The Lower Hudson River Basin As a Bioregional Community

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To Pete Seeger:
For his songs and celebrations
of the River.

Along the mid-Atlantic coast of the north American continent, at the 41st north latitude, the pull of the moon draws the Atlantic tide a hundred miles westward past the Montauk-Cape May region, across the sandbar off Sandy Hook, through the narrows between Staten Island and Long Island, into the upper bay of New York Harbor, then northward into the channel of the Hudson between the Palisades and Manhattan Island. Some twelve miles upstream the tide passes the Harlem River where it meets the mainland of the continent to the east for the first time. Another thirteen miles north, the tide widens into the Tappan Zee; then, after a slight narrowing, the river again widens out into Haverstraw Bay, the broadest part of the river. Beyond the Bay come the highlands, the grandeur section of the river, where the tide pushes its way through the mountains on to the Newburgh-Poughkeepsie region. There the estuary changes to a tidal river, the ordinary salt line is passed, the fresh water begins. After another forty miles passing through a pastoral region of rolling hills on both sides of the river, the tide passes Albany. Then on to Troy where, still some two feet high, the tide breaks against the Troy Dam. Here ends the lower Hudson Basin. The upper section of the river continues north beyond Fort Edwards then turns west to Glen Falls and north in a winding course to its origin on the heights of Mt. Marcy in the Adirondack Mountains.

The region from Troy to the Lower Bay constitutes the Lower Hudson River Basin with a climate determined by its mediterranean latitude, by its prevailing continental winds, and by the remnants of the Labrador current which come down from the north inside the Gulf stream. In January and February the Arctic air masses flow across western Canada and then eastward across this region. At other times the rain clouds move up from the Gulf of Mexico on wind currents that are consequent on the eastward turning of the earth on its axis and also from the solar heat that causes the southern currents to join the prevailing westerlies that arrive in the Hudson region after an extensive journey across the continent.

The river is paralleled on the east by the Berkshire and Taconic mountains which extend down into lower Westchester where the rolling contours of the land extend across the western Bronx. From the east the Wappinger flows into the river at New Hamburg, the Fishkill comes in below Beacon, the Croton above Ossining. On the west the Helderberg, Catskill and Shawangunk Mountains dominate the skyline until the Palisades begin below Tallman Mountain to continue on southward until they disappear below the surface past Hoboken. The principal streams flowing in from the west are the Catskill, Esopus, Roundout and Sparkill. The Wallkill, coming from the south flows into Roundout Creek in the Kingston area. In the lowlands back of the Palisades are the Hackensack and Passaic Rivers. The Hackensack flows some forty miles south from the Parkland area of the Palisades across the Meadowlands into Newark Bay. Further west the waters coming down from the Ramapo Mountains in the Pequannock, the Ramapo and Wanaque Rivers converge below Pompton Lake and then after a few miles the Pompton River flows into the Passaic. This river turns northeast to Paterson where, after spilling some seventy feet over the Great Falls, it turns south along the borders of the Meadowlands, then east past the city of Newark to enter Newark Bay.

The waters of Newark Bay flow into the upper New York Bay through the Kill van Kull along the north side of Staten Island. On the south of Staten Island, Raritan Bay receives the

waters of the Raritan River flowing eastward some seventy miles across central New Jersey. Raritan Bay in turn flows into the Lower Bay. Across the Upper Bay, the East River, a tidal strait between Manhattan and Long Island, brings the waters of Long Island Sound down into the Upper Bay with the ebbing of the tide.

The Upper Bay, the central feature of the estuary, is contained, then, by Manhattan Island to the north, by Long Island to the east, by Staten Island to the south and by the Bayonne Peninsula to the west. The Lower Bay, enclosed by the encircling arms of Sandy Hook to the south and by the Rockaway Peninsula on the northeast, flows into the Upper Bay through the Narrows, the name given the entrance channel to New York Harbor, a channel that passes between Staten Island and the Brooklyn section of Long Island. To the east beyond the Narrows we find Jamaica Bay.

West of the Narrows is Staten Island. Some fifteen miles long and seven miles wide, this Island belongs to the coastal plain of the Atlantic which extends all the way from Cape Cod across Long Island and Staten Island southward until it turns westward across Georgia and on to Texas. South of the line from Sandy Hook to Rockaway Point the estuary becomes the New York Bight; this in turn extends a hundred miles out to the line from Cape May on the south to Montauk Point on the north.

The region from Troy to the southern limits of the Lower Bay functions as a bioregion that is generally known as the lower Hudson River Basin. It needs to be known, however, not simply by description such as this but in its history and its functioning.

The Shaping of the Land

The story of this region might begin with the meeting of all the great continental sections of the earth's crust some 350 million years ago and then their rifting apart some 150 million years later at the beginning of the Mesozoic Period. When the continents crashed into each other to form a single land mass, Pangaia, the Appalachian mountains experienced their most recent uplift into heights far beyond their present elevation. Ever since then these mountains have been eroding. When the break from Africa occurred and North America began its northwestward move to its present position the Hudson River Basin took on its most distinctive shaping. From that time a long sequence of transformations has taken place in both the geological and biological orders. Climate and life forms have gone through fluctuations too numerous to recount.

During this period the great hydrological cycle has lifted enormous quantities of water from the Gulf Region, the Pacific and Atlantic Oceans and poured them down over the region in an unceasing sequence. Such activity above must be taken with the subsurface geological movements below to understand the formation of the region. Another great and continuing force is the rise and fall of the tides that move through the bight, the long estuary, and on through the last tidal section of the river.

To these shaping forces must be added the life systems that extend all the way from the benthic organisms in the bottom-mud and the free-floating phytoplankton and zooplankton through the other aquatic forms of the river and the various insect and vertebrate species of the land to the hawks that ride the winds high above the river. A great community of all these com-

ponents has taken shape over these past many years.

Most recent of these shaping forces, among the most awesome, are the glaciations of the past million years. The last glacier extended from the northeast down through the basin until it reached its southern limits midway across Long Island, Staten Island and central New Jersey. Beginning some 60,000 years ago the glacier reached its furthest extension around 15,000 B.C. when ice, perhaps a thousand feet high, pressed down upon the surface of the Basin. This glaciation changed the area in an extensive manner. It left its moraines along its borders. It further defined the contours of the landscape. It left rock debris strewn everywhere. It gave a new course and for a while a new water source to every stream.

As the glacier receded the Upper Bay was blocked and a vast lake developed over the upper New York area. Only later did these waters break through the section now known as the Narrows to provide the transition from the upper to the lower Bay and on to the open sea. The river, which for a while flowed through the Sparkill Gap back of the Palisades down through the lowlands to the Passaic and Hackensack Rivers and on to the Newark Bay, now found its present channel east of the Palisades. The saline content of the river increased in its upper reaches until it arrived at its present status where the fresh water generally begins in the Newburgh-Poughkeepsie area, although on occasion when the watershed flow is abundant the salt line moves far downstream.

The modern history of the lower Hudson River Basin as a bioregion begins with this retreat of the last glacier. The glacier absorbed so much of the ocean waters that the sea level was lowered considerably. The shoreline extended another hundred miles eastward before the land disappeared under water to form the continental shelf. For some thousands of years the river crossed this coastal plain in a channel that remains until the present, deep beneath the surface of the bight. When we turn from the physical structure and functioning of the basin to its life systems we might begin with the aquatic life forms and then pass on to the terrestrial species of flora and fauna. In every case the basin has experienced a post-glacier renewal.

All the living forms in the region are newly arrived and are still engaged in a process of biological adaptation. This adaptation can be considered in three main periods: the period prior to the arrival of the European peoples; the period from 1609 until 1962, when Rachel Carson published the first critical survey of the biological degradation taking place throughout the north American continent in her book, Silent Spring; and the period after 1962 when a new attitude toward the natural world began to influence our relations with the estuary. Because this last period is already begun in its consciousness expression this present essay has become possible.

The Aquatic Life

Any discussion of aquatic life in the Basin must begin with the plankton and the benthic organisms that are the first living forms that bring about transformation of the inorganic nutrients of the river into organic foodstuffs to nourish higher forms of aquatic life from the smallest of the finfish up to the great sturgeon that are found so plentiful in these waters. Since the retreat of the glacier these micro-organisms have supported the abundant life of the river although now because of the volume of sewage in the river a change is taking place from a natural basis of the chain of life to a detritus basis. During this early period the interior drainage systems of the continent made possible that fish from the Gulf and intermediate regions enter the Hudson system. The great variety of fish in the river is due in a significant degree to this influence.

Although we have no complete account of the sequence of life development in the river during the post-glacier period it is clear that the estuary and the bight beyond became an area for migratory species from both southern and northern waters of the Atlantic as well as from the interior drainage systems. In the bight beyond the estuary some three hundred species of marine fish are found at different times of the year, although only a few species are considered permanent residents in the sense of spawning in the bight or in the estuary.

In the river basin itself well over a hundred species of fish are found. A great variety of habitat is afforded by both fresh water and salt water; also by tributary creeks and streams of all sizes, by shallow basins along the shorelines, and by various coves and wetlands. All these make suitable sites for feeding, for protection and for propagation. Since the completion of the Erie Canal in 1825 and the subsequent canal system to Lake Ontario more species have entered the river from the Great Lakes region. Still others have been intentionally introduced from abroad. These new arrivals are constantly altering the ecological balance of the river. Among the species introduced are the Brown Trout, the Small-mouth and Large-mouth Bass, the the White and the Black Crappie, the Bluegill. But most significant of introduced fish are the Carp. These have so expanded their numbers that in diversity as well as in numbers the fish population of the river is possibly greater now than ever before. There is no record of any species in the river ever becoming extinct there. But while this numerical abundance is clear, it is due primarily to the extreme multiplication of a few species which have limiting effects on other species. The fish that multiply so abundantly seem generally less desirable as edible fish for humans.

Among those fish of the Hudson that spend part of their lives in the river and part in the sea are the American Shad, the Striped Bass and the Tomcod. The Striped Bass is the splendid fish of the River. One of the great game fish of the Atlantic coastal waters it is found both north and south of the Hudson region. Along with the Striped Bass, the American Shad, a member of the Herring family, supplies the fishermen of the Hudson with their most abundant and most valued fish for eating. The Atlantic Sturgeon also finds in the Hudson Basin a favored habitat. Shellfish, Oysters, Clams, Crabs, all in this earlier pre-modern period were abundant in the basin. Because of the extensive variety in the saline content of the river almost any aquatic form could find a favorable habitat.

The Forests

This story of life in the Basin needs to be carried on to the Land and its living forms; its vegetation, its vertebrate and invertebrate life systems. First the trees.

As the glacier receded the tree cover advanced from its southern appalachian region of refuge. First the tundra and the the post-tundra spruce, fir and white pine. But if the spruce was dominant from around 9,000 B.C., this underwent a change around 8,000 B.C. when the white pine and red pine became the dominant species. A thousand years later, as climate continued to change, a greater number of deciduous trees moved in, especially the oaks and hickories. These appeared early in the Long Island and Staten Island area. The hemlock moved into the moist areas to the north. The transition from oak-hemlock to oak-hickory-chestnut in the mid-Hudson took place between 4,000 - 2,000 B.C.

At this time also the various biotic subregions were taking on their more permanent features. These sub-regions can at present be identified as the shoreline region where the red maple, the willow, the eastern cottonwood and sycamore are found among the usual grasses and shrub growth along the river. Farther inland from the shoreline within some five to ten miles especially on the sloping hills of the eastern side of the river we find the oaks, both white and red, the sugar maple, hemlock, tulip and dogwood, all distributed according to ground moisture, earth composition and micro-climate; but all easily recognizable and in a certain abundance where they have not been cleared from the area by human agency.

If we move further landward into the tributary valleys of the River we find new combinations. In the Wallkill valley, along with the sugar maple and the red maple, the oaks, ash, white pine and sycamore, we find the black locust and the American elm. Shagbark hickory grows on the higher elevations. Another sub-region with its distinctive combination of forest growth is the Hudson Highlands. There a type of climax forest can be observed; the red oak, chestnut oak and pignut hickory abound along with sugar maple and with hemlock in moist sheltered areas. In the Shawangunk Mountains below the Catskills the red oak, hemlock and white pine are found along with the tupelo, the birches and striped maples. North of these mountains in the Catskills the colder summit regions have balsom fir, red spruce and birches. Lower down are the sugar maple, beech and hemlock.

Opposite, on the long north-south ranges of the Taconic Mountains, are chestnut and red oaks, pignut hickory, the birches and on the lower elevations sugar maple, beech and hemlock. Further south, in New York City, an exceptional variety of trees is found including almost all that have been named so far except the spruce and fir of the colder mountain heights. A wide variety of oaks are there, the hickories and the sugar maple are prominent. The sweet gum, sycamore and tuliptree fill in many of the warmer areas while the dogwood are scattered beneath the woodland cover. In the sandy areas along the shores are pitch pine. The city provides the northern boundaries of the willow oak.

The greatest loss over the years is the loss of the great American chestnut and the American elm.

Although the trees mentioned constitute the native forests of the basin, a long list must be added of trees that have been brought into the region from other parts of the world, from Asia as well as from Europe. Among these the lombardy poplar is one of the earliest. To this can be added the ginko, the oldest known of the broadleaf trees, the London plane, the Russian olive, the ailanthus, the copper beech, the Japanese black pine and the Japanese maple. So abundant are these imported species that at present most of the city trees, except for those in the botanical gardens, are probably of such imported species.

The Land Fauna

From the trees we pass on to the further story of the terrestrial animal life in the region. This account, too, in its modern phase, begins in the post-glacier period. Any adequate presentation should encompass the insect life as well as the vertebrate life systems. But here, as in so many other instances, insect life will only be referred to since its own magnificent story is still to be discovered in its true dimensions. We can only acknowledge that the human community does itself no honor nor does it strengthen its capacity for survival by its disdain of the insect world and by its efforts to destroy large insect populations. With this slight reference to those life systems that in number of species and in biomass are far greater than that of all the other terrestrial animal forms, we pass on to the vertebrate species in the post-glacier period.

Around 8,000 B.C. we find a number of the larger mammalian species in the region; the mastodon, the moose-elk, the mammoth, the horse, the giant beaver and the giant ground sloth. All these were extinct by 5,000 B.C., for reasons that are not fully clear. Among contributing factors, possibly, were the Indian tribes, for there is clear evidence of their extensive hunting some of these species around 7,000 B.C. Also since the mastodons were browsers in the open spruce woodlands they may have found a more limited food supply when the spruce gave way to the pine forests. Of the large species that still survive, though no longer in this region, are the bison, the caribou and the elk. The bear and the deer do survive in the area, the deer most abundantly. At one time when the deer were diminished to very small numbers special measures were taken to enlarge the population. Now the increase in numbers often causes excessive pressures on the food supply.

Around 5,000 B.C. many bird and mammal species seem to have come in. Among these were the native turkey. To bird species this temperate climate and its diverse habitats has been so attractive that of more than six hundred bird species on the entire continent more than three hundred species have been seen in the single area of Jamaica Bay in recent years. If we include the entire bight, out to open sea, over four hundred species have been observed. In recent times the mockingbird in great numbers has established a year round residence in the Valley.

The Indians

Human habitation of this region by the native Indian peoples began around 9,000 B.C. and continued until around 1700 A.D. when the native peoples, except for a few small surviving groups, had disappeared from the basin. At its height the Indian occupants probably numbered around 65,000, the greatest concentration of native peoples on the continent outside the more advanced areas of the southwest.

Their story can be told in its four major phases: the paleo-Indian phase, from 9,000 - 7,000 B.C.; the archaic phase, from 7,000 - 1,000 B.C.; the woodland phase, from 1,000 B.C. - A.D. 1,620; the contact phase, from 1,620 A.D. until the present.

Five sites of Paleo-Indian presence have been established within the lower Hudson Basin; at West Athens Hill, near Catskill in Greene County; at Kings Road, near Coxsackie; at Twin Fields near Dwaar Kill, in Ulster County; in the Dutchess Quarry Cave and at Port Mobil near Charleston, Staten Island. A number of other sites are in the immediate surrounding area. The main evidence is in the form of camp sites where a variety of fluted points, scrapers and flaked knives are found with fragmentary remains of bones and seeds. The absence of human remains is not to be wondered at since such remains of earlier humans are seldom found on this continent. These paleo-Indians disappeared from the region about the same time as the large animals disappeared and also at the time when the forest changed from a spruce-fir open forest type to a more closed pine forest. This coincidence can only be noted along with the observation that an interval of possibly three thousand years separates these paleo-Indian peoples from the peoples of the archaic period.

Concerning the Indians in the later archaic period (7,000 - 1,000 B.C.) we have abundant evidence. Their dwelling in the region was facilitated by a further change in the arboreal character of the region from white or red pine to mixed woodlands of oak and hickory with some pine and hemlock. This information, obtained from pollen count in surviving bog areas, indicates that a warmer and more moist climate had come to prevail.

At this time the sea level was still some twenty feet below its present level although it was consistently rising and by 1,000 B.C. was within three feet of what it is at the present time. The river was establishing its saline density at various distances upstream. This salinity formed ideal habitats for crustacean life forms; for oysters, clams, shrimp and lobster. Oysters were especially abundant along the river shores where, for a while, they grew to a size much larger than at present. This can be seen from large hidden remains at Montrose Point and Croton Point. Other foods available in almost limitless quantities were berries, nuts, seeds and roots. In addition, of course, there were deer, turkey, small animals and birds.

This period gave way to the Woodland Phase (1,000 B.C. - A.D. 1,620) when pottery became a central aspect of cultural life. Such vessels indicate a settled mode of dwelling since pottery could not conveniently be carried from site to site as in a wandering gathering society. It would thus seem that for two thousand years the woodland Indians continued their subsistence economy of the previous period but did have storage vessels for their water and food supplies gathered from the natural environment. With such natural abundance there were little need for sustained horticulture until around 1,000 A.D. when the domesticated plants of the southwest, maize, beans and squash (the three sisters), were introduced into the life-pattern of the Hudson dwelling peoples. From this time on, village life developed those

more complex patterns that were observed by Europeans in the seventeenth century. Land for cultivation had been cleared, more advanced tools developed, large houses were built, larger social institutions created.

All of this had a significant but limited impact on the ecology of the region since large areas of land were cleared, up to a hundred acres, by burning the underbrush, girdling and burning trees and then cutting them down. Food supplies, dried in the sun or by fire, were stored in underground pits after being wrapped in bark or placed in woven baskets.

Among the greatest and most influential of these achievements in technological and social development was the longhouse. One structure in a neighboring Mohawk village was 210 feet long and 20 feet wide. While no village of such size has been found in the Hudson River Basin itself, it is clear that the capacity for village dwelling was considerably increased in this general region by 1,500 A.D. One oval house on Long Island, 15 by 20 feet, was possibly in a village of well over a hundred persons. The disposition of the tribes throughout the Hudson Basin in this period is well known. The area was mainly occupied by Algonguian speaking tribes. This included the Lenni Lenape or Delaware as they are generally known.

Two divisions of the Delaware existed according to language difference; the Munsee and the Unami. The munsee-speaking Delaware in the lower Hudson Valley were clearly distinct from the Mahican of the upper basin as well as from the peoples of the New England Region. The munsee-speaking tribes include the Esopus Indians on the west bank of the river between the Highlands and the Catskills, the Haverstraw, Tappan, Hackensack and Raritan to the south in those regions still identifiable by these names.

On the east bank the Wappinger were just above the Highlands. Then, moving south, the Kichtawanks were in the Westchester area, the Sinsinks in the Ossining area, the Wiechquaeskecks to the south as far as Dobbs Ferry, and finally the Rechgawanks in the Yonkers, Bronx and Manhattan region. Further across the East River on Long island were the Nayack, Canarsee and Rockaway. Above the Wappinger on the East Bank of the River were the Mahican. They, too, spoke an Algonguian language. Their region extended northward from the western part of Dutchess County on the east bank and from the valley of the Schoharie on the west bank. From there they extended into the Lake George and Champlain areas. Since they also occupied the lower reaches of the Mohawk River they were often in conflict with the Iroquois, especially the Mohawk, to the west. This conflict

with the Mohawk eased considerably relations with the Delaware to the south who much preferred a Mahican supremacy in the region to that of the Mohawk and the Iroquois confederation.

In numbers at the time of European arrival, the Wappinger and the other Delaware tribes may have counted some 35,000 members, the Mahican some 10,000, the Montauk some 20,000. Together over 60,000 native peoples possibly occupied the Basin in its full extension.

At this time, in the opening decades of the seventeenth century, this way of life seems to have attained a certain general level of small village communities with extensive horticulture along with hunting and food gathering. They were, apparently, at a high moment in their cultural development. If they were without advanced metallurgy, without some developed form of writing, and without stone architecture, they did have a functional way of life integral with the bioregion, a way of life with great promise for the future. But then came the Europeans.

The European Presence

While the life community of the Hudson Basin was talking shape a gathering force of enormous consequence was forming eastward across the sea. The peoples of Europe were developing their scientific insight and technological powers and groping their way seaward to this continent from the direction opposite to that of the Indians who came eastward across the north Pacific rim. It was a quiet October day in 1609 when henry Hudson entered the river and later sailed north as far as Albany. The entire bioregion might have trembled on that day as its role in the functioning of the planet Earth was suddenly changed by several orders of magnitude.

The European arrival was another component of the convergent processes taking place in this region throughout the post-glacier period. There the southern Carolingian life forms, especially the hardwood forest of dominant oak-history, begin to give way to the northern hardwood forests of birch, beech, maple and hemlock as a transition zone to the more northerly pine and then to the spruce-fir forests of the Canadian vegetation zone. The marine life of warmer regions spend their summers in these mid-Atlantic coastal waters while the northern species come here in the winter. The coastal plain itself leaves the mainland of the continent at this latitude as it moves northward. So too the interior of the continent is joined with the Atlantic coast more conveniently here than elsewhere. It is not surprising then that the wandering peoples from the European world found their way to this region.

After the arrival of Henry Hudson in 1609 the early trading posts were established in the Albany area, on Manhattan Island, in Brooklyn and Staten Island, and in the Bergen and Jersey City areas of New Jersey. Trading soon gave way to permanent settlements on land obtained either by treaty or purchase from the native peoples or simply by occupation in territories designated by Dutch authorities. Agreements or purchases were made with the Indians in Manhattan in 1626, at Yonkers in 1639, at Rhinecliff in 1647, at Hudson in 1662, Athens in 1665, Poughkeepsie and Verplanck in 1683.

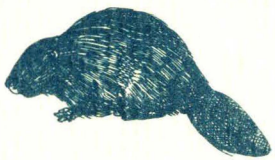
Throughout much of the region the manorial system of land tenure was established, a system whereby the Dutch assigned large areas of land to favored persons who then constituted a land-based aristocracy with tenant farmers who paid a stipulated rent for cultivating the

land. Even when the English permanently took over the Hudson River Basin in 1665 this system continued until it was finally abolished in the mid-nineteenth century by a change in the state constitution.

Alongside the manorial establishments, settlements were made throughout the region during the 17th and 18th centuries, although few places attained even village size. The Manhattan settlement, originally known as New Amsterdam, became New York in 1665 and advanced considerably as a commercial port. Brooklyn was not a city until 1834. Bayonne and Jersey City remained undeveloped. Bergen became a village in 1660. Hoboken became a town in 1804, a city in 1885. Yonkers and Tarrytown developed in the 17th century as settlements within the Philipse Manor territory. Peekskill, a trading place in 1697, became a village only in 1816, a city in 1940. Haverstraw was incorporated as a town in 1854. Poughkeepsie, a village in 1700, became a city only in 1854. Newburgh, settled in 1709, was incorporated as a city in 1865. Kingston became a village as late as 1805. Catskill was a town in 1805. Hudson, a whaling port, was settled by Quakers from Nantucket and Providence in 1783. Athens established itself as a village in 1805. Albany was settled as Fort Orange in 1623 and chartered as a city in 1686. Troy, a part of the Rensselaer Manor, became a village in 1798, a city in 1816.

From these dates it can be seen that a diffuse European presence existed throughout the basin for some two centuries after the flow of Europeans into the region had begun. In the post-Revolutionary period, especially in the early 19th century, a series of new phenomena moved over the basin to the self-exaltation of the incoming peoples who had passed from the settler phase to inhabitants with several generations of background in the region. The new phenomena was especially concerned with increasing the speed and volume of travel and transportation. The steamboat, invented in the early 19th century, made its first commercial journey from New York to Albany in September of 1807. The Erie Canal was completed in 1825. The railroad began functioning in the basin in the early 1830s.

Prior to this period life in the basin had been generally self-contained in the essential functioning of life but now the bioregions of the continent began to lose their functional independence and their inner cohesion. The tempo of life moved out of its natural rhythms. Mechanistic rhythms were substituted. For this, new energy systems were required which impinged heavily on the environment. Trees were cut down at an increasing rate to supply fuel for the furnaces that drove the steamboats and the railway engines and later to supply the charcoal



from making iron and steel.

With greater travel facilities more immigrants moved into the basin from abroad. The great tides of peoples coming as refugees from European countries began with the Irish in the 1840s, the Germans in the 1870s, the Italians, Jews and East Europeans in the 1890s, the Puerto Ricans in the 1920s. Most passed through the basin on their way to the open lands of the west, but many stayed in the basin in a variety of occupations.

Shipment of food and manufactured goods became easier. Grist mills, brick-kilns, sawmills, quarries; all these developed as trade and manufacturing facilities increased. The volume of trade accelerated at exponential rates of in-

crease. Oil and gas came into use as fuels for the increasing volume of transportation which moved eastward through the lower Hudson basin from the interior of the continent and westward from overseas into the western regions. Then in the early 20th century came the automobile. Paved roadways and highways began to traverse the region in all directions. Ferries across the river gave way to bridges and tunnels. The sense of living intimately within the river basin was diminished.

The last great industries to impact the region were the electrical, chemical, automotive and nuclear industries. The electrical industry developed in the basin in the late 19th century with the work of Thomas Edison. The Edison Illuminating Company established the Pearl Street Central Power Station in 1882. From this beginning the modern scientific engineering of the bioregion was begun. After the chemical industry had advanced under Du Pont, Dow and Allied Chemicals, the basin in its mid-New Jersey area became a great center for the new petrochemical and pharmaceutical industries spilling their waste products over the area in unbelievable volume.

At this time the wetlands of the basin were filled in for railways and roadways, for airfields and sports stadiums, for housing developments and, on a wide scale, for garbage dumps. Shea Stadium arose in Flushing Meadows along with the World's Fair buildings, La Guardia Airport, and the associated highways. To the south in the Jamaica Bay area Kennedy Airport took over a vast area for its purposes. Along the Hudson River itself the railroad was built on filled-in land and in a way to isolate people from the river shore. In the Meadowlands of New Jersey, the Newark Airport and the Meadowlands Sports Complex were built along with dump sites, power plants and commercial establishments. This conspiracy against the Hudson basin was only part of the enormous effort made by humans in the 19th and 20th centuries to break down the discipline imposed by the bioregional context of the life itself. This effort to declare the human independent of the functional community and to subdue the bioregion to human subservience can now be seen as a process that could not long endure in the Hudson region or anywhere else. Even the help of the other bioregions of the earth would not make the Hudson River basin a viable life context if the inner spontaneities of the region were extinguished by the neglect and abuse imposed upon it.

The Basin as a Bioregion

Such is in outline the story of the lower Hudson River Basin in the post-glacier period; in its pre-human phase of physical and biological shaping, in its early Indian occupation, and in the changes that have taken place in its functioning since the arrival of the Europeans.

After some hundreds of millions of years establishing a magnificent ecosystem and after seventeen thousand years of renewal after the glacial recession, the entire region has been severely disturbed in its functional integrity and in the purity of its air, its water, its soil and all its living forms. Strangely indeed, with all our scientific subtlety, no significant awareness of this

situation existed until 1962 when Rachel Carson published her critical evaluation of the damage being done to the American continent. This caused a shock to pass over the entire country such as had never previously been experienced. A critical assessment of what was happening to the basin was begun. Entrancement with existing modes of progress began to dissolve. A series of projects were initiated to discover the real condition of the basin, what was required to heal the damage already done, and how to prevent further degradation of the region. The real issue, of course, was to discover appropriate modes of human presence in the region that would lead to the enhancement of the entire bioregional community, including all its members.

Much scientific data has been gathered. An Atlas of the Biologic Resources of the Hudson Estuary was published by the Boyce Thompson Institute in 1977. A two-volume study of The Hudson River Basin: Environmental Problems and Institutional Response was published by the Rockefeller Foundation in 1979. Other projects, too, were carried out, including a series of scientific symposia on Hudson River Ecology carried out by the Hudson River Environmental Society from the 1960s through the 1970s. Most active among these groups in effective real change was the Hudson River Fishermen's Association, founded in 1966.

What is most lacking, however, is our willingness to move from a human-centered value system to a value system centered on the life-community of the basin itself. The sense that humans and their immediate comfort justify any violence done to the other members of the bioregional community is a conviction so deep in the psychic structure of the European-derived peoples of the basin that any radical change requires a conversion of somewhat the same order as that associated with religious conversion.

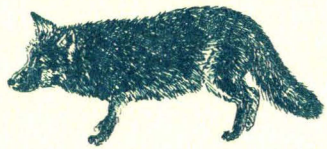
Despite all the abuse that has taken place in the basin, the river remains remarkably resilient. This is due primarily to the complex character and movement of its waters. As a tidal basin throughout its length of over 180 miles it has a complex of tributary streams and bays subject to river flow and tidal fluctuation that make it difficult for humans to conquer or spoil in any absolute manner. Fortunately the river has not been dammed below Troy. It thus escaped the problems associated with such interference with water flow. While fresh water from the tributary streams has been extensively withdrawn for human use, this has led, so far, to minimal direct damage to the basin as a whole. Because the basin was not suited for irrigation the river escaped the withdrawal of its waters for agriculture. Another benign influence on the region can be considered to be the great estates, resorts and parklands which saved large areas from exploitation.

The most important of all causes, however, for the survival of the river and for recent efforts at renewal of its vitality is the human sense of the grandeur of the river, the need for appreciating its deepest meaning. This appreciation found artistic expression in the Hudson River School of Painting, in the work especially of Thomas Cole (1801-1848) who settled in Catskill and did much of his painting of that region. In his work and in that of his associates Asher Brown Durand (1796-1886) and Frederick E. Church (1826-1900) we find the deep emotional

- imaginative resonance that the river communicates so powerfully.

Important contributions of the past in identifying the natural functioning of the region have come from the naturalists and, in some instances, from writers with little scientific awareness but with rich observational powers. This first of the naturalists was Codwallader Colden (1688-1776), who lived in Orange County. He was the first person with some scientific training who did professional work in the study of the botanical species in the Hudson river basin. He had, certainly, no sense of the ecology of the region since this concept was still somewhat distant from the thought of the period; although he did search for a "natural system" of plant classification different from that being used by Linnaeus at the time. A less scientific writer was Hector St. John de Crevecoeur (1735-1813)who also lived in Orange county, near Goshen, in the late 18th century. To him the land and its fertility were the source of all sound human development. His Letters From an American Farmer can be considered the outstanding document on the biosystems of the region in this period. James Fenimore Cooper (1789-1851) perceived clearly the growing conflict between the entire civilization process and the integral functioning of the natural world. He saw the need to look beyond written scriptures to the revelatory aspects of nature in the depths of its mystery and in the awesome grandeur of its manifestations. Cooper lived somewhat outside the lower Hudson Basin as we defined it and he wrote much, in his Leatherstockings novels, of the Mohawk, Upper Hudson, Champlain and Lake Ontario regions, but he also wrote extensively of the Lower Basin in his other novels. In his writings we have some of our first extended reflections on the impending threat to the natural grandeur of the area.

A fourth person who lived and wrote within the basin is John Burroughs (1837-1921). From his home on the west bank near Esopus he wrote his natural history essays, in the general tradition of Henry Thoreau, from 1871 until 1921, precisely in the period when the basin was undergoing its first powerful impact of the new industrial processes. His sensitivity to the natural forms of plant and animal life was highly developed and his writing colorful. Although his reflections never attained the depth or comprehensive quality of Thoreau or John Muir he did establish in essay form some of the earliest appreciation of the natural world as these emerged from within the basin itself. John Kieran might be considered something of a successor to John Burroughs in his essays on the life forms of Van Courtlandt and Riverdale sections



of the Bronx. His book, A Natural History of New York City, 1959, is the first such volume we possess. More extensive in scope is the superb presentation of The Forests and Wetlands of New York City by Elizabeth Barlow published in 1971. This work gives in full detail description of the present status of these rich areas of life propagation that survive its marginal status but which carry the basin for a regeneration of life systems as soon a more benign human context is established. A more scientific study but one of absolute importance in understanding the ecology of the region is that of Christopher J. Schubert, The Geology of New York City and Environs, 1968.

Others too made significant contributions in writing to that sense of awe and veneration of the river, its life forms and the natural phenomena associated with the river, without which no truly human presence to the river can ever be established. Much of this is simple description of scenic views such as those given by Nathaniel Parker Willis (1806-1867), whose writings remain as evidence of the gracious years when the human community was much closer to the river and in greater communion with its mystery than has been the situation in these later years. Robert Boyle, from the more recent research data on the river as well as from his own experience of the river over many years, has written the most comprehensive recent view of the river and its life forms in his book entitled simply, The Hudson River: A Natural and Unnatural History, 1969. He understand the life systems of the basin, their modes of interaction and the need for human dwellers in the region to integrate their own activities into the natural activities of the river and its life forms. Even more recently Arthur Adams has given us a guidebook that will long remain the classic reference book: The Hudson: A Guidebook to the River, 1981. In a more narrative presentation he has also written The Hudson Through the Years, 1982, an account of life on the Hudson with special reference to transportation. He has also given us an anthology entitled, The Hudson River in Literature, 1980.

While all of these writings and other scientific research projects concerned with the river are extremely valuable there is still need for more comprehensive understanding of the basin as a bioregion. This term "bioregion" designates "An identifiable geographical region of interacting life systems that is relatively self-sustaining in the ever-renewing processes of the natural world." Although the earth is a single integrated life system it articulates itself in differentiated regions, each of which has its own distinctive qualities. The life system of a mountainous bioregion is different from the life systems of coastlands, or prairies, or tropical forests. In most cases bioregions are associated with watershed areas since fresh water is such a central need for survival.

The main theme of this essay is the urgency for understanding the distinctive mode of functioning of the lower Hudson River Basin as such a bioregion and for developing a life style integral with this bioregion as a self-propagating, self-nourishing, self-educating, self-governing and self-fulfilling community of all its physical, biological and human members. None of these have any meaning whatsoever apart from the others. Any effort the human to advance itself by degrading the other members of the community can only end in damage to itself.

One of the main obstacles to bioregional understanding of the Hudson River Basin is seeing the basin simply as "environment." If the basin is seen as having its identity, its value and its proper role primarily in its relation to the human then it will continue to be subject to the type of industrial exploitation that has already brought about so much disturbance in both the natural and the human worlds. The alternative is to see the entire natural community of the basin as the primary reality and the human as component members of this community. Such a comprehensive understanding of the physical and biological functioning of the Hudson Basin as a bioregional community has never been attempted in any significant or sustained manner. Yet the only real hope for the Hudson Community is to see itself within the context of the physical and biological functioning of the tidal river and its tributaries, of the estuary, the bays, the tidal straits, the wetlands, the shorelines and

the related land formations with the great variety of living forms from the plankton to the sturgeon, from the shore grasses to the forests of the Catskills, from the earthworms to the humans, to our civic communities and to Metropolitan New York; this is precisely the understanding we need if we are to survive in any satisfying manner. The mechanistic model whereby the Hudson community is seen simply as objective reality, or as natural resource for human use, needs to be changed to the organic model of a regional community with its value in

itself. The human appreciation of the region must be seen as an effort of self-understanding of the community, carried out by the community, in and through its human mode of expression. In its human identity the region celebrates its own mystery and its own glory. The mystery and the glory belong primarily to the community.

In this context every member of the community, without exception, from the smallest physical fragment to the most elaborate ecosystem of the entire basin has its essential role which cannot be thwarted without damaging the entire community. The more elaborate life forms, especially the human, have most to lose. The inorganic nutrients are washed down from the Taconics and Catskills onto the land and into the waters, the elementary life forms in Haverstraw Bay carry out photosynthesis, liberating oxygen into the atmosphere and creating organic foods for other life forms. The bacteria in the bottomlands continually decompose organic substances to make nutrients available for vegetation. Vegetation in turn sustains other life forms all the way to the human. Whether organic or inorganic, every element in the basin is interacting constantly with every other reality in the basin. The insects assist in pollination, the worms enrich the soil, the trees hold the soil and the moisture on the hillsides preventing the sudden runoff in floods and the consequent periods of drought. So too the clouds above the basin hold and diffuse the light and warmth of the sun. Such a wondrous display takes place here in the valley in this great complex of activities. Such incomparable efficiency amid such splendor of expression!

This is not a romantic or utopian view of the basin. Movement from the inorganic to the organic mode of being is also a movement into the sensitive world of feeling with all its consequent struggle for survival amid the inherent pain as well as the exuberance of life. As with all organic process, bioregional processes are both a struggle and play, a process with anxieties and difficulties as well as delight not entirely dissimilar to the complex of emotions involved in living out our individual lives or in raising families.

Sensitivity to the prevailing winds, precipitation, temperature, sunshine and all their seasonal variations in the basin is of primary importance. Indeed these determine human activities in a most basic manner, even though our attention is more on the defenses we erect against the natural world and the mechanisms whereby we establish our independence from these forces, shielding ourselves from heat and cold, bringing food from the distance through elabo-

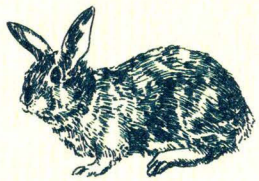
rate transportation systems and water from far-away mountain streams.

Presently natural processes are seen as interfering with human controls, limiting human activities, putting ice blocks into the river, salting up the river so that it cannot serve as safe drinking water. Rains are inconvenient. Snowfall a disaster. The River impedes the roadways. Insects are pests. Chickens bring vermin. Farmlands are better used for development. In this manner the human is not only isolated from its intimacy with the bioregion, it establishes an antagonistic relationship at a destructive level.

Two basic events are drawing to a close the industrial activities and life style and values that have determined the course of affairs in the Hudson River Basin in these past two centuries.

The first of these is the collapse of the physical infrastructures - such as roads, bridges, water delivery, and waste removal systems - upon which the present mode of living in the basin depends. It is unlikely that these structures, at their existing order of magnitude, can either be maintained or renewed. The evidence indicates that there is neither the psychic energy, nor the financial support, nor the natural resources, nor any known human skill adequate to this task. The existing system is too oppressive to every living form in this basin. Even its apparent human benefits can now been seen as too ephemeral to warrant their cost. They system itself has become counterproductive. But even more significant is the revulsion toward the human of the bioregion itself. For some time it appeared that humans had ultimate control over the region, that they could do what they pleased in substituting technological processes for the spontaneities of the natural world and that they could freely interfere with the ecosystems worked out by the planet over some billions of years. All this can now be seen as illusory since the bioregion through its own natural powers is disintegrating the structures imposed by such violence upon it. The chemicals imposed upon the region are now being returned to be absorbed by humans themselves. The bioregional community itself holds the ultimate decision over life and death, a decision that no member of the region can avoid. We can build our superhighways with the most enduring materials we can discover or invent, and with all our engineering skills, but at their existing order of magnitude the forces of the air, the water, the soil, the sunlight and the organisms of the earth are breaking them apart faster than we can rebuild them. The wisdom of working with rather than against nature begins to be manifest.

A second event taking place that is forcing a new appreciation of the Hudson River Basin as a bioregion is the increasing need for a basic self-sufficiency of human communities, each within the resources of its own bioregion. If formerly the Hudson region could so occupy itself with its global role in financial and cultural affairs to the neglect of its role within its proper bioregion, this time is passing. The bioregions of all the world are presently under their own pressures for survival. They can no longer be



freely exploited to sustain parasitical communities such as the New York Metropolitan area as much of the basin tends to be. While the exchange between different regions, especially with the neighboring bioregions to the each and

west of the basin, is often good and even necessary, this easily leads, if not limited in its scale, to wasteful mass production and excessive transportation especially in those human activities that should be distinctive to each region. Each region needs to articulate its own identity and to function properly in its own space. New York has drawn excessively on other bioregions. Such a metropolitan area requires to extended a basis on which to function. This passes over into burdening the wider resources of the planet, the bringing of food from afar in a way that plunders other parts of the planet and other ecosystems. Limitation and proper distribution of the human communities in the basin in relation to the effective functioning of the area as an integral bioregional complex is the urgency that is upon us.

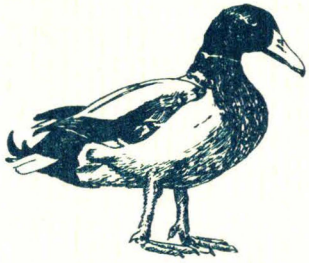
We begin to see that our basic identity is not primarily the political unit but the bioregional community in some one of its distinctive articulations. To say Poughkeepsie or Kingston or Peekskill or Tarrytown should be understood primarily as a geographical rather than a political designation. The real difficulty of the various declining communities along the river is precisely that they think of themselves too much in political or commercial terms. Consequently they look for their renewal through these agencies rather than through a more effective relation to the land and the river and their fertility. To be surrounded by such a bountiful land and teeming river and propitious climate, all abundantly suited for prosperous local communities with ordinary abilities in land cultivation, craft skills, village industries, community cooperation, and cultural creativity, and to see such communities look for their renewal from industrial establishments that are oppressive to the life of the region is to observe the deep paradox of our times.

That this paradox is now so obvious and so painful is already a sign that something new has begun. The critical phase is well advanced, the creative phase has arrived. A wide-spread awareness of the need for human concern for the river and the land with all its flora and fauna now exists. Motivation for this care of the basin has varied over the years from aesthetic and emotional fulfillment, to economic advantage, to health concerns, to recreation and even to a sense of the sacred as manifested in the natural splendor of the region.

All of these are invaluable in establishing a truly human presence and response to the river. But they are not fully adequate in dealing with the more ultimate issues involved. In every instance a human-centered attitude is dominant. The novelty of the present is the development of a bio-centric consciousness, a realization that the ultimate value is in the integrity of the life processes of the region as a whole and that the true grandeur of the human is attained in this larger context, not simply in the human in itself or in its dominance over the larger community. This must be kept constantly in mind as we witness the ever increasing volume of information on the life systems of the basin appearing in book form, in the news publications, in radio

and on television. These too are making their own invaluable contributions to the new context of survival for the Hudson Basin Community.

Our professional groups, our educational and cultural institutions are beginning to accept a reorientation at this level of consciousness, not simply as an intellectual vision but as a program for survival - for economic, emotional and aesthetic survival at a satisfying human level of fulfillment. That our judicial system is also revising its larger sense of the basin is clear from recent court decisions concerning industrial waste disposal. The lawsuit sponsored by the Hudson River Fishermen's Association in alliance with other organizations was finally settled by the defendants' contribution of a twelve-million dollar fund for a Hudson River Foundation to study the ecology of the river and to identify modes of human presence that would bring about a mutual enhancement of the basin.



What is most needed in the immediate future are guiding visions of what the basin might be in its future when the air is again refreshing and the water pure and the soil fertile within its own organic processes; when the shellfish and the finfish are again abundant and edible; when the ospry and the peregrine falcon and the bald-eagle are again familiar features of the landscape; when the animals of the region have their own undisturbed habitat; when the river banks are more readily available for human presence in the evening.

Only in such a florescence of its grandeur and in celebration of its mystery can the long course of formation of the basin, as recounted in the earlier pages of this narrative, be justified. We cannot think of failure at this order of magnitude since here we are faced with ultimacy. What can be said is that the dream drives the action and whatever bountiful future awaits the river must first appear in our dreams.