

MAN: A RENEWABLE NATURAL RESOURCE

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I propose to discuss, in this brief paper, how we think about renewable natural resources, rather than the resources themselves. I do this because I believe that the rationale within which we organize our information and thought on these matters is constantly in need of revision, and because I think it needs a critical reassessment at the present time. In dealing with subjects of this kind I have a strong tendency to build upon specific case histories. In the present instance I shall use the geographic region of the northeastern United States, particularly southern New England.

John Sanderson was a prosperous farmer in the Town of Petersham, in north central Massachusetts, in the second quarter of the nineteenth century. He lived on land now in the Harvard Forest, and his house is still in use as living quarters for staff and students. In the eighteen thirties and forties, when the Sandersons lived there, all but about 100 of the 850 acres that make up the Prospect Hill Tract of the Forest, of which their farm was part, were entirely clear of woodland. They were in pasture or under some sort of cultivation. Most of the tilled land was in tiny fields, and the stone walls separating them can still be seen among the trees immediately back of the main Forest buildings.

Agriculture in Petersham, as in many towns like it in southern New England in the first half of the nineteenth century, offered attractive opportunities. Markets for farm products were good in the nearby industrial communities which had been recently established in the valleys of the larger streams where they had water power. Road nets within the towns, as well as longer stage roads to markets and to the coastal and Connecticut valley cities were being steadily improved. Under these circumstances the Sanderson family and hundreds of others like them were able to accumulate savings--capital in one form or another. The way in which they invested much of their capital--in the improvement and enlargement of their farms, houses, and general living conditions, argues that they considered themselves permanently established. They and their forebears had wrested their land from a forested wilderness and made it flourish--all in a tradition of husbandry that they had brought over from England in the seventeenth century. This tradition had not changed materially, so far as they knew, for some centuries, and they did not conceive of its changing in the future.

Nonetheless this prosperous farming economy declined about the middle of the nineteenth century. Prices for local farm products fell

off disastrously, in competition with supplies that began to invade the market from outside the region. Our upland sandy loam soils are droughty and essentially infertile. They can be made productive, but only by rather heavy fertilization. They are stony, and the fields have always been small. The agriculture of the eighteenth and early nineteenth centuries was based largely upon hand labor, and mechanization requires a large capital investment. The farms there could remain prosperous only so long as they had no serious competition. Once the latter appeared, their economy collapsed. And it did so rather suddenly and on a large scale--over wide expanses of the landscape. Agricultural use of the land was simply abandoned, probably at least half of it and perhaps more, within twenty years after 1850. The abandonment has continued more slowly during the remainder of the last century. Only the lands particularly well situated with respect to market outlets in large population centers have remained in agricultural use.

The white pine was a native, widely distributed tree throughout southern New England in pre-settlement time, though it rarely occurred in pure stands on the upland loam soils. Throughout the period of intensive agriculture in the first half of the nineteenth century it was always present in farm woodlots and in fence-rows around the small fields. Its light, winged seeds find a good seedbed in abandoned pastures and unused cultivated ground, whereas the seeds of native hardwoods do not. The result, in the eighteen fifties and eighteen sixties, was the natural seeding of large areas to pure or nearly pure stands of white pine. Because it takes fifty to sixty years to grow a commercially useable stand of such pine on these sites, large quantities of it became available for use between 1900 and 1920, which was a great logging and milling era in southern New England.

While John Sanderson was prospering in Petersham, in the eighteen thirties, the incomparably rich farmlands of our Middle West were just becoming settled. But markets for the products they could produce so lavishly were far away and difficult to reach. The Appalachian and Allegheny Mountains had been for generations a solid barrier to the free westward movement of people, materials, and investment capital. Transport was expensive and hazardous in the other direction also--to the population centers of the lower Mississippi and Ohio Valleys.

But events of large import were brewing in the Middle West at mid-nineteenth century. The Ohio town in which I grew up was one of several that were famous for the manufacture of farm implements. These industries had started in a small way in the eighteen forties and eighteen fifties, and then grew phenomenally during the next twenty-five years. All of them were reflecting a huge expansion of agriculture in the Middle West, which had, up to this time, got little beyond the subsistence stage because of lack of markets. Now the markets had appeared, and land could be used on a large scale and intensively to supply them.

The timing of the events I have mentioned is significant.

Whatever it was that wrecked the plans of the southern New England farmers about the middle of the nineteenth century was coincident in time with whatever it was that brought phenomenal expansion to the farms of the Middle West.

But in another part of the Northeast, in a region entirely outside both of those discussed thus far, another kind of development had been going on. It was in the minds and hands of a different kind of people, whose frame of reference involved not agricultural production, or the services of supply to this production, so much as the trade and transportation of its products. These were the people of upstate New York who realized in the eighteen twenties that their geographic position gave them the key to an old and troublesome problem. The one low level route from the Atlantic Seaboard to the rich agricultural lands of the Middle West lay through the Mohawk Valley, from the head of navigation on the Hudson at Albany, to Buffalo on Lake Erie. To speed up transportation on this route a canal would be necessary, and the idea of the Erie Canal was born. But to bring it to pass required first a large conceptual structure that could be used to rationalize all the operations that would have to be performed before the canal could become a reality. There had to be a vision of the regional arrangement of productivity, markets, costs and prices in a span of country that up to this time only a few people had thought of as a unit. It was not enough that only Governor Clinton should have this vision--it had to attract the investment of capital, both public and private, in what was for those days a gigantic undertaking.

Nonetheless it was done, and the Erie Canal was opened in 1830. It was an immediate success. Settlers for the western country began using it, and foodstuffs began moving eastward. Actually the canal held pre-eminence for only a few years, because a railroad was pushed through the Mohawk Valley in the eighteen forties. The farmlands of the Middle West now had access to the eastern markets, and were in a position to attract eastern capital for their expansion. They could produce foodstuffs in far greater quantity and far more cheaply than they could be produced in most of the northeastern states. It was this that destroyed the agricultural prosperity of the Sanderson family in Petersham, and of a large number of similar families in southern New England.

When I was a boy in Ohio in the years around 1908 and 1910, and was sent to the store for groceries, nearly everything I bought there came out of a wooden box, barrel or bucket. All or nearly all of those boxes, barrels, and pails came from one or another of the hundreds of factories that were turning them out in quantity in southern New England at the time, a large percentage of them within a radius of a few miles from Petersham. Further, they were being made from white pine lumber that was coming from vast pure stands which darkened the landscape in that region.

This pine, mature for cutting, was coming from land that scarce sixty years before had supported the prosperous agricultural community

I mentioned earlier. Large quantities of labor and capital had been invested in that land with bright prospects for future returns. Whatever the conceptual framework was within which those farmers thought and worked, it did not cover what actually happened to them.

In thinking over this story it is rather easy to become enamoured with the idea that the land and its products have exerted an all-important influence upon the behavior of the people. We in America, particularly the conservation-minded during the present century, have based most our thought upon it. A prosperous agriculture actually did go to pieces in southern New England, and an explanation commonly given for it was that the farmers "wore out" the land by poor treatment. Great pine forests covered the landscape in the early 1900's, supporting prosperous industries. They are now nearly all gone. Some say the forests were "destructively logged", for they have not been reproduced to pine. In both cases there have been social maladjustments that have been costly. The basic significance of the physical resources is expressed in various ways. It is said that the land and its productivity must be preserved at all costs; that every acre must be brought to its fullest usefulness; that our forests are threatened with extinction, and are believed to be growing scarce already, and therefore we must manage them in such a way as to preserve their productivity.

Now we are in a singular position as a nation, for not only do we have no shortages of either foodstuffs or wood, but we have embarrassing surpluses. Production in these resource areas, for the foreseeable future, is literally no problem. The real meaning of this is that the frame of reference within which we have tried to rationalize so much in the last half century has collapsed. Its central assumption of incipient physical resource scarcity is not valid. I think it correct to say that the assumption was never valid.

The first settlers who came to Petersham, in 1733, lived by a subsistence agriculture. They had no external markets worthy of the name for nearly three generations. They cleared and used very little land during all that time, for they had no need to. When they did begin to clear it, about 1800, they did so not in response to any stimulus emanating from the land, but rather to a stimulus that came from the minds of people far away. The industrial revolution had begun in England in the eighteenth century, and its reflection was felt in upcountry New England when capital investment began to flow into the water power mills that I have already mentioned. Only then could the people of Petersham and other farming towns of the region develop new concepts of their destiny and re-evaluate their lands in terms of them. The land itself did not change--only the peoples' concepts changed, in response to another kind of concept superimposed from outside. Then within fifty years their economy went to pieces, and with it their whole system of rationalization, again from causes not initiated by themselves, and not arising from anything they had done to the land. They had to reconstruct their frame of reference on some more modest scale, or move away.

And again the land did not change, except in terms of the human values of the moment. It merely seeded itself to white pine and went on being productive, but in its own way. In the early nineteen hundreds the people who owned this land at the time found to their amazement that it had values again--of an entirely different kind. It had these values for perhaps four main reasons, only one of which had any connection with the inherent productivity of the land. First was a new and seemingly insatiable demand for boxes, barrels, and pails to carry the products of a burgeoning agriculture over a rapidly expanding railroad system. Second was the presence of the pine itself, which was actually a sort of accident in the aftermath of the building of a transport system into the Middle West. Third was the happy location of most of the pine in a readily accessible part of New England, handy not only to railroads and coastwise shipping, but even to an intricate road net within the forested areas--a road net inherited from the good farmers who had built it long before the pine was even thought of. Last but not least, a purely technological development, the portable sawmill, came into its own at this time, to speed up operations and cut haulage costs.

The pine had no value in itself. It acquired value only because in the period of time when it happened to come to maturity there was a human demand for containers that could be made from its wood, a transportation system to carry both the wood and the packaged products, a labor force and a local technology to cut and mill the lumber and make the containers, and a price and wage structure to make the whole thing economically feasible. All of these conditions had to be met at once. They all had first to be conceived in people's minds; then they had to be made attractive to investors so that capital would flow into them. A century earlier or even seventy-five years earlier, all that pine would have had very little value, and most of it would, of necessity, have been cut down and burned, to get it out of the way for farming. If we had it all now, fifty years later, we probably could not sell it.

About the middle of the nineteenth century another kind of people began to take an interest in the Petersham land. At first there was only a trickle, but in the seventies, eighties and nineties, they began to dominate the scene. They were the so-called "summer people". They bought up and renovated old houses and came with their families from the eastern cities to spend the summers in quiet country surroundings. Their conception of what they wanted from this land was basically aesthetic, and they have had an immense influence upon the present form and character not only of Petersham but of a great many other towns in this region. An aesthetic interest in forest and landscape for their own sake was comparatively new in America. It is almost impossible to find evidence of it prior to the middle third of the nineteenth century, and even then it was highly localized.

Petersham acquired its modern form only in the latter part of the nineteenth century, and became desirable to moderns as a place to live only in the twentieth. Now it is attractive not only in summer, but year-around because of good roads and automobiles. Though the land has not changed, the people have. They are responding to economic

growth and innovation. The summer people are now few in number. Their places are being taken by people who think of themselves as permanent residents--people who have business or industrial interests in nearby cities and towns. They like to live there because ideas involving aesthetic values pleasing to them were formulated by people who came there in the last century. They can live there because the capital investments, technologies, and market outlets of their businesses place them in the neighborhood, and because still other capital investments and technologies have supplied them with adequate transportation and living conditions.

Thus we look now at the Petersham lands and forests in a new way--that would have been beyond the wildest dreams of John Sanderson. Even most American foresters, if they are to conceive of it, have to forget nearly all of the "Forester Image" they have created for themselves during the past sixty years.

I suggest that the principal role of the land and the forests has been that of stage and scenery. The significant figures have always been the people, and the ideas they have had about what they might do, at specific points in time, with the stage properties at hand. At each such point in time, each actor could play his role only by the rules he knew--in terms of his own conception of his relation to the play of which he was a part. He was always hampered by lack of precise knowledge of the stage and its properties--the land and the forests. Perhaps more important than this, he had severely limited knowledge of the rules by which other actors of his time were playing. Both of these failings are perennial, and no doubt will continue to be. I suspect that John Sanderson was a good farmer--in Petersham in the second quarter of the nineteenth century. Three generations of his family had worked this piece of land, and I suspect they had made it about as productive as possible with the knowledge, technology, and capital resources they had. But their prosperity was swept away by a new cast of actors, who had a new set of ideas, framed in a new and larger conceptual structure. These ideas had nothing to do with agriculture in southern New England. They began to take form when a lot of Irishmen imported from Erin managed to dig a ditch across upstate New York. The people who visualized and built the canal were primarily interested in moving freight and passengers, at a profit. Where these came from or went, at either end, was of secondary importance so long as the flow continued. Still another cast of characters--the Midwestern farmers--hastily made a new script for their play when suddenly a widemouthed funnel appeared through which they could pour their products eastward. In short, they reconstructed and greatly enlarged their conceptual scheme of things. Before the comfortable old New England farmers had time to adjust, their markets were cut away by a flood of cheaper and better goods than they could produce by their antiquated methods. All the segments of this play were going on in the same short period of time, the second quarter of the nineteenth century, but the actors in each segment were essentially uninformed about what those in other segments had in mind.

About the beginning of the present century an entirely new scene began to be played in the eastern landscape. Its stage was set with the maturing white pine of the abandoned farmlands, and its major theme involved long-term planning for the future production of pine. Its actors were foresters, a kind of thespian just at this time beginning to appear on the American stage.

It happens that we can document one part of this scene rather thoroughly, spanning a period of about fifty-five years. It was laid in the Harvard Forest, established in 1908 in the Town of Petersham. When it was founded the Forest's major purpose was to demonstrate what was believed to be sound woodland management in our part of New England. The land and its forests, about 2000 acres, were received by our University as a gift, but without any capital fund the income from which could be used to support operations. However, the woodland consisted of a large quantity of the mature and maturing timber characteristic of the region. It was believed that this timber could be managed on a sustained yield basis to provide the necessary income, and thus serve as a perpetual, living endowment. The Harvard Forest was typical of a vast area in southern New England, and it was believed that what was done there would be widely applicable.

White pine dominated not only the forest but also the thinking of the foresters at this time. On our own land there were about twelve million board feet of immediately merchantable sawtimber, 90 per cent of which was white pine in nearly pure stands. The markets for it were nearby and seemed able to take all that could be cut. Our Forest was founded at the time when the lumbering of the pine was at its height, and when the local factories were turning out vast quantities of boxes and cooperage from its wood.

But the successful practice of sustained yield required, among other things, that the pine be regenerated on a time schedule that would keep the living capital from being depleted, and within a cost structure that would be commensurate with predictable returns. Within five years after the Forest was established there began to be suspicions that all was not well with the pine regeneration program. By the mid-twenties it became a certainty that on the upland loam soils where most of the Forest was situated the regeneration of the pine, within any reasonable cost structure, was a failure. This experience was traumatic, and led to two major policy changes. First, the Director began to accumulate a capital fund to supply income which would cushion the decline of the living capital. Second, he began to realize that the forest was out of control-- that he could not demonstrate how to manage it until he found out more about it. It was during the mid-nineteen twenties that the institution essentially ceased to be a demonstration forest and became a research forest.

In the time at my disposal I cannot go into detail on the research history of the Harvard Forest. We have published accounts of its experience with the concept of sustained yield, and the consequences of this experience over the half century in which the concept has been followed (Gould, 1960). A good many years were devoted to the behavior

of the white pine, in efforts to understand it and to reproduce the pine economically (Lutz and Cline, 1947, 1956). These efforts led inevitably to studies of the minutiae of site, notably to certain phases of soils research (Goodlett, 1960).

The Harvard Forest was a microcosm, deeply committed to research, planning, and decision making at the local level of the biological and economic management of the Forest itself. But there was another, and larger, sphere of research and policy that had great significance for it. Here the decisions had already been made when the Forest was founded, and were accepted as given. It had already been decided that forestry should be established in America, to protect and replenish a resource that was believed to be getting scarce. The model for the new program was found in Western Europe. It embodied the principle of sustained yield management, the validity of which for American application was not seriously questioned. The Director of our Forest and his staff became so engrossed in the day-to-day and year-to-year problems at the local level that any fleeting concern they may have had for the larger rationalization of their existence gradually disappeared. In this they merely reflected the thought of their time. They acted out their own scene as best they could, but they had only glimpses of its place in the play as a whole.

Here, I think, was a major failure in the planning and decision-making process as it was applied to one of our larger renewable resources. The past fifty-five years have demonstrated all too clearly that decisions in the larger and in the more local spheres are closely interdependent. Assumptions made in the larger sphere, taken as principles without careful assessment of their applicability at local levels, became dams obstructing the flow of ideas.

If I were to select the most important single cause for this failure it would be that the human element had been left out of the calculations. Our foresters have always been more concerned with trees than they have with people. They have tended to let the stage and the scenery play the leading roles, while the people assume an almost puppet-like character. In 1908 it was expected that the little pines coming up from seed in the cutover stands of our Forest would be sold, at a profit, in 1968 or 1970. Those that came up after the next good seed year, about 1911, would be sold about sixty years later, and so on ad infinitum. The foresters looked ahead that far without the slightest hesitation, assuming that people's demands of the early nineteen hundreds would continue unabated. That people might not want their pine in 1970 was unthinkable. Actually the demand that took the pine in 1908 is already gone, and has not been replaced.

Nowadays we think and talk a great deal about planning. We are apt to measure the success of a venture by how well it is planned in relation to how well its plans materialize. We do not know with any degree of precision what John Sanderson's planning horizon was. I have suggested that he probably thought of his general investment in agriculture as fairly permanent, but I suspect that in modern terms we would



say he farmed with "no planning". In any case, the methods he and his neighbors were using could not survive the drastic fall in prices that came with supply from the West.

John Sanderson failed, a modern might say, because he had "no plans". The Harvard Forest program failed with plans--long-term plans made according to the best thought of the time. Perhaps it is incorrect to say that John Sanderson had no plans, or that the foresters were wrong in trying to make plans. Rather we might try the idea that the plans of both were too inflexible. They did not reckon with the imponderables that are inserted by the human mind into all plans for the use of resources.

This brings me back to the central theme of my discussion, which is the way in which man thinks of his position in the world of resources. Man has, traditionally, separated himself from "nature". Thus for the early New England farmers the forested wilderness was an impersonal physical barrier, to be tamed and exploited to the hilt. It was to be used to the greatest extent possible within the limitations of existing knowledge and technology. No change in this view appeared until the romantic movement of the eighteenth century, when a few people began to see aesthetic values in wild land. Even then, and even in the more extensive development of these ideas in the nineteenth century, men did not truly identify themselves with the natural--they merely described, analyzed and revered it. When men began to think seriously about population dynamics, and their effect upon the future supplies of natural resources, a contemporary "back-to-nature" movement might have led them to a better understanding of their relations to these resources. Paradoxically this movement seemed only to lead them farther away from it.

Merely by being himself, and exercising his prerogatives as such, man has gone far toward solving his renewable resource problems. With his ordinary intellectual and mental skills he has learned to produce what he wants for food, clothing, shelter and amenities, and he has shown amazing capacity for innovation that bids fair to take care of future wants. He has not been as clever with distribution as he has with production, nor has he solved many of the basic social problems that have plagued him and his ancestors. Some have learned to control birthrates, but most have not yet achieved this.

Man has accomplished all this against odds. Throughout most of the long period of his early experiments he was dealing with things and processes in wild nature that were entirely mysterious and potentially evil. In the last century or so, with the rise of conservation thought in all its manifestations, he has been confronting himself repeatedly with the accusation of sin against the same "nature" that was for so long his arch enemy. This sin has had to be defended by whatever means came to hand--scientific research, favorable cost-benefit ratios, or simple economic necessity.

Now, when we realize that we can no longer make a sharp separation between ourselves and the things we see, we are beginning to sense

that we are, unalterably, a part of the "natural", and that we must play our role in it and take the consequences. One of these consequences is the realization that we can never be genuinely objective in our relations with the rest of nature. We may set up temporarily useful models as working hypotheses, but we know that they will always have to be abandoned in the face of reality. Once this is fully understood, the entire natural resource problem acquires new dimensions, for we ourselves become the most significant single renewable resource the world possesses.

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