Planning for Forest Development On Small Holdings

In the course of research on forest and farm planning in New England, instructive cases are studied and concepts and models developed which emphasize adaptation to change.

IS FOREST PLANING on small woodlands worthwhile? To answer this question, I will draw on personal knowledge gained from analyzing the problems of more than 275 private operating units. Many of these were farms that combined crop and livestock enterprises with forestry. Others were primarily second homes of owners whose main income originated in the city. And a few were "tax loss" operations. The group included the varied interests characteristic of landowners in heavily urbanized New England.

An Experiment in Planning

The properties were studied as part of an experiment in farm and forest planning. My colleagues and I were interested in helping each landowner decide which of the several forest practices that could be applied to his stands would best meet his special goals. We tried very hard to achieve neutrality in playing the role of technical analysts and to leave decision making to the owners. We were thus constrained from pushing one plan over another, regardless of our own preference. We merely laid out the probable consequences of each course of action and discussed their advantages and disadvantages. In the end, it was the owner who evaluated the pros and cons and struck a balance which satisfied his feelings about security and the uncertain future.

The experience of give and take between analysts and decision makers in designing forest plans and the observation of what happened over the subsequent five to ten years made one thing quite clear: The planning process doesn't work in the straightforward way it is supposed to. For example, one authority (*2*) says that the analyst is frequently told "to begin with some broad 'given' or accepted objectives; to derive from them appropriate local or subobjectives for the systems problem in hand; and then to design the analysis to maximize, in some sense, the proximate objectives." Our experience suggests that as planning proceeds, it clarifies the costs and benefits of alternatives, and the owner often uses the information to change his initial goals. This is an untidy process, since changes in goals call for a new analysis. Thus planning turns out to be the search, not simply for efficient means of reaching given goals, but also, simultaneously for desirable ends. Feed-back considerably complicates the procedure, but can be one of the chief benefits of a systems approach to planning forest enterprises. I will return to the function of feed-back.

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A Large Farm Forest

But first, a few cases to show planning in action. Among the larger holdings was a tract owned and operated by two brothers. One ran a large modern dairy farm on the best land, while the other cut and sold sawlogs and pulpwood from about 1,000 acres of woodland. The two enterprises were closely coordinated to make the most effective year-round use of labor and machinery. The "forestry brother" still had some time to work as a consultant on the side.

With plenty of managerial capacity available, there were few inefficiencies in either the farm or the forest enterprise. The full array of pruning, thinning, improvement cuttings, and partial harvest operations was already in use on the most responsive sites in the forest. As analysts, however, we did assemble more complete information about the character and location of stands, and this paid off immediately in helping the owner rationalize his road net.

Most of the benefit came after the owner mulled over our assessment of how his forest might perform over the next decade if operated at a high, medium, or low intensity. The analysis gave him new insight into the size, character, and capability of the system he controlled, which induced him to change the system.

First, it wasn't big enough to use all his time and talents; so he acquired 500 acres of adjoining land. Second, his income was largely from the sale of sawlogs, and he thought the market undervalued the high-quality timber his intensive management was creating. To obtain his price goals, he bought a mill and sold rough, air-dried lumber on grade.

Given better information, the characteristic response of many owners was both to improve the internal operation of their system and to change the system itself. One sometimes forgets that the line between the controlled system and its uncontrolled environment is drawn largely for convenience. Many of the people we worked with shifted the line whenever it seemed worth the effort.

Plans Which Facilitated Liquidation

An even more dramatic system change was made by the owner of a back-country farm in New Hampshire (*1*). When we first started working with this young man, he was operating the family homestead for his aged parents. For over two generations, the 700 acres of woodland had been carefully managed as a major adjunct to the farming of 60 acres of mediocre field and pasture. Livestock enterprises had dwindled away while the son was in the army, but he was now starting to revive the agricultural part of the business.

The budget analysis we made of his operating unit projected farming changes for one decade and forestry for nine decades. Plans were made with the owner's help, and the results showed that net farm income could be increased fivefold by intensive forest management and full development of the farm enterprise. Net cash income, however, would still be less than $2,000 a year for several decades—a low standard of living even if allowance is made for the added value of housing, food, and the other less tangible benefits of farming. Nonetheless, the operator selected a plan, and during the next five years, he tested our joint expectations against actual performance. With minor exceptions, things turned out about as predicted.

Then the parents died, and the operator married a local girl. The operating unit and its potential remained the same, but a new set of ideas and more ambitious objectives were introduced as an integral part of the system. Two years later, the operator sold out and took a congenial job in town. A useful spin-off of past planning was the success with which the operator converted his tangible resources into cash. Improved knowledge of his forest and farm resources made him not only a better operator in the first instance, but also a knowledgeable seller. Thus the acquired skills gave the family a good start in a new venture.

In the case just described, the possibility of liquidating the homestead had been considered in the initial planning. However, changes of equal magnitude can also come out of the blue. Take the example of the widow who operated about 100 acres of forest in conjunction with a summer home. Her husband had been very interested in forestry and had planted trees on much of the old farm. He had weeded, pruned, and thinned both the plantations and the volunteer stands. These activities not only were an investment in future cash income, but also produced a large psychic income from pleasurable physical activity.

The widow favored intensive forest management primarily for the satisfaction of knowing she was following her husband's wishes. However, the rate of achievement had to fit the meager funds she could invest in hired labor to supplement federal cost-sharing payments under the Agricultural Conservation Program.

Less than a year after the widow had set up a schedule for intensive forest practices, a flood-control project started nearby. The project manager discovered that her carefully managed stands were growing on precisely the kind of fill required for his dam. She decided that the benefits of supplementing her capital reserves by selling fill far outweighed any income potential from existing stands, even when sentimental values were given due weight. Consequently she let much of her forest land be converted into a borrow-pit. The unplanned shift in the system was more easily made because the owner had a clear forecast of the income stream from forestry and could readily compare it with returns from the alternative program.

Planning for the Unexpected

In still another case, past forest management decisions spun off new opportunities for the owner of a 50-acre woodlot close to a growing New Hampshire city. The proprietor chose a program of thinning and improvement cuts. He preferred to do the work himself and got a maximum return by sawing his logs on a small mill that he and a high school boy could operate. Normally he cut to order the lumber for one or two houses each year; or when pine cooperage prices were high, he cut rough trees for this market.

Nearly two decades of management had produced a handsome woodlot of well-spaced white pine. Population growth in the nearby city meanwhile had produced a brisk demand for houselots, and the forest environment brought premium prices as living space. The owner became the developer of a small but high-grade housing project. He was in position to do this because past forestry decisions had not only provided income, but also had raised the amenity value of the area. The owner had acquired enough skill from our experiment in joint planning to anticipate events as the situation unfolded over a decade. With less sensitivity to signals from his environment, he might have been left with an unattractive "stump lot" devoid of amenity value.

What does one learn from the foregoing cases? Although the cases may seem atypical, in terms of principles they are not. While the actual decisions these owners made were not duplicated elsewhere, the other managers we worked with were faced by basically similar problems. In the fullness of time, events turned out to be different from expectations: All owners had to adapt their forest systems to changing personal needs, developments in the technology of use, or new problems and opportunities that arose in their environment. I think that these experiments in planning helped the managers exactly to the degree that they learned to use information more effectively: first, to recognize significant opportunities, and second, to

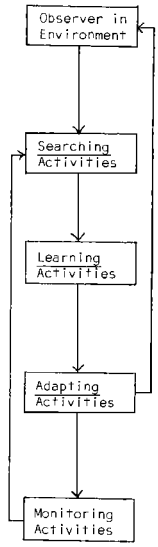

Fig. 1.—Activities of an observer in an environment.

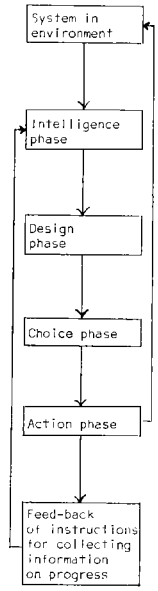

Fig. 2.—Steps in problem solving.

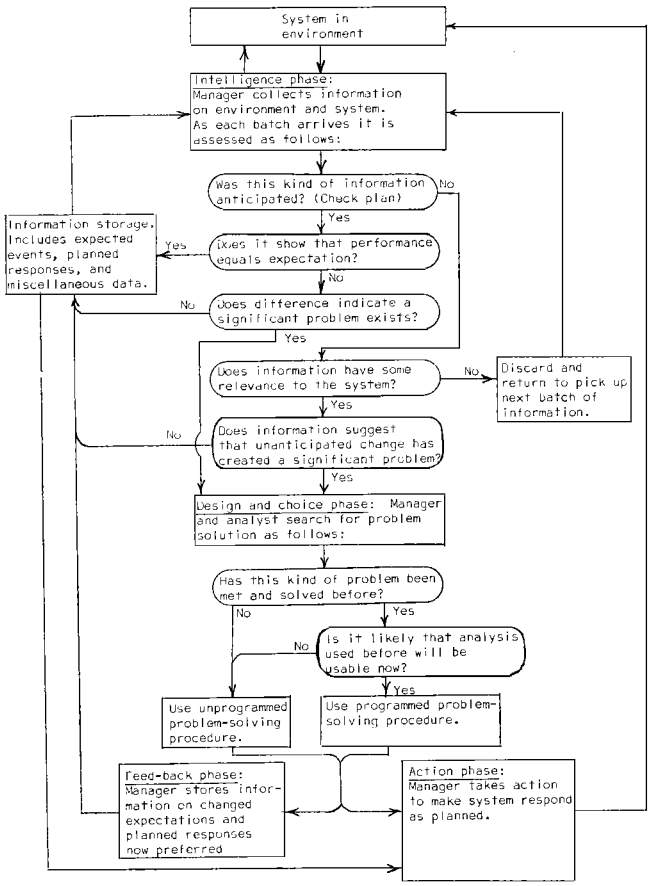

Fig. 3.—The process of planning.

analyze their options in a way that would improve the resulting stream of decisions.

The need for change arose not because there was anything particularly wrong with the plans we produced. Like any plan, ours represented our best judgment of future events and appropriate system responses. Whether written or implied, each prediction was conditional and could be checked against experience. Sooner or later, accumulated differences between expectations and performance made the plans obsolete. A new vision of the future had to be harmonized with real-world events. As researchers, we learned that if planning is going to be useful in forestry, the planning process should be viewed as a continuous dialogue between decision makers and analysts.

Searching, Learning, Adapting

Many planning procedures are known, but apparently those that work best recognize that man is preeminently a searching, learning, and adapting animal. These are his familiar functions; he develops considerable skill with them in the complex process of growing up. But how can he use them advantageously in planning?

The diagram in Figure 1 suggests how each of us behaves as an observer in his environment. Impelled by curiosity, he continually searches out signals that give him information about himself and his surroundings. Thus, putting an *observer in an environment* produces a stream of *searching activities*, as indicated by the arrow. In turn, he is led to *learning activities* because he accepts, stores, and studies some of the stimuli his mind receives. Gradually he learns to recognize patterns of signals and build models of the entities and processes around him. Thus, he can *adapt his activities* to produce a more satisfying environment and simultaneously gather information about whether the change is successful. The last step is symbolized by the *monitoring activities* box and the arrow showing that these bring on special searching activities.

The diagram indicates a continuous flow of information into the system and an output of adaptive action and response measurement. The model can represent those instinctive responses to stimuli that characterize childhood experiences, in which the time is collapsed between search and adapt. The model can describe, too, what happens as the scope of one's contact increases with age: The time between input and output grows longer and one starts to scheme, lay plans, and use his searching, learning, adapting, and monitoring skills deliberately to solve more complex problems.

The Problem-Solving Process

Management normally requires a formal procedure for solving problems. The flow chart in Figure 2 is an elaboration of that in Figure 1. It suggests the steps one takes in problem solving. Here the start is an operating unit or *system in an environment*, just as it was in the four planning cases.

The manager continually gathers *intelligence* about how his system functions and how its environment is behaving. That is, he engages in searching and learning activities. When he detects a problem, he enters a *design phase* to analyze his options. Then follows a *choice phase*, in which he picks the best course for adapting the system. Choice leads directly to adaptive *action*, which in turn stimulates intensive monitoring designed to judge success. *Feed-back*, of course, restarts the whole process at the intelligence phase.

Intelligence, design, choice, action, and feed-back are merely working approximations of the major functions a manager performs in decision making (*3*). We know his activities are not so neatly arranged. But we can make a connection between human problem-

solving behavior and more formal decision making. Reaching a deliberated decision by formal means takes time, but the improvement in outcome may be worth the effort if the problem is complex and large. As the scope of the problem expands to include an entire operating unit and we wish to look ahead over a long period of time we move into a special kind of problem solving which we may call planning.

Characteristics of Planning

A plan has two parts. The first is a set of assumptions about the future. The second is a set of instructions for operating the system if assumptions prove correct. If everything turns out as planned, the prepackaged decisions are an enormous time saver for the manager.

As we have seen, two difficulties loom large. First, actual events are apt to be so different from those forecast that the operating instructions embodied in the plan are inappropriate. Second, it is not feasible for a plan to cover all day-to-day problems that may arise. Thus a plan can save a lot of wear and tear on the manager, but only at the cost of continual checking against the real world. In any case, the manager will have to make some decisions apart from the plan. Thus the most helpful model is the one that fits the formal plan into a procedure for making a stream of decisions.

The flow chart in Figure 3 takes the outline of problem solving in Figure 2 and amplifies it into a planning model. Here are spelled out the main steps a manager performs in processing the information he needs to run his system. In the chart, the steps take the form of questions, asked in sequence about each batch of information. The end results are to store or discard information, take action according to the old or a new plan, and if necessary update the plan.

A Planning Model

Again we start at the top with a functioning system in an environment. In addition, we have a plan put away in a new box labeled *Information storage.* The need for the added box is apparent in the first question. The manager must look here to see whether he anticipated picking up the kind of information he has in hand at the moment. If he expected this kind of information then he checks to see if it has the expected value, and if it does, all is going according to plan. He stores this fact for future reference, selects the packaged response, and goes directly to the *action phase.* Simultaneously he returns to *intelligence* and starts processing the next batch of data. Having responses planned and ready, he can shortcut most of the decision-making model.

If performance doesn't equal expectations, then closing the gap becomes a problem. However, judgment alone may indicate that the gains won't equal the trouble of seeking a new solution, and the manager then may choose simply to live with the difference. However, if he believes a significant problem exists, he goes into the *design and choice phase.*

Judgment is also brought into play to assess the significance of completely unanticipated batches of information. If insight suggests that the new information does not now pose a problem worth exploring, the manager may choose to forget it or may store the data for the future. Alternatively, he decides that he has a significant problem.

Any information that represents a significant problem not solved in the plan forces the manager into the *design and choice phase.* If the problem is one that the manager has met and solved before, he can use the same analytical scheme again. Luckily, most difficulties can be solved this way, because most problems are repetitive and will yield to analyses that are programmed but not included in the plan. If the problem is new and ill-structured, then the manager is likely to draw on his inherent problem-solving capacity and design a tailor-made analytical procedure. Use of unprogrammed procedures takes more time and effort than programmed ones, and so the prospective gains must be large. In any case, a solution will call for action to implement it. It will call also for changes in stored expectations. These will alert the manager to gather information for checking his progress. Thus the cycle in the chart is complete.

In reality, of course, the planning process is far from sequential: The manager may be passing information simultaneously through several parts of the model.

Did any of the managers we worked with actually operate as Figure 3 suggests? I would be surprised if they did. We can say that when they planned with us they were using a problem-solving procedure that was new to them and therefore unprogrammed. Presumably they did the extra work because it promised better solutions than they had previously devised. Also the plans gave them a set of reasoned expectations and prescriptions for action. Moreover, none of the managers followed directions blindly, they checked to see what happened after each increment of change and never hesitated to rationalize new plans in light of the outcome.

The essential question is not whether the model mimics what people do, but whether it provides a working hypothesis for improving management decisions. It looks promising to me as an idea that can be developed. Simply setting down a chart helps in a number of ways. For instance, the role of the plan is clear and we can see how desirable it is to spell out expectations and to specify signals that tell the manager when performance is getting too far out of line. We can also see how important it is to handle efficiently large volumes of information in the intelligence phase. Here computers can be used to great advantage for storing, retrieving, comparing, and combining relevant data. It is also apparent that foresters working with decision makers need a host of analytical schemes in the design and choice phase.

Literature Cited

1. BARRACLOUGH, S. L., and E. M. GOULD, JR. 1955. Economic analysis of farm operating units. Petersham, Mass. Harvard Forest Bul. 26.
2. HITCH, C. J. 1961. On the choice of objectives in systems studies. *In* Systems: research and design. Ed. by D. P. Eckman. John Wiley & Sons, Inc., New York.
3. SIMON, H. A. 1960. The new science of management decision. Harper & Row, New York.