FORESTRY AND THE URBAN REALM[1]

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Self-conscious reappraisal is a popular activity these days, whether one is building missiles, cities, school systems, world peace, or managing a forest. Although there are many reasons for self-examination, I find it convenient to group the driving forces under two headings. One kind of concern stems from the exhilarating knowledge that new powers are loose in the world that make it possible to solve some old and persistent human problems. The other stimulus is the reverse side of the coin—the sobering thought that old solutions may no longer be relevant, and that the stimulating field of knowledge that once produced them has somehow lost contact with the realities of modern culture.

Some foresters I have met place themselves in this second group. I believe this is unfortunate, because it leads them to focus attention on defending old schemes rather than on the exciting search for new points of contact between the forest system and the growing needs of society.

But how can we identify the satisfactions people require, and use our forestry knowledge to devise appropriate responses to these stimuli? Perhaps a brief glance at how foresters reacted to felt needs in the past will give us a clue.

Because formal forestry is so new to North America we don't have to go very far back to examine its origins. We can start the bare outline needed today with the life and times of two Georges — George B. Emerson and George Perkins Marsh. Both were New Englanders, and each was aroused by the things he saw going on around him to analyse the problems created by man's use of natural resources and to propose solutions. The framework of ends and means that they conceived contributed a great deal to "conservation" and "forestry" at a later date.

George Emerson grew up in Massachusetts during the first half of the last century. He saw the economy shift from shipping to manufacturing, when the first wave of the Industrial Revoluton scattered water-power factories along the streams of New England. The rise in jobs and productivity generated by this massive dose of mechanical invention and social innovation also started the growth of cities and led to the rapid exploitation of land resources.

The creation of urban markets for food, fiber, fuelwood, and lumber; coupled with the extension of roads, canals, and coastwise shipping that cheapened transportation, brought all of New England economically closer together. In agriculture few new ideas for raising productivity had been adopted, so farmers responded to the boom by using more and more land in substantially the same ways their fathers had done. In a generation or so the abundant forest land of Southern New England was largely cleared for pasture and tillage, so that by mid-century almost three out of four Massachusetts acres were open.

[1] Talk given to the Ottawa Valley Section, Canadian Institute of Forestry, March 1, 1966.
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Emerson had seen much of this development take place during his adult life. Viewing such a massive and sudden change in the landscape through the trained eye of a botanist he had grave misgivings about what the future would hold if demands continued to mount and land management remained extensive. Eventually he was commissioned to assess the condition of the forest resource, and in 1846 he published his report in a book called "The Trees of Massachusetts." His alarm was clear when he wrote:

> "A few generations ago, an almost unbroken forest covered the continent. The smoke from the Indian's wigwam rose only at distant intervals; and to one looking from Wachusett or Mount Washington, the small patches laid open for the cultivation of maize, interrupted not perceptibly the dark green of the woods. Now, those old woods are everywhere falling. The axe has made, and is making, wanton and terrible havoc. The cunning foresight of the Yankee seems to desert him when he takes the axe in hand. The new settler clears in a year more acres than he can cultivate in ten, and destroys at a single burning many a winter's fuel, which would better be kept in reserve for his grandchildren."

Here was a theme destined to be developed with vigor by the early foresters —timber was being wasted and used up too fast. But Emerson also took a broader view of the forest problem and recognized the important nexus between forests and man's natural environment. He expanded at some length on the idea that forests, "create or gradually but constantly improve the soil . . . and protect the country from the violence of the winds. In a country so exposed as ours, as a consequence of the remarkable clearness of the atmosphere, to the burning heat of the sun, the use of trees for shade is not one of the least importance. The forests are of utmost importance . . . as adding to the beauty of a country." All these environmental values are still matters of current and rising concern.

Less is now heard of his idea that forests "serve as a conductor of electricity between the clouds and the great reservoir of the earth; thus giving activity to the vital power of plants, and leading the clouds to discharge their contents upon the earth." However, we are still exploring the role that forest cover plays in the hydrologic cycle in hope that we can find some leverage for increasing our potable water supply.

Emerson firmly focused attention on land-use as the key to future abundance and landscape amenity. The good husbandry he proposed included most of the forest practices found in modern silvicultural texts. However, he also felt that some sort of planning and control would be needed to implement more intensive forest management. He said:

> "The immense variety, the many and important uses, and the great beauty of our forests, must, naturally, attract the attention of an observer; and, as the preservation and improvement of the forests, in their highest degree, are above private effort, require joint action, and must be effected on a large scale, on a system wisely begun and long continued, by the men of one generation for those of the next; and by the application of science, taste, and skill, not by one man but by many men, not in one village or town, but in a county and state; it is wise in a government not acting merely for the present, but extending its forethought generously onwards, making its knowledge and wisdom as invested capital for future use, and desiring to do for coming generations, what they, when looking back, shall wish it had done,— it is wise, prudent and

> patriotic for such a government to order a survey of the forests, among its other domains, that the people may know the sources of their wealth and its extent and learn how to value, enlarge and enjoy it. The conception and ordering of this general survey, was worthy of the descendents of those who established free schools, free courts of justice and freedom of religion. The idea was a noble one, with whatever success the work may have been executed."

Beyond this rather eloquent expression of confidence in the efficacy of a survey, he didn't elaborate any scheme for the planning and control he seemed to espouse.

We can turn now to George Perkins Marsh, a Vermonter, who spent a good deal of his time as a diplomat in the Mediterranean area. The conditions of human life and of the land that he found there aroused his interest as an amateur historian and naturalist. After careful study he developed some well articulated ideas about the changing relationship between man and the land that had created the rather sad state of affairs then current. Against this background, he too viewed with alarm the ever accelerating consumption of land resources that seemed inevitably to go hand in hand with industrialization. The first paragraph of his book "Man and Nature, or Physical Geography as Modified by Human Action" shows the stage his thinking had reached in 1864:

> "The object of the present volume is: to indicate the character and, approximately, the extent of the changes produced by human action in the physical conditions of the globe we inhabit; to point out the dangers of imprudence and the necessity of caution in all operations which, on a large scale, interfere with the spontaneous arrangements of the organic or the inorganic world; to suggest the possibility and the importance of the restoration of disturbed harmonies and the material improvement of waste and exhausted regions; and incidentally to illustrate the doctrine, that man is, in both kind and degree, a power of a higher order than any of the other forms of animated life, which, like him, are nourished at the table of bounteous nature."

Here was another idea—the balance of nature—that was to seize the imagination of people concerned with renewable natural resources. Although science might eventually lead to an understanding of all the tricky and intricate checks and balances, so that the consequences of human interference with nature could be predicted, Marsh obviously felt that there was considerable risk of being surprised by a deleterious turn of events. The thought that nature is in some sort of delicate balance maintained by obscure automatic forces, that the resulting state of affairs is by definition "good", and that man is likely to change everything for the worse has continued to have wide popular appeal.

I suspect that both Georges were alarmed, not so much by the kind of land-use change that was taking place, as they were by the rapidity with which the landscape was tamed because of the massive settlement that took place during the exuberant 19th century. Thus it was not change per se that worried them, but the very high rate of change, and the consequences that might follow if this rate continued unabated. The answers that both came up with spotlighted the application of science to land through practices that would reduce waste, increase productivity and maintain "bounteous nature."

It remained for others to package these ideas attractively as "wise use . . . for the greatest good of the greatest number, and that for the longest time."

And add an internally logical scheme for attainment like "high-intensity, sustained-yield management"; before forestry and conservation achieved popular acceptance about the turn of the century. The strategy of setting aside areas of the public domain as National Forests, where presumably the scientific management of land could be used on a large enough scale to help avoid a timber famine provided a firm enclave where the profession of Forestry could mature and develop. From this safe haven it was also possible to try to influence the management of private forest land.

But just how appropriate was forestry as a method of satisfying the burgeoning needs of society for shelter, the raw stuff for industry, and a pleasant environment? First of all, forestry was bio-centric and focused its big guns on the scientific management of land to increase its productivity; coupled with planning that would restrain use until it equaled the rate of growth. This response to greater human need essentially said "Manipulate the forest, and force the rest of society to adjust by dampening the rise of demand to suit biological yield." If fully implemented, the immediate effect would be to create a physical scarcity whenever demand exceeded sustained yield, and in the long run the increased cost of more intensive management would probably raise the price of forest products. Both of these moves would create economic scarcity—the very thing foresters hoped to avoid!

There were other anomolies when forestry is viewed as a response to rapid social and economic change. Periods like this are typically fluid and full of great uncertainty about future needs, because old patterns of use are breaking up and new ones being introduced. The concept of long term planning embedded in forestry was predicated on biological and economic certainty, yet it was first implemented at a time when human capacity to predict the future was very limited. Under these conditions it is not surprising that some other form of management frequently seemed more desirable to many forest owners. In general there must be a clear and present danger, before planning to tie up resources for long periods becomes a very attractive course of action.

Of course, there were alternative ways of avoiding material shortage, but unfortunately they lay mainly outside the domain foresters had arbitrarily defined as their own. Beyond the forest, a long chain of related activities took timber and, in the jargon of economists, gave it form, time, and place utility. Logs went to mills where they were turned into lumber, this was sorted and perhaps reshaped and combined in other factories, carried to places where the material was needed, and laid down there in time to be used to satisfy some consumer's need. The main characteristic of this chain was that of being readily subject to technical innovation, easily reorganized, and on the whole flexible enough to adapt in a timely fashion to emerging situations as the need became apparent. The utilization and marketing segments of the forest system have thus been able to keep up with the times and respond to change by a series of short and long-term adjustments so that wood is still used rather freely to satisfy many human wants.

The contrast between the forester's biologically oriented concepts of land management control and the socio-economic concepts of flexibility is well illustrated in Sherry H. Olson's recent thesis entitled "Commerce and Conservation, The History of Railway Timber". At about the turn of the century

the railway industry was a major consumer of wood, and managers were keenly aware of the shrinking supply of preferred species because of rising material costs. At the same time the roads were major land holders and the early foresters' ideas of growing desirable trees near places where they were needed for construction seemed both logical and desirable. Railroad magnates looked with favor on this kind of forestry and in due course trial plantings were made on a considerable scale.[3]

Most of these plantations failed for a variety of reasons including imperfect knowledge of plantation techniques, higher costs than originally anticipated, and the relentless accumulation of interest charges. In addition, the alternative techniques of coping with material shortages that were explored simultaneously, opened other avenues of escape. Treating methods were developed to lengthen the useful life of timber, schemes for the central prefabrication of timber for field use successfully reduced labor costs, and full advantage was taken of the fact that railroad managers were the proprietors of an elaborate transportation system capable of reaching forests all over the country.

This combination of technical innovations successfully solved railway timber problems—not by growing more trees, but by expanding the effective supply to include "weed" species, and far away timber, extending the life of wood, using labor more efficiently, and finding substitute materials like stone and steel. Once the railway timber shortage problem was defined as that of reducing the cost of construction and maintenance, this whole range of possibilities opened up as logical alternatives to planting.

Note carefully what happened—the problem of timber supply was refined into a consumer cost problem, and from this new viewpoint managers could see that it was relevant to explore a much larger system of activities. In addition to the biological factors of land management, they could now consider all of the technical factors that filled the void between forest land and the right-of-way. With control over this whole array of sub-systems through vertical integration, they were free to search out bottlenecks anywhere along the line, find those that would yield most readily to technical innovation, and pass the savings along to the point where they were most needed. This broader definition of the relevant system gave managers much needed scope for finding a blend of adjustments that would meet changes in wood supply most effectively.

The main lesson for foresters is that the line that separates a chosen system from the rest of the world is drawn arbitrarily, purely as a convenience in solving a specified problem. Inside the system one tries to include all those things he needs to operate, and to keep outside it all those things that seem unimportant enough to be taken for granted. The distinction between a "system" and its "environment" is fluid, and makes sense only in terms of our understanding of the problem at hand.

This seems to be the lesson of the past—it is a fact that we cut over whole regions of the United States in rapid succession and liquidated the virgin timber, as was freely predicted. But it is also a fact that national disaster did not follow, because our whole system of using resources was large and adaptable enough to take this changing situation in stride. We no longer talk much about the likelihood of a timber famine in the years ahead, but are more concerned

[3] Unpublished manuscript, the Johns Hopkins University, Baltimore, Maryland, 1965.

with a probable surplus and with the search for ways to get more wood used. Man has shown more flair, panache, and inventive genius in designing systems than the early foresters expected. The old bio-centric conception of forestry was too inward looking, too much bounded by the edge of the woods. Although the "timber beast" handled his job well and continues to serve a useful purpose, the view from the forest gives too narrow a perspective of the power and the problems of modern society.

If this is true we might gain more useful insights by listening first to the harsh voices of the city rather than the soft murmur of the forest. For our society is now decidedly urban, and city folk have the power to say what they want and the technology to see that they get it. This configuration of power is not new, but the trend toward centralization of all kinds is now so steep that we are embarked on another period of major change. We will see changes that will dwarf those that inspired the two Georges, and the men who followed in their footsteps.

Two Johns, Friedmann and Miller, have given us a useful conception of one basic force that will shape land-use in the decades ahead — population distribution:

> "It has become increasingly possible to interpret the spatial structure of the United States in ways that will emphasize a pattern consisting of metropolitan areas and the intermetropolitan periphery. Except for thinly populated parts of the American interior, the inter-metropolitan periphery includes all areas that intervene among metropolitan regions, that are, as it were, the reverse image of the trend towards large scale concentrated settlement that has persisted in this country for over half a century. And like a devil's mirror, much of it has developed a socio-economic profile that perversely reflects the very opposite of metropolitan virility . . . .
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> The emergence in large sections of the country of the inter-metropolitan periphery as a problem area of major dimensions has been the direct result of the concentration of people and activities around closely contiguous metropolitan cores. Growth in and around these cores has drawn off the productive population, economic activities, and investment capital of the periphery, but the forces of urbanization are now in the process of reversing this trend; the pendulum appears once more to be swinging in the other direction . . . .
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> Looking ahead to the next generation, we foresee a new scale of urban living coming into being that will extend far beyond existing metropolitan cores and penetrate deeply into the periphery. Relations of dominance and dependency will be transcended. The older established centers, together with the inter-metropolitan peripheries that envelop them, will constitute the new ecological unit of America's post-industrial society that will replace traditional concepts of the city and metropolis. This basic element of the emerging spatial order we shall call the *urban realm* . . . .
> . . . . the idea of an urban realm . . . represents a fusion of metropolitan and non-metropolitan peripherial spaces centered upon . . . core areas of at least 300,000 people and extending outwards from these . . . for a distance equivalent to two hours' driving over modern throughway systems (approximately 100 miles). This represents not only an approximate geographic limit of commuting to a job, but also the limit of intensive weekend and seasonal use (by ground transportation) of the present periphery for recreation. A system of urban realms delineated by this criterion . . . (contains) . . . between 85 and 90 percent of the total United States population . . . and something less than 35 percent of the total land area of the country . . . These are facts of signal importance. For as the metropolitan influence field is substantially enlarged during the coming generation — and this is precisely what we assert — nearly all of us will soon be living within one or another of the 70-odd urban realms of the United States.[4]

[4] The Urban Field, by John Friedmann and John Miller, Journal of American Institute of Planners, November, 1965.

Couple this idea with the fact that citizens of the urban realm will probably have more money, more mobility, more leisure, more communication, and higher expectations—and it all adds up to change on an unprecedented scale. There is little doubt that to support this organization more material things will be used than ever before, but the role of natural resources per se will undoubtedly be so tempered by a rapidly shifting technology that requirements are hard to predict. The present concentration of people and manufacturing has already strained our capacity to collect, distribute, and process high quality water, and new growth in the urban realm will further escalate water supply and waste disposal problems. Finally, solving that most baffling problem of all, space and the quality of space, is sure to get high priority.

How can forests help meet these demands? First, about the raw materials: Undoubtedly a great deal of wood can be used if it is cheap and versatile enough; but most of it must be hauled from the hinterland and the more remote fringes of the urban realm, if for no other reason than that's where most of it is. Judging from current trends, lumber consumption will decline because efficiency depends too much on finding the right kind of material in the woods; the chance to cut production costs by mechanization seems less than for more homogenized products; and it is harder to engineer desired qualities into conventional lumber. The use of wood in fragments or molecules will probably greatly increase because these forms offer so much opportunity for cost reducing innovations and for engineering end product characteristics.

I suspect that this shift will diminish the importance of tree form, size, and species and raise our interest in producing cheap bulk fiber. Then we could take full advantage of the fact that **forests convert solar energy to fiber with fewer man hours of work per ton than any other North American crop, provided we can harvest and convert this fiber into useful form with a minimum of effort.** At the moment, the worst bottle-neck is between the stump and the mill, right in the foresters' existing bailiwick. We should, however, extend our interest onward to include the correlated activities that take place thereafter, to insure that our raw material makes a truly significant contribution to solving such central problems as the high cost of housing, rapid neighborhood deterioration, and urban renewal. We should scan the whole broad system to eliminate weak parts, if we are serious about drawing foresters firmly into the solution of society's shelter and fiber problems.

In the area of water supply I suspect that we have only scratched the surface of economizing on use, reprocessing, increased capture, and institutional controls. The general role of vegetative cover in the hydrologic cycle seems clear, but I doubt that we know enough about detailed relationships properly to judge responses to cover changes. It is suggestive, however, that preliminary estimates from the U.S. Forest Service experiments on the Beaver Creek watershed in Arizona show that **reduced forest cover produced worthwhile gains not only in water, but also in forage and timber production.** Within some considerable range of management intensity, timber, forage, and some kinds of recreation may be "joint" rather than "competing" products.

The problem of open space is so ill-defined that it is difficult even to talk about it. However, it seems to relate, full circle, back to Emerson's concern for the quality of man's environment. If open spaces can really help keep the strains

of living in the urban realm from becoming intolerable, and forests can play a part, then foresters may make a decisive contribution to the success of this way of life. And this may be more important than anything else we do. As our population spreads further into the inter-urban periphery and intermittently occupies the hinterland, the distinction between the amenity value of a shade tree, a city park, and a wilderness area gets progressively blurred. So too does the line of demarcation between the forester's "system" and its "environment".

In all of these endeavors we may frequently be at least as interested in the economic and social activities that accompany forest management as we are in the goods and services themselves. The fact that forests and poverty so often occur in the same area—where population densities are low and social organization weak—is one indication that past forest use has not been ideal. All round the world people are giving a very hard look at these forests to see whether they can be used as a springboard for economic and social development. I expect that strategic values of this kind will often transcend all others.

If raw materials, water, environmental amenity, and development are all forest related problems modern society deems important, how can foresters address themselves to finding appropriate and simultaneous solutions? I suspect that the answer can be drawn from the "Management Revolution" that has been going on since the advent of computers. The Industrial Revolution once vastly increased our capacity to create things by making it possible to combine men and machines into new production systems. Our modern society is supported on the gains that flowed from these relationships, but many of our problems can be traced to the feebleness of our control over them. Many people feel that new man-computer systems will so strengthen our capacity to plan and make better decisions that we can gain a crucial measure of control. They predict that our lives will be as changed by the Management Revolution as they once were by the Industrial Revolution.[5]

The ability to process a bit of information in a nano-second is certainly important because we can now solve problems that were once simply too big to handle. But only when this ability is coupled with the new emphasis that computer use has placed on conceptualizing problems in terms of process, does the resulting capacity to deal with complexity become fully significant. If this development is used to increase our powers of comprehension as much as some believe it can, we may indeed have something "new under the sun."

The invention of computers and the problem solving techniques they have made possible can give us a new capacity for continuous planning that is better suited to the realities of the world than the older concept of the "master plan". Whether this leads to better resource use depends on how well we design man-computer systems to utilize the fact that machines excel in handling information, and men excel in imagination. It is clear that our important policy choices will not be made by computers alone, but by men whose perception is reinforced and expanded by fast systems of information storage, retrieval, analysis, and display.

[5] The New Science of Management Decision, Herbert A. Simon, Harper & Row, New York, 1960.

One scheme suggested by Simon would recognize that five major functions make up a planning process—intelligence, design, choice, action and feed-back. These acts do not occur in such neat and separate order, they are only convenient divisions for discussion. Intelligence is used in the military sense to mean the gathering and evaluation of information. A good manager does this continually by scanning the system he is in charge of and the environment in which it operates, searching for discrepancies between anticipated and actual performance. This turns up a series of existing or impending malfunctions and unexploited opportunities that call for some new action. Automatic data processing can help gather intelligence, but this function depends primarily on human insight and imagination.

With a problem identified, then new solutions are required and these are produced in the design phase. Although conceptualizing options is peculiarly man's job, working out the consequences of alternative designs so that they are as clear as possible is where computers can really come into their own. We already have a fair battery of computerized methods for analyzing special problems, simulators for imitating decades of forest management in seconds of machine-time, and some programs are being worked out to cope with such intangible concepts as natural beauty.

The next phase involves selecting the alternative that promises to be most satisfactory. This function of choice is peculiarly the skill of a good manager, because responsibility for the outcome is absolutely essential to temper the use of judgement in the face of uncertainty.

The next step is to put the decisions into effect through action, and this is primarily an administrative problem. However, it may well mean going into another round of design and choice before the best system of action is found.

The final phase is provided for in any good plan of action and includes a systematic feed-back of the information deemed essential to judge performance. The importance of monitoring the progress of any new action has not always been appreciated and as a consequence corrective action has often been delayed until the situation got completely out of hand. Automatic data processing can be especially helpful in this stage. Feed-back starts the whole planning process over again by providing additional grist for a new round of intelligence.

It seems likely, from extensive experience in business and government, and from the bare beginnings made in forestry, that a man-computer system of planning can be designed that will be cheap and fast enough to make forest planning a truly continuous process. This new capacity should help foresters generate an acceptable stream of human satisfactions, by manipulating the processes that knit man and his forested environment into an integrated system. Perhaps this can serve as a working definition of a brand of forestry that is compatible with the urban realm.