Inaugural Presentation of the:

HAMILTON RODDIS
MEMORIAL LECTURE SERIES

Responsible Environmentalism

Forests, People, Raw Material Needs, and Environmental Protection

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HAMILTON RODDIS
MEMORIAL LECTURE SERIES

This Memorial Lecture Series honors the late Hamilton Roddis who served as Secretary, President and Chairman of the Board of Directors of the Roddis Plywood Corporation for more than sixty years.

Hamilton Roddis was born in 1875 in Milwaukee, Wisconsin, and moved to Marshfield with his family in 1894 when his father invested in and assumed the direction of the Hatteberg Veneer Company. Mr. Roddis enrolled in the University of Wisconsin–Madison Law School in 1896 intending to proceed through a normal course of study. A fire destroyed the Hatteberg Veneer plant in 1897 and Hamilton Roddis remained in Marshfield to help get the new plant running smoothly—simultaneously, by independent study, he pursued his second-year law program by studying at night. He later rejoined his class in Madison and graduated on schedule. His capacity to operate on many functional levels served him well during the ensuing years in meeting the many challenges of the business world and at the same time maintaining an active involvement in civic, church and cultural affairs. Originally intending to enter the law profession, he was instead persuaded to join his father's firm (then known as the Roddis Veneer Company); he became president in 1920 and headed the company until his death in 1960. His character and intellect combined with his imaginative and progressive leadership spurred a business success through what we would today tout as Quality Management.

The Roddis enterprise spearheaded many innovations in forest products. It was the first to recognize the potential of the flush door and manufacture it on a large scale. During WW II it produced materials for the war effort by fabricating interior plywood for the Liberty ships and aircraft plywood for the British Mosquito bomber and reconnaissance plane. In August of 1960 the Roddis Plywood Corporation, with holdings throughout the U.S. and Canada, was merged with the Weyerhaeuser Corporation.

Mr. Roddis' family, friends and university beneficiaries are pleased to honor the man and his extraordinary accomplishments at the inaugural Hamilton Roddis Memorial Lecture in 1992.

Responsible Environmentalism

Forests, People, Raw Material Needs, and Environmental Protection[1]

INTRODUCTION

I will begin by noting that the next century will bring unimaginable stress to the environment and the world's natural systems. Unprecedented actions will be necessary to maintain air and water quality and perhaps even atmospheric composition. Similarly, close monitoring and proactive responses on behalf of certain wildlife, fish, plant, and other populations will be needed to insure long term viability. No less significant, the world will be faced in the 21st century as never before with the challenge of providing food, fuel, shelter, and clothing for 11-12 billion or more inhabitants.

If we are to have any hope of finding workable solutions to the complex environmental problems the world faces, we desperately need to think and plan on a global scale, and from a systems point of view. Thinking should encompass the entire world, geographically, with local actions framed in a context that makes sense globally. Moreover, it is essential that thinking consider insofar as possible the total system that might be affected by actions intended to produce change in only one or two specific areas. This concept is based on the recognition that when some event occurs in one part of a system, this often leads to another event in some other part of the system. Global, systematic thinking, as opposed to limited scope, single issue thinking, is critically important. A second observation regarding thinking and planning is that a global perspective must be combined with both a rational thinking process and use of a complete set of realistic assumptions if effective, lasting solutions are to be found. Planning which ignores any one of these critical elements is doomed to failure, no matter how well intentioned.

Today, when it comes to consideration of environmental problems, there is a remarkable lack of attention to rationality, realism, or global or systematic analysis. This lack has led to environmentally oriented thinking that, it seems to me, is seriously flawed. For instance:

- We recognize the pervasive effect of population growth on environmental quality, yet steadfastly refuse to deal with this issue in any significant way.
- We know that atmospheric carbon dioxide, NOx, sulfur dioxide, acidification of lakes and a host of other environmental problems are largely traceable to burning of fossil fuels, yet we still have no comprehensive plan for reducing the use of energy or of fossil fuels.
- We watch the results of passive management and conscious inaction as the Great Yellowstone fires of 1988 burn over almost 1,500 square miles, kill countless trees, liberate thousands of tons of CO_2 and particulates, endanger lives and property,

[1] This paper is based in large part on two earlier publications: "Human Populations And Natural Resource Demands" (3), and "Realistic Thinking And The North American Approach To Environmental Issues: A Dichotomy" (4).

and cost $120 million to fight–and when it is over, we listen to park managers proclaim that what has happened is good, because it was *natural*... and the public appears to accept this.

- We actively or passively support those identifying themselves as environmental leaders as they contest, on environmental grounds, virtually every domestic mining and forest harvest operation, particularly when increases in production are proposed. Yet we seem willing to ignore the fact that this nation is the world's leading importer of industrial raw materials, including most metals, cement, petrochemicals, and wood and wood products, a fact which has significant environmental implications for regions outside the U.S.

POPULATION GROWTH

If we consider the environmental problems that the world faces today, *one* stands out above all others as obviously the principal problem, and that is population growth. Population growth is clearly an *environmental* issue.

It is worthwhile noting that human populations are growing rapidly worldwide and that a doubling of world population, from the current 5.4 to 11 billion, is all but assured in the next 70 to 100 years.

The historical record of world population growth is dramatic (Figure 1). It took all of recorded history, to about 1800 A.D., for the world population to reach one billion. The next one billion people were added in only 130 years as agricultural systems were developed and as medical knowledge expanded. In more recent times, population growth has accelerated, with additional billions of people added to the world total in ever shorter periods. Populations rose from two to three billion in 35 years, from three to four billion in 15 years, and from four to five billion in only 10 years. Within the next ten years it is expected that the total population increase will roughly equal the current populations of all of Western Europe, the Soviet Republics, and the U.S. and Canada combined. This explains why environmental issues are critically important...and also why rational, global solutions must be sought.

The population picture isn't all bad news, however. Both birth and death rates, for example, have been falling for some time worldwide. Further, those organizations forecasting population growth now agree that a continued fall in birth rates is likely, such that future growth will occur at a decreasing rate. The authors of the recent book *Megatrends 2000* found this prospect so exciting that they proclaimed "...population is pretty much under control, except in Africa, although the population doomsayers continue to make their dire predictions" (12).

While a declining growth rate does provide a glimmer of optimism, it is difficult to view the population issue as "under control". It is important to realize that birth rates continue at a much higher level than death rates, both in developing and developed regions of the world (9). Worldwide, the annual number of births per 1000 people stood at 28 in 1988, compared to a death rate of only 10 (Table 1). Obviously, birth and death rates must become equal for the population to stabilize

Currently the world population is growing at about 1.7 percent annually, with the growth rates in developing and developed regions markedly different, at 2.0 percent and 0.6 percent respectively. The U.S. population is growing at an annual rate of

0.9 to 1.0 percent. Though those growth rates may upon casual examination appear insignificant, it is important to realize that even a growth rate as low as one percent translates to a 70 year doubling time (Table 2). A two percent growth rate translates to a 35 year doubling time.

What it all adds up to is that world population continues to rise rapidly, although at a decreasing rate. The question now is, at what level will stabilization occur?

The United Nations recently estimated that an investment of $10.5 billion each year for ten years would make family planning services and information available worldwide. If this level of support were to begin immediately, world population could be stabilized at an estimated 9.3 billion by the year 2095. Greater investment in family planning could stabilize human population sooner and at a lower level–7.8 billion by 2050 (2).

If these projections are accurate, they represent very good news indeed, since control of global human populations–and thus, control of the main source of environmental stress–is well within reach. Without concerted efforts to curb growth, however, human populations will grow to much higher levels. Assuming only modest increases in financing of family planning efforts over the next several decades (the most likely scenarios upon which the U.N. medium population projection is based), world population will grow to about 11.6 billion before stabilizing (14). With no increases in family planning efforts, world population could rise to 14 billion, almost three times the current level!

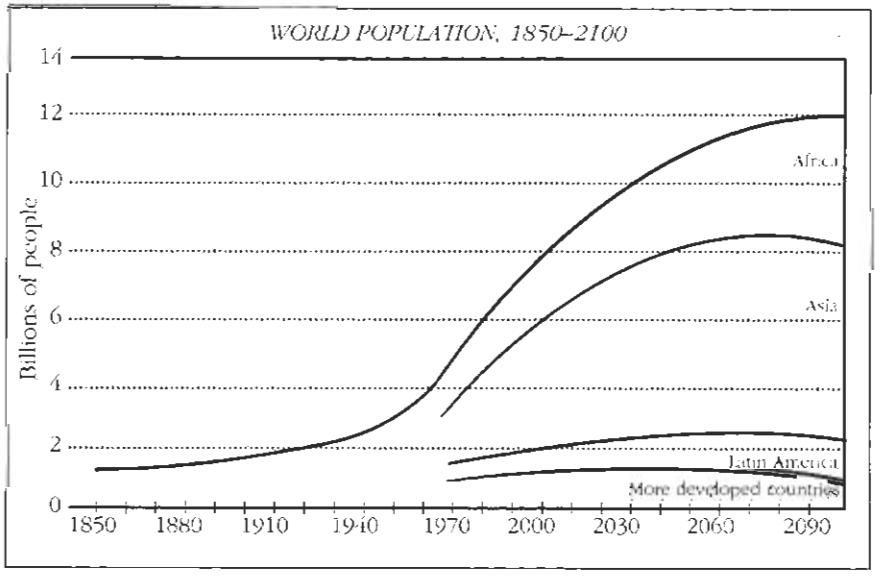

FIGURE 1

Source: The World Bank/Resources For The Future (13).

Note: More developed countries include those of Europe and the former USSR, as well as the United States, Canada, Australia, New Zealand, and Japan. The other regions are those with less developed countries.

TABLE 1 WORLD POPULATION: 1988-2020

Area	1988 (mil)	Birth Rate (per 1,000)	Death Rate (per 1,000)	2000 (mil)	2020 (mil)	Infant Mortality (per 1,000 births)	Percent <15 and >65
World	5,128	28	10	6,178	8,053	77	33/6
More Developed	1,198	15	9	1,266	1,337	15	22/11
Less Developed	3,931	31	10	4,911	6,716	86	37/4
Less Developed (excl. China)	2,844	35	12	3,699	5,312	96	40/4

Source: Information abstracted from "1988 World Population Data Sheet," Population Reference Bureau, Washington, D.C. "More developed" are all nations of North America, Europe, Australia, Japan, New Zealand, and the Soviet Union. All others are considered "less developed." Taken from: (8).

The U.N.'s best case scenario depends on an investment of $10.5 billion per year. It is worth noting that this is a relatively small number, roughly equivalent to about 1 percent of the world's annual military expenditures (2).

By comparison, family planning services in lower income countries were funded to the tune of $4.5 billion in 1990. Of that amount, $3.5 billion came from the countries themselves; member nations of the U.N.'s Organization for Economic Cooperation and Development contributed only $0.7 billion. This level of funding served about 381 million couples (51 percent), whereas U.N. estimates suggest that 567 million couples should be using contraceptives by the end of this century just to stabilize world population at the 11.6 billion level (8).

Surprisingly, despite increasing United States concern about the environment, world population growth has received little attention. The U.S. moreover, is an insignificant player in the family planning effort. Perhaps this is the case because family planning is a taboo subject in some parts of United States society. Norman Borlaug, Nobel laureate for his work in plant breeding and the "green revolution", recently commented on this situation, noting that unless the United States populace and political leaders can separate the population control issue from the abortion debate, and soon, the conse-

TABLE 2 POPULATION DOUBLING TIMES.

Annual Percent Increase	Population Doubling Time
1.0	70
2.0	35
3.0	24
4.0	17

Source: (7)

quences will be disastrous (15). His remarks underscore the importance of United States leadership, both financially and by example, to the success of global family planning efforts.

Whether the U.S. and the world at large will mount a significant effort to slow population growth remains to be seen. One thing, however, is certain. The world of tomorrow will contain much greater numbers of people than today, and this fact is one that should be in the forefront of every serious discussion about the environment. At the same time that we seek to address environmental problems, it will be necessary to face up to the challenge of providing food, clothing, shelter, and fuel for 11-12 billion people. This challenge is not being realistically addressed.

RAW MATERIALS NEEDS

It is probably safe to say that U.S. and Canadian citizens take for granted the lifestyle they enjoy. But we need to understand and keep in the forefront of our thinking the fact that vast quantities of raw materials are needed to support our economy and lifestyle.

A look at U.S. net imports (Table 3) shows that the United States is a net importer of most categories of raw materials used in sustaining its economy, and in many cases by a wide margin. Moreover, many of these raw materials come from developing nations.

But whereas the U.S. is one of the world's leading importers of industrial materials, demand for raw materials worldwide is rising rapidly. Populations of nations from which the U.S. now obtains many of its materials are also rising at very high rates. Moreover, large segments of populations in these parts of the world are ill housed, ill clothed, ill fed, and short of fuel. Needs for shelter and durable and non-durable goods of all kinds are critical and growing, and demand for these things will likely double in the lifetime of a child born today.

Where will the materials come from that will provide shelter, clothing, and fuel for tomorrow's global citizens? In the U.S. we appear to be taking this for granted. Will nations which now provide the U.S. with many of its industrial raw materials be willing to do so in the future? Should they? And if so, at what cost?

But in the ongoing great North American environmental debate there is virtually never discussion of:

- the growing need for industrial raw materials, including wood, worldwide.
- the fact that vast quantities of raw materials are needed to sustain the U.S. economy, and the lifestyle of our citizens.
- the fact that the U.S. is a net importer of almost all types of industrial raw materials–including wood.
- the likelihood that recycling, though very important, will not reduce demand for primary raw materials below current levels.

The failure to realistically address both the issues of population growth and industrial raw materials reminds me of a hypothetical situation in which your teenage son or daughter has invited, unbeknownst to you, all 200 members of his or her high school class to a party at your home. Assuming you can't cancel the invitations, what's to be done? At least two alternatives suggest themselves; 1) Plan elaborately. Consider

TABLE 3. NET U.S. IMPORTS OF SELECTED MATERIAL AS A PERCENT OF APPARENT CONSUMPTION–1990, AND BY MAJOR FOREIGN SOURCES[a] [b]

Material	Percent Imported	Principle Foreign Sources (1986 to 1989)
Columbium	100	Brazil, Canada, Thailand
Mica	100	India, Belgium, France, Brazil
Manganese	100	South Africa, Gabon, France, Brazil
Graphite	100	Mexico, China, Brazil
Strontium (celestite)	100	Mexico, Germany, Spain
Bauxite/alumina	98	Australia, Guinea, Jamaica, Surinam
Fluorspar	90	Mexico, South Africa , China
Asbestos	90	Canada, South Africa
Platinum group	88	South Africa, United Kingdom, Soviet Union
Tantalum	86	Germany, Thailand, Brazil, Australia
Cobalt	85	Zaire, Zambia,Canada
Nickel	83	Canada, Norway, Australia
Chromium	79	South Africa, Turkey, Zimbabwe
Tin	76	Brazil, China, Indonesia, Malasia
Tungsten	73	China, Bolivia, Germany, Peru
Stone (dimension)	70	Italy, Spain, Canada, Taiwan
Barium (baqite)	69	China, India, Mexico, Morocco
Potash	68	Canada, Israel, USSR
Titanium	—	Australia, Canada, South Africa
Silver	—	Mexico, Canada, Peru
Antimony	64	China, South Africa, Mexico, Hong Kong
Cadmium	54	Canada, Mexico, Australia
Petroleum (crude & refined)	42	Saudi Arabia, Canada, Venezuela, Mexico
Zinc	37	Canada, Mexico, Spain, Peru
Silicon	30	Brazil, Canada, Mexico
Gypsum	30	Canada, Mexico, Spain
Iron ore	26	Canada, Brazil, Venezuela, Liberia
Aluminum	23	Canada, Japan, Venezuela
Wood pulp products	15	Canada
Portland cement	13	Mexico, Canada, Spain, Greece
Iron and steel	12	EEC, Japan, Canada, Korea
Wood and wood products	12	Canada
Sulphur	11	Canada, Mexico
Copper	5	Canada, Chile, Peru

[a] Also significant import dependency for Andalusite, Arsenic, Bismuth, Caesium, Diamond (industrial), Ilmenite, Iodine, Leather, Magnesium, Mercury, Mica, Natural Rubber, Nitrogen, Pumice, Pyrophyllite, Quartz, Rhenium, Rubidium, Rutile, Selenium, Sodium Sulphate, Tellurium, Thallium, Vanadium, Vermiculite, Wool, Zirconium.
[b] Data for metals from Morgan (11). Information regarding petroleum from the American Petroleum Institute (1). Information for wood and wood products and wood pulp products for 1988 and from the U.S. Bureau of Census (16); data includes volumes of all shipments of wood entering or leaving the U.S. in logs, chips, semi-processed forms, or finished products.

food and drink requirements; designate available space for dancing, conversation, recreation; provide for shelter in case of rain; do what you can to protect sensitive flowers, shrubs, and lawn areas; take steps to discourage uninvited guests; give thought to collecting and disposing of trash; and so on; 2) Hope for a poor turnout and try to deal with problems as they arise. If you run out of food, maybe no one will notice, or the neighbors will donate. If you haven't roped off a dance floor and kids trample your prize begonias, you can chase them out, or wring your hands. If trash piles up everywhere, you can run around nagging, or live with it.

Hosting a large gathering without advance planning may seem irrational, but it approximates how society in general—and this country in particular—is dealing with global population trends and related issues. With few exceptions, society is taking no significant steps to limit the size of the party. Nor is it thinking realistically about how to provide for those who do show up. These oversights may spell catastrophe for both the flowers and the people.

WOOD AS AN INDUSTRIAL RAW MATERIAL

Before leaving the subject of materials, let me touch briefly on wood and it's use in our society.

Recall that the U.S. is a net importer of wood and wood products. But how much do we use? What role does wood play in our economy and in our everyday lives?

Wood and wood fiber is used in very large quantities in the U.S., both in familiar forms such as poles, timbers, lumber, and plywood, and in less known products such as molded interior panels for autos, adhesives, paints, food additives, drapes, tires, and even ping pong balls. In total, some 16.5 billion cubic feet of wood were consumed in the U.S. in 1987, representing consumption of 80.1 cubic feet per capita, continuing a steady upward trend in domestic wood use (Table 4).

TABLE 4. U.S. CONSUMPTION OF TIMBER PRODUCTS FOR SELECTED YEARS (16)

Year	Total Domestic Consumption (Million Cubic Feet–Roundwood Equivalent)	Per Capita Consumption
1970	11,995	61.1
1975	11,105	54.1
1980	13,020	70.8
1981	12,225	66.9
1982	11,930	65.7
1983	13,665	72.0
1984	14,830	77.9
1985	14,790	76.2
1986	15,920	78.8
1987 (est)	16,510	80.1

Perhaps the most effective way to illustrate the economic importance of wood is to examine how much is used relative to other materials. Today, for example, the quantity (weight) of wood used annually in the U.S. is roughly equal to the annual consumption (weight) of *all* metals, *all* plastics, and Portland cement *combined!*

U.S. FORESTS

In total, there are 731 million forested acres in the United States–about one-third of the land area in the country. It is estimated that this is about two-thirds of the forested area that existed in the late 1400s (10).

Most of the loss of forest land occurred from the beginning of settlement up until about 1920 as land was cleared for crops, pastures, and various other uses. In recent times, the area covered by forests has remained relatively stable. There was, for example, about a 1% loss in forested area between 1977 and 1990; almost all of the recent losses in forest cover have resulted from growth of urban areas.

Of the 731 million forested acres in the U.S., some 245 million acres or one-third, are classed as non-commercial. These lands are characterized by low wood production potential (i.e. less than 20 ft^3/acre/year), or by unique scenic, recreational, ecological, or other qualities. Timber used in manufacturing U.S. forest products comes from the 486 million acres of forest land classified as commercial forest land.

The U.S. is somewhat unique in having extensive land areas designated as wilderness, where no commercial activity of any kind is allowed. Some 95 million acres, or more than 1 of every 8 forested acres in the U.S. are currently designated as wilderness. Additional areas are set aside in national parks, national scenic and historical areas, and in similar parks and reserves under the jurisdiction of the 50 states.

Of the 486 million acres of commercial forest land in the U.S., 136 million, or 28 percent are owned by federal, state, and local governments. Some 277 million acres, or 57 percent are held in relatively small tracts by individual private owners. About 73 million acres, or 15 percent of the total commercial forest land, are owned by the forest products industry.

Within the commercial forests, substantially more wood is added in new growth each year than is harvested. For softwood species the growth/harvest ratio is approximately 1.07, meaning that 7 percent more is added annually in net growth than is removed through harvest. For hardwoods, the growth/harvest ratio is 1.86! (6). For the U.S. overall, considering both hardwoods and softwoods, the growth removals balance is a healthy 1.37.

The only large region of the U.S. where harvest levels exceed growth is the Pacific Northwest where the growth/harvest ratio equals 0.91 (6). Though this situation is now the subject of considerable debate, accelerated harvest of the northwestern forests was initiated as a deliberate strategy. The forests of this region have long been viewed as largely overmature, and actions have been taken to replace the old forests with younger, more vigorous stands. As a result of this strategy, net growth rates in the forests of the Pacific Northwest have been increasing for several decades.

OPTIONS TO USE OF DOMESTIC TIMBER RESOURCES

The public is also rather unaware of the amount of wood used in the economy relative to other materials. And trees and forests trigger strong emotions. So if given a blank page with no constraints, your neighbors' conclusion, based on environmental grounds, might well be that harvesting should *not* be allowed, or it should be drastically reduced. We should, they might conclude, reserve our forest land primarily for its recreational value, for its carbon storing ability, or for maintaining its aesthetic features.

While some lands do have unique recreational, ecological, or scenic value and should be reserved for these purposes, the problem is that we, of course, don't have a blank sheet with no constraints. Let's consider, for a moment, the implications of a decision to not harvest, or to drastically reduce harvest. The options that this kind of decision would lead us to are relatively few.

Options to domestic harvest of timber are to: 1) shift to the use of raw materials other than wood; 2) use wood, but import needed supplies; 3) reduce the rate of raw material consumption in general; and 4) recycle to a greater extent than currently done (5). Each of these options is explored below.

SHIFT TO NON-WOOD MATERIALS

As discussed earlier, the United States is currently a net importer of most important raw materials, and in a great number of instances, by a wide margin. Further, the U.S. today annually uses roughly as much wood by weight as all metals, all plastics, and Portland cement combined. Therefore, if there is to be a substitution of other materials in order to reduce timber harvest, it will have to be a massive substitution. Moreover, the materials substituted will be largely imported and non-renewable, and the gathering and processing of these substitute materials will, in general, result in the use of larger quantities of energy and in more severe environmental impacts than will the use of wood.

From an environmental perspective, the impacts of gathering and processing wood are generally less than for potential substitute materials. A shift to non-wood raw materials is largely unacceptable, not only from an environmental perspective, but from economic and equity perspectives as well. An increase in raw material imports would adversely affect the trade deficit. Such a move would also raise strategic questions; the primary issue here is whether a world which has twice the current population will continue to be willing to export the level of resources it now does to the United States, much less a great deal more. With regard to equity, it is important to realize that when we elect, by design or default, to have raw materials gathered and processed elsewhere, rather than in the U.S., we are, in effect, exporting the associated environmental impacts.

USE WOOD, BUT IMPORT RAW MATERIAL NEEDS

In considering this option, questions must be asked about where substitute wood might come from. Substitute wood supplies could be obtained from one or more of several regions that have relatively abundant supplies of wood: 1) Canada; 2) the Soviet Union; 3) Central and South America; and 4) Oceana.

Of these regions, only Canada, the Soviet Union, and Central and South America, have large areas of well-stocked natural forests, with those in the Americas largely in the environmentally sensitive tropics. In addition to these natural forests, there are relatively small but expanding areas of plantation forests around the world which could (and which likely will) supply a part of our future wood needs. Because of issues surrounding the harvest of tropical forests, and because of the environmental stress now felt by the tropical regions, it is unlikely that the natural forests of Central or South America will contribute substantially to the future U.S. demand for wood. Canada could possibly supply more of U.S. needs, though there are signs that production limits are being approached in at least some of Canada's forests. It is the forests of the Soviet Union that are the most likely candidate as a source of supply, and these will undoubtedly be tapped in the future by U.S. manufacturers. This option may be acceptable as a strategy for achieving some reduction in domestic timber demand. However, the same ethical and economic implications that are connected with increased use of imported, non-wood materials largely apply to this option as well.

REDUCE THE RATE OF RAW MATERIAL CONSUMPTION

When considering the rate of raw material consumption in the United States, it is easy to conclude that a reduction in the consumption rate, through taxation, voluntary conservation, or other means, represents a realistic means of reducing pressure on the world's raw materials. Some reduction in domestic *per capita* consumption may even be possible, though is realistically unlikely. Additionally, it is important to remember that the U.S. population is still growing.

An assessment of prospects for reducing raw material consumption globally shows little likelihood of reduced raw material use. A number of factors suggest that the future will bring significant increases in demand for raw materials of all kinds; among these factors are: 1) a likely doubling of world population in the next 70-100 years; 2) a desire on the part of large segments of the world's population for greater, rather than lesser, consumption of durable goods (e.g. Eastern Europe); and 3) the fact that even modest increases in the standard of living for people now without adequate shelter and other basic necessities will translate into relatively larger increases in raw material demand.

It can be argued that improved technology leading to more efficient processing and increased recycling will serve to reduce future raw material demand. Gains in both areas are likely. In order to even maintain consumption of raw materials at current levels, however, it will be necessary to halve current per capita consumption, assuming a doubling of world population.

INCREASE RECYCLING ACTIVITY

An increase in recycling of solid waste holds great promise for reducing demand for virgin raw materials. Recycling generally reduces impacts on the landscape (by reducing the need for mining or harvesting and decreasing the generation of solid wastes), and significantly reduces the amount of energy consumed in processing raw materials to usable form.

Although the advantages to be gained from increased recycling are considerable, the impact on current levels of raw material demand may be modest even with substantial increases in recycling activity. Using paper as an example, the U.S. is currently recycling 29-31 percent of total paper consumption. The paper industry has set 40 percent as a recycling target by 1995, and it is widely believed that this target is achievable through large investments of capital and some technology development. To reach a 50 percent recycling level will require considerable technology and systems development, in collection, in separation techniques, in sheet formation and so on. Further, as the 50 percent level of recycling is approached, the question arises as to how many times a fiber can be recycled. From initial work at the University of Minnesota and elsewhere it appears that for some products, a large proportion of virgin raw material will continue to be needed. For other products, fibers may be recyclable as many as 4 to 9 times, and perhaps more. One thing that is clear is that each time a fiber is recycled it is degraded; given current technologies this progressive degrading of fiber likely means lower yields each time through the "recycling loop" as well as a secondary material use pattern that will divert fiber to a less demanding application (in terms of needed product properties) with each reuse. This problem, and the extent to which it can be dealt with technologically, will define the limits to the recycling rate. In any event, consider for a moment the impact of recycling 50 percent of paper. Because the current U.S. paper recycling rate is approximately 30 percent, the effect of a 50 percent rate would be to reduce pulpwood demand about 25 percent (20/70 with some decrease in yields due to increased recycling). Should twenty years be required to reach the 50 percent recycle rate, then expected increases in domestic population will blunt the favorable impact upon pulpwood demand. Under this scenario, and assuming no change in basis weights of paper, per capita consumption, or in net import figures, demand for virgin wood fiber would be about 12 to 13 percent lower twenty years hence than it is now at a 50 percent recycling rate.

The public, or at least a part of it, appears to have much different expectations of recycling activity. I recently included a question about recycling in a pre-test used in a sophomore-level class taught in the College of Natural Resources. Asked to indicate whether the following statement was true or false–"More extensive recycling of paper could reduce harvesting of forests in the U.S. by 60 percent or more"–four out of five students, to my surprise, indicated that this was true.

Summarizing the recycling option, recycling will clearly help to reduce demand for virgin raw materials and the effect will be significant. The net impact, though, may be less than a cursory examination might indicate. It is important to be realistic.

SUMMARY

It is important to recognize that the United States uses vast quantities of industrial raw materials each year, and that the U.S. is a net importer of almost all important materials. Materials on the net import list include most metals, petrochemicals, and wood and wood products of all kinds. It is important as well to realize that world populations continue to grow at a rapid rate. Barring catastrophe, the world population will roughly double in the next 100 years. Similarly, demand for shelter and other goods are likely to at least double. Given this situation, it is difficult to imagine that Americans would rationally seek to largely import future raw material needs, when environmentally responsible and sustainable options are available domestically. Beyond the issue of rationality is the fundamental question of whether a U.S. policy designed to create a pristine domestic environment through continued and increasing reliance on other regions of the world for heavy industrial activity is ethically and morally defensible.

In conclusion, we need to recognize that there are problems with the world's environment. We need to aggressively address the most serious problems–and soon. And these problems include population growth and energy use. We need to consider human needs, including the need for materials, as part of any plan for environmental action. We need to aggressively pursue development of recycling technologies and systems, not only for paper, but for a wide variety of products. At the same time, we must view the potential of recycling realistically. We need to apply our professional knowledge and creative energies to develop better systems of management. Though we have much to learn, we know a great deal about forest and land management. But we need much better information on the natural distribution of species across a variety of habitats and we need much more and specific information on habitat requirements. We need to shift our thinking in regard to land allocation and management. The idea that nature is good and man is bad is simplistic at best, and the solution to environmental problems here and abroad is not simply to create a myriad of park preserves.

And finally, if we are to make any significant progress in solving environmental problems, we must be sure that whatever we do is based on realistic, logical, systematic, and global thinking.

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