Imperial Oil and its employees share the concern of all Canadians for the conservation of the quality of the country's air, water and soil. The company believes that the public interest is best served by regulations that

a) provide the appropriate protection of the environment at the least possible cost to the economy

b) are based on standards for environmental quality developed from adequate data

c) provide reasonable time to develop and implement the methods of control

d) treat equitably all materials and operations that contribute to pollution

e) place control with appropriate governmental agencies

In the field of air, water and soil conservation, it is the company's policy

- to comply with existing regulations

- to provide such additional protection of the environment as is technically feasible and economically practical

- to encourage, support and conduct research to establish standards of quality and to develop and improve methods of measurement and control

- to cooperate with other groups working on protection of the environment, such as universities, control agencies, technical societies and trade associations

- to anticipate future pollution control requirements and to make provision for them in long-range planning

- to keep employees, government officials and the public informed
Everyone appreciates sparkling water and clear blue skies, and most people prefer peace and quiet to the roar of city traffic and the scream of high-powered jets. The question that remains still to be answered is: How much are we prepared to pay for these rapidly vanishing luxuries?

A professor from Texas told a meeting in Toronto recently: ‘There’s no clean air left in North America. The only clean water you’ll find is in the laboratory.’ To some extent, what the professor asserted about today’s conditions would have been equally true of the situation a hundred, a thousand, or even 10 million years ago. No air is truly pure. It always contains the breakdown products of vegetable decay and, very often, it is suffused with the dust of desert storms or forest fires, sea salt and debris from outer space. Even the whitest snow may have picked up some of this muck on its way down and, sooner or later, as the same water washes its way across and through the earth on its way to the sea, it will pick up elements and salts of all sorts from the ground and become ‘hard’. But it wasn’t contaminants of this sort, the result of natural processes, that the professor was talking about. It was those that are man-made, that have turned crystal clear trout streams into turbid sewers and have occasionally even made the air over some of our cities foul to breathe and harmful to the eyes.

Environmental pollution is many things to many people. Recently, it was defined by the U.S. Presidential Scientific Advisory Committee as ‘the unfavorable alteration of our surroundings, wholly or largely as a by-product of man’s actions, through direct or indirect effects or changes in energy patterns, radiation levels, chemical or physical constitution and abundance of organisms.’ Of the air, it has been said that

Precipitators reduce emissions by 98% per cent at two smokestacks at Ontario Hydro coal-fired generating station; smoke belches from third stack where precipitator is turned off. Fourth stack is idle.
pollution occurs 'when wastes are produced so rapidly or when they accumulate to such concentrations that the normal self-cleansing properties of the atmosphere cannot cope with them.'

Rivers, too, have their own self-cleansing properties. The trouble is that, as man multiplies and covers the earth, and as his activities multiply, these natural potentials are completely overwhelmed. At this point, if someone doesn't step in and do something to remedy the situation and bring it under control, others are bound to suffer for there is only so much air, so much water, in the world. We depend on being able to use both these essential commodities, over and over again.

Dr. Albert E. Berry of the Canadian Institute of Pollution Control points out that, in our modern world, it must be accepted that the environment will never be entirely free of pollutants or other unnatural conditions. The air cannot be maintained free of all obvious ingredients, nor can water be the same as it was in the period before man inhabited the earth.

'It would be foolhardy,' he says, 'to think that conditions can be restored to that level. Neither is it necessary to do so. There is a level of tolerance below which man's well-being is not adversely affected. These levels have been prescribed over the years and are constantly subject to change. But no longer can it be expected that the environment will be maintained, even at this tolerance level, without involving expenditures and efforts.'

Man, went on Dr. Berry, must be prepared to pay out economic premiums because air and water are not as pure as they were originally. This must be considered as the cost of pollution brought on by man's activities. The main objective should be to see that the defined tolerance limits are not exceeded.

W. T. Perks of the National Capital Commission in Ottawa made a similar point. 'Although the natural conditions' is useful as a theoretical basis of measurement, it is virtually useless as an ideal for environmental improvement,' he said. 'Yet it persists in the ideology of pollution reform. We are constantly exhorted to "restore rivers to their natural condition" and to "prevent the atmosphere from being used for any kind of waste disposal". The costs of the ideal are frequently overshadowed by the moral force of the proposition. But, if restoring the elements of the environment to their pristine state is an extreme goal, accepting the unmitigated pollution of air, water and soil is equally extreme, he says.

Two incidents in widely separated areas of Canada recently underlined the complexities of the problem. In Cesterville, N.B., the citizens, normally a law-abiding lot, reached the limits of personal endurance one day last summer. The stench of rotting vegetation and dead fish in the Presquile River that flows through the city from the state of Maine got so bad that they requisitioned five bulldozers and dammed the stream at the feeder. Said one housewife: 'We can't even try to live with that smell.' The pollution from a factory on the Maine side that processes potatoes and sugar beets was such that a merchant said he feared the decaying matter could give rise to an epidemic. 'We've had the odor before,' he said, 'but it's never been this bad.'

Cesterville is a case where, partly because of international boundaries, local authorities had been powerless to act. In Bradfort, Ont., on the other hand, where the Ontario Water Resources Commission took a strong line and gave a long-established oil factory till Aug. 31 to do something about its pollution, the company responded by giving notice to 70 of its 100 employees. The president of the company said it would cost $300,000 to build and $50,000 a year to operate a waste treatment plant that would comply with regulations.

With this financial burden to bear, the company's glue prices would no longer be competitive. 'The company has been doing business in Canada since 1896,' he said, 'if there was anything else we could do we would have done it.'

D.

O. M. Solandt, chancellor of the University of Toronto and chairman of the Science Council of Canada, points out that, although the broad choices that have to be made are obvious in a general sort of way, they are hard to define precisely because they involve complex value judgments. 'I guess the first thing to be considered is, is what we consider to be a tolerable level of pollution of any particular kind in a specified place, and what we are prepared to pay to avoid overstepping that level. Each decision reached interacts widely throughout our environment. Nonetheless, the problem must be faced and all available data assembled, analyzed and studied before a choice is made. All the necessary facts will rarely be available but it is better to use all the information that is at hand than to make blindly intuitive judgments.'

In a few cases, clearly definable tolerance levels of pollution can be set. Unfortunately, in many other cases, this is a value judgment based on complex and little-understood factors. An automobile graveyard, for example, may be necessary if the streets are not to be clogged with abandoned cars, but to some people it represents an intolerable blot on the landscape. Acceptable purity of water means two quite different things to an industry struggling for survival and a fisherman out for sport.

'When it comes to deciding how much we are willing to pay for avoiding pollution or even for adding to the non-essential amenities of life, it is an arena of complex value judgments, but also one where Canada is subject to some external constraints over which we have very little control,' says Dr. Solandt. 'There is probably no other country in the world that appears at first glance to have as wide a spectrum of economic choices available to it. At one extreme, we could follow the early pattern of the post-revolution Russian economy and put all available resources into productive investment to expand our primary and secondary industries. Our stores would contain only the bare necessities and most of the amenities of life would be absent, but our rate of economic growth would be very high. At the other extreme, we could devote all of our very substantial earnings to the perfection of the welfare state and to investment in such admirable projects as parks, concert halls, museums and art galleries. This might be a very pleasant society but, with a dwindling source of revenue from productive industry, the idyll would not last very long.'

While its obvious that neither of these two extremes would be acceptable to the average Canadian, it is not so obvious where the correct balance can be struck between investment in productive industry and longer-term social projects such as better education, better health services and highly desirable amenities of life like a pleasant environment. In making the best choice we can, says Solandt, we must recognize that Canada does not live in isolation, nor does the Canadian environment stop at the border. We are part of the world economy of nations.
reach it that would be uneconomical for them to continue in business in competition with companies based elsewhere. This is not to say that nothing has been done.

In Quebec's 64 pulp and paper mills have spent $30 million in the past nine years to reduce solid wastes in their effluent fluids by about 2,000 tons a day. The remaining solid waste, however, is still substantial at 6,000 tons daily. The mills are working on further reductions of 860 tons a day to meet a December, 1969, objective they have worked out with the Quebec Water Resources Board. After hitting that target, the Quebec mills face a new directive for further reductions in the next five years costing an additional $80 to $100 million.

The pulp and paper industry's experience demonstrates one of the depressing aspects of pollution control—that costs go up far faster than improvements do. For example, during the five years from 1960 through 1964, the mills in Ontario reduced the solids in their effluents by 371 tons a day at a capital cost of $9 million. By the beginning of 1968 the amount of solids removed had been increased to 657 tons a day—nearly twice as much—but the capital cost had gone to $26.4 million—nearly three times as much.

For all Canadian pulp and paper mills to install primary and secondary waste water treatment, the Canadian Pulp and Paper Association's W. F. Fell and H. D. Pauvila estimate the total capital cost would exceed $250 million, plus annual operating costs of $40 million. Yet even these measures would not assure compliance with the most stringent features of some present regulations, they point out. Closing the last inch of that gap, says a CCPA spokesman, is simply not economically feasible with the present state of industry technology. The proper course clearly lies in concerted action, taken after proper discussion between industry and all levels of government, after all the facts have been ascertained.

Basically, much of pollution can be traced to conversion of vegetable matter or fossil fuels into energy or new products. Consequently, much of the opportunity for improvement lies in designing and manufacturing apparatus that will remove pollution at the source and convert it into useful energy or worthwhile products.

When the Ontario Water Resources Commission in January, 1965, announced new objectives for the pulp and paper industry, the response of the industry was to appoint immediately a committee of three men, made available by their respective companies, to see what could be done. The committee visited all 42 mills in the province. Its findings showed that, in the period 1960-64, the total quantity of solids released into rivers had been cut by 235,000 tons a year, at a cost of $18.3 million. Since then the mills have made further reductions of 271,000 tons—including estimates for 1968—at an additional cost of $24 million.

The demand for further action by all segments of industry is widespread, to the point where pollution control has become a major political issue. In the last Canadian federal election, for example, anti-pollution legislation was a major plank in the platforms of the Progressive Conservative Party and a survey of those who attended the Liberal leadership convention showed that delegates ranked pollution control just behind the constitution as a matter of national concern.

That this concern is shared by the leaders of industry is obvious from many recent statements. But all segments of industry that have required an effort of material assistance need action that will affect all major segments of industry and government. The product of the conference, although it was not yet in final form, did indicate an understanding that coordinated action, taken hastily on the basis of insufficient information, could, it is emphasized, do incalculable harm to Canada's economic position without achieving the desired results. This is the stand taken by businessmen who must operate industries in compliance with regulations, but it is not only the one that our government's exports. It is the government's responsibility to establish national pollution standards.

The public, for its own part, must realize that progress cannot be achieved without enormous expenditures of money. Even the minimum cost in U.S. government budget studies is $5.2 billion annually through 1972—and this does not include sewage facilities. Other studies call for $5 to $10 billion annually through the year 2000 to assure the availability of clean air and water in the United States. In Canada, one government estimate is $350 to $600 million annually through 1980. A study by the American Petroleum Institute came up with an increased cost of two cents per gallon plus a capital expenditure of four billion dollars in refining equipment to make lead-free motor gasoline.

Heavy fuels with low sulphur content will certainly add to our heating and hydro bills. These costs will inevitably be borne by the public in higher taxes to pay for the public services and in higher prices to pay for the increased costs of manufacturing. How much we can afford to pay will determine the quality of our environment.
Most of you who read this, the actuaries say, have a 50-50 chance of reaching the year 2000, assuming science keeps patching us together instead of blowing us up. Whether you'll want to reach it is something else. By then we may have lost a priceless asset that Canadians now regard as a birthright, and without which life would be intolerable: accessible outdoor recreation space, a place to 'get away from it all.' We may have abundant leisure, money and mobility, an overwhelming urge to flee from cities and crowds, but nowhere to go.

Thirty years from now, about 36 million Canadians—90 percent of us—will live in urban areas of steel, glass, plastic and concrete. Montreal's seven million will sprawl in a 35-mile radius as far as the satellite cities, Joliette, Sorel and Valleyfield. Another 4.5 million will occupy Metropolitan Toronto and its fringe—a human fan spreading 20 miles out from the present downtown core. Beyond it the 'Golden Horseshoe,' embracing the north shore of Lake Ontario, will be solid with people from Oshawa to Niagara and north to Barrie. Another million will live in each of Edmonton, Calgary, Winnipeg and Ottawa; 2.2 million in the lower mainland of British Columbia.

City life in 2000 will be forecast in summer detail. There will be technological efficiency beyond our wildest dreams, but precious little privacy or natural beauty. The yearning to run in grass, sniff damp earth, fish in a brook or picnic among rustling leaves and bird songs will become an obsession. The work week will be only 30 hours or less and, with human work rather a luxury, moonlighting will be forbidden. We'll be better educated and have twice as much disposable income. There will be a high-speed transit of several kinds, with superb motor vehicles and freeways still the mainstay of most families.

Thus, while our numbers will have doubled, our demand for outdoor recreation will have tripled. As well, many of the 320 million vacation-hungry Americans will be surging over our border. But where will all of us go to play? We're letting the space slip away. 'Canada seems to have the doubly honor of destroying more wild landscape faster with more waste, with fewer people to do it, than any other country on earth,' wrote R. Y. Edwards, biologist with the Canadian Wildlife Service, in a recent Canadian Audubon magazine.

The impending crisis is not in total space but in effective space, one- to three-hour's drive from major urban centers and, says James Woodford, executive director, Federation of Ontario Naturalists: 'It will literally require a revolution in policies, programs and personnel to preserve it.' There will be elbow room in the Rockies, Saskatchewan, Newfoundland and parts of the Precambrian Shield. There will be plenty of empy Arctic. But as Canadian author and naturalist Fred Bodsworth puts it: 'Three million square miles of boreal spruce forest and Arctic tundra are no consolation to the people who seek the thrill of hiking under towering pines or paddling a wilderness waterway within a one-day drive of home.' We are witnessing the final over-running of wild areas in southern Ontario,' M. D. Kirk, resource manager for one of that province's conservation authorities, warned a 1967 conference of the Conservation Council of Ontario. 'We must act now. There will be no second chance.'

Parks, which Canada has in quantity, are not the whole answer. For example, British Columbia, a province with fine natural assets and enlightened recreation management, has 260 parks, 2,250 areas other reserved for future use and in 1965 passed a Regional Parks Act to help fringe area municipalities get facilities. But a 1966 report of the Lower Mainland Regional Planning Board warned of 'people unable to find space at the beach, crowding at golf courses and people simply staying at home to avoid frustration and disappointment.' We should have 66,480 acres of developed parkland in the Lower Mainland but we have only 34,700 acres and much of this is not developed.

Ontario has 93 provincial parks but only six are within 50 miles of Toronto. A provincial fish and wildlife official says his branch is haunted by a half-million anglers and hunters in the Toronto area 'who, generally speaking, have no place to go.' The Metropolitan Toronto and Region Conservation Authority, one of 36 which give Ontarians outdoor recreation as a fringe benefit to conservation, has ringed Metro with a dozen super parks but some are choked to the gates by noon on a summer Sunday. And, predicts Clive Goodwin, executive director of the Conservation Council of Ontario: 'The major test of the conservation areas will come as the cities

by Robert Collins

What we need is someplace to get away from it all in only an hour's drive.
Last year the Community Planning Association of Canada, in a brief to the federal government, reported a few city problems: a Vancouver golf course lost to subdivisions because the city was unable to meet the high price placed on it by its owners; a beach 10 miles from downtown Victoria 'where cost has limited public purchase to 40 acres of a 200-acre potential'; a privately owned beach near Halifax, bought at the eleventh hour by the provincial government, under pressure from a citizens' committee, after the owner started selling off the sand.

Government intervention is a sore point with conservationists. The Ontario Naturalists' James Woodford, citing two choice Ontario properties that slipped through the government's fingers to American speculators, says: 'The taxpayer sometimes bears a heavy burden for faulty decisions and lack of foresight of a civil servant.'

Yet the civil servant is only partly to blame. He must operate with the funds and priorities assigned to him and outdoor recreation is low on both counts. Government, in turn, puts the money where it thinks the voters want it. 'Government has a way of providing those things the electorate seems to want,' points out Clive Goodwin.

Therefore, much of the onus is on us. Private individuals, organizations and the press could, by raising sufficient outcry, divert some existing government funds into recreation.

Sources. The waste of federal money alone, as detailed in the auditor-general's annual report, would buy several parks.

But few Canadians understand or care about the recreation crisis. We cling to the outdoors with our gardens, lawns and window boxes. We migrate like lemmings to our summer cottages. Yet we grumble at tax money devoted to parkland. We see tangible values in sewers, highways and education, but not in 'open' space. The Americans have calculated that their outdoor recreation is a $20 billion-a-year market for goods and services, as well as being a replenishment for man's soul. Here, we still cling to the pioneer belief that the only good space is filled-up space; that the outdoors was made to be dug up, cleared of trees, conquered. Unless we shake off that concept, we are doomed to endless urban sprawl.

We have to use the country, manage it, protect it, care for it, cherish it and love it,' said the B.C. writer and naturalist, Roderick Haig-Brown, in an eloquent plea at a 1965 conference of the Canadian Audubon Society. 'We shall not achieve this without a major change of attitude and thinking. Until now the North American ideal has been an aggressive, pragmatic and often destructive individual who crowns every rule and ethic in the effort to achieve. This idea served a purpose in opening up the country. It serves no longer, though it persists too much in our thinking. We've got to change it, in ourselves and in our children.'

If we heed his and similar warnings we must immediately calculate our long-range recreation needs and our remaining accessible space. Then we must coordinate our efforts and get the property before it is lost forever to the builders.

By 1971 we'll have the results of a national outdoor recreation study, now being conducted by the federal government in conjunction with the provinces. But already, thanks to a masterful U.S. recreation study and the preliminary returns from the Canadian study, we can guess some of the overall findings. Here and in the United States, for example,
what land is left and what it is good for. The Canada Land Inventory, a nationwide Agricultural and Rural Development Act project now classifying a quarter of the country in terms of agricultural, forest, wildlife and recreational suitability, should provide the answers by 1970. Thus causes the tricky part: acquiring property. Prices skyrocket every year in urban fringe areas. Even 80 miles from Toronto, farms sell for $300 an acre. The U.S. survey recommended that 'all levels of government should provide continuing and adequate funds for outdoor recreation, in most cases a substantial increase over present levels.' This suggests that governments should become much more efficient in all their spending and that taxpayers should expect to pay for their future play space.

However, there are ways to ease the pain of high prices and still obtain property before the costs increase. One is to buy land and lease it back to the farmer or other user until it is needed for recreation, as does the NCC around Ottawa. Land might also be bought on the installment plan, with the buyer assuming the taxes immediately, taking over the property in stages and letting the owner stay until the purchase is complete.

Another possibility is the 'scenic easement', providing recreation access to private land over a long term, with option to renew. For years conservationists have urged the Ontario government to thus protect the world-famous Bruce Trail, 400 miles of winding footpath from Queenston to Tobermory, and the Niagara escarpment, a geological rarity which the trail runs along. The property, almost all privately owned and used by verbal agreement, could be lost to public use at any time. Its future hinges on a long-awaited government study which was due for completion this year.

Donations are another source that few communities pursue. Families will often turn over a favorite property for public use, perhaps as a memorial, rather than let it fall into the hands of subdividers or speculators. But such donors like to be assured that their land is needed, will be well used and cared for, and that the communities have a thought-out plan.

All of this suggests a need for coordination and planning at high levels, something Canada totally lacks. 'We need unified action,' pleads Clive Goodwin of the Conservation Council.

'A clear situation where urban and rural planning cannot be separated,' says Jeanne Wolfe of Montreal. 'We need a federal-provincial policy for outdoor recreation to make sure that the various open space requirements of Canadians for parks and outdoor recreation will continue to be met,' says T.G. Henderson, executive director of The National and Provincial Parks Association of Canada, and the Community Planning Association of Canada last year called for a federal-provincial-municipal open-space program; a pooling of local, regional and federal know-how and money in urban affairs.

The CPAC also wants changes in the National Housing Act to assist Canadian communities to buy and preserve urban open space, patterned on similar legislation in the U.S.

Some Canadian planners also suggest we adopt another U.S. innovation: the Bureau of Outdoor Recreation, a re-

search and coordinating body that serves as a catalyst to resource planning at state and federal levels. It also dispenses sizeable grants, but only to states with sound outdoor recreation plans.

Canada, so far, is nowhere near such organization. Each province has bureaus of recreation and the branches involved in outdoor recreation, with sometimes ludicrous results. In one province, recreationists sought a particular park area while the highways department planned to run a four-lane road through it. In urban localities with no regional plan, fringe zone land goes to speculators while city, township and county staff like outfielders watching a flyball drop between them. Even national parks can't be set up without a province's consent; consequently Ontario has only 12 square miles of national parks and Quebec has none.

The end result of our indifference and ineptness could be much more serious than 'nowhere to go.' Ecologists now know that much disease is related to unsanitary environments and that where the habitat is unfavorable the species dies. If Canada is to act in time, the impetus must come from all sides: leaders in resource management, planners, naturalists, educators and 'bored youth' looking for a challenge. Parents and teachers, in particular, have an obligation to see that Canadians grow up with respect for the outdoors.

'We need an informed, considerate and ethical approach in all our citizenry towards the land and all its values and creatures,' Roderick Haig-Brown told the Audubon Society. 'We need a new spirit of responsibility, a new sense of the meaning of the land and the purpose of society, in all our people.'
The Fight for the Caribou

Once the mainstay of the Arctic, these big deer face extinction.

Catching caribou from a canoe with a shepherd's crook looks like dangerous and exciting work. Actually, it isn't. The biggest danger the catchers face is the danger of catching cold when they get soaked with the spray kicked by the struggling animals. As for the caribou themselves, what they get from the ordeal is a temporary sore throat and a bright yellow plastic streamer pinned to one ear for life.

Why would anybody want to tag a caribou? The answer is simple: the animal is in danger of extinction, and if it should die out the Indian and Eskimo way of life that it supports will die out too. The caribou is the livestock of the north—it flourishes in the tundra as no other large animal can, providing food, clothing, even shelter by means of skin tents, and makes it possible for man to exist in that hostile world. Other animal species in Canada may be as hard-pressed as the caribou, but none is so vitally important a resource over so large an area. Tagging is just one project being carried out by wildlife agencies trying to learn enough about the caribou to save the species. Tags returned by hunters will, it is hoped, establish the routes these animals follow in the seasonal migrations from their winter ranges in the northern forests to their summer ranges on the open tundra.

Their range covers almost a fifth of Canada's land area. It comprises the Northwest Territories from Hudson Bay to the Mackenzie delta, and it takes in northern Manitoba and Saskatchewan and a part of northern Alberta as well—about 750,000 square miles. In that huge territory they once roamed in large numbers—the estimated capacity of the range is a little more than two million. At the last count...
When the herds reach mid-crossing, taggers run for the boats to intercept them.

Caught with an oversized shepherd's crook, the animals are hauled to the canoe and tagged in seconds.

The terrible decline was caused by man. Since 1907 the north has been penetrated by white men, and they brought guns, outboard motors and fire. The guns and motors have made it possible for the Indians and Eskimos once, when they picked off the caribou one at a time with spears to kill them in hundreds of thousands—the 1940 kill is estimated to have reached 200,000 animals—although they often left the carcasses to rot. In the spring of 1957, for example, the Indians and Métis of Stony Rapids, Sask., killed 1,090 caribou, mostly pregnant cows, so that the hunters could not be satisfied with the bears. The relentless hunting pressure over the years killed more bears than the herds could replace, reducing them to the remnant that survives today. And fire has destroyed so much of the winter ranges where the slow-growing lichens occur on which the caribou depend that the herds have not been able to recover.

To put it in money terms, John P. Kelsall, supervisor of mammalogy research for the Canadian Wildlife Service in Edmonton, estimated that a herd of a million caribou could produce a harvest of 150,000 animals a year providing meat alone worth $4,125,000. If you add the revenue from recreation and sport hunting that a large population of animals would permit, the value of the hides of the harvested animals as leather, in handicrafts, or specialized clothing; the value of the antlers for cutlery handles or handcrafts; and the value of the bones, hoofs and viscera ground up for dog food or meat for fur ranchers, you get as much again.

That the caribou can be saved and its numbers increased sufficiently to ensure its survival there is no doubt. Kelsall suggests that if all caribou hunting were stopped completely, the number of animals would double in five years, perhaps in three. At that point Kelsall believes it should be possible to permit hunting adequate for all essential human needs. The difficulty, he points out, is providing alternate food sources and occupations for caribou-dependent people in the interval. Perhaps it would be possible to allow limited hunting if a complete ban could not be obtained, he concedes. But the practice has been unsuccessful in the past and he does not believe it would be successful in the future. If nothing is done, the very scarcity of the caribou might help them to survive if hunters gave up the chase in frustration. But this is a gamble with the odds stacked against the caribou which, Kelsall points out, quite literally come to the hunters. Many of the larger settlements in the north where most caribou are killed, are on the most commonly used migration routes or winter ranges. It is quite conceivable that the last remaining barren-ground caribou would be shot while migrating, in traditional fashion, through the centre of a northern village.

Even a mature bull can be tagged easily. Since the program began, 6,796 animals have been tagged.
Why Worry about Wolves?

OR ANY OTHER WILD ANIMALS. WOULD IT REALLY MATTER IF WE KILLED THEM ALL OFF?

Consider the wolf. Through nursery tale and legend he stalks, a terrifying monster threatening the lives of every little Red Riding Hood or pursuing panic-struck travelers caught by darkness in winter woods. So bad is his reputation that he has been hunted, poisoned and trapped to extinction in many parts of the world. In Sweden wolves are hunted fanatically; sportmen will spend weeks tracking down a single animal or seeking out a den so that they may destroy the pups. Yet a recent study showed there were only about 15 wolves in the whole country. The Lapps also hunt wolves, because of the threat they pose to reindeer herds. Here in Canada, wolves survive in the northern wilderness, although they have been all but wiped out elsewhere.

Does the wolf deserve such impenetrable hatred? Not in the view of Douglas Pinnell, a University of Toronto zoology professor who has done extensive research on wolves. Pinnell considers the wolf the most interesting and intelligent wild creature on this continent, and thinks his survival is one of the most important conservation questions of our time.

Many people are beginning to share Pinnell's view. Studies by authorities like Dr. Pinnell and the Austrian biologist and writer Konrad Lorenz show that the wolf possesses qualities men admire in each other: intelligence, consideration for others in the group, devotion to family. Lorenz even goes on to suggest that dogs with wolf blood in their veins are more loyal to their masters and more intelligent than dogs without it. Midnight trips to lonely wilderness roads for the purpose of hearing wolves howling are organized events in Ontario's Algonquin Park.

Yet wolves face an uncertain future. The deer and moose on which they depend are sought by sport hunters and are subject to increasing hunting pressure as this sport gains in popularity. The wolf's champions have been trying hard to educate outdoor enthusiasts to understand this predator's role in nature and to see how the deer's own food supply is often of greater importance than either wolves or hunters in deter-mining the size of deer populations. Wolves have to work hard for their prey and are often unsuccessful. Frequently it is the weak or diseased animal that they pull from the herd, thus helping to keep it healthy. Where wolves have been absent, or exterminated, as on Anticosti Island, and in Pennsylvania and Wisconsin, white-tailed deer have become so numerous they have caused extensive damage to the forests. In winter many of them have died of starvation. But many-perhaps most-hunters, guides and outfitters remain unconvinced that the wolf is not a serious threat to their sport. If their luck goes bad, they'd rather stay hidden.

There has been a bounty on wolves since 1792, when one was imposed in Upper Canada, and at one time bounties were being offered in every province and territory where wolves were found. But most wildlife managers have become disillusioned with the effectiveness of the system. They feel it doesn't deal effectively with local problems of predation by wolves on domestic animals, or on hard-pressed deer herd; it is difficult to administer; and perception is possible. Because of these other and smaller bounties on wolves have been discontinued everywhere in Canada except in Ontario, Quebec and the Northwest Territories.

Wolves are victims of deliberate persecution, but other creatures face depletion of their numbers even extinction of their kind—perhaps the haphazard result of actions that had entirely different objects. All hawks, owls and eagles appear endangered because these predators tend to concentrate pesticides that have accumulated in the tissues of their prey. One species, the eastern race of the peregrine falcon, has probably become extinct.

Some people will say 'good riddance' to birds of prey, but in their defense it can be argued that, besides being delightful to observe, hawks perform useful roles in controlling popula-tions of rodents and other pests. A study made in Superior Township, Michigan, showed that 165 hawks and owls killed a total of 79,437 mice over the fall and winter of 1941-42. Most species are shy of civilization, but the red-shouldered hawk is not uncommon in eastern woodlands near cities. It gives an impressive performance, soaring and screaming over.
the woods, but despite the fearsome sounds, it takes only mice and other small animals.

Birds other than raptors have also been affected by pesticides. A survey in 1967 revealed that the gannets of Bonaventure Island were heavily contaminated with DDT. These birds feed only on sea fish—a fact that indicates how persistent and widespread this pesticide is.

Perhaps the most poorly understood species is the whooping crane, which now has a wild population of about 50 birds. Wildlife scientists are convinced that the whooper cannot survive without help, and to this end eggs have been collected from wild nests and hatched. Eleven birds are being reared successfully in captivity. Eventually, when the captive breeding flock is large enough, young will be released.

Less well known is the Eskimo curlew, a large shore bird with a curved bill. It was thought to be extinct until sightings were reported in Texas and Barbados in the spring of 1966. Scientists are looking for its nesting grounds in the Arctic.

The trumpeter swan, which was once widespread, is now found only in parts of Alberta, British Columbia, and the Yukon. There are thought to be only about 2,000 of these magnificent birds. Despite protection under the migratory bird treaty, they are occasionally shot by hunters who mistake them for geese—although they are three times as large.

This problem of mistaken identification is widespread and urgent in need of solution. Most game waterfowl are not endangered, in the sense of being threatened with extinction; but hunting and destruction of habitat are seriously reducing the numbers of some species. It has become important, therefor, that duck hunters be able to identify the birds they are shooting. The Canadian Wildlife Service and other agencies offer films and pamphlets to sportmen's clubs to help train their members. The wildlife service is now developing a training kit that will include a film and identification clips for 16 species of ducks.

Some species of wild animals have become rare because their habitat has been destroyed, or because they can't adapt to man's ways. In the case of the greater prairie chicken, a medium-sized grouse, there just isn't anywhere left to live on the prairies because most of the native grassland on which it depends has gone under the plow and it has disappeared from there. Few of us have seen a northern fox, or even heard of this small species. Changes that man has made to its environment and various predator control programs have been major causes of its decline. The National Parks Service hopes to introduce this animal into a park being planned for short grass prairie country.

Other species possibly on the way to oblivion include the Vancouver Island wolf, the woodland pine martin, and the black-footed ferret of the prairies.

The eastern species of the cougar was thought to have disappeared from its range until a few years ago. Bruce Wright, director of the northeastern wildlife station at Fredericton, N.B., turned up evidence of the continuing existence of this elusive and rare animal. Since then he has compiled and studied reports of the mountain lion to prove that about 100 cougars survive in eastern North America.

In the remote mountains of the Yukon and Alaska live 500 rare grizzly or blue bears. Their range is a game sanctuary and it is hoped that this protection and a ban on hunting will save the bear from extinction. Another bear, the great plains grizzly, was thought extinct until sightings in the Swan Hills area of northern Alberta were reported.

There are only about 10,000 polar bears remaining in the world, of which about 6,000 are thought to be in Canada. Hunting of this animal is permitted only for Indians and Eskimos, but there has been pressure from game hunters and settlers to have sport hunting allowed.

The great thuderung herds of bison that once swept across the plains have dwindled to remnants; and the wood bison, a subspecies, has been reduced to about 80 animals. Half live in wilderness near Fort Providence, close to the northeast corner of Great Slave Lake in the Northwest Territories. Others are in Wood Buffalo National Park and in a large reserve in Elk Island National Park in southern Alberta.

And yet the list of endangered species continues. Also rare are the white-footed gosse, the Ipswich sparrow, Hollister's mouse-eared bat, three pikes, or rock rabbits, and various species of mice and rodents.

Does it really matter if some species are exterminated by man? Can this not be considered the normal process of evolution? Our attitudes toward wildlife and our attempts to save its value are sometimes put in economic terms. Surveys have shown that hunters and fishermen spend about $250 million annually on their sport. It has long been thought that so-called non-consumptive uses like observing and photo-
graphing wildlife result in expenditures many times those of hunters and fishermen, but this contention hasn't been proven, but more. A profound assessment of the value of wildlife was given by C. H. D. Clarke, chief of the fish and wildlife branch of the Ontario government, speaking before the Resources for Tomorrow Conference in 1961.

'Once saw an experimental herd of domestic cows whose whole life was controlled and whose diet was weighed against milk production. Theirs was a life of stanchions and cement courts—no bare ground, let alone pasture. Remembering the cows of my youth, I asked what had become of the beasts who had to roll on the fresh earth, where the slightest variation in the social ritual of bedding and milking could reduce the flow of milk. The answer was that cows with likes and dislikes, jealousies, and above all a response to fresh earth and green pastures, had been culled in the herd selection.

We have been deprived of species and some of our choicest landscapes have degenerated, but we are still sleek and comfortable, and if a few people had not spoken or written rousing about these things we should be none the wiser. Physical starvation we resist, as we would the threat of physical death that is implicit in it, but we could die spiritual, as we would in a world devoid of the sparkling lights of nature, and still retain as much physical health as the experimental herd of cows. We could exist in a world without wildlife. Some people live quite well without freedom.

The attraction that wild animals exert is undeniable, even in the most degrading circumstances. So many eager people come to watch the bears foraging in an Algonquin Park garbage pit that a park Jeep is necessary to haul out cars that venture too deeply into the stuff in their drivers' desire to get close. Such an experience is a travesty of the genuine thrill that a glimpse of a wild creature at home in its element provides, but it serves to illustrate the difficulty of satisfying a large public desire to see and photograph wild creatures.

Survival of our wildlife depends to a very large extent on public appreciation of natural values, and nature doesn't give us up easily. Even today in the Green Mountains of Vermont it is still possible to walk on graceful trails where you can find starflowers and trilliums, see warblers and watch a hawk soaring over the misty hills. And in the heavily used Adiron-
THE job ahead is not taming Canada, nor is it exploiting her resources, but conserving them. And the first problem of conservation is knowing what you mean by it.

In North America conservation became a government concern in the first few years of the 20th century after Theodore Roosevelt appointed Gifford Pinchot to a position as government forester in 1898. A popular movement arose, but soon broke up into factions quarrelling over the meaning of the term. Through the years the definition of conservation has evolved from an arbitrary 'locking up', through the rather vague 'wise use', to the business-like 'maximum cost-benefit'. In practice, every interest group has a different interpretation. Conservation of forest land, for example, means to a naturalist that it should be preserved as a wilderness. To a provincial government forester, it means securing a sustained yield from crown lands through rescinding programs and other controls on logging operations. To the forest industry, it means flexibility within sustained yield restrictions in order to take advantage of a year when prices for forest products are high. To the ecologist, true conservation may be grasped only by analyzing the total flow of energy through the input-output phases of a balanced natural system.

Differences in the meaning of the word reflect a gradual change in attitude toward resources as the population has increased and technology has advanced. For example, conservation of air and water didn't worry pioneer politicians when they drew municipal, provincial and international boundaries. With strokes of the pen they split river valleys and bisected watershed systems, erecting countless barriers to the solutions of today's problems, where one city's breakfast dishwater is another city's afternoon coffee. It will take time to untangle such territorial dilemmas and establish international standards of purity. Meanwhile, many urgent air and water conservation efforts bog down in unrelated local restrictions which befuddle social planning and curb productivity.

The problems created by tangled lines of authority can be solved. Among the leaders in overcoming such conflicts on a provincial level is the Ontario Water Resources Commission, through which the provincial government took away from
is to manage it in ways that resolve conflicting uses and yield maximum social benefits. 

There are other reasons for slow progress in conservation of minerals, among them the fact that exploitation has kept discovering new deposits, that better technology improves the recovery from the ground, and that rising prices make it worthwhile to mine lower grade deposits. Yet economic incentives decide how much to take out of an ore deposit and how much to leave in the ground. Perhaps the biggest hurdle to mineral conservation is an economic one: both private companies and provincial governments can enjoy high profits by producing the richest mineral deposits quickly, before the market turns to substitute materials or alternate sources. However, this can backfire painlessly, as in the rapid development of Saskatchewan's potash deposits, leading to overcapacity and depressed prices. Eventually the market will absorb the overcapacity, but its cost must be recovered somewhere—either from public funds (through tax relief, subsidies, etc.) or from future customers.

In oil and natural gas, there are unique reasons to practice conservation: a controlled, sustained flow eventually recovers much more than a gusher. Efficient recovery is a problem that has plagued oilmen since the first well was sunk. Oil doesn't lie free in lakes that occupy caverns underground; it is trapped under pressure in the holes of porous rock or between the grains in mud or gravel beds. And it clings to its bed, like water clings to the structure of a sponge; except for a small percentage it will not come out by itself—it must be probed. Therefore, there is always force there to do some probing, and in the form of gas dissolved in the oil itself or trapped above the oil. Frequently there is water under the oil, pushing up from below. The use of both pumps can be used to drive the oil out, but the well must be drilled carefully to make the most of these forces. And not only must the intake of the well pipe be situated properly; the flow of oil itself must be carefully regulated. If it is withdrawn too fast the water will surge up from below and the gas push down from above to choke off the oil. Producers augment the natural forces in some wells by injecting water and gas; they make thick oil more mobile by heating it; in some extremely gumy oils are heated by setting fires in the pool—the fire burns some of the oil, but its combustion gases drive some of the oil out. Even atomic explosions have been suggested for oil recovery, and one has been tried in a natural gas deposit in northwestern New Mexico.

Such techniques, and others still being developed, are necessary because the average recovery for oil is about 32 per cent. Roughly speaking, for every barrel you get out there are two left in the ground. Sometimes it goes higher; one of the world's most efficient recovery operations is at the Golden Spike field near Edmonton, operated by Imperial. There, by a method that involves pumping solvent that is manufactured from the produced oil back down into the formation to wash the oil off the rock, the eventual recovery is expected to reach 55 per cent.

But at the other end of the scale are fields that will release hardly more than one barrel in 10. To get at those billions of barrels of oil still clinging to the rock the industry is spending millions of dollars on research. Such research has always paid off in terms of extra oil recovered.

The many difficulties of the fishing industry are yielding slowly to research and conservation programs. Our policy is twofold: to hold what we have, and to try to increase stocks of fish, says C. P. Ruggles, chief biologist in the resource development branch of the Canadian Department of Fisheries at Halifax.

"One of our main problems is conservation of Atlantic salmon in the Saint John River. It's one of the major salmon runs on the east coast, and as one of Canada's largest rivers, the Saint John has an unrealized potential we'd like to work on. But for the last three years this salmon run has been on the brink of extinction because of hydro dams and pollution. In fact, in the Maritimes generally, commercial fishing is being threatened by hydro dams and pollution. We don't know if it's being reduced or depleted, but it's certainly being threatened."

"We're mounting a large and complex program to safeguard the Saint John run. Our conservation measures include conventional fish ladders at one dam; a unique fish hoist at an elevator at another dam; screens at the entrances of power canals to let young fish by-pass the turbines and get safely back to the sea."

An even greater danger to fish is water pollution. "Although
productivity is soil management. Even the basic concepts of soil conservation were almost entirely unknown in Canada for many years. Today there are still barren landscapes in the prairies, on the shores of lakes and reservoirs, leading to heavy soil erosion and choked drainage channels on water sheds and siting of better lands below. Excessive clearing and burning for agriculture is still the norm instead of growing crops on it, contributed to the disastrous wind erosion and dust storms of the thirties. Some farmers were urged to drain swamps to ‘reclaim’ their ‘rich soil’ which preceded mould in deep and impound water capacity, dropping the water table for miles around and wiping out most of the wildlife and birds. Excessive plowing and black summerfall depleted the humus on many farms.

Soil conservation efforts today are directed largely at correcting these practices and rehabilitating the land. Prairie governments support the planting of trees as windbreaks and the seeding of forage on marginal and unproductive land including croplands slopes and gullies. Farmers are now urged not to drain sloughs. Instead, their support is sought for major irrigation projects and studies. Many farmers now leave harvested fields covered in stubble and crop stubbles, in order to prevent wind and water erosion. Prairie universities provide soil testing services, supported by the provincial government, by examining the structure of the topsoil, to determine the right type and amount of fertilizer for each of his fields. Now that fertilizer is readily on the prairies, aided by Imperial’s 400 new Enog warehouses, there is widespread proof that planting off soil depletion and adverse weather. Fertilizer can also support continuous cropping and make possible a wider variety of crops. On southern Manitoba wheatfields, for instance, the less; they should grow potatoes and sunflowers, easing the current pressure on grain storage and handling facilities.

Soil management and rehabilitation measures have made so much progress that government spokesmen feel that there is no long-run conservation problem that can’t be solved with present knowledge. And that includes bad weather. The last few years have been as dry and windy as the years that created the blizzards of the 1930s, but soil management, says the Manitoba Department of Agriculture’s G. T. Somers, has compensated for those conditions: there is no dust bowl today.

Soil management and better farming technology are being supplemented by exotic new methods of getting higher crop yields, such as correcting “micronutrient” deficiencies with special fertilizers, and improving quality of the crop. The new fertilizer is replacing seven Canno-type water bombers with a multimillion dollar fleet of 20 new custom-built Canadian water bombers. Other provinces are lagging behind. New Brunswick is supplementing lookout towers with small patrol planes in hilly country where the view of lookout towers is blocked. Four water bombers follow up. Nova Scotia operates two water bombers, three patrol planes and a chain of lookout towers. Ontario is equipping most of its fleet of 44 patrol planes as water bombers, and the province circulates five helicopters during the fire season. British Columbia’s fire-fighting equipment is improved from helicopters to the huge Mars Mars amphibious bombers and in 1967 included 42 contract aircraft and 30 chartered planes. Their cost is low compared with British Columbia’s estimated 'loss of $43 million for 4.5 million burned acres in the past 10 years in 1967.'

A less spectacular but equally vital conservation battle between men and insects is the control of the forest. An epidemic of beech-losslooper insects infested Newfoundland and Labrador in the summer of 1968. Forests hired 16 planes to spray 300,000 acres in western and central Newfoundland with two types of pesticides not considered harmful to birds and wildlife,' according to Edmund P. Ralph, the province’s chief forester, but the battle isn’t over. Pulp and paper companies plan large-scale emergency salvage operations, and the government will do more spraying next year. At the other end of the country, emergency logging of balsam forests overlooking Vancouver was ordered in the summer of 1968 to <br>cost an information by the woody aphid.

Large seedling nurseries are the only way to balance the losses due to fires, insects and Canada’s normal cut of millions of trees annually. Ontario is planting 54 million trees a year, and increasing the rate by 10 per cent a year—by 1973 the province expects to be planting 103 million every year. Quebec planted 20 million trees this year, and hopes to reach 100 million in eight or 10 years. The British Columbia government last year planted 6,000 acres, and for six years it has been at 30,000 seedlings annually by 1975, in addition to large industry planting programs. Nova Scotia is one million trees a year and New Brunswick two million.

Either natural or assisted regeneration is plentiful in many areas at present. One forest company started a program six years ago which it claims is increasing wood yield by an average 40 per cent over natural yield. The company has been experimenting since 1954 to see if the wood yield can be further increased economically and the present 80-year crop rotation period shortened through large-scale forest fertilization. If fertilizer can economically increase the yield by even 10 per cent, the coastal forest alone would support an extra 275 million pulp mill with a capacity of 750 tons a day. Three quarters of British Columbia’s heavy forest forest is deficient in nitrogen; recent tests of nitrogenous fertilizer showed increases in wood yield by amounts ranging from 15 per cent to 50 per cent.

Maybe one day the water bombers will be kept busy all year round, says MacMillan Bloedel’s W. E. Ryan. ‘They’ll be useful in periods outside the fire season spraying the coastal forests with fertilizers.’ The company has other exotic conservation ideas: it could be extracting chemicals and pharmaceuticals from waste bark in the near future, so that more of the tree can be used.

In agriculture, the goal of conservation is to feed the human race forever. Since the green plant is the essential link between us and the life-sustaining energy of the sun, the key to survival is plant productivity, and one of the vital keys to plant

Fertilizer can increase forest yields. Both trees are from stands in the same area of Vancouver Island and both are the same age, but the tree on the left was fertilized with nitrogen in 1968.

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Imperial Oil reduces phenols in refinery waste water by biological oxidation. Enlargement (left) shows the "rubs" created when water and air are whipped to provide oxygen for phenol-eating bacteria

In the spring of 1834, Hugh Johnston fell in love with the St. Clair River. He had left London by horse a week earlier to look for land, and came upon the river after an uncomfortable ride through densely wooded country. In the afternoon, I reached the beautiful blue St. Clair," he wrote, "and it was such a relief to breathe the fresh cool air from the water." He liked it enough to stay.

Johnston, whose descendants are still there, would hardly recognize the area today. The houses of Port Huron, Mich., a city of 36,000-line the far shore of the river where it leaves Lake Huron. On the Canadian side is Sarnia, population 56,000, grown up on the site of the village Johnston knew as The Rapids, a community with 44 taxpayers. Most of the industry is on the Canadian side. "Chemical Valley" the greatest concentration of petrochemical plants in Canada—runs for 20 miles south from Lake Huron.

The 48-mile-long river seems unchanged. Children still swim off its banks and fishermen still angle in its waters. But nothing is the same in southern Ontario today after 135 years. The St. Clair is still blue and beautiful, but it isn't an untouched forest stream anymore; it's an industrial river, used by the people who live and work along its banks. Its enormous supply of cold, clean water has helped make Sarnia one of the richest cities in the country, and its vast flow has helped to dispose of the wastes its progress has created.

The startling thing, though, is not how much pollution there is in that water, but how little. Since the last major published survey of the river, taken between 1946 and 1948 by the International Joint Commission, the number of industries located along the Canadian shore in Chemical Valley has almost tripled. Industrial activity, measured in the selling value of factory shipments, is more than five times as great, and water use is four times as great. Yet in terms of units of production, industrial pollution has dropped, according to Ron Gutt, a district engineer with the Ontario Water Re-

sources Commission (OWRC).

Pollution from municipal sources has dropped, too, despite population increases. Sarnia, the largest city on the river, has grown by 22,000—almost 65 percent—since 1951. Its new sewage treatment plant, built under a federal loan which "forgives" about one sixth of the capital cost, and the plants built at Port Edward and Corunna by the OWRC to be repaired on a long-term basis, have reduced disease-carrying bacteria counts in the river. For example, the 1946-48 survey by the International Joint Commission (IJC) found median coliform values near the shore at Corunna—just downstream from Sarnia—were in the range of 1,600 to 2,400 organisms per 100 milliliters—2,400 is the danger level. When the OWRC surveyed the area in 1966, the median had dropped to 1,200.

Phenols—found in the wastes of petroleum-based industries—are the main yardstick of industrial pollution in the St. Clair River. The 1946 survey indicated there were 220 pounds of phenols contained in waste water discharged daily to the river from the Canadian shore. The level is now up to 300 pounds a day—about three parts per billion in the Canadian shore stream, or roughly three pounds of phenols for every 500,000 tons of water. Nevertheless, the OWRC expects phenols to drop well below the 1946 level when current anti-pollution measures come into operation.

In parts of the river, the concentrations are higher. Close to the outlets of refineries and chemical plants, their concentrations reached as high as 30 parts per billion and in these locations they average 11 parts per billion—more than five times the OWRC objectives for the average concentration—but the figures drop farther downstream as the phenols become dispersed in the river water. Industries along the St. Clair River have reduced their phenol emissions drastically over the years.

HOW TO SCRUB A RIVER

The industries of Ontario's Chemical Valley use the St. Clair River without destroying it.
Imperial has cut its emissions of these substances by 90 per cent--but industrial activity has grown faster than the rate in phenol reduction.

Each new phenols-producing plant that locates in the area puts greater pressure on all the others to reduce their emissions to make room for the new plant. As Imperial’s pollution expert Hugo Holland points out, it’s an Alice-in-Wonderland situation where you have to run as hard as you can just to stay in the same place. It’s simply too difficult, although it can sometimes be done: Imperial’s 90 per cent reduction in phenols emissions was achieved while the Sarnia refinery was tripling in size and becoming vastly more intensive in its operation. The result is a wide range of petrochemicals as well as fuel and oil products.

Phenols are not the only problems, though. The amount of oil that is irradiated and other industries have located in the area. Chloride levels off the Canadian shore in 1964 were higher than in 1946, due to increased loads from industry and the increase in population. The chlorides are generally present as dissolved solids in the form of sodium or calcium chloride.

By 1967, the level of ammonia put into the river by industry on the Canadian side was 6,000 pounds a day, an amount that, by itself, is not toxic to even the most sensitive animal or vegetable life; it is of concern only as part of the total amount from all sources--mainly municipal and agricultural. Suspended solids dropped 47 per cent, from 2,000 gallons a day in 1946 to 1,080 gallons last year, excluding those inadvertent escapes of oil that are called spills. In that time, two new refineries were built in the valley and Imperial’s Sarnia refinery nearly tripled its capacity.

Contaminants don’t affect the entire river the same way. The St. Clair flows in three rivers whose waters flow in the same bed for many miles with little mixing--it has two narrow streams along the shore and a wide stream in the middle. Most of the pollutants entering the river from each shore stay in the stream running along that side. Studies made by industry on the Ontario side show that the band carrying wastes extends no more than 300 feet into the river; it appears as a narrow ribbon of milky, blue-green water along the shore.

The middle of the river is cleaner than required by international objectives for pollution control. About half way down, the St. Clair narrows and the three streams mix, spreading out the pollutants and diluting them.

In the five to 16 days it takes river water to cross Lake St. Clair, some pollutants decompose and spills--the major problem--the river gets diluted. By the time it reaches the Detroit River, there is “basically clean”--in the words of a U.S. government study.

Concern about pollution in the St. Clair is nothing new. When Allen Kemnitz arrived in 1863 he noticed about his first canoe--brought in Canada’s first oil-spouting gusher in 1862 at Oil Springs, 22 miles southeast of Sarnia, almost 3,000 barrels a day flowed out, covering Black Creek and flowing downstream to coat Lake St. Clair with a black film. The waters also carried disease, and typhoid outbreaks were common. After an epidemic in 1912 Sarnia began to chlorinate its water supply but continued to dump its sewage in the river. A study made a year later by the International Joint Commission found the river below Sarnia and Port Huron “quite unfit for drinking purposes unless extensively treated.” 

Today, Sarnia’s sewage is partially treated and the industries almost completely. The workers spent $11 million on pollution control equipment. The quality of the water in the river has improved, and according to the International Joint Commission’s 1968 report, it even looks better. “Oil and aesthetic problems in the St. Clair River are restricted to occasional accidental industrial spills from the Sarnia area and from intermittent ship pollution,” the report says. Those spills still annoy residents, though, who complain that their children sometimes get their feet coated with a tar-like substance when they walk along the banks. Occasionally, spills that would go unnoticed by themselves combine and react to create a nuisance. When a gas oil solidifies in an oil tank at a refinery, millions of tons of asphalt can lead to a breakdown of the coating and the release into the river of a foamy, buff-colored surface mass that is unsightly but harmless and short-lived.

Any dust that can accommodate a certain amount of waste without its uselessness being limited. But when too much of something goes into fish, and other desirable water life may be killed or disappear due to adverse conditions, swimming may be improved. This is what is being done in the upper river.

This is the way the IJC wanted to achieve it when it set some “objectives” during its study 20 years ago of water linking the Great Lakes. Composed of three Americans and three Canadians, the IJC is concerned with pollution of the boundary waters. It sets specific limits for contaminants in storm water, sewage and wastes from ships and industry. Similar aims were adopted by the OWRC after its formation in 1956. The OWRC is now revising its aims to put more emphasis on the capacity of the stream to handle pollution without interference with other present or potential uses, rather than the concentration of pollutants in the effluent to the river.

Industry along the St. Clair was concerned about pollution even before the IJC formulated its standards. As early as the turn of the century, Imperial Oil installed separators to take oil out of refinery water. Another early program involved a converted lifeboat nicknamed The Juicy Soap. Alex McRae, an Imperial Oil chemist, used to cruise the St. Clair River on the 1906 safari of the boat. He used them for chemical analysis--and to make tea. It may seem unscientific but tea magnifies the taste of phenols; the tea will give you a good idea of phenols concentration, particularly if the water is chlorinated. McRae’s early work on the need for phenols control led to Imperial’s pioneering the application of biological oxidation to reduce phenols in refinery waste water. This process causes bacteria to consume the phenols, converting them into harmless carbon dioxide and water. Imperial’s biological oxidation plant is designed to get rid of 800 pounds of phenols a day.

Another early anti-pollution measure was a cooperative research project set up in 1952 by the Ontario Research Council with Imperial Oil, Dow Chemical and Polymer Corp. Called the St. Clair River Research Committee, it was the first of its kind in Canada. Its job is to assess pollution and make suggestions for its control. Among other things, the committee financed four biological surveys of the river between 1957 and this year.

Last year, the 12 companies now involved in the project broadened the committee’s scope by forming the Lambton Industrial Society. The research group continues as the society’s technical arm. This year, the member companies started to monitor the quality of water coming into each plant. Analysis will show what the company immediately upstream is putting into the river. The society also recently set up a central office to handle public complaints. “When we get a complaint,” says manager Mason Jones, “I get the details and if we can identify the source of the pollution--notify the company.”

Members of the research committee have spent roughly $15 million between 1948 and 1967 on water pollution control, and contributed to the society’s annual operating budget, which is now more than $100,000. Imperial Oil alone spent an estimated $6 million from 1956 to the end of last year to purify water it sends back to the river.

This large-scale spending reflects Imperial’s big use of water. Imperial’s Sarnia refinery uses five times as much water as the city of Sarnia does, pumping 50 million gallons of river water in and out of the plant each day. The flow of the St. Clair River is 95 billion gallons a day--2,000 times as much. Most of the intake is used for cooling. In theory, this cooling water never mixes with oil, but leaks can happen so, as a safety measure, the water goes through a separator that removes oil before the water is returned to the St. Clair. More older refineries, built near large water sources, use the cooling water only once before returning it to the source. But with stricter quality requirements, refineries have been cutting their intake and recirculating the cooling water. By reusing water at Sarnia, Imperial has been able to avoid any increase in effluent, yet expand crude capacity.

Water that does mix with oil in refining processes gets more complete separation. This doesn’t mean no oil gets into the river. Mixed in with the 50 million gallons of water Imperial discharges to the St. Clair every day are 320 gallons of non-volatile oil--less than half the amount now permitted by OWRC objectives. Even so, the company plans to reduce this discharge.

Oil in the waste water is just one of the things refineries worry about. There are many different types of chemicals present in refinery waste water and each requires special treatment. Relatively minor quantities of chlorides, sulfates, ammonia and nitrates are usually discharged in waste water. At Sarnia, Imperial strips and incinerates most of the ammonia. Organic chemicals containing oxygen--alcohols, for example--are treated in a biological process; or the practitioners of a science-based diet who believe that what you eat directly affects your health and well-being. They are seeking ways to transform the way we produce and consume food by focusing on sustainable practices, organic farming, and reducing waste. However, it is unclear how many such practitioners are involved in this project, and therefore, it is difficult to assess the extent to which they are contributing to the overall effort. As such, we do not include them in our analysis.
example—usually water soluble and are consumed biologically in the river.

Individual plants and refiners along the St. Clair have made reductions in the amounts and concentrations of wastes they release to the river, but their achievements in pollution control are obscured by the fact that there are more plants and more people using the river all the time. Even with these increases in human and industrial population, control is acceptable under normal conditions. There are still discharges, usually oil spills that are beyond the river’s capacity to absorb. Some chemical spills can kill fish and other wildlife. Even non-toxic spills are serious because water treatment is geared only to average conditions.

Ships are one of the sources of spills in the river, and some of these come from oil tankers. Imperial is equipping its tankers with Correzit 76/64, an oil slick dispersant recently developed by Ewa Research and Engineering in New Jersey. Correzit spreads oil into a thin film that shatters into tiny droplets with turbulence. This accelerates the effect of natural forces—mainly bacterial action—that decompose the oil, and reduces its tendency to cling to sand, dock pilings and sea birds.

Imperial’s practice is to hold effluent quality at the point where natural oxidation, dilution and biological digestion ensure that downstream users get water of the quality they require. This means that as population, industry and agriculture expand and place greater demands on streamflow, everybody using them will have to reduce the effluents the citys emit into them.

It’s our responsibility to take proper advantage of the re-

Marine life settles in these limestone-filled trays put by OWRC survey team on the river bottom. Analysis shows chemical quality of the water.

Copper is among the world’s biggest producers of garbage. Every day we throw out more than a hundred million pounds of the stuff—five pounds for each man, woman and child. And more garbage is piling up all the time. In Metropolitan Toronto alone, where 1,645,000 tons of waste were tossed out in 1966, garbage men can expect to haul away 1,640,000 tons in 1971. What’s to be done with it all?

What is being done is dumping and burning, but each system has its own restrictions. Incineration creates its own waste disposal problem. It cuts down the volume of raw waste by 80 percent, leaving ash residue. And a lot of municipal garbage is just not combustible. Incineration can handle only half of a city’s garbage, by weight.

Air pollution from incinerators can be cut with scrubbers, which collect dust and noxious gases from the effluent. Toronto’s new incinerator in North York has a scrubber system that takes air containing one-quarter of a pound of dust from every 1,000 pounds of flue gas released into the air. A similar incinerator in North York used to discharge six pounds of dust per 1,000 pounds of effluent before having a scrubber installed.

Dumps are so respectable that they’re not even dumps any more: they’re sanitary landfill projects. They are commonly used to effectively dispose of parkland, such as Ottawa’s Greenbelt and Sarnia’s centennial park. Toronto area skiers will be able to slide down a 600-foot slope of compressed industrial wastes in Etobicoke this winter. Strip mining areas can be reclaimed by filling them in with solid wastes. But the spread of cities is gobbling up landfill sites.

Someday cities may be using pipe lines to get their garbage to landfill sites. The University of Pennsylvania is studying the possibility of using a pipe line to transport solid garbage in a liquid slurry. Sweden is using pneumatic tubes to move garbage by vacuum to central collection points in congested city areas.

One way to limit the build-up of garbage could well be to re-use it. Already auto scrap yards go back to the steel mills to be used again. How about squeezing waste into blocks and coating the blocks with concrete to produce a new building material? This is one way to get rid of old or wrecked cars and is now being developed under a U.S. government contract. Car bodies are burned to destroy flammable materials. The remaining scrap metal is cut into sections, compressed and then encased in two inches of concrete. Tests show that walls of these scrap-cored blocks equal those of solid concrete blocks in load bearing strength. The scrap-cored blocks are lighter and provide better insulation than the conventional type. They show promise in the construction of commercial buildings, bridge abutments and piers, foundations and retaining walls.

A Japanese firm has come up with a variation on the building blocks theme. It has created a machine to compress garbage into compact rectangular shapes that will be encased in iron to make building blocks. The machine can turn garbage into building material at the rate of seven tons a minute. Earlier this year, Chicago planned to test the idea with a pilot project of its own.

Garbage can also be made into fuel. First, you remove the scrap iron, pulp and paper, wood, copper, aluminum, rubber and plastic, leaving the food and biological wastes. Shredded and with the moisture squeezed out, this part can be extruded into blocks and used as fuel.

Packages constitute an enormous amount of everyday garbage. One way to eliminate package garbage is to make the package edible. Edible papers solved the problems of containers for on-the-run servings of ice cream years ago. It’s been suggested that soft drinks could come in frozen form—a kind of popsicle on an edible stick. The meals aromatize eat come in bags of edible film.

Getting rid of those handy plastic containers is not yet a problem, according to the Society of the Plastics Industry (New York), although it may become so in the next decade. Plastics are now only 1.5 percent of total refuse, the study found, but by 1976 plastic packaging alone may be two percent of the total. This could mean headaches with incineration. Burning plastic releases tremendous heat which the older incinerators were not built to handle. In addition, plastic needs more oxygen to maintain combustion, reducing the amount of rubbish that can be burned.

Composting methods are not practical with plastic because its biological digestion rate is so much slower than that of other solid wastes. Sinking the stuff isn’t much better: buoyant polystyrene foam wastes hatted experiment pits at permanently sinking garbage in the sea; the foam brought the sealed containers bobbing to the surface.

The whole problem of packaging was neatly summed up in a statement to a U.S. government subcommittee: "The aims of packaging and solid-waste disposal are mutually exclusive," said Arsen Damay, Jr., of the Midwest Research Institute. "The package wants a container that won’t burn, break, crush, degrade or dissolve. The waste processor . . . wants just the opposite."