly agrees with Cogoy's warning about overextension of the market system; Daly is particularly wary of calls to extend the market system globally through untrammeled free trade.[5]

These theoretical perspectives suggest, then, that consumption must be seen in its social and ecological context, and that it should be subject to limits in relation to its destructive effects in either context. This provides an interesting contrast to the current efforts by many economists to extend market valuation to the environment. Through techniques of "contingent valuation," economists seek to transform aspects of the environment into quasi-goods, which potential consumers are then asked to value. This is recommended for cases in which the environment cannot actually be transformed into goods through privatization. In effect, this takes a theory that is primarily suited to the consumption of economic goods under conditions of institutional stability and resource abundance and attempts to apply it to problems that have arisen for exactly the reason Daly identifies—the environmental stress caused by an expanding macroeconomy. The alternative approach is to look to the physical laws of the ecosystem and to higher social values for guidance in reforming and limiting consumption.

Consumption and Economic Development

These contrasting theoretical perspectives give rise to different interpretations of economic development. Clive Ponting's *Green History of the World*

offers an application of the environmentalist's perspective on economic history. Here we can see some of the practical realities that give rise to the theoretical issues discussed in the first three articles. We are accustomed to hearing the industrial revolution of the nineteenth century and the economic modernization of the twentieth discussed primarily in terms of technological progress and rising living standards; Ponting emphasizes the massive increase in resource use that accompanied economic growth. This inevitably means that impacts on ecosystems have multiplied, but Ponting also suggests that the momentum of economic growth makes it difficult for industrialized nations to step off the path of ever-growing resource use.

In a finite world, inequality of resource use may actually increase with economic growth. Economic power implies command over resources; greater power for some means less power for others. (Consider the issue of carbon emissions, where a global emissions limit would only permit developing nations to increase fossil fuel use if advanced nations actually decrease emissions.) Ponting cites the dramatic inequalities between "developed" and "less developed" economies, but would surely reject the implication of these terms—that eventually all will reach high levels of "development" and resource use. He suggests rather that the evolution of an affluent global consumer class has locked in inequalities of resource control, constraining the economic futures of most of the world's people.

This theme is picked up in Alan Durning's article, which further indicts the global "consumer class" (roughly, the richest fifth of the world's population) as the source of most environmental problems. While some aspects of economic development are seen as environmentally positive—in particular the shift toward improved technologies and services in developed economies—these effects are not enough to reduce overall environmental impacts, merely to limit their growth. Durning's primary point is the impossibility of global "development" as conceived by economic theory. The resource and environmental demands of bringing all the world's people up to "consumer class" standards of living would be catastrophic. This is all the more true in the context of planetary population growth up to an eventual eight or ten billion,[6] which would nearly double resource and environmental requirements even with *no* increase in living standards.

Lest one might think that Ponting and Durning are overgeneralizing or exaggerating the problem, the World Resources Institute biennial report provides a wealth of specific detail to support these assertions. The problem is not, as originally conceived in the Club of Rome's 1972 *Limits to Growth* report,[7] foreseeable shortages of specific nonrenewable resources—at least for the next fifty years or so. Rather, it is the impacts of industrial growth on renewable natural resource systems, including the atmosphere, that pose the greatest dangers. Global inequality accentuates environmen-

tal impacts at both ends of the scale: The rich damage the environment through their high consumption levels, and the poor damage the environment by being forced to utilize marginal and fragile ecosystems. If indeed it is impossible for all to ride the escalator up to mass consumption, then some form of development that will reduce inequality while lessening environmental impacts seems essential.

Consumption, Resource Efficiency, and Social Priorities

Some suggestions of how greater sustainability in consumption might be achieved emerge from the article by Young and Sachs. They address only the technical feasibility issue in their discussion of sustainable materials use, but their vision of improved industrial ecology is an essential component of a global alternative to rising consumption of resources. It is difficult, if not impossible, to imagine any scenario in which goods consumption does not rise, if only to keep pace with rising population. Young and Sachs suggest, however, that the environmental impacts of consumption might be dramatically reduced by extensive recycling and use of secondary rather than virgin materials.

A partial solution to the "addiction" to growth is offered by the labor-intensive nature of a recycling economy. Recycled materials generally use less energy and have less environmental impact, but require more labor. This higher labor cost is one reason why such systems are not more widely adopted—it is cheaper to exploit virgin resources and externalize environmental costs. Daly's proposal for a tax shift from labor and capital to resources would greatly expedite the transition to the kind of materials- and energy-efficient economy that Young and Sachs propose.

However, this can be at best only a part of the solution. The most resource-efficient economy will eventually be overwhelmed by the high material demands of a world population growing toward eight or ten billion people, unless more sweeping alternatives to the mass consumer lifestyle evolve. Paul Ekins points out, for example, that technological progress would need to reduce the environmental impact of consumption by a factor of sixteen over the next fifty years to offer any significant environmental improvement in the face of projected population and consumption growth.[8] Environmentally sound technology is undoubtedly crucial. But as Sagoff, Cogoy, and Daly have argued, the forces that drive markets toward ever-higher levels of consumption will have to be tamed if the underlying conflict between consumer desires and biophysical realities is ever to be resolved. This can come about only by redrawing the boundary between market consumption and community life, between the individual as consumer

and the individual as participant in the social and natural world. Individual motivations toward greater goods consumption will have to shift in favor of deriving fulfillment from community and nature. This inner shift in priorities is the greater challenge. In Parts IX and X of this volume we will explore the forces driving consumerism worldwide, and the possible alternatives to an insatiable consumer society.

Notes

1. John Kenneth Galbraith, "How Much Should a Country Consume?" in Henry Jarrett, ed. *Perspectives on Conservation: Essays on America's Natural Resources,* (Johns Hopkins Press, 1958), 89–99.

2. The classic demonstration of this is the "Impossibility Theorem" developed in Kenneth J. Arrow, *Social Choice and Individual Values* 2nd ed. (New York: Wiley, 1963).

3. See selections by Herman Daly in Volume I of this series: Krishnan, Harris, and Goodwin, eds., *A Survey of Ecological Economics* (Washington, DC: Island Press, 1995).

4. A biological perspective on the issue of macroeconomic scale is provided by Vitousek et al. in the article "Human Appropriation of the Products of Photosynthesis," which estimates that "nearly 40 percent of potential terrestrial net primary productivity is used directly, co-opted, or foregone because of human activities" (Vitousek et al., in *Bioscience* vol. 36, no. 6, June 1986).

5. See Herman E. Daly, "The Perils of Free Trade," *Scientific American* 269 (November 1993), 50–57, summarized in Krishnan et al., eds., op. cit.

6. This figure is consistent with U.N. low to median estimates (*United Nations Long Range World Population Projections: 1950–2150,* United Nations, 1992). If fertility levels do not fall rapidly, ultimate world population levels could be much higher, above 12 billion.

7. Donnella H. Meadows et al., *The Limits to Growth* (New York: Universe Books, 1972).

8. See Paul Ekins, "The Sustainable Consumer Society: A Contradiction in Terms?" (*International Environmental Affairs,* Fall 1991). Ekins uses the famous I = P x A x T equation introduced by Paul Ehrlich, which states that environmental impact equals population (P) times per capita consumption (A) times environmental impact per unit of consumption (T). If population doubles and per capita consumption grows at 3 percent for fifty years, P x A increases by a factor of eight. T must then decrease by a factor of eight to keep environmental impacts unchanged, and by a factor of sixteen to achieve a "sustainable" lower-environmental-impact global economy.

Summary of

The Allocation and Distribution of Resources

by Mark Sagoff

[Published in *The Economy of the Earth*
(Cambridge: Cambridge University Press, 1988), 50–73.]

This summary argues that individuals hold inherently contradictory views on questions of consumption and the environment, that policy debate cannot be confined to the economists' familiar framework of equity versus efficiency considerations, and that we cannot put a price on things, such as the natural environment, that we value the most.

Consumer and Citizen Preferences

An individual often has different preferences as a consumer and as a citizen. Proposals to open national parks to commercial ski resort development can be (and are) opposed by citizens who would nonetheless enjoy skiing at such a place if development occurred.

> I love my car; I hate the bus. Yet I vote for candidates who promise to tax gasoline to pay for public transportation. I send my dues to the Sierra Club to protect areas in Alaska I shall never visit. . . . I have an "Ecology Now" sticker on a car that drips oil everywhere it's parked. [53]

The distinction between consumer and citizen preferences has long been noted by economists in the field of public finance. Recognition of the existence of distinct public policy preferences does not imply rejection of individual preferences, but requires awareness that the two are different and often inconsistent.

Attempts to find a combined preference ordering are bound to fail; individuals have incompatible beliefs, and do not rank them in a single hierarchy in the manner of the "rational man" of economic theory. Citizen preferences are judgments about what *we* should do, while consumer preferences are expressions of what *I* want. No single preference map combines these two very different kinds of statements. Indeed, statements about what we should do as a nation express judgments, which may be true or false, about our shared or common intentions. These objective beliefs must be judged on their merits through legitimate processes of collective deliberation and choice; they cannot be "priced" at the margin.

Allocation and Distribution

There is also an important distinction between the allocation and the distribution of resources. As a matter of allocation, a mountain can be used for either a ski resort or a wilderness; as a matter of distribution, some people gain while others lose from whatever allocational choice is made. Economic theory often suggests that allocational decisions should be made purely on the basis of efficiency, to maximize wealth; distributive choices can then be made separately on a political or ethical basis if desired.

Analysis along these lines tends to break down the discussion of policy into questions concerning efficiency on the one hand and equity on the other. Not all policy proposals allow for a distinct separation between the issues of efficiency and equity; some writers discuss a trade-off between these two goals. Yet efficiency and equity are complementary objectives. Some writers propose placing a greater weight on efficiency, others on equity; but both share a common vocabulary and conceptual framework. They agree that any claim on resources must be based either on rights and fairness or on preferences and productivity. The debate between the two perspectives has become an academic exercise and does not provide useful guidance to public policy and social regulation.

The Rights of Future Generations

Some writers suggest that we need to balance our consumer interests with those of future generations. Yet

> [T]here are few decisions favorable to our wishes that cannot be justified by a likely story about future preferences. Even a nasty strip mine or a hazardous-waste dump produces energy that will strengthen the industrial base left to future generations. [60–61]

In fact, the preferences of future generations will likely depend on education or advertising, and on what is available to them. Citizens of the future depend on the decisions we make today. If we destroy our environmental or cultural heritage, our descendants will be illiterate in those areas, unable to appreciate what they have lost.

Our obligation to provide a future consistent with our ideals is an obligation not to the future generation, but to our ideals. It is morally good to preserve our environmental and cultural heritage, not for the good *of* individuals, but to allow the development of *good individuals*. Although political liberalism has traditionally called for an avoidance of acts of authoritar-

ian paternalism, we cannot avoid paternalism with respect to future generations. "What is worth saving is not merely what can be consumed later; it is what we can take pride in and, indeed, love." [65]

The Conflict Within Us

The conflict between citizen and consumer preferences occurs within each of us; it is an inescapable ethical dilemma. Moreover, it is a conflict that could never arise in a society whose only goals were efficiency and equity in the satisfaction of consumer demand. Yet environmentalists shy away from the presentation of ethical issues, frequently seeking to calculate costs and benefits rather than discuss moral arguments for popular environmental policies. It is tempting to retreat into the "neutral" theories and criteria of economics for evaluating policy problems. "It's scary to think about problems on their own terms; it's easier to apply a methodology. . . . As a result, public officials often discuss the meaning of magnificent environments using a vocabulary that is appropriate to measure the degree to which consumers may exploit them." [68]

Money and Meaning

The worth of things that matter most to us, such as love and religion, are measured not by our willingness to pay for them, but by our unwillingness to pay. Neither true love nor eternal salvation is available for purchase at any price. Such things have a dignity rather than a price. Things that have dignity are those that help us define our relationships with one another. Our common natural and cultural heritage, including the environment we share, has such a dignity. It is dignity, not the calculation of costs and benefits, that ultimately explains why even avid skiers often oppose opening national parks to commercial ski resort development.

Environmental policy may be rational in one of two ways: It may be economically rational in terms of the calculation of costs and benefits, corrected for market failures and environmental externalities whenever possible, or it may be rational in a deliberative sense, based on cogent collective debate about the principles and ideals that we stand for and respect as a nation. The latter approach assumes that the values on which we base policy are objects of public inquiry, and are not derived either from exogenous preferences and market mechanisms or from metaphysical truths about human nature and rights.

Compromise and Community

Although the conflict between citizen and consumer interests is inevitable, compromise can reconcile the desires of individuals and communities. If every mountain were preserved as a wilderness, there would be no place to ski. The judgment that national parks should be preserved, even if commercialization would be profitable (and, in a narrow market sense, "efficient"), rests in part on the belief that there are already many opportunities for skiing and other commercial recreation, but comparatively few wildernesses.

If the stakes were reversed and enormous financial sacrifice was required to protect an environmentally insignificant landscape or to achieve only marginal reductions in pollution, these same people might reach the opposite conclusion. Just as we can reject the dogma of the perfect market, we can also reject the dogma of the perfect environment. Entering the realm of compromise and debate over public policy does not require abandonment of the ideals we hold as citizens, only evaluation of those ideals in the context of the means available to achieve them.

Summary of

Market and Nonmarket Determinants of Private Consumption and Their Impacts on the Environment

by Mario Cogoy

[Published in *Ecological Economics* 13 (1995), 169–180.]

Consumption is an activity that combines market and nonmarket elements. The environmental impacts of consumption depend not only on the physical requirements of market production, but also on the social and institutional frameworks that determine the boundary between market and nonmarket aspects of consumption. This summary argues that environmental degradation results from a bias in the consumption process toward a predominance of market relations and an excess of paid labor in industrial society.

In a modern society, market relations constantly invade and reshape nonmarket sectors of life. The industrialization of formerly nonmarket activity is likely to imply more intensive use of energy and materials, and centralization of skills and process control. Little attention has been paid to the permanently shifting border between market and nonmarket activity as a possible source of environmental degradation. Traditional economic theory considers only market demand for goods and leisure, ignoring the social in-

frastructure in which consumption is embedded, and the consumption labor and consumption skills that are combined with goods to produce the desired enjoyment of life. Consumption labor includes household work, shopping, traveling, and waiting in lines; consumption skills include the defensive skills of "protecting the brains of consumers from the negative effects of advertising," as well as planning skills and technical knowledge. [171]

Since "economic labor" (working for wages), consumption labor, and consumption skills are all inputs into the production of enjoyment, they are potential substitutes for each other. That is, increased consumption labor and/or skills may be substituted for paid labor time. If taken to the extreme, this substitution would lead either to a market utopia in which all consumption labor and skills are replaced by market relations, or to a "do-it-yourself" utopia in which the largest portion of social labor is performed outside the market. Neither extreme is necessarily efficient or desirable.

Modern society has a strong bias in favor of the market sector, as has been described in great detail by Juliet Schor. Her analysis of the "insidious cycle of work-and-spend" explains a significant source of environmental degradation. In addition, the satisfaction of basic needs such as heating and transportation is organized in a way that gives an inefficiently large role to the market sector, and also leads to unnecessary environmental damage.

The Consumption Process

A formal model can illuminate some aspects of the process of consumer choice. Assuming a fixed-coefficient input-output model, it is easy to calculate the material and labor requirements for delivery of one unit of each type of commodity to final demand. With the further assumptions of constant wage and profit rates throughout the economy it is possible to calculate the paid labor time required to earn enough to buy a unit of each commodity. The consumer combines this economic labor requirement with consumption labor to yield enjoyment. If individuals were free to vary their hours of work at will, it might be assumed that the optimum combination of economic labor and consumption labor would be chosen. However, as Schor has shown, institutional constraints in the labor market prevent such flexibility.

Innovation in consumption can involve a reduction in market inputs and an increase in consumption labor, a change in the mix of market inputs, or an increase in purchases at the expense of consumption labor. Market-expanding innovation increases total profits and paid labor time, but is not always worse for the environment. If a commercial firm introduces innova-

tions that consumers could not have done on their own, the environmental result may be positive—as in the case of some utility-sponsored energy conservation programs. But if consumers utilize the resulting gains for increased consumption with high environmental impacts (using home-energy savings to finance a holiday flight), the global result may still be negative.

Two examples—household energy conservation and transportation—illustrate how environmental damage can be interpreted in terms of the shifting border between market and nonmarket activity.

Household Energy Conservation

The consumption goal of a comfortable dwelling can be attained by using enough heat in a poorly insulated house, or alternatively by using less heat and more insulation. The latter alternative requires more skill and investment planning on the part of the consumer, and possibly more consumption labor, but less economic labor in the long run. The scope of market activities is reduced, as reduced fuel purchases are only partly replaced by increased insulation purchases.

Studies of home energy consumption have repeatedly found a high potential for energy conservation that would produce net financial savings. But home energy conservation programs have had disappointing results, for several reasons. Households are reluctant to engage in investments with long break-even times, energy sales promotions and rate structures often encourage wasteful consumption, and institutional barriers discourage conservation investment in rental housing.

Solutions may be sought in either of two opposed directions. One is to strengthen the consumer's role in planning and investing in energy conservation, thus increasing the importance of nonmarket skills and labor inputs. The other is to expand the market for household energy conservation services, thus making consumption skills and labor less essential by selling the goal of a "comfortable dwelling" directly to consumers. Either alternative would reduce the fuel requirements and environmental impacts of reaching current levels of comfort.

Private Transportation

Desires for mobility result from complex social processes that have important environmental implications. But even if mobility targets are accepted as given, existing consumption patterns are quite inefficient.

Transportation options depend heavily on an inherited infrastructure that poses problems for current mobility needs. Even if the costs of infrastructure were fully charged to users, problems of externalities would remain: Making a highway more useful for cars, for example, can make it less attractive for bicycles or pedestrians.

To envision unbiased choices between modes of transportation, consider the assumption that users are charged the full costs of infrastructure as well as operating costs for each mode, and can lease any transportation option at its full cost per kilometer. The economic labor needed to pay for a mode of transportation plus the consumption labor for that mode (travel time, repair time, etc.) would add up to the total time requirement. Consumers could then choose the time-minimizing mode for each travel route. In reality, the prevalence of traffic jams, in which it would be faster to bicycle or even walk, provides evidence that time-minimizing choices are not being made.

The system of private ownership of automobiles itself is a cause of inefficiency. Once a car has been purchased, many of its costs are fixed and independent of the distance driven, encouraging excessive use. The alternative of full-cost car leasing would charge for all costs on a per-kilometer basis. This would allow consumers to buy automobile services as needed, while preserving the freedom to use cheaper transportation systems whenever appropriate. Since leased cars would spend much less time idle than privately owned cars do, the total number of vehicles could be reduced. For the same reason, depreciation would be accelerated and replacement by new, improved models would be easier and faster. Of course, private car ownership has acquired a symbolic and ideological meaning that goes far beyond its technological qualities as a means of transportation.

Conclusion

Ecological economists have often pointed out that the economy is embedded in a natural environment; but it is also embedded in a social one. The shifting boundary between the economy and its social environment has a significant effect on the relationship between economic activity and the natural environment. In the examples discussed above, consumers spend too much time in the economic system, resulting in too little capital investment in conservation and too much in automobiles. Thus, the impact of the market system on nonmarket aspects of life is interrelated with its impact on the environment.

Summary of

Consumption: Value Added, Physical Transformation, and Welfare

by Herman Daly

[Published in *Getting Down to Earth: Practical Applications of Ecological Economics,* eds. R. Costanza, O. Segura, and J. Martinez-Alier (Washington, DC: Island Press, 1996).]

Economic theory typically neglects the importance of natural resources for production and consumption. This summary argues that the economy has exceeded the optimum scale relative to the carrying capacity of natural ecosystems, and that resource constraints on consumption will become increasingly binding.

Resource consumption is inherently limited by the extent of the earth's ecosystem, a limit that we are fast approaching. Total consumption, which is the product of population and per capita consumption, can be limited or reduced by controlling either of these factors. While the South needs to focus more on population, the North should focus on per capita consumption. Toward the latter goal, this article reconsiders the meaning of consumption.

Consumption and Value Added

Alfred Marshall's view that production of goods is a rearrangement of matter that creates utility and consumption is a rearrangement of matter that destroys utility incorporates the physical laws of matter conservation. Matter and energy cannot be created in production; rather, useful structure is added to matter/energy by the agency of labor and capital. The value of this useful structure is referred to as "value added" and is used up in consumption. Economists have studied the creation and destruction of value added in great detail but have paid little attention to that to which value is added.

Lester Thurow has argued that there is no reason to fear that growing worldwide consumption will cause resource exhaustion, since it is "algebraically impossible" for the rest of the world to reach American consumption standards without also reaching American productivity levels.[1] William Nordhaus believes that global warming would have only a small effect on the U.S. economy because only agriculture, accounting for a mere 3 percent of gross national product (GNP), is sensitive to climate. The entire extractive sector of the economy represents only 5 to 6 percent of GNP, yet

it provides the resource base on which the other 95 percent rests. Even the widely used Cobb-Douglas production function suggests that other inputs (e.g., man-made capital and labor) can be substituted indefinitely for natural resources. Ever-growing output can be achieved with ever-diminishing resource inputs if sufficient quantities of other inputs are available.

Consumption and the Physical Transformation

Although matter/energy cannot be created or destroyed, there are still physical limits to our ability to add and subtract value repeatedly from the same natural resources. The second law of thermodynamics states that entropy (randomness or disorganization) is always increasing, that each rearrangement and recycling of matter leads to both energy and material dissipation beyond recall. To replenish value added that is worn out or consumed, new low-entropy inputs are continually required. Thus we consume not only the value we add to matter but also the value of the preexisting low-entropy arrangement of resources created by nature. The scale of the economy is important: The rate of use of low-entropy resources must be consistent with the workings of the ecosystem that creates them.

Natural value added is just as important as value added by labor or capital. But we tend to treat natural value added as a free gift of nature. The greater the natural value added to a resource, the lower the human effort required to exploit it, and hence the lower the price we put on it.

The basic pattern of scarcity has been changed by economic growth. In the past value added was limited by the supply of labor and capital; now it is also limited by the availability of natural resources. Turning a tree into a table provides net benefits when there are many trees and few tables, but today much of the world has many tables and dwindling numbers of trees. Eventually the economy must reach an optimal scale relative to ecosystem capacity, at which point production should be geared toward maintenance rather than growth. Our goal should be to minimize maintenance costs—to minimize rather than maximize production. As Kenneth Boulding said long ago, "Any discovery which renders consumption less necessary to the pursuit of living is as much an economic gain as a discovery which improves our skills of production."[2]

Consumption and Welfare

As the economy reaches its optimal scale, the shift from maximizing production efficiency to maximizing maintenance efficiency can be interpreted

as a shift from economic growth to sustainable development. Growth can be defined as increasing the provision of economic services by increasing material throughput, holding efficiency constant. Development, in contrast, can be defined as increasing the provision of economic services by increasing efficiency, holding material throughput constant. Sustainable development is simply development without growth, with throughput held at an environmentally sustainable level.

Empirical measures of the value of natural capital services are virtually nonexistent; even measures of the value of services of man-made capital are problematical and incomplete. Thus we cannot provide a firm, empirically based answer to the question of whether the economy is above or below the optimal scale; commonsense judgments must be used instead. What judgments can we make about the marginal benefits of growth in human-made capital versus the marginal costs of consumption of natural capital?

In wealthy countries the marginal benefit of growth is surely low. Expensive advertising is required to cajole people into buying more. Deaths from stress and overconsumption are more common than from starvation. For the poor, for whom higher consumption remains important, gains could be made either through redistribution or through additional consumption of natural resources; the economic system has a strong bias toward the latter alternative, to the extent that it makes any provision for the poor.

The marginal costs of growth include the familiar litany of environmental problems. A large part of GNP is spent on defensive expenditures to protect ourselves from the side effects of growth, including pollution control, some aspects of health care, commuting time, and so on. In addition, capital and labor mobility tears communities apart in the name of growth. It is time to redirect our economy away from growth and toward development.

Policy Implications

If natural and human-made resources were good substitutes, then neither factor could be a limit to growth. If, on the other hand, they are imperfect substitutes, or even complements, either one can be limiting. Today natural capital is the limiting factor: The worldwide fish catch is limited, not by the number of fishing boats, but by the remaining population of fish in the sea. We need to economize on natural capital, which means its relative price should rise. Since much of natural capital is outside the market, public policy changes are needed. Instead of taxing value added (labor and human-made capital), natural resource use and pollutant emissions could be taxed.

All taxes are "distortionary" relative to a perfect market; resource taxes would induce desirable distortions.

Different countries will employ different policies to limit total consumption, some emphasizing population and others focusing on per capita consumption. The faddish advocacy of global economic integration will not solve our problems; indeed, national policies cannot be pursued effectively under a regime of completely free trade and capital mobility. This need not imply autarky, but does require some backing away from global integration toward relative self-sufficiency.

Notes

1. Lester Thurow, *The Zero-Sum Society* (New York: Penguin Books, 1980) 118; cited by Daly, 6.
2. Kenneth Boulding, "The Consumption Concept in Economic Theory," *American Economic Review* (May 1945), 2; cited by Daly, 17.

Summary of

Creating the Affluent Society

by Clive Ponting

[Published in *A Green History of the World*
(New York: Penguin Books, 1993), 315–345.]

In the last two centuries a sizeable minority of the world's population has achieved a standard of living that would have been unimaginable for previous generations. But this improvement has been obtained at a price—a vast increase in the consumption of energy resources and raw materials, widespread pollution from industry, and a variety of social problems. In addition it has raised questions of equity regarding the distribution of wealth, both within individual countries and between the industrialized world and the Third World. This summary reviews the history of the emergence of the affluent society and examines the environmental and social implications of its unprecedented levels of resource use.

In the Beginning

Hunting and gathering societies traditionally kept few possessions, as mobility was valued more highly than most material goods. The accumulation

of goods, then, could only begin in earnest eight to ten thousand years ago with the rise of agriculture and settled societies.

Until the last two centuries, all societies were primarily agricultural, and average incomes were very low. With limited long-distance trade and transport, regional economic self-sufficiency was vitally important. In medieval and early modern Europe, about 80 percent of most households' expenditures were on food, half of that for bread alone.

The first sustained rise in European standards of living began in the seventeenth century as agricultural productivity improved and trade and manufacturing expanded; however, the gains during this period were small and uneven, and largely confined to the Netherlands, England, and France. More widespread increases in standards of living did not occur until after the Industrial Revolution.

However, large-scale industrialization required a substantial increase in capital investment; accumulation of this capital led to an initial deterioration in the standard of living for the majority of the population. In England, although industrialization began in the last decades of the eighteenth century, living standards did not rise for most of the population until the late 1840s. In the second half of the nineteenth century, living conditions slowly improved but much of the population existed in a state of permanent want and in substandard housing.

In the Soviet Union, the industrialization of the 1930s led to immense increases in the output of basic industries and doubled the industrial labor force in just five years. But the accompanying forced collectivization of farms led to millions of people starving to death in the countryside; concurrently, urban living standards fell sharply, not recovering to the levels of the late 1920s until the mid-1950s.

Impacts of Industrialization

Industrialization altered the patterns of work more quickly than the standard of living by enforcing a strict labor discipline and drawing increasing numbers of women and children into work outside the home. This allowed unprecedented increases in labor productivity and output, leading to a succession of new technologies and industries that have changed the quantity and types of available goods. World industrial output is now fifty times greater than in the 1890s, with most of the increase occurring since 1950. At the heart of this industrial growth have been vast increases in the consumption of energy and metals.

Although iron has been used for weapons and agricultural implements throughout the last three thousand years, total world production was less

than 100,000 tons in 1400 and 300,000 tons in 1700. With the onset of industrialization, world iron output rose to 12 million tons a year in the mid-nineteenth century, and 1.2 billion tons in 1980. Similarly, explosive increases have occurred in the use of other metals. The mining required to produce metals on this scale has had a major impact on the environment, including the destruction of topsoil and the creation of large waste piles that often give rise to toxic runoff. The exploitation of increasingly lower grades of ore, as the best deposits are exhausted, produces growing amounts of waste and consumes increasing quantities of energy per ton of metal.

With the rise in affluence has come the emergence of new industries to supply automobiles and other consumer durables. Auto production, barely under way at the beginning of the twentieth century, has reached 33 million vehicles annually, consuming 20 percent of the world's steel, 10 percent of the aluminum, and one-half of all lead production. More than one-third of all oil consumption is accounted for by cars. The rise in automobile ownership has also allowed for the emergence of many related activities. Vacation travel, for example, was made affordable for many people as a result of cars, fueling the twentieth-century take-off in tourism (later boosted further by the rise of commercial airlines).

Pavement in Paradise

Although inequalities in income and areas of poverty persist in industrialized countries, the basic needs of the majority of citizens have been met. Yet the complex economic system that has developed must be sustained by continuing economic growth. Competition forces companies to expand in order to survive; elected governments promise and encourage growth in order to retain popularity; rising expectations and conspicuous consumption propel an ever-expanding consumer market. The expansion of affluence itself creates social and environmental problems.

When automobiles first appeared, it was hoped that they would ease the urban congestion of horse-drawn traffic and reduce the cost of road maintenance associated with cleaning up after the horses. But soon it was apparent that cars created new levels of congestion. Since this time, cities have been rebuilt, at great expense, around the needs of automobile traffic. In the United States, public transportation use reached a peak in 1945 and then fell rapidly as car ownership increased; this has had important environmental effects. Compared to railways, highways require four times as much land, and almost four times as much energy to make the steel and cement needed for construction. Overall railways are six times more energy-

efficient than roads in carrying freight and passengers. Yet in most industrialized countries today, cars—the majority of which are occupied by only one person—account for 80 percent of all passenger miles.

The rise of tourism has brought with it a blend of opportunity and blight. Waves of visitors threaten to overwhelm and destroy the original attraction of the places they came to see. Hawaii received 15,000 tourists in 1964, and three million a decade later. Spain accommodates 54 million tourists annually. In some Mediterranean resorts, crowding has resulted in water quality problems; dumping sewage—usually untreated—into the sea has made many beaches unfit for bathing. Third World tourism often involves the construction of luxury hotels, isolated from the country in which they are situated, and providing few benefits to the local economy.

Affluence and the World Economy

Until a few centuries ago, there was little difference in wealth among major European and Asian societies. Medieval Europe, India, and China were at similar stages of development; China was perhaps the wealthiest country in the world in the eleventh and twelfth centuries. After 1500, the distribution of wealth became increasingly unequal as Europe extended its control over other regions and began to industrialize. Today an average Rwandan has 1 percent as much income as an American, while Sweden has almost 100 times as many hospital beds per capita as Nepal. In recent times only a handful of poor countries have made much progress along the road to industrialization and affluence.

Development aid, despite official rhetoric to the contrary, has been modest and is frequently tied to the commercial interests of the donor country. Multilateral development agencies such as the World Bank have often supported projects that have caused major social and economic damage; massive hydroelectric dams that have flooded agricultural land and displaced huge numbers of people are just one example. Economic necessity leads many Third World countries to concentrate on the production of crops and minerals for export, even when these export industries interfere with local food production and damage the environment.

Economic growth since the second World War has increased the gap between the industrialized world and poorer countries. During most of the 1980s, the Third World transferred more money to the industrialized world in debt interest than it received in new loans and aid. Austerity programs imposed on debtor nations by the International Monetary Fund have placed the heaviest burdens on the poorest people. The World Bank officially estimates that 800 million people worldwide (excluding China) exist

in conditions of absolute poverty, including 20 percent of the world's children.

The emergence of an affluent society has thus been accompanied by a huge shift in the pattern of wealth distribution worldwide. The industrialized countries utilize the vast majority of the world's resources to support unprecedented high levels of consumption. Internal inequity has persisted, but international inequality has greatly increased, together with a large increase in the worldwide impact of pollutants.

Summary of

Natural Resource Consumption

by World Resources Institute

[Published in *World Resources 1994–95*
(Washington, DC: World Resources Institute, 1995), 3–26.]

Global consumption of natural resources has reached unsustainable levels. Yet, a majority of the world's population remains impoverished and requires additional resources for future development. This summary reviews recent trends in natural resource use and the associated environmental impacts in an international context, and contrasts resource use in the United States and India.

Resource Consumption and Development

Consumption in the affluent Northern countries accounts for a vastly disproportionate share of world resources, and includes expenditures that may appear self-indulgent to Southern countries still struggling to meet basic needs. U.S. expenditures on lawn care or on video games, for example, are roughly comparable to the nation's total contribution to foreign development assistance. But in recent decades natural resource use, together with its associated environmental impacts, has been growing more rapidly in developing countries than in the already industrialized nations.

Nonrenewable resources are, by definition, finite and hence will run out someday. However, physical shortages of most materials are not imminent. Reserves of major metals and fuels range from about 20 times larger than current annual production (for zinc, lead, and mercury) to well over 100 times larger (for iron, aluminum, and coal). As shortages become a threat, price increases often stimulate technological innovation, which makes use of more abundant substitutes—as in the replacement of copper telephone

wires with glass optical fibers. Recycling metals also reduces the demand for new resources. Yet, although global shortages are unlikely to check development in the early decades of the next century, current rates of use of most nonrenewable resources are not indefinitely sustainable.

Renewable resources are too often treated as free gifts of nature, but it is these very resources that are most in danger of severe degradation and depletion. Clean air is becoming an increasingly scarce resource for much of the world's urban population. More than one billion people lack access to clean water. More than 10 percent of the earth's fertile soil has been eroded or otherwise degraded; in Mexico and Central America, 25 percent of vegetated land has been degraded. Biodiversity is being lost at an alarming rate as tropical forests and other ecosystems are destroyed by development. The emerging shortages of renewable resources are concentrated especially, although not exclusively, in developing countries.

Resources and Environmental Degradation

The consumption of many types of resources gives rise to environmental degradation. Fossil fuel use results in land degradation from coal mining, freshwater pollution from mine drainage and oil refinery operations, marine pollution from oil spills and tanker operations, and air pollution from all forms of combustion. Air pollution from fuel combustion has local effects on public health, regional impacts such as acid precipitation, and globally contributes to greenhouse gas emissions that may lead to climate change. Industrialized countries now account for just under half of all fossil fuel use, with about a quarter in developing countries (including China), and a quarter in the formerly planned economies of the ex-Soviet Union and Eastern Europe.

Metal mining degrades vast amounts of land: In 1991, more than one billion metric tons of copper ore were dug up worldwide to obtain nine million tons of metal. Other effects include air pollution, leachings from mine tailings or abandoned mines, disposal of chemicals used in mining, and dispersion of toxic trace metals found in many ores.

Consumption of forest resources can lead to environmental problems as well as the loss of critical habitat and species. In many parts of Africa and Asia, fuelwood consumption exceeds forest growth, contributing to forest degradation. In principle, logging for timber can be sustainable, but often in practice it is not. Clearcutting in North America and similarly destructive practices in many tropical forests have contributed to habitat loss, soil erosion, and watershed degradation. Commercial tree plantations—which are increasing in number—can supply wood on a sustainable basis and pre-

vent erosion, but do not support the same level of biodiversity as natural forests.

There are 1.3 billion cattle in the world, and their numbers are growing much faster than the human population. More than half of the grain consumed in industrialized countries and in some developing countries is fed to livestock. In addition to the magnitude of grain consumption, problems associated with raising livestock include overgrazing of arid lands and conversion of forest and other lands to pasture. On feedlots in industrialized countries, manure disposal and water pollution are also problems.

Resource Consumption Patterns and Implications: United States

The United States consumed 4.5 billion metric tons, or 18 tons per person, of natural resources in 1989. Construction materials and fuels accounted for more than 75 percent of the total, but significant amounts of many other materials were included as well. The intensity of resource consumption, either per capita or per dollar of GNP, is declining for some commodities but not all. Consumption of paper, plastics, and many chemical products is still growing rapidly.

U.S. per capita consumption of selected ores and basic materials ranges from 1.5 to 7 times the world average. Resources consumed in the United States are largely from domestic sources, with a few important exceptions (such as aluminum, petroleum, and iron). Thus, the local environmental impacts of U.S. resource use are felt primarily within the country. However, as the leading producer of greenhouse gas emissions, the United States also contributes to global warming. U.S. emissions of carbon dioxide (the most significant greenhouse gas), largely from fuel combustion, are still growing, although not as fast as GNP. The United States has an obligation to the rest of the world to take a leadership role in seeking technologies and policies to protect the environment, and specifically to reduce and stabilize greenhouse gas emissions.

Resource Consumption Patterns and Implications: India

In 1990, the wealthiest 1.5 percent of India's population had incomes equivalent, on a purchasing power parity basis, to (U.S.)$6,200 per capita—well below the U.S. average income of $19,300 per person for that year. At the same time, 59 percent of India's population (495 million people) had incomes equivalent to $600 per person on average. Much of this

group cannot rely on meeting basic needs for food, clothing, and shelter; as such, they depend directly on the environment—particularly the common property resources of forest, ponds, and rivers—to meet many of their survival needs.

Not surprisingly, reported consumption by low-income groups is negligible for most goods other than basic food crops and clothing. On a per capita basis, the poorest half of Indians consume only 8 to 10 percent as much minerals and fuels as do the richest 10 percent. However, there are still important environmental impacts of resource use by the poor. Overuse of wells, ponds, and rivers for household water needs has contaminated water supplies; scavenging wood, crop residue, and animal dung for cooking fuel not only exposes households (particularly women and children) to risks of disease from burning these fuels, but also contributes to forest and soil degradation. Sanitation services are available to 37 percent of urban and 8 percent of rural India; improper disposal of human waste spreads pathogens via the air, water supplies, and direct contact. Thus, the poor are both agents and victims of environmental degradation.

The environmental consequences of resource consumption in India include not only growing industrial pollution, but also the resource degradation that results from poverty and population growth. Development and environmental goals are inextricably linked in countries such as India: Development must alleviate poverty if renewable resources are to be preserved for current and future use.

Summary of

The Environmental Costs of Consumption

by Alan Durning

[Published in *How Much Is Enough?* (New York: W.W. Norton, 1992), 49–61.]

The high consumption levels of the global upper-income "consumer class" account for a vastly disproportionate share of worldwide environmental impacts. This summary documents the environmental consequences of consumer class resource use and considers the implications for the future growth of lower- and middle-income living standards.

Per capita use of virtually every natural resource varies dramatically with income. Fossil fuel use by the poorest one-fifth of the world's population releases a tenth of a ton of carbon dioxide per person per year, compared to half a ton for the middle-income majority and 3.5 tons for the top fifth, or consumer class. Industrial countries, with one-fourth of the world's pop-

ulation, consume 40 to 86 percent of various natural resources. The average resident of an industrial country consumes three times as much fresh water, ten times as much energy, and nineteen times as much aluminum as someone in a developing country. Not surprisingly, industrial countries account for almost all industrial pollution, including emissions of hazardous chemicals and nuclear wastes.

International comparison of consumption patterns shows that as income rises, consumption of ecologically less damaging products such as grains rises slowly, while purchases of energy, metals, and other more ecologically damaging products multiply rapidly. The components of a consumer lifestyle, such as automobiles, throw-away goods and packaging, high-fat foods, and air conditioning, can only be provided at great environmental cost.

Fortunately, once people join the consumer class, their impact ceases to grow as quickly. Per capita use of chemicals, energy, metals, and paper have been stable in industrial countries since the mid-1970s. This is due in part to higher energy prices, but also reflects a long-run shift toward consumption of technology and services. But the high levels of per capita consumer class resource use is far too high for the entire world to reach without devastating the planet: Bringing everyone up to current consumer class standards would triple greenhouse gas emissions, mining, and logging, for example.

Consumer class environmental impacts are felt worldwide as developing nations export resources and resource-intensive products to the industrial world. Japan imports more than 50 percent of its wood, much of it from the rapidly vanishing rain forests of Borneo. The Netherlands imports an agricultural output equal to three times its own area, much of it from deforested and pesticide-doused tropical regions. In 1989 the European Community, Japan, and North America had combined net imports of primary commodities (crops and natural resources) of $136 billion.

Shifting tastes among the consumer class have, in years past, fueled commodity booms in the tropics, for products such as sugar, tea, coffee, and rubber. Today the illegal trade in exotic and endangered wildlife continues that pattern, as does the production of illegal drugs for American and European consumers. What was once the untouched cloud forest of the Peruvian Amazon is now the herbicide-poisoned heartland of the world's cocaine industry.

Upper-income consumption is too often ignored as a cause of environmental decline. While other factors such as technology and population growth are important, consumption levels play a key role as well. As such, technological change and population stabilization alone cannot save the planet; a complementary reduction of material wants is also required. A

study of the international potential for reduction in fossil fuel consumption concluded that the entire world's population could live at the level of West Europeans in the mid-1970s. This includes modest but comfortable homes, refrigeration for food, clothes washers, hot water, and ready access to public transit plus limited auto use.[1] It does not include, nor could the world support, American lifestyles for all, with their larger homes, numerous electrical appliances, and auto-centered transportation. Even the European standard of the 1970s, if projected worldwide, may not achieve the global reduction in carbon emissions that is believed to be necessary to stabilize the world's climate.

"Even assuming rapid progress in stabilizing human numbers and great strides in employing clean and efficient technologies, human wants will overrun the biosphere unless they shift from material to nonmaterial ends. The ability of the earth to support billions of human beings depends on whether we continue to equate consumption with fulfillment." [60–61]

Note

1. José Goldenberg et al., *Energy for a Sustainable World* (Washington, DC: World Resources Institute, 1987).

Summary of

Creating a Sustainable Materials Economy

by John E. Young and Aaron Sachs

[Published in *State of the World 1995*, Worldwatch Institute (New York: W.W. Norton, 1995), 76–94.]

Current patterns of consumption in industrial countries involve unsustainable levels of virgin raw material use. This summary examines the requirements and prospects for a transition to a sustainable economy based on the reduced use, reuse, and recycling of materials.

Society's Consuming Passion

Industrial countries account for about 20 percent of the global population, but consume about 80 percent of many vital materials. Although technological advances have kept material prices low, growth has exacted an increasing environmental cost in both extraction and disposal of these mate-

rials. Around the world, mining moves an estimated 28 billion tons of soil and rock annually, ruining whole mountains, valleys, and rivers. Four primary materials industries—paper, plastics, chemicals, and metals—account for 71 percent of toxic emissions from U.S. manufacturing. Cutting wood for paper and other materials plays a major role in deforestation; since 1950 nearly one-fifth of the world's forested area has been cleared. The impacts of chemical and plastics production include hazardous waste dump sites and industrial accidents that have resulted in released toxic chemicals. Raw materials industries are also among the world's largest energy consumers, with mining and smelting alone taking an estimated 5 to 10 percent of global energy use.

Extractive industries have caused environmental problems at a local level for many centuries, but the scale of the problems has expanded with the rapid economic growth of recent years. U.S. consumption of virgin raw materials was fourteen times larger in 1991 than in 1900, while the population only tripled. Much of the growth in per capita resource use occurred in the 1950s and 1960s. Demand for raw materials now appears to be leveling off in industrial countries, but is still rising worldwide. The continuing increase is a result of both population growth and increasing per-person use of materials in newly industrializing countries.

Materials use occurs within an antiquated legal and regulatory framework that often subsidizes and promotes consumption. Some U.S. policies date back to the frontier era; the 1872 General Mining Act, for example, still gives miners the right to purchase mineral-bearing government lands for $5 an acre or less, and does not require royalty payments or reclamation expenditures. Former colonial powers often provide development assistance for primary commodity exports from the countries they once controlled. World Bank and International Monetary Fund planners generally advocate heavy investment in commodity exports. Public agencies, at the other end of the materials cycle, have often subsidized landfills and incinerators far more extensively than recycling facilities.

Building a Secondary Materials Economy

Sustainability requires a shift from today's throw-away culture of convenience and planned obsolescence to an approach that designs products to reduce material use and seeks value in reusable goods. Bottles and containers could be reused dozens of times before being recycled and remanufactured; composted organic wastes could be plowed back into gardens and farms; recycled paper mills and metal smelters could come to outnumber their virgin material counterparts. Cities, where secondary resources are

found, would then become a more important source of materials than mines or forests.

This transition will require a mobilization of capital, skill, and commitment on a scale usually seen only in wartime. An obvious starting point would be to eliminate the current subsidies for virgin materials extraction and to tax polluting industries to cover the full environmental cost of their activities. This would raise virgin material prices to more realistic levels, providing market incentives for materials efficiency. Other initiatives could include making households and businesses pay the full cost of disposing of their waste, and developing the infrastructure needed to support recycling and reuse on a broader scale.

It will ultimately be necessary to go beyond recycling, to make basic design changes that reduce overall material throughput by eliminating waste and inefficiency at the source. Since the energy crisis of the 1970s, new technologies have made it possible to cut energy use by 75 percent or more in many applications; the same can be done for materials use. For example, wood consumption could be cut in half by a combination of technologies already available, ranging from improved sawmill and housing construction techniques to two-sided photocopying in offices.

As recycling programs expand in both North America and Europe, policies are needed to create markets for the materials that are collected. Secondary content requirements and procurement standards are among the quickest and most effective market stimulation measures. Economic and community development financing programs can be oriented toward secondary materials industries. Commodity markets for recycled materials, in their infancy today, must be strengthened at a national level.

Economic Opportunity

The transition to a sustainable materials economy may initially be difficult, but will eventually create many opportunities for employment. Recycling rather than landfilling one million tons of waste creates a thousand new jobs, and many additional jobs in related activities will open up in an economy dedicated to reuse and recycling. While labor costs will rise, capital costs will fall, making secondary industries a good investment even by conventional measures.

The jobs lost in extractive industries and related sectors are comparatively small in number, and are unstable in the best of times. Logging and mining towns are often little more than quickly constructed frontier outposts, becoming virtual ghost towns when the nearby resources (hence jobs as well) are exhausted. Today, for example, metal mining employs only 0.1

percent of the workers in the American West. Tourism, which depends on a healthy landscape unscarred by industrial waste, is now much more important to the economies of all of the U.S. western states.

Recycling, reprocessing, and repair services have in fact been among the world's most reliable "growth industries" in recent decades. Supplies of recycled metal, paper, and other materials have grown rapidly in the United States and other nations, becoming an important part of existing industrial processes. Secondary industries are generally far less polluting than their virgin raw materials counterparts, contributing environmental as well as economic benefits.

The current materials economy is a worldwide system; as a result, change in that system must be global as well. Improvement in materials efficiency is most urgent in the industrial nations, but is important in poorer countries as well. Developing nations will need new technologies and assistance from wealthier countries, particularly since virgin material exporters will be hit hard by a reduction in worldwide materials use. Money that now goes toward funding virgin materials projects could be redirected toward retraining displaced workers and shifting them into growing industries.