2 A HISTORY OF ENVIRONMENTAL TRANSFORMATION

Increasing awareness of the wider environment in which Americans live has led to much interest on the part of both citizens and scientists in describing that environment. A new breed of historians has arisen to chart and describe such matters, and within the world of science a greater number of specialists have been enticed to examine systematically how the environmental world works. New fields have emerged from botany and zoology, now transformed into varied ecological specializations to explore the interactions of living organisms. Using biology, geology, and chemistry, biogeochemical cycles have been reexamined to determine how human influence modifies these natural cycles.

A crucial task of this desire for environmental understanding is to chart the path of environmental transformation: what is the state of our environment today and how has it changed over the years? The beginning point is the impact of human activity on our finite surroundings of land, air, and water. What has that impact been in the past; how has it increased or diminished over the years; what are the kinds and pace of human influence from one period of time to another as population totals and levels of consumption have grown and technologies have changed?

For many years these environmental transformations went on without much widespread notice or without giving rise to scientific study or public concern. But by the mid-twentieth century, an awareness of the changes emerged to shape a general public consciousness of environmental conditions and to direct an increasing amount of scientific energy into understanding them. Thus were born the two main facets of contemporary environmental affairs: scientific inquiry and public action. To chart all this change requires that we separate these two aspects: environmental transformation as it took place over long periods of time, with relatively little notice or concern, and the rise of public environmental consciousness.

It matters that this increased interest in environmental affairs occurred at a particular time in particular places rather than at other times and places, and among particular people rather than others. These differences help to identify the origins of environmental awareness. People in the past were not completely indifferent to environmental circumstances; protests to environmental conditions occurred, especially in cities. As time went

on, these limited reactions evolved into a more widespread interest and gave rise to extensive scientific study and public action. I am interested, therefore, in exploring the precise timing and social roots of environmental awareness as well as the pace of actual environmental changes.

In this chapter I outline the major transformations out of which environmental interest sprang, but do so in only a limited fashion. Here I am concerned primarily with more recent environmental developments rather than a full-fledged history of environmental change; hence that topic will be dealt with only as a background for the larger theme of the book. I divide the historical stages into three parts: (1) the years prior to industrialization and urbanization, in which the human impact on the environment was relatively limited; (2) the first hundred years of urbanization-industrialization in the United States (1850–1950), in which new directions of environmental change can be identified; and (3) the years since 1950, when that change accelerated markedly.

PREINDUSTRIAL SOCIETY

Native Americans and Farmers

Historians have written extensively about the environmental culture of American Indians but less about their environmental surroundings and practices. Within the limited environments that their small populations inhabited, the Native Americans engaged in practices little different from those of the Europeans who displaced them. Their major use of the environment was for food and shelter. Some practiced agriculture in cultivated fields as well as hunted and fished and gathered edible plants. In many cases, their practices exhausted resources and prompted movement to new places to exploit new resources. They used fire to generate browse for deer and to enhance deer populations for hunting, thereby continually interrupting forest ecological processes. In the Southwest they practiced irrigation. These practices reflect not a people "in harmony with nature" but a native people who used their immediate environment intensively. Their comparatively small populations, lack of firearms, and ability to move to new unoccupied areas limited their impact and allowed for environmental recovery. European peoples who displaced them exercised far greater pressure on the environment because of their greater numbers and more powerful technologies.

A second stage in environmental history has been called "agro-ecology," and it represents the beginnings of more intensive agriculture and extraction of raw materials. This analysis has focused primarily on agricultural changes in Europe rather than America, but with the understanding that these changes were brought by

European settlers to America to constitute a new phase of American environmental history—one marked by agricultural settlement rather than more mobile aboriginal occupation. Increasingly intensive agriculture is one of the more significant facets of human pressure on a finite environment. Increasingly intensive use of labor and capital (fossil fuels, pesticides, irrigation, and fertilizers) overcame environmental limits and increased the output of farms and orchards. These intensive practices were used by all sectors of society, from individual farmers to large-scale private enterprise. Their impact on the environment was accepted—with few concerns—by people of their time.

These two earlier stages of environmental history involved far more direct relationships between humans and their natural environment than we experience today. Over time, those relationships became less direct, more impersonal, and less easily perceived. In the later years of the twentieth century, human values and perceptions also changed as the human impact on the environment became more evident and of increasing concern. The earlier acceptance of human environmental impacts makes the emergence of quite different values even more remarkable.

Early Settlement

European settlers in America introduced a distinctive stage in environmental history that emphasized settled agriculture, wildlife hunting, and resource development—all of which increased considerably the intensity of the human load on the environment. Since this occupation was extensive rather than intensive, it proceeded at first without dramatic environmental effects save in limited localities, as was the case with Native American settlement.

The most extensive of these changes was the occupation of lands formerly either sparsely occupied by the Indians or, more commonly, lands that were "empty" forests or prairies. European diseases had generally preceded the new settlers and decimated native populations, a massive environmental change in itself, so that lands once occupied now appeared empty. From the beginning of the nineteenth century, settlement, once largely confined to areas near the Atlantic Coast, rapidly moved westward to carve out farms and establish more concentrated settlements in towns, and in so doing brought about significant change in the environmental landscape. The keywatchword motivating such settlement was "land improvement," that is, the process of turning wetlands, forests, and prairies into cultivated cropland. These lands and waters were thought of as wastelands awaiting human occupation to make them produce crops, fuels, or minerals used by settlers as food, fiber, and raw materials. Forests, now in the way, were cut down and the timber disposed of as surplus; scrub land was cleared, prairies were plowed, and swampland

was drained so that crops could be grown. Although timber companies were responsible for much early deforestation, land clearing for farming brought about a more comprehensive environmental change.

As deforestation proceeded under the drive to create more farmland, its negative impacts were little noticed. Ohio was an exception. Here the main cause for deforestation was land clearing for food and fiber. By the 1870s over 70 percent of the state's land had undergone "improvement." A few of the state's leaders began to warn of the undesirable effects of such extensive change, and it was here that the modern forest-conservation movement first arose. In later years the role of farming in causing declines in forests and wetlands was almost forgotten as more emphasis was placed on timber harvesting for the market rather than for farmland clearing.

Land clearing and hunting combined to bring about huge changes in the nation's wildlife populations. Early settlers had prized the abundant wildlife found in America. In Europe, wild forests and wildlife were controlled by the royal and noble families, and commoners were denied or given only limited access to them. In contrast, the vast wildlands in America, which were unsupervised by either governments or private owners, were readily accessible to all. Over the years hunting had a devastating effect on wildlife. Some animals were considered dangerous—for example, predators such as wolves—and were not simply hunted but "exterminated." Others such as bear and buffalo were hunted almost to extinction, and by the end of the nineteenth century this was also the case with deer.

Changes in wildlife populations also occurred when wilder habitat was replaced with domesticated habitat around settled areas. Settlement created a more fractured landscape in which large intact forest areas were now divided into parcels by roads, fields, homesteads, villages, and towns. Animals that required large forested areas (such as bears) declined in number, and those that could live, or even thrive, in proximity to humans and human settlements (for example, raccoons) increased. Modern ecological science emphasizes the impact of habitat fragmentation on many species. The first stages, however, came with early land clearing and the substitution of farmsteads for wildlands.

A significant feature of the transformation from wild to domesticated habitats was the entry, even invasion, of non-native species of plants and animals. Often the seeds of exotic plants, mixed in with grains, were brought by the settlers as "green immigrants" to the American landscape. Many species (Queen Anne's lace, St. John's wort) were introduced in feed for horses and then spread their seeds to the farms, forests, and roadsides of the nation's interior. Often foreign birds (house sparrows, starlings) and plants were brought by settlers who wanted to establish a familiar piece of "home" in their new setting. Other species were brought by exper-

imental scientists for research purposes and subsequently escaped (gypsy moth), and still others came as stowaways in transportation devices, such as in the holds of ships (zebra mussels) or on imported timber (chestnut blight).

In the course of westward settlement, some areas were bypassed as being relatively unfit for settlement. Often these were hills too steep for farming or for road building. Other areas were unproductive for agriculture, such as the pine barrens of Long Island and New Jersey. Some swamps were too extensive to be drained. Such bypassed areas were "lands that nobody wanted" and hence remained in an undeveloped state for years and decades to come. By the mid-twentieth century, when undeveloped and natural lands were far more prized, these lands, once rejected, presented major opportunities for wildlands protection and management. Many a land parcel preserved from development by either private or public means could be traced to such origins.

Early Manufacturing

Environmental transformation within the countryside was augmented by early stages of industry, involving raw-material extraction and processing, small-scale manufacturing, new sources of power and energy, early forms of steam transport, and the beginnings of waste disposal from manufacturing. We consider this stage of early industrial development separately from later stages in order to distinguish initial environmental influences from later ones.

Two features of these environmental circumstances deserve attention. Despite the growth of industry, the more natural features of the dominant agrarian environment seemed, to most observers, to be able to accommodate change without severe consequences. Most of the environmental impact was local or regional in scope and hence appeared to be relatively unobtrusive in the larger environment. Artists who depicted the early railroads as fitting into a larger agrarian and natural landscape, rather than dominating and overwhelming it, seemed to be making a statement that the old and new were compatible. At the same time, however, the local and regional impacts of raw-material extraction, manufacturing, or transportation were often striking and extensive.

The impact of the new on the old can be traced most readily in the complaints of those who claimed to be harmed by change. These complaints were brought to the courts, which sought to deal with them in traditional common-law fashion. Those who fostered manufacturing and industry were pitted against those who were adversely affected by these changes. Water power was an important case. Early small-scale manufacturing enterprises, such as flour and lumber mills, were located near streams to use the power of falling water; waterwheels were placed in the rivers

themselves or in channels into which the flow was diverted and then allowed to return to the streams. As the scale of production increased, such as with textiles in New England, manufacturers wanted a larger and more constant flow, and to obtain it sought to "engineer" the river to regulate stream flow through dams and reservoirs. These changes reduced the water level below the dams and flooded upstream lands, both markedly changing the aquatic environment of the streams and provoking considerable protest from those whose land was flooded or who lost water and wished to keep the river "natural." Those who wanted to create more intensively engineered rivers generally won out because courts argued that the change was more beneficial to society as a whole.

Equally significant changes came with the industrial use of wood for fuel, but in this case some environmental effects led to conflicts and others did not. In their early years, locomotives fueled by wood emitted sparks that set fire to farmers' fields. In sorting out the resulting protests, the courts at times found that the farmers were at fault because they left combustible material in their fields. The widespread use of wood to make charcoal for the early iron industry, however, created little opposition. Charcoal making required a large amount of wood and usually drew upon younger trees that were smaller and were called "roundwood." Each iron furnace soon outran the geographical range of its supply, motivating the iron companies to purchase large tracts of forest land. At the same time they cut trees when quite young, which in turn grew back to produce more supplies. Though later forest ecologists would observe the significant impact of such practices on forest conditions, rural landowners at the time thought little of it, as it provided a market for their wood.

THE INDUSTRIAL YEARS, 1850–1950

Throughout the nineteenth and twentieth centuries, the three major human pressures on the environment—rising levels of population, consumption, and industrial production—grew persistently and steadily. Yet there were breakpoints in which more than ordinary spurts took place in the acceleration of one factor or another. For the influence of industrial production, 1850 is one such specific point, but the decades of the 1840s and 1850s were a transition period. While population and consumption continued their steady growth during the century from 1850 to 1950, they also took a distinct spurt in the mid-twentieth century, with 1950 as another specific breakpoint and the decades of the 1940s and 1950s as a transition period. We look first at the century from 1850 to 1950 and then at the years thereafter.

The main themes of environmental history from 1850 to 1950 pertain to the evolution of the various human influences on the environment—population, consumption, and industrial production. One might describe the century as one of gradual maturation of the factors that would produce the environmental pressures that increased in marked intensity after 1945 and led to their becoming the subject of inquiry and action in the last half of the twentieth century.

The general directions of industrial growth, and especially its environmental effects, were set prior to 1850, but the two decades surrounding that year marked a rapid acceleration of both growth and impact. One factor responsible for this more rapid pace was the expanding use of coal to replace wood as a fuel in manufacturing and transportation. Coal burning produced air particulates and left deposits, such as lead, in areas downwind of the early coal-using industries—in bogs on mountain tops, in lake sediments, or in layers of snow and ice on the Greenland ice cap. Scientists have been able to track the change from wood to coal by examining those residues. The data identifies slow changes over the years and then marked changes in the 1840s as the use of coal rose sharply. Thus we establish 1850 as an arbitrary but meaningful date that separates a new period from an old.

Population

Population data is standard historical evidence of national "growth," but its meaning in environmental terms is not as clear-cut. Historians have been slow to identify and examine the environmental consequences of population growth from impacts that were regional in scope in 1850 to those that became more pervasive and closely interconnected over the years. One can also outline these environmental consequences by contrasting areas with lower population densities with those having greater densities. Within each state there are similar variations; populations concentrated more in some areas and less in others. Environmental history, therefore, requires a study of population growth that relates it not just to broad national trends but to specific environmental circumstances as well. We can better understand this by comparing environmental change in areas of differing population density, such as urban, countryside, and wildlands areas, and by tracking changes in population density over time. In Michigan, for example, there are three distinct population regions, in tiers from south to north, each relatively equal in geographical extent but varying in the percentage of the total state population from 70 percent to 20 percent to 10 percent; the impact of population in each region has been quite different.

Environmental history differed between settings of decreasing and increasing density. Communities based on raw-material extraction such as mining and lum-

bering collapsed when the resource was exhausted, thereby reducing population loads. In the rural north above the Mason-Dixon line, population reached a density peak in the last third of the nineteenth century and then declined in the face of competition from more productive agricultural areas to the west, a process that took place first in New England, then in the mid-Atlantic states, and finally in the midwestern states. Farms were abandoned and villages declined. The census of 1900 brought home this change to the nation as a whole and led to considerable interest in the loss of what many considered to be a vital segment of the nation's population. Rural populations continued to decline throughout the twentieth century.

A major result of this rural population decline was the creation of many "lands that nobody wanted." Real estate values dropped, farms were abandoned, and rural property taxes went unpaid. Towns and counties now called upon state and federal governments to shore up their economies by acquiring such lands to be managed for timber production, hunting and fishing, and later a host of outdoor recreation activities. Governments acquired lands in the East for national and state forests, parks, and hunting lands, especially in the northern states of New York, Pennsylvania, Michigan, and Minnesota, and in the Appalachian Mountains. After World War II, previously bypassed lands such as wetlands and pine barrens provided opportunities to establish permanent "natural reserves" amid growing urbanization.

Consumption

Human consumption levels grew steadily over the nineteenth and twentieth centuries to impose an increasing load per person on the environment, until by the last quarter of the twentieth century it was often remarked that the high level of consumption in the United States constituted the heaviest such consumption load of any nation in the world. Through those years consumption went through several distinct stages, from necessities (food and housing) to conveniences (household appliances and cars) and then to amenities (recreation, knowledge, and leisure activities). In the century from 1850 to 1950 the main change was from necessities to conveniences, as electricity and the gasoline motor brought a new dimension to the lives of Americans. The impact of these innovations came first in the 1920s, expanded even during the depression years of the 1930s, and accelerated markedly after World War II.

A significant feature of these changes was the way in which food, clothing, and shelter came to be designed not as necessities but as conveniences and amenities,

and in this form constituted the greatest change in consumer-based environmental loads. Increasingly food was advertised in terms of "convenience" as it was precooked and packaged for ease of preparation and consumption; clothing was modified in ways that had little to do with basic protection and more to do with style and consumer preference; homeowners came to expect rooms for each child and several family-use rooms, including dining, living, and recreation rooms. The size of yards and gardens grew. Earlier forms of necessities had produced a significant load on the environment, but these newer forms, with large components of both convenience and aesthetics, increased that load dramatically.

Each new stage of consumption involved a significant expansion in raw-material extraction, and these materials were increasingly gathered from more diverse and distant sources. More intensive methods of refining, greater use of transportation and communication in bringing factors of production and sale together, and far higher expenditures of energy were all required. Each stage of this process of production and consumption was associated with greater, more elaborate, and increasingly far-flung environmental consequences, making the task of tracking the connections between consumption and its consequences ever harder. At one time those consequences were near at hand and clearly visible, but they evolved into consequences that were farther away and more difficult to observe. In later years, more serious efforts to track the environmental consequences of consumption came to be known as "life-cycle costing."

Developing a history of the environmental impacts resulting from increasing levels of consumption is thwarted by a tendency among historians to write simply about the manipulation of consumer choices by those who promoted sales. Enticements to greater consumption were, of course, ever present, but they worked their way on human desires that were more than receptive to the overtures of marketing specialists. People wanted higher levels of material goods, conveniences, and amenities. The role of human values in consumption trends in the nineteenth and early twentieth centuries contrasts with later years, when an increasing focus on quality of life sharpened tensions between material and qualitative aspects of human well-being within individuals, communities, and the society as a whole.

Industrial Production

As the number of factories and their size and scale of production increased, so also did their impact on the environment. These effects were known to economists as "externalities." Many communities that had accepted a factory in their midst when it was small found that the same factory, now grown large, produced undesir-

able waste, smells, and noise. As time went on, factories came to be located not just close to raw materials in rural areas but close to markets and managerial resources, giving rise to urban factory districts. These, in turn, attracted the construction of nearby worker housing and enticed workers to accept less than desirable residential conditions because of the proximity to employment opportunities.

Rapid growth in industrial production gave rise to environmental consequences that often could be traced to the raw materials from which that production was derived. This backward flow of links from entrepreneur to raw-material production is well charted by William Cronon for Chicago, where business leaders in the nineteenth century shaped Chicago's economy by bringing beef, grain, and lumber from far-flung sources to the city and processing them for sale elsewhere. In this way, Chicago entrepreneurs shaped the extensive transformation of the farms and forests in the city's hinterland. Undeveloped land became intensively cultivated and forests were cut down, leading to massive biological changes. Urban demands for food led to massive drainage of wetlands in northwest Ohio, northern Indiana, and southern Michigan. These backward links and their environmental consequences affected a host of communities that were sources of raw material for the new industrial economy.

Two features of the industrial economy played an especially significant role in increasing pressure on the environment: transportation and waste. Innovations in communication evolved in close connection with passenger and freight transport. Mail traveled by horse and carriage and later via railroads; telegraph poles were strung along railroad lines. But these communication devices were of far less environmental consequence than were new modes of transportation, from roads and canals to railroads, and then to highways of ever increasing density and size that evolved at an unrelenting pace. Their occupation of land went on unabated and their use of energy escalated. One could chart, therefore, the successive environmental consequences accompanying the innovations in transportation that came with the growth of the industrial economy as some of the more severe forms of the increasing loads on a finite environment.

Persistent growth in both consumption and production led to the persistent growth in waste. For individuals and families this involved "household waste" ranging from human waste to the ever increasing importance of "consumer waste." For industry it involved the waste produced from raw-material extraction, manufacturing and distribution, and other factory "externalities" objectionable to people. Waste produced by households, tolerated earlier, now came to be intolerable. In rural areas, human and animal waste was disposed of in the open countryside or

in outhouses, and discarded household items were dumped in out-of-the-way places and accepted as part of the rural landscape. In towns and cities, however, homes were located much closer together, and the increasing limitation on space led to organized and often highly engineered programs to direct human waste away from where people lived, first via drainage ditches or "dry wells" and then underground sewage drainage systems. In later years, rural people also sought to remove the offending human waste with underground septic systems and to collect household waste in managed "sanitary landfills."

In the more congested areas of cities, waste from processing and manufacturing now also came to be unacceptable. The most offensive of these processing industries were the slaughterhouses, which simply dumped the remains of slaughtered cattle and pigs into streams or burned them near the plant, giving rise to an intense stench. Reaction to the industry was so strong that municipal governments declared that it was a nuisance and must be moved outside the city. Some manufacturing plants also disposed of their waste nearby: iron and steel mills had piles of coal waste, lumber mills produced sawdust waste that was incinerated on-site, and oil refineries dumped their liquid chemical waste onto the ground, allowing it to seep into the groundwater below or drain into nearby rivers and harbors.

As people began to live closer to the offending industries, or closer to each other, waste was "removed" farther from its source. Sewage was discharged into waterways to affect those downstream; factory smoke was directed through stacks up into the air above the surrounding community; and solid waste was taken to an incinerator located beyond residences. In addition to removal, some recycling began to occur, such as the rag pickers who sorted through piles in urban streets to find discarded products that could be sold as raw materials, or those who gathered human waste and carried it to farms near the cities, where it was used as fertilizer. These methods, however, could not keep up with the production of waste. Hence there was a continuous search to find "someplace else" where waste could be "disposed of."

ENVIRONMENTAL TRANSFORMATION AFTER 1950

The environmental tendencies of earlier years, arising from the growth of population, consumption, and industrial production, established a clear historical direction that proceeded throughout the twentieth century. Each of the earlier types of impact became more elaborate and more deeply rooted in the everyday lives and practices of individuals, families, and institutions, and in modes of industrial production.

Population

The rate of population growth within the country rose sharply from 1938 through 1956, then leveled off, and then began another rise in the 1980s. The decline in the fertility ratio, the number of births per mother, was offset by a sharp rise in immigration fostered by more liberal immigration policies. Both legal and illegal immigrants came to the United States, especially from the nearby countries of Central and South America. By the 1990s the nation was experiencing the most rapid annual absolute growth of population in its history. It was encouraged by the desire of employers to secure cheaper labor, by the general attractiveness of individual opportunities in the United States, and by provisions in the law that enabled those already in the United States to bring their families and relatives into the country as legal immigrants. Behind all this was a general public acceptance of an economy and society ever growing in people and productivity.

Consumption

The nation's consumption also grew as a burst of income growth after World War II led to rising levels of consumer spending. Individuals and families could now afford a wide range of consumer products, all of which added to environmental pressures. Most consumption involved considerable energy use, first in the manufacturing process and the transportation of goods to market, and then in consumers' operation of such commodities as cars and appliances. As high rates of population growth combined with a high rate of consumption, the United States displayed an environmental impact probably heavier than any other nation in the world.

The greater distance between consumption and its environmental consequences increasingly depersonalized the links between the two. Earlier the link between one's consumption and its consequences was more clearly visible and often understood through personal experience. Now the links became almost invisible and made it possible for people to expand their consumption without so much as a thought about its environmental effects. Manufacturing and processing usually impacted specific places, but the market that was the starting point for those activities entered into the environmental equation as a broad-based influence in which the place of activity was one's home or place of business, far removed from the place of environmental impact. As long as the problem was evident in the immediate impact of a local factory, it led to public objection and outcry, but in a more global economy much of the environmental impact was more removed from where consumers consumed and hence that impact was more readily ignored.

Industrial Pollution

As the unusable by-products of industrial production accumulated, they added new dimensions to the historical evolution of waste. One was the never-ending search for new places and methods to dispose of waste as tightening policies led to restrictions on previously used places and practices. Waste was often moved from one "sink" to another: water became solid waste as it underwent "treatment" and was spread on land, or solid waste became noxious air and gases through incineration. Polluters increasingly searched for "out-of-the-way" places to dispose of waste, such as under the ground (through injection), the ocean, or new landfill or sludge-disposal sites that might not raise forceful objections. The "search for the ultimate sink" spread waste far from its source to pollute the landscape in new regions and even abroad.

Initially air pollution was thought to be harmful primarily to the communities immediately surrounding the industrial sources, so tall stacks were used to spread it elsewhere. But new knowledge linking up wind sources with downwind effects made it clear that air pollution traveled long distances. Air-pollution episodes that had been only local now became regional as urban smog at times blanketed the northeastern United States and, over time, extended to the South as well. A wide range of chemical pollutants originating from industrial regions of the globe were found around the earth, and by the 1980s chlorinated compounds and other toxic substances had been discovered far beyond their places of origin.

A major new dimension of air pollution arose from the increasing use and dispersion into the atmosphere of synthetic toxic chemicals. These chemicals, not biodegradable, persisted in the air, water, and land; in fact, they were manufactured and used primarily because they did not degrade. But their resistance to biological processes and their persistence made them hazards to biological life generally, humans as well as plants and animals. They concentrated to toxic levels in animal tissue as they moved up the food chain. Because they did not biodegrade, these toxic chemicals migrated widely from their source via water and air and were transported by humans and animals, hence becoming pervasive throughout the globe.

Dimensions of Economic Growth

In the years after World War II, human pressures on the environment became dramatically visible, especially in matters relating to buildings, transportation, and energy. All were closely related aspects of the mounting environmental pressures of the time. They deserve special attention to better understand the environmental transformation in those years.

Rapid construction of homes, commercial establishments, factories, shopping malls, and recreational centers—frequently referred to as "overdevelopment"—was an ever present feature of the prosperous postwar years. Residential areas grew rapidly around cities, and commercial centers grew in connection with them; in many small towns and rural areas, development brought "citylike" influences arising from congestion. The desire for "growth" absorbed the imagination and energies of local and regional leaders, who constantly emphasized the advantages of more population and more jobs. Open areas were continually turned into permanent development, giving rise to many proposals to restrain "growth" or to foster the preservation of still undeveloped land and natural areas. Public discourse displayed a mixture of these two contradictory impulses: public leaders fostered growth and residents participated in it. Now it also seemed that development was being organized and shaped by regional and national efforts. The scale and rate of environmental change had expanded enormously.

In close tandem with increased development came expanded transportation—more and more automobiles, parking lots and garages, airports, and interstate highways. Massive innovations in transportation took place after World War II to accommodate the increasing use of passenger automobiles, trucks, and airplanes, both within and between cities. This expanded consumption was identified from the increase in passenger miles per person, and many environmental consequences resulted: air pollution from automobiles, noise from airplanes, and both pollution and noise from trucks. All became issues, especially where the transportation lines and facilities concentrated in airports, travel routes from home to work in the cities, and trucks on the interstate highways. Conflict arose when land was "taken" by public transportation agencies for highway and airport construction, causing inevitable controversies within the affected communities as to how their land should be used.

Almost every development issue was, in one way or another, an energy issue, since development required energy, gave rise to new modes of transportation that required energy, produced pollution that required energy to mitigate, and generated consumption that required energy both to produce what was consumed and to facilitate consumption itself. An oil shortage in the 1970s gave rise to the related but quite different problem of just how the insatiable energy appetite of the American people was to be satisfied. A decline in economically competitive sources at home had increased U.S. reliance on foreign sources of oil. The ensuing "crisis" generated considerable interest among many Americans in renewable and decentralized forms of energy, such as solar and wind power. Movement toward solar and to a

lesser extent wind generation proceeded slowly but surely, yet it was also clear that even these somewhat "environmentally benign" energy sources would not eliminate the huge American energy appetite that fostered increasing consumption.

After World War II the capabilities demonstrated by the atomic bomb were used to develop nuclear power as an alternative fuel in electrical generation by coal, oil, or water. Research and development of nuclear power generation was heavily subsidized by the federal government. Initially touted to be environmentally benign and cheap, nuclear power turned out to be very expensive due to the need for complex safety measures. It also gave rise to the new problem of assuring safety in the required long-term isolation and storage of nuclear wastes. A series of small and large nuclear accidents and spills caused the opposition to nuclear power to grow, so that by the end of the twentieth century no new plants were on order for the United States, though the industry still sold its technology abroad.

Pervasiveness, Scope, and Intensity

The environmental consequences of increasing population, consumption, and industrial production took on many new dimensions in the years after World War II—dimensions of scale, of comprehensiveness, of integration, and of subtlety in their environmental impact that were far less apparent in earlier years. These gave rise to a new era of environmental consequences that reached more deeply into the nation's daily and institutional life, and provided the circumstances within which new environmental values were given impetus and expression.

Especially significant was the increasing reach of environmental effects from the local community to the region, nation, and the entire globe. The depletion of the ozone layer that limits the penetration of genetically harmful radiation into the Earth's atmosphere showed that the adverse consequences of human action extended even to the stratosphere above the Earth.

Equally noteworthy was the way in which the expansion of environmental knowledge and the extension of human environmental experience generated a perspective that "everything is hitched to everything else." As the biology and chemistry of the environment became better understood, the intricate connections between rocks and soil, plants, animals, water, and the atmosphere became more firmly planted in human thinking. These intricate relationships challenged human understanding even as they posed difficult choices for humans amid this complex environmental circumstance.

THE CITY IN ENVIRONMENTAL TRANSFORMATION

As environmental transformation proceeded, the focal point of human loads on the environment was the city. Here the growth of human population concentrated; here also were the higher standards of living with increasing levels of consumption and industry with its environmental externalities. The expanding city was a growth machine calling for ever more development, transportation services, and energy expenditure not only in the city itself but in the region and beyond. Understanding environmental transformation over time, therefore, requires that one outline the environmental stages in the evolution of the city.

Urban environmental historians have customarily considered only the environmental problems internal to the city, such as waste and pollution, and failed to explore the environmental impact of urban centers on the wider region, the nation, and the world at large. All these effects are rooted in the intense population concentration of the city. Here we can only begin to trace the dimensions of this aspect of environmental transformation.

As people congregated in increasing numbers in cities, they created new patterns of human density and experienced the complex tensions between enjoying the benefits of more intensive development and living patterns and witnessing the environmental degradation that accompanies these activities. It is here that the conflict between industry as a source of employment and the human desire for an improved standard of living collided with the desire to live removed from the less desirable areas surrounding factory production. It is here that waste from industry, commerce, and residential consumers came into conflict with the desire for a higher quality of daily life. It is here that the increasing intensity of land use for buildings and streets reduced the open spaces that enhanced urban living. Cities, therefore, define more precisely many of the tensions inherent in environmental circumstance and choice.

From the cities also came the increase in human consumption, with its ever growing impact on the wider environment. Urban consumption increased the demand for raw materials, lumber, coal and oil, minerals, and agricultural products as its own local supplies became exhausted. The impact of urban consumption was also felt in the search for places in the countryside to deposit city waste and in the city residents' use of the countryside as a place for outdoor recreation, vacation residences, and retirement homes. New transportation and communication technologies enabled urban people to penetrate farther and more readily into the countryside, to bring that countryside more fully into the urban orbit, and to facilitate its use and occupancy. The gradual but persistent penetration of urban culture into the countryside is a central theme of environmental history.

Finally, an essential element of environmental history involves the consequences of urban growth for the less settled parts of whole regions, nations, and the world. Those effects have been profound. Demands placed by urbanization on the countryside modified rural land use, altered water cycles, degraded the quality of water in its streams, changed the habitats of plants and animals, and deposited chemicals from the cities onto its lands and waters. Areas of large, intact forest land were carved up into smaller parcels by urban residents who wanted to own their own piece of the woods, with fragmenting effects on wildlife and wild resources generally. Water pollution increased indirectly as urban people consumed more and more mineral resources and stimulated mining-based water pollution, and directly as they deposited waste in rivers and modified the aquatic environment of rivers, lakes, estuaries, and oceans. Cities such as Los Angeles appropriated water resources far beyond their borders. Air pollution originating in cities spread to the wider countryside as well as cities downwind. One of the most dramatic examples was the way in which urban-based automobiles spread lead from gasoline throughout the wider environment.

The urban component of environmental change has been profound and far-reaching, extending far beyond the city. Yet though urban people had a vague sense of the larger environmental connection, that sense truly was vague, and the general environmental consciousness of people and institutions in the cities was quite limited. Hence, though this limited understanding was sufficient to be a major factor in driving a new environmental consciousness, most urban residents remained quite divorced from the impact of their numbers and their actions on the limited environment around them. A focus on the city sharpens our understanding of the nature and extent of environmental change and of both the existence and the limitations of environmental consciousness.