1976: Economics of Southern Forest Resources Management

Louisiana State University and Agricultural & Mechanical College

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ECONOMICS OF
SOUTHERN FOREST RESOURCES MANAGEMENT
1976

25TH ANNUAL FORESTRY SYMPOSIUM
25TH ANNUAL
FORESTRY SYMPOSIUM

ECONOMICS OF SOUTHERN FOREST RESOURCES MANAGEMENT

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FOREWORD

The 25th Annual Forestry Symposium was opened appropriately by the original founder of this annual event, A. Bigler Crow. Professor Crow has announced his retirement effective June 31, 1976.

This year's topic, "Economics of Southern Forest Resource Management," proved to be very timely. There is always a greater interest in economics topics during periods of economic problems. Currently the national economy in general and the "forest industries" are in a recovery stage.

One hundred twenty participants from 16 states and Washington, D. C., were officially registered. In addition, 20 to 30 local staff, faculty and students attended parts or all of the symposium.

A program committee made up of Professors A. Bigler Crow, Robert W. McDermid, Clifton B. Marlin, Dr. Norwin E. Linnartz and Dr. Paul Y. Burns formulated this year's three-part program. Forestry symposiums have historically been designed to update practicing foresters, and this year's program was designed to provide practical information to foresters concerned with forest economics.

The initial section was devoted to examining a portion of the basic economic theory as it relates to forests and forestry and updating the theoretical understanding of the economics of forestry. Dr. James Yoho, Manager, International Resource Development, International Paper Co., coordinated the four papers and moderated the section.

Jay Gruenfeld, Vice-President, Lands & Forestry, Potlatch Corporation, ably moderated and minimized overlap between the speaker-authors of the second session, which introduced and re-acquainted forestry practitioners with techniques for economic analysis of forestry problems.
A final segment was devoted to two topics of current interest: costs and taxation. Dr. Leon Hargreaves, School of Forest Resources, University of Georgia, directed these presentations. The speaker-authors examined current costs in depth and discussed some proposed changes in forest taxation laws.

Dr. Bart A. Thielges was very helpful in sharing his experiences as chairman of last year's program. Judy Hite, Coordinator, Short Courses & Conferences, was very cooperative in making the meeting arrangements, registration and budgets. A number of graduate students volunteered to perform necessary items such as operation of audio-visual equipment and transporting speakers to and from the airport. The assistance of graduate students Rudy Sparks, Henry Langston, Allan Ardoin, David Vendt, Mike Henderson, Mike Hamilton and Zakariya Bin Hajiabdulla was greatly appreciated.

LSU Cooperative Extension Service artists Ruth Thompson and Mary Thrasher did an excellent job in preparing figures.

And finally, a special thanks is due to Elaine Jolliff for her expert typing of this manuscript in addition to ably handling advance registration and other arrangements.

Alden C. Main
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25TH ANNUAL FORESTRY SYMPOSIUM
WELCOMING REMARKS

A. Bigler Crow
Louisiana State University
Baton Rouge, Louisiana

I am here to welcome you to Louisiana State University and to the 25th Annual L.S.U. Forestry Symposium. I bring you greetings from all the appropriate officials -- the president, the chancellor, the dean, and the director -- and join them in the hope that your stay here will be both productive and enjoyable. What we as hosts try to do is provide a good program, present it in suitable and comfortable quarters, and look to your well being while here. We hope, too, that you enjoy the facilities and the flavor of our city, Baton Rouge.

Now to the business at hand. I trust you will forgive me if I indulge for a few moments in a bit of nostalgia. As many of you know, it was my privilege to originate the LSU Forestry Symposium back in 1951. At our first meeting in March, 1952, we were amazed and delighted to find over 200 people in attendance. They kept coming over the years, and we estimate our total attendance for the 25 meetings has been about 8000.

Also over these 24 years we have had 70 moderators and some 320 speakers -- people knowledgeable and articulate in their fields and willing to share their expertise with us. I was recently looking at a list of the themes for all our symposia, and the speakers and titles of their papers. I was much impressed by the wide range of topics that have been covered here the past quarter century and by the stature of those who spoke to us. Here from this platform we have had chronicled the events and the findings, translated into accomplishment in the field, that have made southern forest resources management the wonder and the envy of our professional colleagues around the world.

I am less certain, however, about what effect all this has had on the people and the communities to whom we must ultimately answer for what we do in the name of ecosystem management. I like
to think it has on the whole been for the general good. Perhaps here we have an idea for future consideration — a theme for the 26th Annual LSU Forestry Symposium next year.

I have one more thought I should like to express along these lines. From the beginning in 1952 to the present meeting, we have always tried to provide something for the field forester — the person whose job it is to translate theory into action and to get practices established on the ground. Many forums, and rightly so, are for specialists who meet and talk to other specialists. Although it may not always have turned out that way, our idea was to find specialists — and generalists, too — who could convey information and ideas so clearly as to be understandable and applicable to the field man's daily tasks. Obviously, they and we did not always succeed, but we tried.

Finally, since it is probable this will be my last appearance before a Symposium audience, I want to say it has been a privilege for me to have been a part of all this the past 25 years. Next to teaching and working with students, it has been the most moving experience of my life. I want to thank my colleagues, too, for helping make each meeting a success. They never waivered in their support of this idea.

Lastly, there are our audiences — you people sitting here now and all the others before you. Had you not elected to attend, and to return year after year, this idea and this opportunity would long since have disappeared. It is you who have made it all worthwhile.
My assignment is to spell out some essential ideas in economics, with special reference to forestry. I could argue that there is just a single essential idea in economics: the idea of human behavior in the ordinary business of life. This is Alfred Marshall's phrase. It emphasizes that the economy is a social system, one with many parts, to be sure, but still a unit, in which all the parts are interconnected. So closely are the ideas of economics woven together that one is tempted to imagine that they should not be named in any sequence because no particular sequence could be appropriate, and the only way to deal with them is to blurt them out all at once.

I'll resist any such temptation as this. I'll speak of essential ideas in economics as though they were separable: as though I could probe the system, seeking the thin places, cutting and tearing it apart at those places.

I'm aware that I am asked to talk about ideas. Why ideas and not objects or events? I know that economics can be viewed as an abstraction, but what about its application to forestry? Isn't applied economics a system of objects and events? I suppose the fact is that the main stream of economics, whether general or applied, is loaded with material things, but the stream itself is a stream of ideas. This, at any rate, is how I shall regard my assignment.
The idea that comes first to mind is that forestry economics concerns people. What sort of idea is this? Why should one need even to mention it, considering that economics is a social science? Truly, we can stand frequent reminders that human beings are the subjects of economics, because it is much simpler and perhaps more fun to suppose that economics is peopled by regression equations, graphs, matrices, dollars, and maybe some economic men, and that forestry economics is the same sort of thing, with some land and trees and an interest rate or two thrown in for good measure.

Our general economy's function, as I see it, is to help promote human well-being. As a subset of the whole economy, the forestry economy has this same function. The work of the economist, then, is to understand what makes the economy run and to participate in it, helping answer questions (that is, solve problems) posed by people. Because the forestry economy is a subset of the total, it involves far more persons in the role of consumers than in the role of producers. Does this mean that our primary obligation in the economics of forestry is to consumers? Here is a moot question, but in any case it is easy to believe that we might well give more attention to consumers than we have been.

If it is true that economics deals with real flesh-and-blood human beings, then it follows that the subject is considerably dialectical, and this is the second idea that comes to my mind. By a dialectical subject I mean one whose propositions can be simultaneously true and false. That is, the subject admits of overlap or even coincidence between the set S and the set not-S. The economics of forestry deals with concepts such as value, cost, benefit, equity, development, conservation, ..., all of which have dialectical qualities. The identity of the conservation concept, for example, depends on who is using the concept and, indeed, the whole context of its use. Conservation can entail, at one and the same time, cutting a stand of timber and not cutting it or cutting only part of it.

Dialectical propositions are messy to work with. They are abhorrent to the logician. But they are very human and are inescapable in social science: Human behavior isn't necessarily
logical. Even logicians can be hugely illogical in their non-professional lives.

Dialectical propositions are at odds, not only with logic, but also with arithmetic. They defy quantification and the use of the scientific method. They soften the claim of economics to status as a science. Indeed, this claim in itself gives the concept of science a dialectical taint.

The propositions of economics can be contradictory, not merely at a point in time from case to case, but over time for a given case as well. Here's another way to look at it: Since the composition of economics is a function of culture, it varies from one culture to another and also changes as a culture evolves. In the United States, the various identities of conservation are different from those of a generation ago.

III

There is a way to surmount the dialectical handicap in economics, and this is to pretend that it doesn't exist. Such make-believe in economic theory and thus in the economics of forestry is the third essential idea that I want to stress. Make-believe is embodied into economics by means of the models used to answer questions—that is, to solve problems. Models are simplified statements about what is sometimes naively termed "reality"—"reality"—being in fact the master model of the world that comes to us through our senses, such as they are, and that portrays everything as depending upon everything else. The master model is too complicated—too "precise"—to be used or even grasped. And so the economist backs away from it: He abstracts from it, to some point along a continuum that leads to the following model, which is the ultimate in simplicity and lack of precision: X has the given value K; this is so because I say so.

It is in the process of abstraction—of withdrawing from "reality"—that economics receives its infusion of make-believe. One pretends that things are simpler than they "really" are and gains thereby the opportunity to answer the question at hand—propose a solution to the problem—and at the same time keep one's sanity. It is especially tempting to pretend that the economy can be simulated with numbers, as though it were a mechanical device. It is tempting, and rather fun to pretend that human behavior can be described in mathematical terms and explained by
the rules of logic—that people seek to maximize financial profit—to earn a return on capital no less than the rate obtainable from alternative investments—that our society is untainted with the dialectical.

How far along the path from everything-depends-on-everything to X-equals-K does the economist withdraw? In other words, where does he find the best trade-off between precision and simplicity—the best degree of abstraction? Ordinarily he follows some rote or at most uses his so-called judgment." For the economic theorist, the decision may be trivial: Behind his equations may lie, not people, but moon-men; it doesn't really matter so long as the journal will accept the manuscript. On the other hand, for the forester faced with an economic problem to solve, the abstraction decision is vital. It is perhaps the central decision in his professional life. He is under fire to produce, not simply an answer, but one that will work.

IV

So much for the third essential idea in forestry economics. Let me reach for a fourth. It is the idea of choice. The idea comes readily to mind because I have just been speaking about the choice of an abstraction level, and now I realize that all sorts of choices pervade economics, so as to become virtually the subject of it.

Do we take the existence of choice for granted? If so, it is interesting to reflect that we have choices to the degree that we have freedom and abundance. A prisoner has few choices, and the same holds for a person who is on the frail edge of poverty. Given freedom and abundance, we have choices to the extent that our alternatives are mutually exclusive, and this is necessarily a large extent.

The existence of choice creates the necessity for decisions, or plans. Decisions may be made very simply, as when one turns to one's culture for an answer. Coming to a fork in the road, one takes the turn that is customary. Most of the little, ordinary decisions, and some of the big decisions, made by individuals from day to day are customary in this sense.

By contrast, decisions or plans may be based upon detailed deliberation. The consequences of taking each turn at the fork
are studied in detail, and what are seen as the alternatives are then weighed with a set of values derived from the decision maker's goals. Persons who take an interest in the economics of forestry often find themselves playing some role in deliberated decision making, perhaps in behalf of government or perhaps corporations or other private firms. They may make feasibility studies, land-use and management plans, and cost-benefit analyses, or try to estimate rates of return on investment. They may seek to identify values that will accrue to society or to individuals. They may declare that they are in search of the optimum and thus commit themselves to a high level of abstraction.

One recognizes, of course, that no decision is purely deliberated. Every decision based upon deliberation is also based in part upon custom.

V

Whoever makes decisions makes forecasts, for choice is available only in the future. The central place of the future and of forecasting in economics is the fifth essential idea that I will mention.

Our alternatives exist only in the future. As they float by us on the stream of time into the past, they collapse into single, fixed events, out of our hands now, and forever beyond reach. In this sense, only the future lives: the past is dead; and the present, merely a point in time, is dimensionless and without substance.

Because the economy and its context are changing and the character of change is changing and we expect such changes to continue, we are uncertain about the future; and the farther the future, the greater our uncertainty, which for forestry is a major consideration.

How is it possible to make predictions and decisions in the face of uncertainty? It is possible, and in fact it is inescapable. We may hear someone say, in reference to the future, "I won't predict: I'll simply use today's value"—or "today's situation." This person doesn't mean what he says. He is predicting: that tomorrow will be like today.
In general, there are just two ways to face uncertainty, to make the necessary forecasts, and to come up with a decision. These are the same two ways that I have already identified. One is to deliberate the matter, perhaps making elaborate forecasts, in terms either of single values or of probabilities. The other is to fall back upon custom. The latter is common procedure in forestry. The use of sustained-yield doctrine is a case in point. Setting the rotation at the crest of mean annual growth is another.

VI

In any case, what the decision maker decides is how to use his resources. The idea of resources is my sixth essential idea.

For many of us, the word "resources" carries an image of forest land, timber, picnic grounds, wood-using plants, and other such material objects. But on further reflection, we conclude that this is too limited a view, and that nonmaterial things, too, can be resources, and indeed our most valued resources. Ideas are the outstanding example—knowledge, technology: how to be an efficient and happy consumer, how to be a successful producer, how to grow a forest, make paper, run a government, clean up the environment. Resources are anything that has value: anything for the possession of which, people will make sacrifices.

That knowledge is the prime resource is well illustrated by the southern pinery. When the Spanish and the British settlers reached this region, they found a magnificent forest, but it was of little value to any human being: a handful of savages were using it as hunting ground and a hiding place. Today our forest is comparatively puny. Yet it has incalculable value. What has happened? We have come into possession of knowledge. We have learned how to convert southern pine into such goods as kraft, newsprint, and plywood. Furthermore, we have learned how to build a social structure and an economy capable of providing people an abundant life. This is an environment that encourages imaginative invention and permits high demand for the fruits of such invention.

What creates resources, apparently, is human effort. Resources, we might say, are man-made.
Now one more idea—a seventh and last—comes to mind. It comes to mind when I think over what I have said so far and recall my early point, that the essential ideas in forestry economics really demand to be blurted all at once, for they form a tightly packed set. Yet I have strung them out one by one. Have I emphasized their oneness sufficiently? Probably not, but possibly I can make amends by pointing out that they are all elements in a system. The idea of the system, then, is my seventh. And let me make clear that I refer, not to the so-called economic system, but to the economics system, with special reference to forestry: the system of essential ideas for forestry economics, in which the system is itself one of the ideas.

In this system, people hold the center of attention. Thus the system partakes liberally of the dialectical. The inputs to this system are abstractions about resources and their relationships one to another. The outputs are decisions and plans for the future, regarding resource use. This is a relativistic system, in the sense that everything depends on everything else, though necessarily we back off from the ultimate relativism.

People, dialectic, abstraction, choice, future, resources, and system count out seven ideas. Or they are just one idea. Or I could easily have elaborated the list into a dozen ideas or a baker's dozen. But since the number turned out to be seven, I have a fortunate opportunity: I can call these ideas the seven pillars of wisdom in forestry economics.

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1 The writer acknowledges with many thanks the help of graduate students to whom he assigned a term paper on the subject in hand for the winter quarter of 1975-76. Members of the class were Frederick Baggott, James Brickell, Lee Faircloth, E. C. Ford, James Glaque, Douglas Jolley, Michael Liebenow, Thomas Lynch, John Spittle, Everett Stephenson, Steven Twiford, Samuel Wathen, Rodney Williams, and Rodney Young.
DISCUSSION

Question: Is there a trend for forest economists to orient more toward people considerations? (Jay Gruenfeld)

Answer: Yes, there are more and more people interested in the economics of forest labor, woods labor, mill labor. I think this is a marvelously encouraging development. How about the consumer? This would be another straw in the wind. I don't see this one altogether clearly. Perhaps some of you do. But I'll tell you one thing. I for the first year and many years I am teaching a small class of undergraduates or seniors and we have organized ourselves into teams. We take case materials. One team dissents from the decisions that are described in the case and the other team supports these decisions. We have a little debate and a general discussion. I was thinking back to the time when I was an undergraduate in 1895. It was very impressive because these seniors show a sensitivity to the human values in the problems that we were discussing. My graduating class would have been totally incapable of these perceptions. We were ingrained with thoughts about the physics, engineering and biology of our subject matter. People entered into almost no extent at all. Well, this has been the better part of a century just passed, and you would expect some change. There has been a lot. I feel very encouraged, and I might say that of course the two great elements in the profession that are responsible for what has been going on are the schools on the one hand, the employers on the other. (William Duerr)

Comment: Just to pursue that one a little bit further. Bill brought up the question of consumers in forest economics and the fact that forest economists are taking their wants more into
account than a few years ago. One problem that is going to face the profession of forest economics in the future is dealing with the wants of consumers objectively, especially in the field of forestry. Normally economists are accustomed to dealing with the wants of consumers in the marketplace where demand is felt and measured very easily by the dollar bidding of the consumer. We have a somewhat different situation. Perhaps one of the challenges of the next few years will be to do objective work in forest economics and take into account the wants of consumers.

(Dr. James Yoho)

Comment:

That is a very interesting point. We are not spending a lot of time on consumers. Think of all the efforts the Forest Service puts in to its so-called demand studies. To whom could these conceivably relate except consumers? Now I don't know that they do really relate to consumers. I don't know to whom they relate. If I take a historical series on assumption and use that as the dependent variable the quantity of consumption per year over time. I go through a long regression analysis in which I try to discover the principal independent variables to which this consumption is related. Things like population and GNP and so on and so forth. I don't think of that as being a study of human beings. I think of it as—well—frankly I am afraid that there is an element of hogwash in it. What's wrong with it anyhow? The thing that's wrong with it is precisely that it is not consumer oriented; despite the title that's given to it, it is producer oriented. This kind of calculation of what the demand is going to be, boys, in 2020 is part of it— it is a recrudescence of the professional philosophy that whatever ails us has got to be remedied by producers. If we foresee a 20% increase in demand in 2020, then obviously there is only one
answer and that is that somehow we've got to produce 20% more. Now how obvious is it, as a matter of fact, because there are always, are there not, two ways of approaching any problem that arises from the disparity between supply on the one hand and demand on the other. Suppose that it is forseen that we are going to be short of wilderness acreage in the U. S. Don't we tend as a profession to hop to the conclusion that there is only one answer and that is to reserve more wilderness? It seems to me that we neglect the other alternative and that is to take the wilderness that we have or even less than we have and learn to use it more effectively. There is a tremendous opportunity in improving consumption technology. We are always forgetting about production technology. How about consumption technology? There are all kinds of ways of being a more intelligent consumer. Up until recent times we have been scoffing at the Malthusians. I don't think we can really think we can scoff at them any longer. We had better remember we've got a pair of shears with two blades. It isn't just a knife. You can go at it from two sides: consumption and production.

Question:

In regard to your comments on economic models, are not economic models as valid a sampling technique as other samples? (Dr. Clemente)

Answer:

The point made is that well after we look at the matter don't we find that models are extremely useful and can be made so and that the validity of the model depends upon the accuracy with which it can predict. Yes, certainly I agree with this and I'll go further and say I know of no way to think, speak, behave except without the help of models. We are always separated from so-called reality by a model and the only question is what model shall it be for a given case. If we know in general the kind of model we want, then the question is how far are we going to
abstract from totality. That is from the gigantic matrix that says that $x_1$ is a function of all the other $x'$s and that in the next line $x_2$ is also a function of all other $x'$s and so on and on until you reach the last line which says that $x_N$ which is an exceedingly high number is also a function of something. How far are we going to abstract from that? We can't use it, and I guess the only thing that concerns me really, in the last analysis, is what sort of a compromise between simplicity on the one hand and realism or accuracy on the other is appropriate to the question at hand. I am a little worried sometimes with the thought that perhaps in a given case there may not have been quite enough abstraction to allow ordinary human beings like you and me to take that thing and really use it. To answer the kind of down-to-earth questions that face us every day.

(William Duerr)

Question: Over the years, a considerable amount of money has been devoted to agricultural economic research to increase agricultural production. Last year Dr. Earl Heady suggested that now this money ought to be given to sociologists to solve the people problems created by the agricultural research. Do you foresee a similar change in emphasis in forest economics?

(V. L. Robinson)

Answer: Well, of course you and I, Vern, both see this kind of thing going on to a limited extent. We see some of the forestry schools bringing social scientists other than economists into the faculty. We see the Forest Service, don't we, putting on sociologists and psychologists and such like folks. I think this is all to the good. I will say this. I think that teamwork amongst these people is unbelievably difficult. I don't think I understand why it's as difficult as it is, but in my observation, looking at the results, it seems to be
terribly difficult. It arises from the fact that even within social science each branch has its own special vocabulary and its special way of behavior and its special feeling of separateness from other groups. In theory the multi-discipline area or wider discipline area approach is absolutely unassailable. I think that we see some work by economists which is amazingly insightful and sensitive in these matters. I don't pretend to know what the answer is, but I do know we're trying to work with other disciplines. (William Duerr)

Comment:

In the last ten years, I have had the opportunity of traveling around the world. It has struck me many times that our measures of economic well-being are very much lacking. That is, our measures as economists—of this particular factor. I do not think there is any doubt but what no one for the money can live more luxuriously anywhere else in the world than here in America. But when you look at the numbers, I doubt that we live twice as well as people in many parts of Western Europe. I think they have found a way to be more efficient consumers with actually less to go on than we have had over the years. (Dr. James Yoho)
DETERMINING THE VALUE OF FORESTS TO COMMUNITIES AND THE GENERAL PUBLIC: THE CASE OF SOUTHERN BOTTOMLAND HARDWOODS

Lloyd C. Irland
School of Forestry & Environmental Studies
Yale University
New Haven, Connecticut

The Southern bottomland hardwood forest covers more than 30 million acres of land and includes more than 60 species of trees, many of which are commercially valuable. Much of this forest has high timber-growing potential. This ecosystem is of prime importance for birds and wildlife, and provides significant recreational and other values. Foresters and wildlife people have been well aware of the continuous disappearance of this resource, and have documented the downward trend (Sternitzke, 1976; Yancey, 1970; Frey & Dill, 1971.

How can public officials, members of the public, and resource professionals determine whether this trend is in the public interest? This paper attempts to provide a general framework for asking the questions that can lead to an answer to this question, either on an acre-by-acre basis or at a regional level.

A DECLINING RESOURCE

Since settlement, the bottomland hardwood resource has been under pressure from competing land uses. In the first wave of settlement, large areas of accessible riverfront were cleared for plantations. Some of these lands were subsequently abandoned, and now support fine second growth forests. Other areas were cut through one or more times for their high-grade hardwoods. Today's foresters have inherited a number of difficult silvicultural problems from that era.
The general trend, however, has been toward decline in acreage supporting bottomland hardwoods. In the southern Mississippi Alluvial Valley, for example, forest acreage declined by 35%—from 11.5 million to 7.4 million acres between 1950 and 1969 (Frey & Dill, 1971). Most of the forest land cleared went into cropland (3.8 million acres), but considerable amounts went into grassland and urban uses. Small areas of former pasture and grassland reverted to forest. In the three Lower Valley states of Arkansas, Louisiana, and Mississippi, 4.6 million acres of forest land were converted to other uses between the 1930's and the early seventies (Table 1). In recent years, the trend has accelerated in some areas—in Louisiana from 1964 to 1974, four Delta parishes lost more than 50% of their commercial forest land (Earles, 1975).

Most of this land conversion was made possible by flood control programs. Additionally, some conversion has been hastened by various federal and state programs subsidizing crop prices and drainage improvements (Harrison, 1961; Harrison and Kollmorgen, 1947). Clearing was also boosted by a growing export market for soybeans. Soybean acreage increased by 10 million acres from 1950 to 1970 in the five Mississippi Delta states. Land in farms in the Alluvial Valley region grew by more than five million acres from 1930 to 1969; cropland increased apace, while pastureland declined. Woodland in farm ownership declined somewhat (Table 2).

Stream channel alterations, aimed at flood damage reduction, have been important in promoting land clearing in some areas. Nationally, these programs are of impressive scope. As of 1973, some 1600 Corps and SCS projects accounted for more than 28,000 miles of channel alterations and 5,800 miles of levee work. Much of this work has been concentrated in southern states (U.S. CEO, 1973; U.S. Congress, House, 1972-73; U.S. Congress, House, 1973).

Most observers expect additional conversion of forest to farmland in the South’s bottomlands. A 1972 USDA study estimated that fully 19.8 million acres of poorly drained woodland could be converted to cropland at 1970 costs and prices (Davis, 1972). This is about 2/3 of the remaining resource base. Crop prices have risen dramatically since 1970. But clearing costs, estimated at between $90 and $125 per acre at that time, have also
Determining the Value of Forests to Communities and the General Public: The Case of Southern Bottomland Hardwoods

TABLE 1. FOREST ACREAGE IN THE LOWER MISSISSIPPI DELTA REGION, STATES OF LOUISIANA, ARKANSAS, AND MISSISSIPPI, 1930's to 1970's.

<table>
<thead>
<tr>
<th>PERIOD</th>
<th>THOUSAND ACRES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1930's</td>
<td>11,835</td>
</tr>
<tr>
<td>1950's</td>
<td>10,172</td>
</tr>
<tr>
<td>1960's-70's</td>
<td>7,122</td>
</tr>
</tbody>
</table>

Source: Sternitzke, 1976.

TABLE 2. LAND IN FARMS AND PRINCIPAL USES, 1930-1969, DELTA COUNTIES OF THE LOWER MISSISSIPPI ALLUVIAL VALUE REGION.

<table>
<thead>
<tr>
<th></th>
<th>1930</th>
<th>1950</th>
<th>1969</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land in Farms</td>
<td>14,698</td>
<td>19,899</td>
<td>20,399</td>
</tr>
<tr>
<td>Cropland</td>
<td>9,840</td>
<td>12,886</td>
<td>15,724</td>
</tr>
<tr>
<td>Pasture</td>
<td>2,348</td>
<td>4,482</td>
<td>1,564</td>
</tr>
<tr>
<td>Woodland</td>
<td>2,803</td>
<td>4,958</td>
<td>2,332</td>
</tr>
</tbody>
</table>

escalated dramatically. For other approaches to this question, see Harris and White, (1971); USDA (1965). For the five-state Delta region, Harrison (1961 p. 309) predicted that about 5.2 million acres of hardwoods would survive clearing and drainage in the longrun.

VALUING MARKETED PRODUCTS OF THE ECOSYSTEM: TIMBER AND HUNTING

This section reviews approaches to appraising the social value of the two principal marketed services of the bottomland hardwood ecosystem—timber and wildlife. Other services such as recreation and fisheries may be capable of yielding income to the land under institutional arrangements not now in wide use, so I describe those as unmarketed services, but not as unmarketable ones.

Timber Values

Timber growing prospects in the southern bottomland hardwood ecosystem depend on a host of variables, including soil and moisture conditions, existing stand condition, and financial or other constraints. The ability to realize good prices also varies, depending on local markets.

Assessment of timber production capacity is complicated by the fact that many stands carry a heavy burden of volume in culls or low-value species, and may require a decade or more of management to reach full stocking and productivity. Discounting these deferred returns at any reasonable interest rate means that a high price is paid for past mismanagement. Annual averages of productivity may be meaningless for any particular tract. But for purposes of this paper, we can specify some overall averages, and then review some of the uncertainties analysts must take into account.

Many stands in the bottomland types are capable of producing 500 bf/A/yr. and more under management, once they reach good stocking levels (Walker & Watterson, 1972; Putnam, Furnival, & McKnight, 1960). Stumpage values for many species have been in the $30 to $50 area for many species, though premium species, large sizes, and high grade material can command multiples of this. So we can expect that managed stands can earn at least $15 to $25 per acre per year in gross stumpage income. Owners
with stands well-stocked with premium species can expect a good deal more (Davidson, 1972).

But costs must be deducted from gross revenues. Costs of protection and administration, silvicultural treatments, roads and other property improvements, should be considered. These vary so widely from owner to owner that little purpose would be served by attempting estimates here. A private owner, in doing his own profitability calculations, must consider the interest charges on the opportunity costs of the forest enterprise as a whole, and must consider property and income taxes.

But these may not always enter as costs from society's viewpoint, so that private investment calculations are likely to underestimate the social value of forests (or any other wildlands). For example, an analyst comparing farming and forestry uses of a given tract from society's standpoint need not consider land opportunity costs, since land is common to both uses. Further, taxes should not be considered, since if forests and crops are taxed differently, the analysis would be artificially distorted. From society's standpoint, taxes are merely transfers.

Appraisals of resource value must be made on the basis of the estimated future stream of services to be produced. In forestry, such estimates are especially difficult to produce. There are three major obstacles:

**Time horizon.**—Our ability to predict is very weak beyond a few years into the future. Looking a rotation length into the future, we can see very little with clarity. Given the low stocking and poor condition of many bottomland stands today, the benefits of management may be farther in the future than the time horizons of many private owners extend. Yet society ought to be concerned with the long run, and this justifies the use of longrun productivity in comparing forestry with alternative land uses. Predicting future alternative uses is also difficult.

**Price expectations.**—Anyone who has watched the course of wood products prices for the past few years will have a solid appreciation of the difficulty of price forecasting. We may suspect that today's prices are misleading for longrun comparisons, yet we have no basis for projecting believable future prices.
We can be confident that high grades of premium species will always be valuable. But the veneer market for some species will be under pressure from import competition for some time to come. In lumber, a steady market for a growing number of species can be foreseen. The low grade portions of the growing stock will bring pulpwood prices, if that, for some time. Over the years, southern hardwood stumpage prices have kept ahead of inflation and will probably continue to do so. Beyond this, little can be said with certainty. Every enterprise must use its own best judgment.

Utilization assumptions.—Inadequate markets have hindered effective utilization of timber felled for land clearing, and have also hindered improved silviculture. In appraising longrun production possibilities, however, we must look to the markets of the future.

Foresters, believing themselves to be eminently practical people, have for generations marked stands on the basis of yesterday's markets, rather than today's markets. The memories of all the valuable hardwoods that were killed years ago as "weed trees" are painful to us all. The engineers and technologists are rapidly proving to us that the weed tree is dead, or soon will be. They will be able to make products out of anything we can grow for them.

If the competition for wood in the bottomland areas increases, as most expect it will, then more and more of the existing growing stock will be usable in the future. Currently marketable material may find higher value uses. The result will be higher revenue producing opportunities for the forests, and new approaches to hardwood silviculture.

Wildlife

The bottomland hardwood forest has been spoken of by wildlife biologists as the most productive wildlife habitat on the continent (Stansky, 1969; Wood, 1954). Hunters know well its productivity in deer, squirrels, and game birds. Nongame species flourish as well.

The existence of large forested tracts in the South has made possible a sort of market in wildlife hunting rights.
Owners may either permit public hunting on a day-by-day fee basis, or may lease large tracts to individuals or sporting clubs. On one property, hunting rights are currently worth $1-$3 per acre per year on upland sites and $2.50 to $6.00 in bottomlands (Stuart, 1975). Glasgow and Noble (1971) have predicted that Midsouth bottomlands will bring at least $5.00/acre for hunting rights within 25 years.

These figures represent concrete revenue items and can therefore form an acceptable basis for an appraisal. Many analysts, however, would argue that hunting values should be determined from estimates of annual hunter use per acre and hunter benefits per user-day. This approach requires good data on the number of hunter-days produced per acre per year, and the consumer's willingness to pay for the day's experience. On a managed property, estimates of hunter use can be obtained. But determining willingness to pay is another matter. For simplicity, many analysts simply use the arbitrary values established in Senate Document 97 (1962) for evaluating water projects--ranging from $1.50 to $7.50 per user day. Others have advocated using hunter expenditures, or even interview estimates of how highly hunters value their sport (USDI, 1972; Horvath, 1974). But such methods are unavoidably arbitrary from an economic standpoint. They may indicate how much hunters spend per year on their sport, or how much they value hunting in general, but they cannot indicate how much a hunter would pay for access to a specific piece of ground.

To avoid these difficulties, the recreation economists have attempted to derive recreation benefits from statistically estimated demand relationships (e.g. Martin, Gum, and Smith, 1974). Results of such studies may help in appraising hunting or recreational values of bottomlands.

Market Structure

Economists consider market prices to be the best place to start in valuing commodities for benefit-cost analyses. But market prices are not reliable measures of opportunity cost or of consumer willingness to pay unless markets are perfectly competitive. In general, markets for hardwood stumpage and for hunting rights in the southern bottomland hardwood ecosystem are not competitive, but are in fact highly imperfect.
For example, a hardwood owner may find that only a small number of mills can bid for his timber. He may have high-grade veneer logs or other specialty products, but be too distant from a mill capable of using the product. Pulpwood-sized material may have no market at all. Under such conditions, it is clear that stumpage prices will probably not reflect the true potential value of the wood to society.

Is this example merely a caricature, or does it reflect the reality facing timber sellers in the South's bottomland areas? One bit of evidence suggests that it does—at least in the Mississippi Delta. The studies show that much of the timber felled in land clearing is not utilized. If there were vigorous competition for timber in the area, more of this timber would probably be used.

Imperfect markets imply that current prices for stumpage and for hunting rights probably understate the true potential value of the bottomland hardwood resource. I have seen no workable method of correcting market prices to adjust for this problem. In the future, we will have to rely on market data while recognizing their weaknesses.

An effectively competitive wood market requires processing capacity that is equal to a large fraction of current or expected growth, a diversity of wood-using outlets, and a large number of independent firms. A vigorous sector of loggers and consultants can help immensely. The current decline in bottomland hardwood acreage is a threat to the emergence of such competition for hardwood. As acreage and volume fall, the resource becomes spread more and more thinly across the landscape. Maintenance of a diversified, atomistic industry becomes difficult. Timber prices suffer from limited competition, and some products in particular locations may find no market at all.

What I am arguing is that there may be a minimum timber resource base that is needed to maintain a diversified, competitive, and productive wood industry. We do not know how large that base is. But we can be sure that failure to maintain that base will seriously cripple forest management, reduce incomes of forest landowners, and eliminate employment opportunities.
UNMARKETED SERVICES

The bottomland hardwood ecosystem performs a variety of services for which landowners, under today's institutional arrangements, do not receive revenues. These services, including flood control, waste treatment, and environmental values, have received considerable attention (Delorme & Wood, 1974; Holder, n.d.; Hewlett, 1972; Wharton, 1970).

Flood Control

Bottomlands and streamside swamps perform important flood control functions by providing additional channel storage at high water. Elimination of these areas through channelization or levee building can increase flood stages elsewhere along the stream. In a number of instances, in fact, flood control agencies have recommended preservation of marshes and bottomlands as the only practical flood control measure, especially in urbanized areas.

Waste Treatment

Bottomlands are significant in the self-purification capacity of lowland streams. They can remove heavy metals, oxygen-demanding wastes, and organic chemicals from water (Delorme & Wood, 1974; Wharton, 1970). These services can be appraised based on the cost of removing such substances in treatment plants. Delorme & Wood estimated that a 100,000 acre swamp near Augusta, Georgia, provides about $12.5 million in treatment services yearly. Since Congress has set zero discharge as a long range policy goal for water quality management, the value of these treatment services will decline in the future.

Environmental Values

The bottomland hardwood ecosystem provides a wide range of important environmental values, including nongame wildlife, fishery habitat, scenic and recreational values, ecosystem preservation, and open space. Because of the ecosystem's diversity and productivity, its values for habitat preservation are undoubtedly high. Because of its riverside location, its scenic, recreational, and open space possibilities are great.
Environmental values of the forest can often be expressed quantitatively, as for example, by surveying populations of plants or animals, or by tallying recreation uses. Other values may be rated qualitatively or on ordinal scales if need be. A fairly thorough attempt at appraising environmental values of the Alcovy River swamp in Georgia was made by Wharton (1970).

Concern over environmental values has motivated groups seeking preservation of bottomland areas in the Congaree Swamp in South Carolina, the Big Thicket in Texas, Louisiana's Atchafalaya Basin, and Florida's Big Cypress Reserve. Areas that have captured public attention to such an extent will have their environmental values appraised through the political process, which is as it should be. It would be desirable if the interest in these unique areas succeeds in triggering a broader concern with the future of the bottomland hardwood ecosystem as a whole.

IMPORTANCE TO LOCAL COMMUNITIES

Declining acreage of the bottomland hardwood ecosystem has been a significant factor in weakening the manufacturing economic base of many southern communities. For example, hardwood lumber production declined markedly in the three Delta states from 1946 to 1971 (Table 3). This decline was caused in part by the falling acreage of hardwood forest.

Unless the declining economic supply of hardwood logs in these areas can be reversed, jobs and industry will continue to disappear in small rural towns. Almost 19,000 persons work in sawmills in Arkansas, Louisiana, and Mississippi. Many of these jobs depend on bottomland hardwoods.

Published statistics do not permit an easy estimate of the extent to which local industry depends on the bottomland hardwood timber supply. An elaborate analysis of timber supply and log hauling patterns would be required.

Once data on the relation between resource supply and regional wood products output is known, economists can use two analytical tools to estimate the effect of changing output on a local economy. These are input-output analysis and economic base analysis.
**TABLE 3. HARDWOOD LUMBER PRODUCTION, DELTA STATES, 1946-1971 M Bd. Ft.**

<table>
<thead>
<tr>
<th>YEAR</th>
<th>ARKANSAS</th>
<th>LOUISIANA</th>
<th>MISSISSIPPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1946</td>
<td>520</td>
<td>517</td>
<td>703</td>
</tr>
<tr>
<td>1960</td>
<td>357</td>
<td>339</td>
<td>399</td>
</tr>
<tr>
<td>1971</td>
<td>344</td>
<td>272</td>
<td>372</td>
</tr>
</tbody>
</table>

An input-output study estimates the flow of income through a community from sector to sector. The model allows the analyst to determine the effect on any sector of the local economy—say retailing or government—of a change in lumber production in the area. Applications of interest here have been made by Kaiser (1972) and by Main (1971).

An economic base model is a simplified input-output model. The economic base approach divides the local economy into a basic sector—which provides services to nonresidents—and a service sector, which serves needs of workers in the basic sector. In this formulation, the basic sector controls the level of community economic activity. In many southern communities, forest products are the most important basic industry. Useful examples are provided by Garrison (1972) and Convery (1973).

Both input-output and economic base studies produce multipliers. These can be used to determine the effect on total community employment or income resulting from changes in any basic industry. For example, consider a town employing 100 persons in sawmilling and with an employment multiplier of 1.5. Suppose 50 mill jobs are lost. This will result in a total decrease in community employment of 75 persons (50 times 1.5), including 25 additional workers in the service sector.

PUBLIC AND PRIVATE ACCOUNTING

Evaluating the significance of bottomland forests to the South is a matter of perspective or accounting stance. The major differences in accounting are those between public and private and between regional and national stances.*

Public and Private

Private landowners have to make decisions based on the actual costs and revenues they can expect from different land uses. Owners may differ in their tax position, in their time horizon, and in the implicit cost of capital they demand as a return on investment.

This private perspective is usually inadequate for public decision-making. A public accounting stance must take account of unmarketed services, must recognize that private market prices are often misleading, and may treat land opportunity costs and taxes differently. Yet too often we are told that certain

*See, for further discussion, Howe (1971) and U. S. Water Resources Council (1973).
land use changes are justified—or not justified—only on the basis of narrow landowners' calculations. It is time to broaden this perspective.

A public accounting stance must also consider the social costs of competing land uses—fertilizer and pesticide pollution in the case of agriculture. Such costs almost never appear in private calculations, although nonpoint pollution control regulations are attempting to force their consideration by landowners.

Finally, a public accounting stance should give prominent weight to the environmental values often ignored in private decisionmaking. In addition, a public stance should consider the value of flexibility preserved by foregoing a current decision to develop or modify a natural ecosystem.

National and Regional

A national accounting stance focuses attention on real resource costs and benefits. Changes in employment and financial transfers only appear under special conditions. But a regional accounting stance is properly concerned with the impact of decisions on the welfare of a particular local area. In such a context, changes in local employment, in local economic stability, and in local government revenues and outlays will be key items.

THE FUTURE OF THE BOTTOMLAND HARDWOOD ECOSYSTEM

The bottomland hardwood ecosystem, and the industries dependent upon it, face a future strongly dependent upon public policy. This is because the tradeoffs that have to be faced can only be resolved in a political forum.

There is no public body with an overall view capable of harmonizing conflicts between farmers, developers, timbermen, and recreationists over the bottomland ecosystem. Public decisions will be made by local zoning boards, by state agencies, and occasionally federal agencies, through construction programs or regulatory actions. We can expect, therefore, that the resource will continue to be nibbled away. Decisions will be made acre-by-acre, by private and public organizations, with no consideration of any overall perspective.
In the past, major public projects were constructed without considering many environmental and economic impacts. This was the case with the flood control system that made possible much of the farming in the lower areas of the Delta. In decisions about future flood control programs, we hope that more careful accounting will be used. More sensitive public works planning—for highways, flood control, and other public facilities—is essential.

Private owners cannot be expected to supply valuable services to others without compensation. They will continue to develop the Delta's resources as they see fit. But public agencies can attempt to assure consideration of broader social values through a variety of policies.

State and federal agencies can acquire land or easements in land to protect the most valuable natural areas, streamsides, and wildlife habitats, and to provide for public access to waterfront. Game agencies can lease property for multiple-use management. Zoning boards can apply performance standards to guide intensive development into the least sensitive areas.

SUMMARY

The rapid decline of the southern bottomland hardwood ecosystem, which has been accelerated in some cases by publicly subsidized projects, raises significant resource supply and land use planning issues.

Major economic principles involved can be concisely stated as follows:

—Marketable services such as timber and hunting rights can provide a starting point in estimating the social value of the ecosystem. But problems of imperfect markets, differences in time horizons, uncertain wood prices, and utilization assumptions make estimates difficult.

—Private profitability calculations are not an adequate guide to the social value of the ecosystem or its major services. This is because of differences in time horizon, different treatment of taxes and land opportunity costs, and different emphasis on unmarketed services.
The bottomland hardwood ecosystem produces important unmarketed services—including flood control, waste treatment, and environmental services.

The wood supply produced by the bottomland hardwood ecosystem is important to many local communities. In towns substantially dependent on wood processing for their manufacturing base, wood supply is an issue of considerable importance. In addition, tax revenue and public expenditure effects can be significant from the local viewpoint. It is not known whether 100,000 acres will provide more jobs in soybeans than in hardwood forest—this should be a high priority research topic.

The amount of bottomland hardwood forest remaining in the year 2020 will depend heavily on public policy. It seems unlikely that the "nibbling" problem can be overcome. But public agencies have many policy tools that can be used to help preserve the most important remaining forests. They deserve foresters' strong support.

It should be clear from the tentative tone of this essay that there are real limits to what economics can contribute to future land use planning for the bottomland hardwood ecosystem. But applying the correct economic concepts can at least help clarify issues and lead analysts to asking the right questions.
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DISCUSSION

Question: I am disturbed about the trend toward land use planning and control. Eight or nine states have comprehensive land-use plans; 40 states are considering such laws. I am trying to look into the future and see how I as an economist should act—the position, even attitude, I should take toward land use planning and control. Do you have any comments regarding this? Recall that Sam Jackson, Rep. Udall, et al are pushing for national legislation at this time. (J. Edwin Carothers, La. Tech. Univ.)

Answer: I think that one thing economists can do is to attempt to come up with sensible ways of thinking about all of the marketed and non-marketed values. Economists could help in identifying and prioritizing the resource to the point where we can say here are the parts of the bottomland hardwood ecosystem that have broad significance for the public and about which something ought to be done. Here are the parts where we can let the market do what it will with the resource. Other parts could be identified which are in between. We might want to make some regulatory or other restrictions which would account for public concerns in the resource. There is a tremendous diversity of opportunities. People drawing pictures on a map and making regulations are simply unable to deal with all the possibilities. (Dr. Lloyd Irland)

Question: What about Federal, State, and local tax incentives to help encourage land owners to retain bottomland forests? (Wm. B. Singleton)

Answer: Tax incentives are extremely complicated. I think there can be uses for tax incentives of various kinds: Open space tax laws or forest tax laws that do not appraise land for property taxation at market values but at use values. These have to be designed with safeguards so that they don't turn into methods of subsidizing speculation as they have in my home state, Connecticut. (Lloyd Irland)
The benefits that the public receives for tax incentives depends on ownership patterns of the land. (Wm. B. Singleton)

Yes, the ownership pattern of the land has to be looked at and the types of people who own it. It is fairly clear that for a broad range of problems, tax incentives have no impact on what happens to the way the land is used. The ownership pattern is one reason. Safeguards and recovery factors are necessary. In the State of Washington, for example, under their open space tax program the difference is recovered at 7% interest so that there is a cash flow benefit provided to the landowner. Over the period of owning the land, there is no economic subsidy involved and the public recovers the benefit on the sale of the land. This is an important question especially from a political standpoint. Large industrial ownerships tax incentives on a blanket basis are bound to be criticized for being handouts to the wealthy. (Lloyd Irland)
DEMAND AND SUPPLY--ECONOMIC THEORY APPLIED TO
FOREST RESOURCES

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INTRODUCTION

Applying economic concepts of demand and supply to forest resources provides insight into current consumption of forest resources in the United States as well as international trade in wood products. Uncertainties about future supply and demand cloud financial prospects and inhibit investments in forestry.

DEFINITIONS

To establish common understanding, the terms "demand", "supply", and the "function of price" must be defined. Further, any peculiarities imposed on these terms by the nature of forestry must be spelled out.

Although often misused, "demand" has a specific meaning in economic literature. One of the classic economic textbooks defines it as... "the relation between the market price of a good and the quantity demand of that good" (Samuelson 1964). This relationship between price and quantity bought is called the "demand schedule" or "demand curve" or, for short, "demand". Thus, the demand for any item, such as stumpage or recreation on forest lands, is an expression that relates the various amounts of the good that would be consumed at different prices. As prices rise, less of the commodity or service will be purchased; conversely, if a greater quantity of goods is placed on the market, it can be sold only at a lower price.

* Presented by Vernon Robinson, U. S. Forest Service, S. E. Forest Experiment Station, Athens, Ga.
"Supply" is similarly defined. The supply schedule or curve is "the relation between market prices and the amounts of the good that producers are willing to supply" (Samuelson 1964). Again, a price-quantity relationship, but here focusing on price and production. Whereas demand exhibited an inverse relationship with price, we find that production levels increase with higher prices.

Price is the mechanism that determines the quantity of goods flowing from producers to consumers. The balance between demand and supply is termed "equilibrium price." We can consider equilibrium price as:

"...The only price at which the amount willingly supplied and amount willingly demanded are equal. Competitive equilibrium must be at the intersection point of supply and demand curves" (Samuelson 1964).

SPECIAL CONDITIONS IN FORESTRY

Are there any peculiarities of forestry that tend to negate or alter the meanings attached to these terms? Demand for forest resources, particularly for stumpage where demand and supply interact through a market price, conforms closely to the textbook definition. However, the demand for stumpage is not for final consumption. Instead, stumpage is sought for its use in producing other goods. Thus, demand for stumpage is derived from consumer desires for finished wood products.

With supply there are several significant departures from typical production practices. First and foremost, the tree is both factory and product. When we harvest a tree, we also destroy our capital investment in the productive factory. Since the productive period for a tree is much longer than for most economic commodities, there is very little that can be done to rapidly augment the supply of timber. Therefore, supply response to price in the short run is limited by the existing stock of trees.

However, if we extend our time period somewhat, there are a number of things which can be done to increase the supply of timber. First, the land manager can increase nontimber inputs of labor and capital. Additional thinning, pruning, planting, road construction, and protective endeavors would fall in this
category. In choosing among these alternatives, the manager would be guided by costs and interest rates. Money would be spent only to a level likely to be recovered when the stumpage is sold. Naturally, additional land could be acquired for timber production, or existing lands could be managed more intensively if prospective stumpage prices justify such actions.

NATURE OF THE MARKETS

The nature of the market influences exchanges of stumpage and other forest resources. Economic theory recognizes a number of market conditions ranging from monopoly, where a single producer or seller can restrict output, to perfect competition. Between these two extremes, a third market category, oligopoly, is recognized. In this condition there are few sellers or producers, and the behavior of any affects market conditions for all.

Although the perfectly competitive market of theory does not exist, economic competition does occur daily, and society is likely to gain most when competition is greatest. It is competition that enables us to produce trees or consume lumber at lowest prices and acceptable quality. Another essential benefit of competition is the creation of markets wherein prices for each commodity are just cheap enough to undersell potential close substitutes.

We do not, of course, buy on price alone; the reputation of the timber appraiser, the brand name of the lumber, grading standards, and confidence in retailers all enter our decision to purchase or look elsewhere. Competition here and throughout our economy is in large measure competition for reputation or good will. We learn, in addition to the asking price, who can best serve our needs.

In the national timber market, there is one predominant owner of sawtimber: the Federal Government. Economists often define monopoly as the four largest firms controlling 50 percent or more of the output of a given industry (Mead 1975). About 52 percent of the Nation's softwood sawtimber is on national forests, and an additional 12 percent is in other public ownerships. Thus, if monopoly power exists in stumpage markets, the government holds that power.
The government has traditionally allowed free competition through open stumpage sales. Interested purchasers can bid for public timber through auctions that permit stumpage sales up to the limits set by allowable cut and administrative workload.

In the South public ownership is not large; only about 10-1/2 percent of softwood stumpage is in all public ownerships combined. Southern softwood lumber and plywood, however, must compete with similar western products on many markets. Hence, stumpage prices in the West, where government ownership is very high, can affect stumpage markets in the South.

The influence of government ownerships is far higher on markets for recreation, wildlife, and other multiple uses than it is on the timber market. Recreation has traditionally been supplied free or nearly so on public lands. Even on private lands, recreationists have been able to gain access free or at a nominal price. When consumers pay less than they are willing to pay for a given item, they will consume inflated quantities. Thus, low charges for recreation have been a form of subsidy, spurring demand. If this pricing policy continues, demand is likely to increase until overcrowding decreases psychic rewards. This situation demonstrates one danger of heavy government ownership. Markets can easily be influenced in unintended and unfortunate ways.

Ownership patterns are only partial indicators of market structures in forestry. A critical determinant is transportation cost. Logs are not very valuable per unit of weight and, for this reason, cannot be transported very far before transportation costs become prohibitive. In reality, then, stumpage markets are extremely limited geographically with few potential sellers and buyers. Under these conditions, competitive forces are not given full reign and stumpage supplies may be dictated by prices artificially high or low depending on whether market power rests with the seller or buyer.

EXPANDING DEMANDS

Anyone who is contemplating investments in forestry must be aware of local market conditions, particularly if he does not own a wood processing plant. Since forestry investments are necessarily long term, he will also want to know about long-term projections in national markets.
Since demand is a price-quantity relationship, future consumption will certainly depend upon price. Current demand schedules are not going to be much help in long-term projections because major shifts can take place over time. Substitute goods or consumer preferences can change, altering the quantity of forest resources demanded.

Most prognosticators call for higher consumption of forest resources because wood has many uses, is renewable, and is biodegradable. From an environmental viewpoint, increased use of wood seems desirable. It takes far less energy to produce a ton of lumber than an equivalent quantity of competing materials (Bethel 1976). The range of materials made from wood can probably be expanded considerably. As economical conversion techniques evolve, wood fibers are likely to become increasingly important sources of organic chemicals (Bethel 1976). Finally, housing construction and replacement rates are predicted to increase through the year 2,000 in spite of a leveling off of population growth (President's Advisory Panel 1973).

It seems safe to assume that demand for wood and wood products will increase during the next 20 or 30 years. Consumption is predicted to increase from 1970 levels of 12.7 billion cubic feet to between 19.2 and 22.8 billion cubic feet in 2000 (Outlook for Timber in the United States 1973). Thus, regardless of price assumptions, the level of wood consumption is predicted to increase markedly.

NONTIMBER DEMANDS

By any measure, recreation use of our forests has skyrocketed in recent years. Economists and sociologists attribute gains in recreation activity to several factors. First, there are more people in our country than ever before, and many of them live in crowded urban environments from which they attempt to escape as often as possible. Second, until recently incomes have risen faster than the cost of living; and more people have chosen to spend part of their discretionary income on recreation. Third, work schedules and patterns have changed, with more retired people, longer paid vacations for workers, and numerous young recreators who have not yet joined the work force. Fourth, improved transportation quality and opportunity have brought recreation experiences closer to the consumer. Lastly, there just seems to have been an increased preference for outdoor recreation (President's Advisory Panel 1973).
Use of forests for recreation is likely to increase, but at a somewhat slower pace. Recreation attendance has been doubling every 8 years (Report of the President's Advisory Panel 1973). Surely, this rate cannot go on without destroying the opportunity that people seek. Even so, a doubling or tripling of attendance by the end of the century seems probable.

Demands for wilderness have been increasing at an even greater pace than those for recreation. Although wilderness is still but a fraction of recreation use, the effects are far reaching. Potential demand for wilderness experience must be balanced against the limited capacity of the land to provide it. Wilderness areas allow little opportunity for most multiple uses of the forest, and the wilderness experience itself is debased by increasing levels of human consumption.

Wildlife demands are closely related to use of the forest for recreation and wilderness activities. Hunting, fishing, photography, and observation of wildlife all are pastimes of growing popularity.

INTERNATIONAL TRADE IN FOREST PRODUCTS

The United States has been a net importer of wood since 1914. Since then, the fraction of national wood consumption represented by imports has grown to over 12 percent (Bethel and Schreuder 1976). Our largest import item is softwood lumber from Canada. However, Canada will only serve as a wood reservoir for the United States as long as profits from selling to us are higher than elsewhere. Unforeseen changes in world prices for softwood, particularly in the European common market, could quickly alter the amount and price of softwood supplies provided by Canada.

The United States has been content to meet its needs for softwoods from imports which, admittedly, have been offered at reasonable prices. However, this policy places the United States in a vulnerable position should foreign wood sources change their marketing practices. Current government restrictions on cutting on federal lands combine with court injunctions against removals to make us even more susceptible to foreign price dictates.
Our growing dependence on foreign wood products is also caused by inadequate manufacturing capacity in the U. S. Compliance with environmental regulations in recent years has limited the growth of productive capacity. Capital investments in wood conversion facilities have been made largely to control pollution rather than to increase output of wood products. Furthermore, construction of new mills has been inhibited by uncertainties about the direction and extent of forthcoming governmental regulations (Bethel and Schreuder 1976).

Logs are our major softwood export item, going almost exclusively to Japan. Growth of this market for logs can be attributed to two factors. First, West Coast producers of lumber and other wood products are confronted with problems of cost in transporting their output to major U. S. consuming centers. Second, in the past the Japanese have preferred logs because their industry obtains greater yields and lumber sizes in the U. S. and Japan differ. Adoption of construction practices similar to ours by the Japanese will likely open more export markets for softwood products and reduce the significance of log exports (Bethel and Schreuder 1976).

**PRODUCTIVE CAPACITY AND ECONOMIC CONSTRAINTS**

Can our forests produce the goods that people will want over the next 30 years? Yes, they can—if sufficient investments are made in them. If the best known silvicultural techniques were applied to all our commercial forest lands, some 35 billion cubic feet of timber could be produced each year (Spurr and Vaux 1976). This figure is twice our present net growth and two and one-half times our 1970 removal rate. Furthermore, this estimate includes only material that is currently regarded as merchantable. Technological advances could increase the yield of forest products from trees of a given size by as much as 40 percent.

The key question, then, is how much will be invested to increase production from our forests. A long-term answer to that question cannot be given at this time. Forests present a broad and complex array of investment opportunities. The attractiveness of individual investments depends upon the initial productivity of the site, the probable improvement from the investment, the term of the investment, and the probable value of the final product.
No one knows how much stumpage will be selling for 30 to 40 years from now. The price will certainly vary with distance to the processing plant as it does now, and there will presumably be some premium paid for large logs capable of producing knot-free lumber or veneer.

Clawson (1974) concluded that our forests contain more than 4,000 different management possibilities or purposes. He listed our major forest types, major productive regions, site productivity classes, ownership categories, levels of stocking, and present volumes. Each of these factors affects returns on investment.

Only certain owners are willing and able to make investments in forestry. Timber growing involves substantial physical risk of loss to fire, insects, and disease. The investor must be willing to accept modest rates of return on substantial capital investments, and he must provide stable management over long periods of time. Additionally, relatively large properties are required to achieve the economies of scale needed to justify operations that produce relatively low returns per acre.

Regardless of the desired output from our timberlands, we need inputs of labor, capital, and managerial expertise. The level of management can range from virtually zero, where periodic cuts of all merchantable growing stock are made, to sophisticated measures designed to improve the future stand and perpetuate forest productivity.

Managerial activity and investment bring forth richer fruits on better sites. A given investment in intensive forestry may double annual wood output per acre, but this might mean only 35 cubic feet on a poor site or as much as 175 cubic feet on the best site. Thus, estimates must include probable gains measured against estimated costs.

Those who suggest investments on all forest acres to augment national supplies of wood are asking us to waste money. On many sites, the cost of growing wood far exceeds the value of wood produced. Therefore, delineation of potentially profitable sites would be helpful.

Currently, it appears that full economic potential is most likely to be realized on lands controlled by forest industry. The required managerial objectives, stability of management,
capital funds, and managerial know-how are present there. Achieving wood-growing potential on public lands is another matter. Most public lands that qualify for wood production are managed under the multiple-use policy. This means that portions of the wood-growing potential will be foregone in favor of alternative values such as outdoor recreation.

An overriding cause for underutilization of productive potential on private and public lands is lack of capital. For our national forests, appropriations necessary for the highest rates of wood production have failed to materialize. Non-industrial private owners face a number of obstacles, including small acreages, little access to capital funds, high risks, and unfavorable local tax systems.

With these considerations in mind, it has been concluded that some 15 percent of the aggregate biological potential for wood production is submarginal for economic production in the next 50 years. These economic considerations lower our estimate of potential national supply of wood from 35 to about 29 billion cubic feet per year (Spurr and Vaux 1976).

Forest industry and public land managers respond to price changes in different ways. Industrial managers may respond to price increases by cutting more timber, but they immediately re-plant cut acreage to insure a continuous supply of timber. Corporations have indefinite life spans, and acres of young vigorously growing timber are valuable assets.

Public agencies, too have long planning horizons, but their goals include much more than timber production. As a result, public agencies may not respond to price increases by offering more timber for sale. In fact, response may be totally dis-associated with price and highly unpredictable. Since more than half of the softwood timber is on public lands, decisions to sell or withhold timber from the market can have far reaching effect on prices of logs and lumber. Public agencies are not entirely to blame here. Often, conflicting political philosophies deny opportunity to set forth and follow any policy with consistency. Whatever the cause, the failure of public agencies to respond to changes in stumpage price affects investments of private landowners.
Private owners of forest land control almost 60 percent of forested area of the United States. While size of tract and site quality vary widely, recent statistics show that productivity on these lands is surprisingly high. Net growth per acre was above the national average and almost double the growth rate on national forests. And, recent harvests have been less than growth, so the inventory of standing timber on these lands is increasing.

Much criticism is directed toward timing of harvest, regeneration efforts, stocking, and intermediate steps to increase growth on these forests. But, growth does occur and investment is practically zero. Harvests take place periodically, adding substantially to the nation's output of timber and offering the landowner a source of income when he chooses to use it.

**POLITICAL CONSTRAINTS**

When we mention political constraints or uncertainties today, one of the first issues that comes to mind is the Monongahela decision. Irrespective of forces of demand and supply, timber sales from national forest within jurisdiction of the fourth circuit court will be cut from 111 million board feet to an estimated 30 million board feet. Or, if the precedent is applied nationwide, national forest timber sales could plummet from a planned 1976 harvest of 12 billion board feet to 3 billion—a 75 percent reduction (McGrath 1975). I'm not in a position to judge the merits of the Monongahela decision, but the immediate effects will be a drying up of timber supplies and jobs for smaller companies that depend on national forest sales. Upward pressures on prices already may be occurring.

Conflict between advocates of multiple-use forestry, or continuation of existing practices, and environmentalists, who would reduce timber production on public lands, culminated in the Monongahela decision wherein strict restrictions of the 1897 Organic Act were invoked. Opposing philosophies of how to manage public lands have been debated in and out of court for a number of years for lesser prizes, but the Monongahela decision will surely lead to telling battles in the Halls of Congress. Although at this point the outcome is uncertain, it appears that forest management goals and methods on public lands will be more clearly defined.
Currently, there are two bills being considered in Congress. The "Randolph" Bill, sponsored by environmental forces, would extend the basic concepts of the Organic Act with sharp curtailment of clearcutting. The opposing Bill, sponsored by Hubert Humphrey calls upon the Secretary of Agriculture to promulgate regulations for the management of the National Forests. Supporters of the Humphrey Bill see it as a continuation of the existing emphasis of multiple use and an extension of the Resources Planning Act.

The present national forest cutting levels are based solely on biological criteria; they are drawn up for hundreds of years into the future. Many concerned economists and foresters argue that this need not be the case. They contend that cutting rates on national forests could be permitted to fluctuate with economic conditions without endangering long-term productivity or the environment.

Another politically imposed constraint is the general property tax on standing timber. Many attempts have been made to nullify adverse effects of taxes on timber production, but the problem remains a significant burden, especially for small woodlands owners.

Let me quickly summarize a few additional political or institutional restrictions. The overall effect of these may be for the social good, but another result is an increase in consumer costs for wood products. First, the Occupational Safety and Health Act of 1970 sets safety standards which are to be enforced by federal compliance officers. Employers and, ultimately, consumers pay the additional costs imposed by the act. Second, the Forest Practice Act as proposed by the Environmental Protection Agency restricts certain timber harvesting practices. Again, the balance may be for social good, but the efficiency of the logging contractor will suffer. Finally, Workmen's Compensation Insurance and Unemployment Insurance have been taking an increasing portion of the logging contractor's profits in recent years. In Georgia, this rate increased 94 percent from 1970 to 1974.

The general outcome of political constraints and the uncertainty they create is to surpass timber investments and to apply upward pressures on prices of stumpage and wood products.
CONCLUSIONS

Demand, supply, and price provide information about tomorrow's forest resources as well as today's. The economic and institutional policies set forth in the next few years will largely determine outputs from our forests at the turn of the century. Stringent management and cutting restrictions imposed on public lands will elevate demand, and price, for timber production on private lands. Public lands will satisfy a large segment of the growing demands for outdoor recreation. As in the past, the result will be diminished recreation-by-fee opportunities in the private sector.

It is not so important that we advocate either side of such issues. But it is important that we insist that our decision-makers carefully weigh the outcome of their actions on our forest resources. Specifically, what are the probable changes in demand, supply, and price of the given commodity or service as well as induced changes in outputs that serve as complements or substitutes? The choices that must be made are complex. The benefits of our decisions will only accrue to the extent that our analyses are accurate, pertinent, and clearly presented.
LITERATURE CITED


The usual objective of the economist dealing with specific industries and specific types of problems is to analyze the subject matter in terms of the main body of economic theory. Even if the mainstream of analysis is somewhat inappropriate to the peculiarities of some areas of economic activity, it is still necessary to participate in a discipline on its own terms if one's insights are to be part of a working body of knowledge.

However, the other obligation of the economist is to use the insights he may obtain from formal or traditional theory to generalize or organize the problems with which practitioners are familiar so that a broader overview can be developed as a basis for general policy decisions. In this connection it is worth pointing out that forest production, defined as the production of wood on the land rather than as the mere harvesting of wood, is significantly different from most productive processes in our economy in two important aspects, namely its time patterns and its role as a residual land use. It therefore has a potential to add more to the breadth of economic analysis than it receives from that discipline in many areas.

My objective is to take some general ideas from formal economics and to elaborate them in terms of some of the specific characteristics of the forest industry in such a way as to bring together many of the relationships that all practicing

* Part of the material in this paper was elaborated in formal economic terms in an article, "The Kinked Cost Curve and the Dual Resource Base Under Oligopsony in the Pulp and Paper Industry," Land Economics, Vol. No. 2 (May 1974), pp. 185-192 which was co-authored with John C. Winfrey. Much of the research on this material was done with the assistance of a grant from Resources for the Future, Inc. during the spring and summer of 1973.
foresters understand quite clearly in their individual contexts. We can, in this way, develop an overview that will deepen our grasp of the economic processes in the industry as a general system. Our attention is primarily directed toward the cost considerations implicit in the flow of wood from the land to the mill. We are not concerned with specifics like actual production costs, labor, equipment, taxes, etc., but with institutional arrangements and how they affect the decision-making process and how they may affect the flow of wood from the forest to the mill.

Defining the Problem

What we are interested in is a better understanding of how the price paid for raw materials influences their flow to the raw material user, or the pulling or drawing power of price. It is an easy question in many parts of our economy where all that needs to be said is that if the price offered covers the cost of production, then the material will be forthcoming. In forestry, however, we have some special time and space problems which deserve attention, and one of the prime analytical perspectives of formal economics can be bent a little to serve as a basis for a good overview of the problem.

Rather than trying to generalize our problem in terms of formal concepts like "marginal revenue" and marginal cost," it would be more useful to take a simple example everyone already understands and generalize from it. Suppose an independent trucker has a contract to haul logs to a sawmill some twenty miles away for $25.00 per Mbf and he is hauling two thousand feet of logs in a trip. He considers this profitable, as do several other truckers who are engaged in the same hauling activity. Now suppose you want a number of loads of lumber hauled back from that same sawmill to a point near the trucker's source of logs. If he can haul two thousand board feet of lumber in a load, what criteria should he use in deciding how much to charge you? Assuming he would otherwise be coming back empty, the bargaining may go something like this:

Trucker - "Since I have calculated that I can't haul for less than $25.00 per Mbf in logs, the same ought to be true for lumber, and I will haul the lumber for you for $50.00 a load."
Buyer - "Yes, but it will only take you an extra fifteen
minutes at the mill to load the lumber and fifteen minutes here
to unload it, and the extra gasoline will not amount to more than
a few gallons. Since you are already making the trip and your
present return is covering all your costs, only $15.00 for the
load of lumber ought to be profitable for you."

Trucker - "That's right, $15.00 would be more than it
would cost me to haul the lumber and anything I get for the
empty backhaul is better than nothing since it is an involuntary
by-product of the main trip. But it just doesn't seem right
since I am charging $25.00 a thousand for hauling logs. If I
get $65.00 for a round trip and can come out on it, I should
charge you at least half, or $32.50."

Buyer - "Yes, you could charge me $32.50. This would give
you $82.50 for the round trip, which we agreed you could make
all right for $65.00. And charging me $32.50 for hauling lumber
would not put any pressure on you to charge less for hauling
logs since everyone knows that $50.00 is the going price for
that job. But any of the other truckers would be glad to haul
the lumber back for me for $15.00 a load because they realize
that the increased return would be higher than the increased
cost since the primary business activity (hauling logs) is al­
ready established. Of course, in a long term and large scale
return haul business, the cost of back hauling would wind up
being averaged in, but a short run or compartmentalized incre­
ment has to be treated differently."

While many semiliterate truck drivers intuitively understand
the rationale of the above sequence, they would not understand
what you meant if you said that pricing will cover costs when
set at the intersection of the marginal cost and marginal revenue
curves even in a situation involving decreasing costs where the
marginal increments are severable and do not affect average costs
of the going concern. And indeed there is no need to formulate
such isolated bits of understanding in formal economic terms for
its own sake, but it is useful when the general concepts can be
applied to a number of issues in forestry to develop a common
explanation of a large number of problems so that specific policies
can be understood in more general terms.
The Dual Resource Base Problem for the Mill

One of the more important cost problems in the forest industry is determining the cost of raw materials. At first glance, one might follow general economic presumptions and say that the price paid for raw materials must cover the cost of producing the raw material, and as long as it does, there will be a dependable flow of raw material. However, every industry must deal with its own institutional structure and specific material or physical relationships. The forest industry raises some particularly interesting problems. If we take a hypothetical pulp mill inducing a flow of raw material from the forest in a given area, we can picture the problem as in Figure 1.

Let us assume that the mill is drawing half its raw material from company-owned land (inside wood), or a captive resource base. The other half of the raw material is being drawn from the open market (outside wood), supplied by the small land owners who hold roughly two thirds of the forest land in the South. If we assume that this mill is consuming 1,000 cords a day, 500 from its own land and 500 from the open market, and that a price of $25.00 per cord is sufficient to induce this flow from the open market sector to the mill, we have a situation where decisions to expand raw material consumption require separate cost analyses for the two different sectors.

In the open market sector, the "A" sector dominated by the mill, the decision to buy an extra hundred cords per day will require the addition of Q6 to the existing quantity flow. If we assume that this can only be achieved by offering an additional $5.00 per cord, the extra 100 cords will cost the mill $30.00 per cord instead of $25.00. However, since in an open market in a homogeneous or common area only one price can be paid, $30.00 per cord will have to be paid for the 500 cords represented by Q1-Q5, so that the extra cords will, in fact, cost $55.00 each. This is arrived at by adding to the $30.00 for the extra cords $5.00 each for the five cords in categories Q1-Q5.

In the trucking illustration discussed earlier, we were dealing with a case where the incremental cost was lower than the going cost of operations. In this case, the incremental cost is higher and, since we are dealing with a market situation, the character of the market system makes it quite high, so that a very high return from expanded operations is necessary to justify experienced costs incurred on the open market. The
FIGURE 1
FLOW CHART OF RAW MATERIAL THROUGH DUAL INSTITUTIONAL BASE
TO MONOPSONISTIC PULP MILL

- a1-Induced expansion.
- a2-Increased payment for previous supply resulting from open market price system.
- a3-Increased land value.
- b1-Planned expansion.
- b2-Functional niche.
- b3-Expansion which can be financed by b2 in preference to a1.

THE FOREST
additional money paid to suppliers already delivering wood at the old price is represented by rectangle a2 in Figure 1, and is usually assumed to migrate into the hands of the land owners. By augmenting the income received by the forest land owner, it contributes to the increase of forest land values which may be at cross purposes with a firm's land acquisitions program.

Before dealing with some of the actual practices this analysis may help explain, let us look at the contrasting cost patterns implicit in the captive resource base.

If the mill chooses to expand its operations by a hundred cords per day and chooses to extract them from its own captive resource base, it faces a different cost pattern. Assuming it obtains an extra hundred cords per day from its own lands at a cost of $30.00 per cord by pulping small sawtimber, by utilizing smaller wood, or by some higher cost silvicultural techniques, etc., the higher costs incurred for the additional wood will not affect the cost for the established flow of wood since the actual costs are all that the mill needs to calculate. The mill can isolate the costs for the incremental wood so that the additional wood only costs the mill $30.00 per cord (or a total of $3,000 per day for the additional 100 cords) instead of the $55.00 per cord (or $5,500 per day for the additional 100 cords obtained from the open market).

If the mill wishes to expand from 1,100 cords a day to 1,200 cords per day, it could afford to incur a cost of $35.00 per cord for the second 100 cords if it did not increase the cost of its basic flows. Even though this incremental price is much higher than the open market price of $25.00 per cord, it is still cheaper wood than wood obtained from the open market that would force the average price up to $30.00 per cord ($3,500 as opposed to $5,500).

This situation results in some real problems when one considers the standard assumption that marginal cost pricing is appropriate in regulated industries and that therefore marginal cost should be the basis for valuing the product of the woodland division of a forest industry for tax purposes. By setting the transfer price between the woodland division and the mill at this marginal cost figure, a significant capital gains effect could result. Tax rules, however, try to tie inside accounting
prices to the open market price which the firm is trying to keep low. As we move into the era of horizontally integrated mills where tree-length wood is bought from the open market and distributed into various production systems at designated prices, the open market valuation problem may well become a hopelessly moot joint cost dilemma.

The general conclusion we can arrive at with the aid of the foregoing analysis is that a firm can validly increase its costs for incremental amounts of wood to a relatively high rate by increased investments in technology through such processes as total tree utilization or higher cost wood drawn from alternative uses before it would be justified in inducing increased amounts of wood to flow from the open market, if the open market technique of offering a higher price is used. In addition, the influence of higher prices paid on the open market upon land values may stymie the acquisitions department which can justify high cost acquisitions as a valid source of incremental wood in the first place.

Everyone in the industry fairly clearly understands the open market problem and we all know that the most common solution to it is to compartmentalize the market so as not to pay more for all wood, but only for incremental wood. The easiest technique is to open a railyard at some distance and to pay the going market price for wood in that area, absorbing the higher cost resulting from the otherwise unwarranted transportation cost. This absorption of higher transportation costs is commonly known as "eating the freight". Higher prices can thus be paid for wood at one yard where an expanded flow of wood can be generated, while lower prices can be continued at other buying points. Higher prices might be paid for mill residues which would generate increased flows without affecting the presumptive flow from the open market. Every region and every company has its own experiences associated with ramifications of this problem of compartmentalization.

Up to now, we have discussed the influence of the dual cost pattern situation and the resultant pressures upon the individual firm to make every effort to circumscribe the open market sector and avoid using price as an inducement for expanding the flow of wood. We all know, however, that in most areas buying territories overlap, particularly in the southeast, where competition for wood can be very intense.
The Case of Several Buyers in the Open Market, or Oligopsony

Where several companies are buying wood in the same area, it is obvious that if one firm pays a little more for wood, it can get all it wants and the others will have to be satisfied with the leftovers. If, however, all of the available supply of wood in the area is already being bought, every additional cord purchased by one firm will be a reduction in the amount available to the others, who may have to find other sources of raw material or curtail operations. It is also clearly understood by both theorists and men in the field that if one company raises its price, the others will be forced to do likewise. The end result will be that competing firms will get the same proportional share of the available wood they were getting before, only at a higher price. There is a strong common sense tendency to avoid this eventuality, formally defined as a "kinked cost curve". Companies, therefore, use as many kinds of non-price competition as possible. More money can be spent helping harvesters or independent loggers, called "producers", and more can be spent on personal relations with land owners, etc. It is also to the advantage of any given firm to keep other firms from having to resort to short-run emergency use of higher prices in order to induce a supplemental flow from the open market since all firms in a given buying area are under pressure to pay the same price. There is also much resistance to lowering prices once they have gone up. The selling or lending of wood between nominally competing firms is understandable in these terms. Also, the peculiar position of the small firm, for example one relying entirely on the open market for, say, 500 cords per day, in a market area dominated by a firm using 1,500 cords a day from the open market, is worth noting. The small firm can offer an additional dollar per cord to increase its flow of wood in the event of a competitive shortage. If the open market price is driven up by such an eventuality, the larger firm will have to pay out a sizeable additional amount so that it behooves the larger firm to see to it that the small firm does not incur short-run stresses that might tempt it to bid up local prices. However, there also has to be a limit to this potential pressure.

The real problem in the situation where there is competition for wood is to distinguish between resistance to price offerings which merely raise the price of wood, leaving everyone getting the same share of a given flow of wood, and price offerings which induce a net increase in the amount of wood arriving at the buying yards. This leads us to a discussion of the characteristics of the supply base itself and its responsiveness to price.
What is the Response of Forest Production to Price?

When only a part of the forest resource base is being drawn upon, it is easy to assume that if the present price being paid for forest raw materials is covering the costs necessary to generate a flow of wood, a slightly higher price will cover the cost of slightly more distant wood, wood more expensive to log, or induce more reluctant land owners to part with their timber. From this perspective, the cost of supply is an elastic harvesting cost, plus some given amount for stumpage. It is worthwhile to inquire into the problem of what costs stumpage prices cover in such a situation. The next step is to ask what costs have to be covered when nearly all the wood growing in an area is already being bought by the forest industry. Do additional costs have to be covered under these circumstances? A final question is what costs have to be covered if the forest industry desires to induce an increase in the flow of wood from the forest land base in a given area, and what relationships have to be taken into account to analyse the potential reactions?

The first issue is relatively simple when looked at in terms of the trucker's backhaul problem with which we started this discussion. Where wood grows on unmanaged land and ownership of woodland is a byproduct of agricultural activity just like the return trip is a byproduct of a hauling contract, there is no general cost of production. This is the case because there is no alternative use of the land that will generate an income and replace tree growth if prices paid for wood are too low. As long as there is a significant amount of forest growth resulting from land abandonment or indifference (involuntary forestry), and as long as there is no use antithetical to forest growth to which the land will be put if stumpage prices are too low, the stumpage price paid for wood has nothing to do with inducing the growth of the wood. It need not cover any cost associated with wood production, but only serves to induce the owner to part with it, or to compete with another buyer to obtain it. There is a hierarchy of land uses with timber growth, frequently mixed with woodland grazing, as the residual use of the land. Obviously, in a society where everything is owned, a price must be paid to induce an owner to part with timber rather than hold it speculatively on the assumption that it may become more valuable. The mere fact that someone wants it suggests that there is a value in it.
and therefore the owner expects a share, but this is a cost of transfer, not of production.

We may call this cost a "nominal inducement cost". It can vary rather widely depending upon the knowledge of the seller of the potential value of the timber when manufactured and the convenience of harvesting that may induce a logger to want to buy that particular stumpage. This general situation has given validity to the long standing assumption in the southern timber industry that if you wait long enough any given stand of timber will come on the market at any given nominal price since the land is bound to eventually get into the hands of someone who wants to clear it for agriculture or improved pasture, or one who needs ready cash or who follows the time honored tradition of clearcutting the stand just before selling the land. Under this assumption there is a steady, average flow of wood to the industry from this residual land use at a price which does not have to cover any specific costs of production. On the other hand, land held by a firm has to be carried on the books, and all costs of carrying and managing the land must be calculated since the fact of industrial ownership presumes a justification of incurred costs in terms of timber values. Under these circumstances, the open market price paid for wood has often been much lower than any calculable cost of holding land and producing wood under management by industry. This situation is made more complicated when prosperity and the American tradition of setting a premium on land ownership in the abstract combines with the speculative search for long-term investments so that land prices get quite high. Speculative land prices can advance without altering the hierarchy of actual productive values and the residual position of unmanaged timber growth. Under these conditions, the accumulated timber still tends to come on the market at regular intervals, while the bookkeeping costs of the firm and the actual cost of acquiring land make the calculated costs of growing timber on land held with no other justification completely beyond reason.

The second situation to examine is the problem of inducing an increased flow of timber from a given area, the unmanaged growth of which is already being completely utilized. Here we have a situation where emphasis on the different cost patterns in the dual resource base problem helps explain some of the developments in southern forestry in the last few decades.
Rather than try to induce management on current stands by offering higher prices for timber being bought through independent loggers, the industry, if prepared to incur higher costs for raw materials, and aware that oligopsonistic competition will only increase the short-run price without increasing the short-run flow of wood, reacts by buying up forest land and introducing intensive management. This was easier to justify on lands inherited from earlier periods with lower book value but, provided the artificial speculative price of land can be segregated from the bona fide timber value of the land and carried as a separate investment, intensive forestry as a source of more actual wood volume can be justified even when it costs more than open market wood.

Where more wood is desired from the privately held open market sector, fire protection, planting assistance programs and public reforestation programs tend to increase the percentage of unmanaged land in timber, and to increase stocking on that already forested without changing the assumption that nearly all wood that grows will get into the market sooner or later at a nominal price.

As a matter of actual fact, we all know that in some areas, going rates paid for wood have resulted in prices getting high enough to support pencil and paper calculations of the cost of growing timber on short rotations. Because of the complexity of the market process by which the price paid for wood at the mill is transmitted into stumpage production (growth), the situation cannot be analyzed as simply as, say, an agricultural market where buyers are reasonably sure that if they bid up the price of corn, more acreage will be planted and more corn will appear on the market the following year. Higher prices paid to independent loggers may induce them to compete more intensively for available stumpage instead of persuading reluctant land owners to sell timber, and higher stumpage bids may put loggers into such a bind that they take short cuts which add to the number of reluctant sellers. One response to this possibility is the intervention by the forest industry by direct purchase from the land owner without agreed upon guarantees of supervision and regeneration in order to induce timber sales. Competition between firms for existing supplies of wood and competition between independent loggers for available stumpage has, over the past decade, led to significant increases in the price paid for wood, but the real question is whether trees are
going to be grown in increased volume in response to prices that may, from time to time, cover calculable costs, and how will those costs be calculated?

A View of the Problem

The problem to be analyzed is how higher market prices for wood can reach back through the harvesting and landholding system in such a way as to induce an increase in wood growth by encouraging higher levels of management on small holdings. As the structure of land ownership changes, the responses can be expected to vary. The objective is to induce more wood production through higher levels of management. This must be done by convincing a calculating landowner that the increased return from management is greater than the increased costs associated with higher levels of management. This has to be done in a setting where much rural land is held by more prosperous people, under less pressure to sell wood, particularly during prosperous periods when industry is expanding. In addition, recreational uses may well be developing a new residual use for uncut, unmanaged timberland which can be expected to take many small holdings off the market as sources of steady flows of wood. It is also difficult to rationalize the timber investment on land that has an irrational speculative value except as a secondary return, and we can wind up going full circle back to forestry as a byproduct of speculative holding of land for future sale similar to the prior agrarian pattern.

The real question is whether the pull of price can induce a stable, longrun land management pattern supported by a sense of family continuity, or by a high market value for intensively managed forest land. There is much evidence that this is more likely to be induced by ethical and ideological developments than as a response to fluctuating prices. However, leasing and direct acquisition by companies still appears to be the most prominent purely commercial means of increasing management along with some partially speculative investment on large holdings by individuals freed from short-run economic pressures.

If we look at the problem in terms of the advantages of compartmentalizing sectors of the resource base, however, it is obvious that the most desirable system of inducements would be one in which the actually induced expansion in wood flows is rewarded without making general payments to the whole market for wood forthcoming in any event. It does not seem feasible to
achieve this through the open market, but one way of viewing public assistance programs is as an expression of this phenomenon. By tying assistance to specific acts which increase the amount of wood eventually growing on otherwise less well managed land, the higher costs are tied to actual increases in the flow of raw material. One could argue that it is a necessary supplement to market imperfections where much of the problem is associated with the lack of a culturally established forestry tradition in the country.

This whole area of market response and market patterns deserves much more attention through analysis and empirical research. This is particularly important and interesting in a period of rapidly changing values and practices. We may even see the day when forest products enterprises incur the cost of site preparation and planting, free of charge, on abandoned farmland or cutover land in exchange for the right of first refusal on any future timber sales off that particular tract. Such a program could well be a cheap way of compartmentalizing the higher cost of incremental wood.
ANALYZING FOREST INVESTMENTS

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Introduction

It seems appropriate that this session of the Symposium, devoted to economic tools for the practitioner, should begin with an overview of forest investment analysis. Within this context, I see my task primarily as providing a foundation for the papers to follow. Thus, my paper will be a broad discussion of some of the factors to be considered in analyzing forest investments.

An investment can be defined as a commitment of capital for a period of time—usually more than a year. In forest production there are three broad categories of capital investments—those for timber, for land, and for equipment. To stay within the time available, this paper will be primarily limited to timber production investments.

In analyzing investments, we are concerned with the flow and timing of the associated costs and revenues. For forest investments, the factors affecting this flow and timing can be broadly categorized as either internal or external. Internal factors are those which are characteristic of the forest itself. External factors include the non-forest impacts upon forest investments. Under internal factors, I will discuss the long period of production and the dual (product-factory) nature of timber. External factors will include non-monetary forest values, social costs, and taxes. After discussing these factors, I will consider some criteria for assessing investment decisions.
A General Capital Budgeting Model

The basic idea of selecting between investment alternatives on the basis of capital efficiency is generally referred to as capital budgeting or capital rationing. The underlying need for some formal framework to budget or ration capital is that virtually all organizations, agencies, firms, etc., have opportunities for capital use in excess of capital availability. Therefore, it is necessary to choose among investment alternatives in such a way as to optimize some criterion—usually a measure of the return to the capital invested.

The general idea of capital budgeting is captured in Figure 2. Rate of return, expressed in percent, is shown on the vertical axis, with level of investment on the horizontal axis. The first commitment of capital should be to the most attractive investment. Successive investment alternatives are added until either the next possible alternative falls below the guiding rate of return (the minimum acceptable return) or the amount of capital availability is exceeded. In Figure 2 investments A, B, and C are acceptable when measured against the guiding rate of return; investment D does not meet this requirement. However, the amount of capital available will only allow funding investment alternatives A, B, and a portion of C. If investment C is a discrete investment, that is, all or none, only investments A and B can be funded. Figure 2 is, of course, a very simple picture of capital budgeting. Very rarely, if ever, will an array of investment alternatives be as neat as depicted in Figure 2. In fact, most forest investment analyses are based upon very imperfect information; i.e., uncertainty is a factor in forest investment decisions. A more refined treatment of capital budgeting is beyond this paper, but there are numerous references on the subject (Cf., Bierman and Smidt, 1966; Halter and Dean, 1971; Lundgren, 1971; Thompson 1968).

Internal Factors Affecting Forest Investments

Gregory (1972:168-171) listed seven peculiarities of timber production. I have consolidated and reduced these to two which seem most pertinent for our discussion. The first is the long period required for timber production; the second is the dual nature of timber, that is, the tree is both the factory and the product.
GUIDING RATE OF RETURN

LEVEL OF INVESTMENT

A

B

C

D

RATE OF RETURN (%)

CAPITAL AVAILABLE

FIGURE 2 A GENERAL CAPITAL BUDGETING MODEL.
Long Period of Production

We all recognize that forest production is a long-term endeavor, one of the longest economic activities in which man engages. There is nothing particularly unusual or mystic about this; however, it does underscore some factors requiring special attention in forest investment analysis. Of these, the interest rate and the influence of inflation on forest investments will be discussed.

Interest Rate. Of all the tools in the forest economist's bag, the interest rate is probably the most important, the most misunderstood, and the most criticized. Interest is either the payment for borrowing or the reward for lending capital. If we are concerned with capital and the commitment of capital to long-term forest production, we must deal with relative rates of compound interest.

After admitting the necessity of including interest in forest investment analysis, the critical question is "What rate to use?" That is, "How is the interest rate derived?" All approaches to obtaining an interest rate come back to the same concept—opportunity cost. In economic jargon, opportunity cost is the return foregone by not taking the next best alternative. For example, if my only alternative use for funds is investing in a bank savings account paying 6% interest, it would be irrational for me to consider a timber investment which did not promise to return at least 6%. In other words, 6% is the opportunity cost of my capital and is the rate below which I would generally not consider alternative investments.

For the individual, the opportunity cost, or alternative or guiding rate of return, is established in one of two ways (Duerr, 1960:144)—either through alternative opportunities for spending or through alternative opportunities for investing. The above savings account example illustrates the idea of establishing the alternative rate through opportunities for investing. However, individuals, and firms for that matter, have non-investment uses for funds; that is, they may use funds for current consumption as opposed to saving for future consumption through investment. If a person needs all his available income to support current consumption for food, shelter, clothing, health care, etc., it is very unlikely that any alternative rate of return established through investment opportunities will be attractive. An alternative rate of return established
through opportunities for current consumption, i.e., spending, is referred to as the individual's rate of time preference for money. As an individual satisfies his basic needs, his rate of time preference will decrease to the point that the alternative opportunities for investing become dominant and define his alternative rate.

The above idea is expressed in Figure 3. Rate of return is again expressed on the vertical axis in percent. The horizontal axis is labeled level of income and the inference is, as income goes up, the individual is increasingly able to meet his current consumption needs. Therefore, his alternative rate of return, as expressed by his rate of time preference for money, decreases as income increases. The operative alternative rate of return is the rate of time preference until the level of income is achieved at which this rate coincides with the rate of return available from alternative investment opportunities. Beyond this level of income, investment opportunities establish the alternative rate of return. Many individuals have incomes below the level necessary for the rate of time preference to coincide with the return from investments. For these individuals, timber investments are not a feasible use for their capital.

For the corporation, the generally accepted alternative rate of return is the firm's cost of capital. That is, the firm should not invest in any projects whose returns do not exceed the cost it pays for funds. Cost of capital is the weighted average cost of all the outside sources of capital available to the firm. For example, a firm may be financed 50 - 50 with debt and common stock capital. If common stock capital costs 20% and debt capital costs 5%, then the firm's cost of capital is 13%. In this case, 13% would be the correct interest rate to use in analyzing investment opportunities, subject, of course, to any safety factor acceptable to the Board of Directors.

Even though cost of capital is the accepted approach for determining a firm's opportunity cost, it is immediately apparent that many firms make investments which do not appear to return the cost of capital. For example, some timber management investments or corporate investments in timber lands fall into this latter category. This would seem to reject the idea of cost of
Rate of return for money and its determinants. Figure 3: Determinants of individual alternative rate of return.
capital as the valid standard by which to evaluate investment opportunities. In his text on capital budgeting, Dean (1962, Ch. 9) discussed such cases in terms of "strategic" investments. Strategic investments, according to Dean, are those which are either risk reducing or welfare improving and, while they produce returns, the returns are very hard to measure. Also, the benefits tend to be spread over many aspects of a company and frequently stretch into the far future.

Within the general category of strategic investments, Dean includes those which are made for the purpose of gaining control over sources of raw material supply. According to Dean, firms go into this type investment for a number of reasons, including (1) reducing the risks that are associated with outside supply, (2) protection against shortages of supply, and (3) long-run protection of the price position in supply markets.

How is an interest rate obtained for analyzing strategic investments? Dean recommends an "exception" rate, which is a rate lower than the market rate or the alternative rate of return and which applies only to strategic investments. In effect, employing an exception rate gives strategic investments an edge in competing for corporate investment capital. The exception rate is not precisely determined by a well defined procedure but is a judgment decision by top management.

Before leaving the topic of interest rate, I should at least mention the use of interest in public investments. Theoretically, the same concepts apply to both public and private investments. As a political and often practical matter, many public investments are not evaluated with economic criteria. However, more and more, arguments are heard that interest rates should be taken into account for project type public investments. When the use of interest is appropriate, the public cost of long-term capital is considered by some, but not all, economists to be the appropriate alternative rate of return.

Considering Inflation in Forestry Investments. Inflation, the loss of purchasing power of money, has been and promises to remain with us. If inflation is operative over the life of a forest investment and not taken into account, the analysis may very well discriminate against the forest investment. This
discrimination is the result of inflation not being considered when future incomes and costs are estimated for a forest investment opportunity, coupled with the implicit inclusion of inflation in establishing the alternative rate of return.

Investment analyses can be made in terms of current prices or real prices. Current prices are those that actually occur at the time the cost or revenue is expended or received. Real, or relative, prices are relative to some index, such as the Wholesale Price Index. Real prices frequently are adjusted or referred to as deflated prices, that is, do not include the effects of inflation.

Suppose, for example, that an individual's alternative rate of return is established by his opportunities for investing in a bank savings account which pays 6% annual interest. Payments into the account and receipts from the account are current prices; that is, inflation is included. If inflation is 4% per year, the real or relative rate of increase from the savings account is closer to 2%, rather than 6%. If today's prices and costs are used in developing a forest investment alternative, comparing the rate of return from the forest investment against the 6% return from the savings account will bias the evaluation against the forest investment, since the influence of inflation on future stumpage values is not included. If today's prices are used for the forest investment, the savings account should be deflated and a 2% alternative rate of return used. In other words, the analysis needs to be consistent. Gregersen (1975) discussed the effect of inflation on forest investments and provides the mathematically correct approach for handling inflation in investment analysis.

Dual Nature of Timber

The second characteristic of timber production is the dual nature of timber; that is, the tree is both the factory which produces the output as well as the output itself. In other words, it is impossible to annually harvest the actual growth of timber. It is possible to harvest a volume which is equivalent to growth but not the growth itself. For forest investments, sooner or later it is necessary to completely liquidate the entire capital represented in a tree or stand and start over.
Three other aspects of timber affecting forest investments are very closely related to or derive from the dual nature. First, the unit value of the factory, the tree, is the same as the unit value of the product, the growth, at any point in time. Certainly the value of both may increase over time, particularly as the tree becomes large enough to move from one product class to another; but at any point in time, the unit value of the product is the same as the unit value of the factory. This means the rate of value increase is equal to the rate of volume increase. Rates of return higher than the volume growth rate are associated with expectations of either product class change or relative price increases for timber products. Once a change occurs, the rate of increase reverts to the rate of volume growth. This aspect is important in investment analysis for two reasons. First, it tends to set an upper limit on rate of return which may reduce the attractiveness of forest investments. But, second, it also emphasizes the value of cultural practices designed to stimulate the growth rate.

Another related aspect is the high ratio of inventory to product. To produce the desired product, it is necessary to accumulate many years' growth. It is not unusual to find ratios of the value of forest inventory to the value of growth as high as 10:1 or 20:1. In most manufacturing enterprises, a value ratio of 1:1 is considered high. For the investor, this necessity to accumulate timber capital means a major cost of timber production is the cost of holding timber capital—the annual interest charge on the money tied up in growing stock.

The third related aspect involves the one way flexibility in forest production and marketing. It is very difficult to significantly increase timber production in the short run; it takes time to produce timber. On the other hand, it is quite easy to reduce short run timber production by cutting in excess of growth. However, if decisions to reduce growing stock turn out to be poor investments, they cannot be quickly reversed.

Marketing flexibility, on the other hand, is one of the real pluses for forest investments. Timber, unlike many crops, can be stored on the stump. With the exception of old-growth, timber stored on the stump will continue to increase in volume and value, although perhaps at a lower rate. Therefore, if the stumpage market is down this year, it is possible to wait a year or two, knowing there will be an increase in physical volume and probably in quality and value with better future markets.
External Factors Affecting Forest Investments

Regardless what we do in the forest our activities frequently impact upon our neighbors. For example, logging practices affect stream quality, but the associated costs may not be borne by the logging operation but by a water treatment plant downstream. On the other hand, forestry practices enhance wildlife production without the benefits necessarily accruing to the forest owner. Legislative bodies pass laws which affect or control forest operations, set taxation levels, and in other ways regulate our activities.

More and more these external factors must be considered in our investment decisions. Many times the investment alternatives may be modified to reduce or increase the effects depending upon their relative desirability.

Non-Monetary Benefits and Social Costs

Non-monetary benefits refer to those forest outputs which are not traded in an established market. They are particularly important on public lands. Since Society has decided it is best not to price some of the non-timber outputs of public forest production in an economic market, it is not possible for many private forest owners to realize income from the production of forest-based goods and services such as wildlife habitat, recreation, etc. Non-timber products, such as water, may impact upon forest investments in terms of increased costs (e.g., logging modifications to improve water quality), but timber (or other marketed goods and services) is required to cover the costs. For the investor, this can mean increased costs which do not generate additional revenues. In other words, investment opportunities become less attractive.

Social costs, important in this paper, are those the forest investor must incur due to some action by Society. This action usually, but not always, derives from legislation or regulation. Most of us are familiar with the impact legislation and regulations can have on forest management. For example, the Clean Air and Clean Water Acts will require modification of forest practices in many localities in such a way as to increase the investor's costs without increasing his revenues. All legislation, however, is not negative. The federal FIP legislation and similar state action in Mississippi and Virginia are aimed directly at reducing the cost of forest production; thus, making investment
opportunities relatively more attractive.

Taxes

Another session of the Symposium is concerned with forest taxation, so I will limit my discussion to some highlights particularly relevant for investment analysis. Two aspects of the federal income tax particularly influence forest investment analyses. These are long-term capital gains treatment and the ability to expense certain cost items. Long-term capital gains tax rates are, except for small corporations, lower than ordinary income tax rates. Therefore, forest owners will want to take advantage of federal tax provisions which allow timber revenues to be taxed as long-term capital gains, rather than as ordinary income. The main point here is that most timber sales from private land can qualify for long-term capital gains treatment. If a timber sale does not qualify, it may be because a mistake was made either in writing the contract or in the method the timber was offered for sale. Needless to say, any time the amount of net revenue forthcoming at the end of an investment can be increased, for example, by lower taxes, then the relative attractiveness of the investment is increased.

Most maintenance costs, such as cull tree removal, road maintenance, property taxes, etc., can be expensed against ordinary income in the year in which they are incurred. This is opposed to waiting until the timber is sold and deducting the costs from gross sales receipts as is required for costs such as regeneration. This year-by-year deduction, called expensing, means many of the costs associated with timber production can be recovered against income which is taxed at the higher ordinary tax rates. The subsequent revenues generated by these costs are then taxed at the lower long-term capital gains rates. This again has the effect of increasing the relative attractiveness of forest production investments.

Since both the costs and revenues associated with forest investments are modified by federal income tax provisions, and the degree of modification is sensitive to the levels of long-term capital gains and ordinary income tax rates, it is generally advisable to analyze forest investments on an after-tax basis.
A tax which is sometimes overlooked in forest investment analysis is the inheritance or estate tax. For individually-owned properties, this can be a serious mistake. For estate tax purposes, forest properties are valued at their current market value. These properties, however, may have less liquidity than other forms of wealth, and there are numerous cases where the inheritance tax has caused timber to be liquidated prematurely. In assessing investment opportunities for the individual, the role of inheritance taxes should be considered and steps taken to insure that, should inheritance taxes become a reality while the investment is immature, some provision has been made to protect the investment. This protection is generally achieved through a life insurance program which explicitly recognizes the possible impact of inheritance taxes.

Criteria for Investment Decisions

The last major topic concerns criteria for choosing between investment alternatives. First, what is a criterion? My definition of criterion is simply a standard of comparison or a common denominator by which alternatives can be judged and a choice made among the alternatives. It seems obvious that we need criteria as a basis for making rational, consistent decisions. This discussion will be limited to those criteria having economic relevance, specifically, present net worth, internal rate of return, and cost effectiveness.

Many economists argue, and the literature is full of their arguments, about which investment criterion is preferred. The answer is "it depends." It depends upon the investor's goals and objectives. Of the following criteria, present net worth and internal rate of return assume the investor's goal is maximum profit. The cost effectiveness criterion assumes the investor is interested in achieving a specified goal at minimum cost, or maximizing production from a given budget.

Present Net Worth

Present net worth (PNW) or discounted cash flow is the difference between the present value of all future relevant incomes and the present value of all future relevant costs, at a given interest rate. The interest rate used is ordinarily the alternative rate of return. Present net worth figures can be
ranked to show the financial returns an investor could expect to receive from alternative investment opportunities.

The interpretation of present net worth is straightforward. A positive PNW indicates the investment will offer a higher return than the selected interest rate. A zero PNW reflects an investment that just earns the selected rate. A negative PNW indicates that an alternative investment is preferable to the one under consideration.

**Internal Rate of Return**

Internal rate of return (IRR) is the compound interest rate that equates the present value of the incomes with the present value of the costs associated with the investment. Internal rate of return is a relative measure showing the rate at which the investment increases in net value over time. This criterion is very popular and is commonly referred to as return on investment (ROI) or yield. In general, this criterion will provide the same relative ranking of investment alternatives as under present net worth. However, two aspects of IRR should be remembered. Investments which have "non-conventional" patterns of costs and revenues, that is, intermingled with intermediate costs and revenues, may have multiple yields. In other words, such investments may have zero present net worth at more than one internal rate of return. Also, a basic assumption of this criterion is that all intermediate incomes are reinvested at the internal rate of return. This is a very critical assumption and if it is not met for a particular investment opportunity, an erroneous answer may result. Marty (1970) has suggested a composite internal rate of return calculation procedure to avoid the difficulty associated with this latter assumption. Neither of these aspects are important for present net worth calculations.

**PNW vs. IRR**

The preceding discussion may seem to imply that present net worth is preferable to internal rate of return as an investment criterion. This, however, would be an over simplification. There are also difficulties with PNW.

While an investor should accept every possible investment opportunity having a positive PNW, the criterion by itself tells nothing about the size of the investment. Initial investments of
either $10 or $10,000 can have PNW's of $100. Managerial judgment is always an ingredient in investment analysis.

Internal rate of return, while still not specifically related to size of investment, does give more information on amount of "elbow room." In both PNW and IRR the guiding interest rate must be defined. For PNW the guiding rate is used in the calculations. In IRR the answer is compared with the guiding rate.

However, a PNW of $100, with an alternative rate of return of 10%, may represent an internal rate of return of 10.1% or 20% (or more). IRR provides some immediate information on the degree to which the investment exceeds the guiding rate. This is probably the reason, despite its drawbacks, most foresters seem to prefer IRR. The choice between PNW and IRR is obviously not simple. For a more complete discussion, see Bierman and Smidt (1966:Ch. 3).

Cost Effectiveness

Cost effectiveness is somewhat of a departure from the two preceding criteria; however, it is quite relevant in many aspects of forest production. By definition, cost effectiveness is the ratio of output to cost. For example, a forest investment opportunity which is designed to produce wildlife habitat is very difficult to quantify in terms of both cost and revenues. Alternatives in this case might be evaluated on the basis of how much habitat improvement is obtained per dollar of expenditure, or what is the least cost method for obtaining a specified habitat improvement goal. That is, which alternative is most cost effective?

Cost effectiveness is also relevant in the private sector. For example, a forester may be given the goal of providing a given volume of raw material per unit of time. The criterion for choosing among alternative methods is "Which achieves the goal at the lowest costs?" That is, which is most cost effective?

Summary

There is nothing basically unique about forest investments. Essentially we are talking about a commitment of capital now and a return at some time in the future. There are, however, a number of peculiarities of timber production which make it subject
to particular attention with respect to investment analysis.

A number of factors impact upon forest investments—some of these are peculiar to the forest itself; others derive from external sources. Internal factors include the long period of production which leads to the particular importance of the interest rate as well as consideration of inflation. Another internal factor is the dual nature of timber and how this relates to the rate of return from forest production, the high ratio of inventory to product, as well as flexibility in production and marketing.

External factors, those which develop outside the forest, include non-monetary benefits, social costs, and taxes.

Criteria for analyzing forest investments generally involve use of present net worth or internal rate of return. For those forest investments which do not have directly comparable costs and revenues, cost effectiveness may be the appropriate criterion.

The following highlight the major points in the paper.

--An investment is a commitment of capital.

--Both internal and external factors must be considered in assessing the relative merits of a forest investment.

--Capital budgeting is the underlying framework for analyzing forest investments.

--The interest rate used in analyzing forest investments is derived from alternative opportunities to either spend or invest.

--Forest investments often have strategic benefits which justify using an exception rate in analysis.

--Because of the long period involved in forest production, an explicit consideration of inflation is necessary in analyzing forest investments.

--A major cost of forest investments is the cost of holding timber capital.
--Non-monetary benefits and social costs often increase the forest investor's costs without related increases in revenues.

--The federal income tax regulations which allow long-term capital gain rates and the provision to expense maintenance costs increase the relative attractiveness of forest investments.

--The choice, and proper use, of criteria for analyzing forest investments is important.
Literature Cited


INTRODUCTION

In the South, forest product prices are normally associated with timber products and are generally market-determined prices. In contrast, non-timber products such as outdoor recreation, water, wildlife, and other multiple-uses are seldom sold in a commercial market and their "prices" are not competitively determined. Non-timber uses carry little or no price tags on private lands and fee charges on public lands (if any) are determined administratively or legislatively and not by economic competition.

The multiple outputs and management goals of southern forestry and the problems associated with pricing non-timber products reminded me of the poem credited to the economist Kenneth Boulding:

Programming sticks upon the Shoals
Of incommensurate Multiple goals
And where the tops are no one knows
When all our peaks become plateaus
The Top is anything we think
When measuring makes the mountain shrink.

The Upshot is, we cannot tailor
Policy by a single scalar
Unless we know the priceless price
Of Honor, Justice, Pride and Vice
This means a crisis is arising
For Simple-minded maximizing.
In this presentation, I have first re-examined some of the major economic characteristics of forest resources that influence forest product prices. Second, I have peaked in the not so "black box" of monopolistic or imperfect competition in southern forestry. Third, I have reviewed price forecast methods and included a forecast of the near future for price levels of some forest products.

**Definitions.** Price is defined in the *Dictionary of Economics* simply as "value expressed in terms of money" (38). G. Robinson Gregory defined forest prices as "the quantity of one thing measured in money terms, that is exchanged or demanded in barter or sale for a specified commodity in a particular area at a specified time" (14).

John Beuter has stressed the distinction between value and price in reviewing bid-appraisal ratios of public timber sales (6). He defined price "as the actual amount paid by the buyer and accepted by the seller in exchange for a thing at the instant in time that a transaction takes place." Value was defined "as an estimate of the amount (usually dollars) that will be paid by a buyer or accepted by the seller in exchange for a thing." By these definitions an estimate is subject to the objectives, assumptions, limitations, and judgement of the person making it; a particular transaction can have many values, but only one price.

Price in itself is important, but price as an indicator of basic supply-demand relationships is more important. Prices are normally expressed in relative terms. When time series data are studied, it is necessary to deflate absolute prices and express them in real terms.

**Price Sources.** Annually, the Marketing Research staff of the U. S. Forest Service, publishes a comprehensive report containing many price sources, entitled *The Demand and Price Situation for Forest Products* (3). Some additional important sources of published information include the following:

1) The Southern and Southeast Forest Experiment Stations publish annually in either trade journals or station research notes, the production and prices of roundwood and chips.
2) Several states publish reports for stumpage and delivered forest products. For example, the Louisiana Department of Agriculture published a quarterly report for this state.

3) The Southern Hardwood Lumber Manufacturer's Association published the weekly Memphis market report for hardwood lumber.


6) Prices for major forest products are published by the Census Bureau as part of important price indexes.

**Timber Markets**

In the South, the primary timber markets for both hardwood and pine have many similarities. The major differences lie in secondary markets. Both markets include sawn lumber, pulpwood, veneer, particleboard, plywood, and cross ties (40).

Major pine markets include pulpwood, sawlog, plywood, stud log, and poles and piling. The naval stores' industry is also associated with the southern pines, and it is perhaps the most directly price-supported forest product industry (19). A large advantage of the pine markets is the fact that wood properties are considered similar enough to group and utilize all southern pine species. This characteristic has influenced forest product industry in the South which has applied the system approach to the harvesting, transporting, merchandizing, and converting of pine timber. Thus, the total product can be brought from the forest and utilized in a highly economically efficient manner.

Hardwood timber marketing presents different problems. Most markets are species dependent, while hardwood stands in nature are mixed. While southern pine primarily serves the construction and paper industry, southern hardwoods have primarily served the furniture, and pulp and paper industries. Hardwood lumber production, consumption exports and imports are shown in table 4. However, the secondary manufacture of hardwood lumber is growing more diversified. The secondary mix for
TABLE 4
G. R. Wells

HARDWOOD LUMBER PRODUCTIONS, IMPORTS, EXPORTS, AND CONSUMPTION LUMBER PRODUCTION

<table>
<thead>
<tr>
<th>YEAR</th>
<th>PRODUCTION (Billion Bd. Ft.)</th>
<th>IMPORTS</th>
<th>EXPORTS</th>
<th>APPARENT CONSUMPTION</th>
<th>CAPITA CONSUMPTION Bd. Ft.</th>
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</thead>
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<td>1950</td>
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<td>0.3</td>
<td>0.1</td>
<td>7.5</td>
<td>.50</td>
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<td>0.3</td>
<td>0.2</td>
<td>7.6</td>
<td>.46</td>
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<td>0.3</td>
<td>0.2</td>
<td>6.4</td>
<td>.35</td>
</tr>
<tr>
<td>1965</td>
<td>7.5</td>
<td>0.3</td>
<td>0.1</td>
<td>7.7</td>
<td>.39</td>
</tr>
<tr>
<td>1970</td>
<td>7.1</td>
<td>0.3</td>
<td>0.1</td>
<td>7.3</td>
<td>.36</td>
</tr>
<tr>
<td>1971</td>
<td>6.9</td>
<td>0.4</td>
<td>0.2</td>
<td>7.1</td>
<td>.34</td>
</tr>
<tr>
<td>1972</td>
<td>6.8</td>
<td>0.4</td>
<td>0.3</td>
<td>7.0</td>
<td>.34</td>
</tr>
<tr>
<td>1973</td>
<td>7.0</td>
<td>0.5</td>
<td>0.2</td>
<td>7.3</td>
<td>.35</td>
</tr>
<tr>
<td>1974</td>
<td>6.9</td>
<td>0.4</td>
<td>0.2</td>
<td>7.2</td>
<td>.34</td>
</tr>
</tbody>
</table>

SOURCE: U.S. FOREST SERVICE (1975)

TABLE 5

U.S. HARDWOOD LUMBER CONSUMPTION-1972

<table>
<thead>
<tr>
<th>INDUSTRY CLASSIFICATION</th>
<th>VOLUME CONSUMED (Millions Bd. Ft.)</th>
<th>PERCENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIMENSION AND FLOORING</td>
<td>992.9</td>
<td>14.4</td>
</tr>
<tr>
<td>HOUSEHOLD FURNITURE</td>
<td>1,446.9</td>
<td>21.0</td>
</tr>
<tr>
<td>WOOD CONTAINERS AND MISC. PRODUCTS</td>
<td>2,101.0</td>
<td>30.5</td>
</tr>
<tr>
<td>MILLWORK, PLYWOOD, &amp; STRUCTURAL WOOD MEMBERS</td>
<td>1,242.3</td>
<td>18.1</td>
</tr>
<tr>
<td>LOGGING CAMPS, SAWMILLS, &amp; PLANING MILLS</td>
<td>829.5</td>
<td>12.1</td>
</tr>
<tr>
<td>OFFICE, PUBLIC BUILDING, &amp; MISC. FURNITURE</td>
<td>175.5</td>
<td>2.6</td>
</tr>
<tr>
<td>WOOD BUILDINGS &amp; MOBILE HOMES</td>
<td>54.3</td>
<td>0.8</td>
</tr>
<tr>
<td>SPECIAL WOOD PRODUCTS</td>
<td>36.9</td>
<td>0.5</td>
</tr>
<tr>
<td>TOTAL CONSUMPTION</td>
<td>6,879.3*</td>
<td>100.0</td>
</tr>
<tr>
<td>TOTAL CONSUMPTION*</td>
<td>(7,019.0)</td>
<td></td>
</tr>
</tbody>
</table>

SOURCE: 1972 CENSUS OF MANUFACTURERS, BUREAU OF THE CENSUS

*DISCREPANCY OF 1.7 PERCENT IN ADDITION OF INDIVIDUAL SIC REPORTS PARTLY DUE TO ROUNING ERROR
primarily hardwood species is shown in table 2 for 1972. It is interesting to note that 1972 was a peak period for hardwood lumber prices, and for the first time in over a decade the North outproduced the South in hardwood lumber production (see table 6). Several studies have suggested a declining resource base in southern hardwoods, especially in the Mississippi Valley (9) (39).

Characteristics of Forest Resources

It is difficult to generalize about prices in forestry and especially forest product prices, since there are estimated to be over 5,000 forest products made from wood alone. Price theory as applied to forest products is influenced by many unique characteristics and fundamental relationships. These key characteristics and the theoretical aspects of each are briefly reviewed next.

1. **Joint Products.** The multiple-product nature of forest resources are well known. The heterogeneity of products and the joint-product relationships among timber and non-timber resources makes product specificity and hence pricing difficult. For example, the value of timber land and timber varies greatly if viewed by a single product firm as compared to a horizontally integrated firm (41).

2. **Producer Goods.** Most timber products are producer goods as opposed to consumer goods. Lumber, pulp, and plywood make up a large share of the market for southern forest products. These products and their demand are derived from the demand for construction, shipping materials, and manufactured products. Prices of wood may often be a small cost component of the total cost of the final consumer good (18).

3. **Residual Value of Stumpage.** Given the derived demand for most forest products, residual determination has become a traditional theoretical concept for appraising the market value of standing timber. The principle for determining residual value of stumpage is to subtract from the total price received from the sale of the manufactured product all costs of manufacturing and marketing the forest product fabricated including a reasonable profit margin. Thus, stumpage values,
### TABLE 6

**HARDWOOD LUMBER PRODUCTION BY REGION AND YEAR**

<table>
<thead>
<tr>
<th>YEAR</th>
<th>NORTH (Billion Bd. Ft.)</th>
<th>SOUTH (Billion Bd. Ft.)</th>
<th>TOTAL* (Billion Bd. Ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950</td>
<td>3.0</td>
<td>4.4</td>
<td>7.4</td>
</tr>
<tr>
<td>1954</td>
<td>3.0</td>
<td>4.1</td>
<td>7.1</td>
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<tr>
<td>1960</td>
<td>2.7</td>
<td>3.4</td>
<td>6.3</td>
</tr>
<tr>
<td>1964</td>
<td>3.2</td>
<td>3.9</td>
<td>7.1</td>
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<tr>
<td>1970</td>
<td>3.4</td>
<td>3.6</td>
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<td>1971</td>
<td>3.3</td>
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<td>6.9</td>
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<td>3.3</td>
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<td>7.0</td>
</tr>
<tr>
<td>1974</td>
<td>3.5</td>
<td>3.4</td>
<td>6.9</td>
</tr>
</tbody>
</table>

*Difference from Total between North and South is made up by current estimated 0.2 billion bd. ft. of Western hardwood lumber.

**Source:** U.S. Forest Service (1975)
following this theory, move directly with the selling price of forest products and inversely with the cost of logging, manufacturing, and merchandising. Stumpage values are in general price determined as opposed to price determining, i.e. have small influences on forest product prices. The costs of growing stumpage are to a large degree independent of market prices, and normal prices that include these costs may exceed or fall below market prices, at any one point in time (41).

4. **Long production period.** Physical production responses in growing trees from more intensive management increase the product supply schedule only after relatively long periods of time. The greater the attempts to regulate production (timber output) to growth, a goal of traditional forestry, the greater the probability of price effects, or wider swings in market prices. The essence of traditional timber management is the control of the rate of cutting by physical criteria rather than by market criteria exclusively. Wide-spread adoption of forest management hence contributes to price inelasticity (41).

5. **High capital to output ratios.** Forests containing merchantable timber are simultaneously a "factory" for producing wood and an inventory of marketable products. Normally, from 10 to 15 times the capital to output ratio is carried in forestry compared to national averages in other industries. Unlike agricultural crops, trees may be stored on the stump and frequently continue to grow and defray storage expenses. Reservation price can thus play an important role in timber marketing, since it is possible to withhold timber from the market for several years. Conversely, the high inventory to production ratio makes it possible to market over a short period of time large portions of timber, much larger than the production of growth of this same period (18).

A real rise in timber prices therefore tends to raise the level of value of timber as capital stock in higher proportion than the value of output, and raise the opportunity costs of holding timber.
6. **Ownership pattern.** In the South, the ownership pattern has an important influence on marketing and timber prices. Private, nonindustrial owners control the majority of the timberlands. There is some evidence that this class of ownership is undergoing structural changes. Examples of these changes include large shifts from farm to non-farm owners and fragmentation of ownerships which will likely contribute to short-run price inelasticity. Owners of small tracts infrequently make sales during their tenure and often lack the requisite market information to maximize returns from their forest resources. These institutional changes can negate increases in the timber resource measured in physical terms.

In an ownership study in Tennessee, concerning timber availability, we have found many institutional changes in large, private forest holdings, above 500 acres. For example, in one selected timbershed the number of forest owners has more than doubled during a 30 year period because of fragmentation.

7. **Other Institutional Effects.** Prices are influenced by tariffs, taxes, and subsidies which can expand or contract economic supplies of timber. For example, Marty (25) estimated that federal capital gains taxation was about $130 million in 1970 with about $104 million or 80 percent of direct benefit to forest industry. For the same year, some $560 million worth of other types of federal subsidies went to other private forest owners. Marty concluded that the removal of capital gains treatment would have immediate price dampening effects as many private owners would disinvest in timber growing as fast as the market could absorb the timber. However, unless other alternative subsidies were offsetting it would take up to 20 years for timber growth investments to recover to the same level.

The court's ruling concerning the Monongahela National Forest and the possible strict application of the 1897 Organic Act to other National forests has the potential to reduce the 1976 timber supply by 75 percent, according to Forest Service Chief McGuire. Unless
Congress acts, the supply could drop by 50 percent for the remainder of this century. Widespread price effects could be expected especially in softwood lumber and plywood markets since more than half the standing softwood timber is in National Forests (2).

8. Forest Product Price Trends. The historical trends in real prices of many forest products have been upward. For example, relative lumber prices have been rising at an average annual rate of about 1.7 percent since 1800. Decreased accessibility of timber stands, increasing competition for available timber, declines in timber quality and lagging productivity in lumber industry relative to the general economy are common explanations for this phenomena (3). However, Irland in his dissertation states that only sawtimber and lumber have had real price rises since 1950. Moreover, by more broadly defining resource scarcity, he rejects the hypothesis that timber is scarce in an economic sense. The resurgence of second growth of wood use, and resource-expanding technical changes were cited as causes of timber availability (21).

9. Forest Product Price Fluctuations. Many forest product prices fluctuate readily. Future trading occurs in both softwood lumber and plywood, which are offered on three commodity exchanges. The seasonal patterns in construction activity and the year to year demand for housing, maintenance and repair of structure, and heavy construction are thought to be major causes in fluctuations. Hardwood lumber price trends generally lag behind softwood lumber and are geared to a large degree by the markets of the furniture industry.

Stumpage prices follow closely the roller coaster effect of product prices. Often the sheer volume of goods in process operate to affect price instability in regional markets. Strikes, rail car shortages, bad weather, and the like can interrupt volume flows and cause regional price effects. Since logging is affected by bad weather, mill inventories often are built up in the fall of the year. Stumpage prices are frequently affected by the seasonal adjustments (18).
10. Problems of Measurement. Changes in product sizes, grade standards, quality, and the like make comparison of prices at different points in time difficult. Partial adoption of weight-scaling and variances among buying practices of individual companies often make it difficult to directly compare stumpage prices even for knowledgeable sellers. Many lump-sum sales are initiated, with the risk of unfavorable tax consequences, to avoid problems of measurement.

Imperfect Competition

The economist's model of either perfect or pure competition is more often used as a yard stick to identify problems associated with optimism resource allocation and economic efficiency, than as a gauge of economic reality. In a complex-industrial society, oligopoly and various degrees of monopolistic competition is more the rule than the exception.

Walter Mead in his study of mergers and economic concentration in the Douglas-fir lumber industry, concluded that this industry was far more competitive or less concentrated than its major competitors. When 1972 Census of Manufacturers data are compared to the 1954 used by Mead, only slight increases in concentration have occurred (8).

David Qualls, Bureau of Economics of the Federal Trade Commission, completed a recent study of price stability in concentrated industries. Of the 31 oligopolistic industries selected for study, only one—wood office furniture—used wood products. Moreover, it was judged to be moderate to low in the concentration category. This suggests that few wood-using industries are price givers but rather are price takers.

Fawlins and Sorensen, in 1965, examined market structure and production of southern pulpwood. They reported that three of seven East Texas firms they surveyed purchased 93 percent of the total volume of pulpwood produced. They stated, "In view of the small number of buyers and the high concentration among buyers, this group may be classified as an oligopolistic market. Prices were reported to be of minor importance in competing with other dealers (33).
Market Imperfections. It is possible for concentration in resource ownership to have price effects. Timberland is immovable, growing stock is immovable and the absence of relatively cheap transportation means extracting and processing must be restricted to a geographical area thereby affecting competition (28). Possibilities of spatial monopsonies always have existed since competition is greater on the extensive margin of any particular firm's timbershed. Several writers have questioned forest industry's motives in owning timberland, generally with respect to roundwood prices.

Esko Jaatinen, a Finnish economist, suggested three motives for timber cutting on land controlled by forest industry. They were: 1) to safeguard the acquisition of raw material, 2) to influence stumpage price levels, and 3) to take advantage of taxable income while increasing cash flow (23). He proposed two hypotheses with respect to price concerning the first two motives. Following the safeguard hypothesis, heavier timber cutting would be expected during periods of low prices since this would be the period most likely to find production less than mill requirements. That is to say industrial cuttings on company lands should be inversely related to price. However, the opposite would be true if the objective is to dampen price levels. Heavier cutting from company lands would occur during periods of high prices to create an artificial glut of open market wood (23).

Sizemore pointed out a possible conflict between forest industry at the manufacturing level and the woodland division level of industry. He said,"If the objective of woodland ownership is recognized for what it is, a means of depressing stumpage prices - it becomes apparent that woodland operations must show an unsatisfactory rate of return". Thus, the more success, if any, at dampening prices by forest industry the poorer would be the expected performance of a woodlands' profit center.

Buford, in an analysis of pulpwood prices, stated "An industry which can secure 20 percent of its raw material from residue chips, 30 percent from hardwoods, and 20 percent or more from its own lands, has a relatively long-term inexhaustive supply and can affect price (7)."

Moreover, Clawson has pointed to the fact that often sawlog size material with assumed higher timber value is converted to
pulpwood by industry. He states "I interpret this situation to mean that paper companies are using their own sawlogs for pulp to avoid disturbing the market for pulpwood they buy" (10).

Resource concentration is being increased by forest industry through long-term contracts and leases. Siegel reported that in 1970, there were 6.7 million acres of timber land in addition to the 35.3 million acres owned in fee simple by industry that were under long-term contracts and leases (36). The benefits, including those to society, of increased management practices on these lands is well recognized. In fact a proposal to step-up leasing with federal support was recommended by the Presidents' Advisory Panel Report on Timber and the Environment (14).

Another significant trend in the South is the use of management agreements, between private landowners and forest industry, which give companies the first refusal of stumpage at "prevailing rates". Some consulting foresters have questioned the ability of owners of such properties to obtain serious bids from other companies under such agreements.

**Market in absentia.** In addition to possible price effects caused by the concentration of forest land ownerships in some locales, Clawson has raised the question of how much timber actually goes through private markets. It is well known that consumption may and often does occur without a sale, as when a farmer cuts fuelwood or fence posts for farm-use as a prerequisite. However, Clawson estimated that more than one-third (about 18 million board feet) of hardwood and softwood sawtimber in the United States annually fails to go directly through a "free market system" (10). He has thus included all timber sales from national forests and timber harvested and presumed processed by industry from their own timber holdings.

In the South, data from sales of national forests have been analyzed during several periods (4) (5) (13) (17). These analyses have identified several price determinants and market imperfections. For example, Anderson has predicted both sawtimber and pulpwood prices from timber characteristics, number of buyers, and time trends. Most of these studies show the expected number of bids as an important price determinant. It has long been recognized that imperfect knowledge exists on private holdings, since such owners do not make frequent sales and are often ignorant of marketing procedures. The number of buyers that bid on public sales also show the expected influence of their competition on price. There
has been no evidence found to suggest that public timber sales are less competitive as private sales.

Timber Sales. It is widely known in forestry circles that individual prices vary significantly from the average sale price because of species mix, quality, road and logging costs, size and length of sale, number of bidders, and numerous other related determinants.

Economies of size and scale are well known to have price effects. Prices rise directly with the value of wood sold, but decline with increases in acreage of sale, when wood volumes are held constant (5).

Dutrow has predicted prices of cottonwood stumpage from quarterly data of sales relating price to agricultural wages (12). The seasonal availability of rural labor is a principal factor influencing price patterns. Agricultural crop activities generally tie-up rural labor particularly in the early spring and fall.

There has been found a positive but slightly unstable relationship between tree diameters and stumpage prices (11). Weighted tree diameters would be expected to often correlate with timber-sale volumes, since logging cost and manufacturing costs should decrease and product recovery values increase as diameters increase. If such relationships tend to hold better in the future, it would be easier to measure the impacts of silvicultural practices.

Forecasting and the Timber Economy

In 1971, an IUFRO working group reviewed the major forecasting carried out in the field of forestry and forest product pricing (22). Forecasts were defined as a quantitative estimate of some specified future condition or event. Four forecasting methods 1 were given: 1) Simple methods including extrapolation of past trends, i.e. projections of a particular time series from its own history; 2) Barometric techniques, based on the idea that future development can be predicted from statistical

1/ Forecasting methods may be combined. See the National Association of Furniture Manufacturers econometric model, that uses opinion polling of an advisory panel as input to their model.
indicators; 3) Opinion polling that are surveys designed to ascertain businessmen's intentions regarding plant investment, consumer buying plans and the like; 4) Econometric models, which utilize a set of mathematical relationships between economic variables.

**Forecasting in Forestry.** One of the first econometric models built by a forest economist was developed by Gregory, who used the model for price predictions in the hardwood flooring industry (16).

McKillop, in 1967, developed perhaps the most comprehensive model in forestry. His model estimates both the supply and demand for lumber, softwood lumber, paperboard, building paper and board, and softwood plywood with price projections through 1975 (26) (27). Recently an econometric model for softwood lumber was developed by Mills and Manthy (29).

In the South, an Interregional Timber Model (ITM) was developed by Holley, Haynes, and Kaiser (20). Their model departs from the traditional projection techniques, such as the U. S. Forest Service's Timber Resource Analysis System (TRAS) by considering regional allocations of timber resources. While TRAS is used to project timber volume in response to net growth and timber removals (24), ITM uses economic logic in allocating the nation's timber resources to meet forecasted demand for wood products. It simulates a logical future pattern of wood location and output.

A second timber supply and demand model built in the South was developed in the State of Georgia by Montgomery, Robinson, and Strange (30). It has been proposed for adoption to other southern states. Their model results forecasts for the year 2000 a one-third decline in real sawtimber prices in Georgia. Concomitantly, recent harvest levels would be expected to double. These results are based on the assumption of only private timber investments, and a highly inelastic demand for timber products. However, this model was developed to test public policy decisions more than predict long-term prices.
Forecasting Future Prices. Not having claim to being clairvoyant, I have relied on other peoples' forecasts and the well-known Wharton Business School Econometric Model (3), to focus on the likely future prices of some forest products. The Wharton model is used to predict future housing starts, Gross National Product (GNP) and Disposable Personal Income.

Most economic forecasts of the housing industry use household flow-of-funds and mortgage markets as the driving force in forecasting in the housing industry. Most forest product prices, such as lumber, plywood, and paper leveled off during 1975 below the general price level. These were mostly adjustments to the recession and were caused because demand remained low.

According to Resources for the Future..."This relative stability in prices of forest products is indicative of economic weakness rather than strength and does not imply any basic change in the historical pattern of price volatility. Past experience suggests that doubling of lumber prices within a six month period would be a distinct possibility if housing starts rise above 1.5 million annual rate" (2).

An opinion of a West Coast industrial economist .. "It would not surprise us to see softwood lumber and plywood next year rise to all time highs" (1).

The Economy

The economic news is better--much better by some measure, a little bit better by most measures. The forecasts of 10 percent unemployment proved unfounded and by December, unemployment was down from its high of 9.2 percent to 7.8 percent. The stock market, long regarded as one of the best predictors of future economic activity, rebounded sharply, and recently has been flirting with the 1000 level of the Dow Jones Industrial Index--which isn't bad considering the all time high is about 1050. A recent survey of consumer confidence levels indicated a dramatic increase, with consumer confidence higher in January than at any

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1/ I am grateful to Dr. H. Dudley Dewhirst, Associate Professor of Industrial Management, College of Business, University of Tennessee, for many of the ideas and work presented in this section.
time since October of 1973. Inflation has slowed. The most recent data indicate that the cost of living rose 6.8 percent from January of 1975 to January of 1976, and the January increase was only 4.8 percent on an annual basis. That's still too high, but it is a dramatic improvement over the 9 and 10 percent rates of a year or two ago.

Construction spending was up again in December, and although the increase from November to December was a modest one; construction spending is nearly up to the previous peak level of mid-1974.

Let's take a look at this recession and the recovery up to now, to see what happened and to set the stage for a forecast of the future. First, we'll look at Gross National Product—which is the total value of all goods and services produced by the country. Figure 4 shows two plottings of the GNP. The line with the steeper slope is the GNP in current dollars (thus including inflation); the flatter line is GNP corrected for inflation—a better measure of real economic activity. A recession, in practical terms, is said to start at the previous peak in real GNP—and end at the lowest point. The peak occurred in November of 1973 and the bottom occurred in March of last year. The recession lasted 16 months—the longest since World War II. It was the most severe since the "great depression" and roughly 50 percent deeper than its closest post war competition, the recession of 57-58 (which lasted 11 months). Fortunately, history indicates that expansions last longer than depressions. Of the six expansions since World War II, all but one lasted more than three years and the longest ran over eight years.

Figure 5 shows the percentage of disposable income spent on durables—things like furniture, cars and appliances. In early 1973, this percentage reached a peak of 15.9 percent, and then started to decline. It rose briefly in early 1974, but then dropped below 13 percent for the first time in five years. Since that time it has recovered somewhat, but certainly not to the level of the late 50's and early 70's.

Housing. Figure 6 shows housing starts, and the shape of that curve is remarkably like the one for durable goods. Housing had its worst year since 1946, with total starts at 1.16 million units.
FIGURE 4
GROSS NATIONAL PRODUCT
ANNUAL 1968-1972; SEASONALLY ADJUSTED
ANNUAL RATES BY QUARTER, 1973-1975

SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis, Commerce News,
FIGURE 5

PERSONAL CONSUMPTION EXPENDITURES FOR DURABLE GOODS EXPRESSED AS PERCENT OF DISPOSABLE PERSONAL INCOME

FIGURE 6

NEW PRIVATE HOUSING STARTS

ANNUAL 1968-1972; SEASONALLY ADJUSTED
ANNUAL RATE, 1973-1975

MILLIONS OF HOUSING STARTS


Figure 7 shows sales and inventory levels for furniture and home furnishings.

Roughly speaking, about half of this combination classification is furniture and the other half represents appliances. These numbers have had the inflation factor removed. The figure shows that the recession in furniture and household equipment came later than did the general recession. Actually, sales held up fairly well until the last half of 1974; but when the recession came, it came more sharply.

The Future. Frankly, economists are somewhat puzzled about what the economy will do over the next several years. The recovery, although it has not been spectacular, came more quickly and was sharper than most economists expected. However, there are some problems of a fundamental nature. Inflation of roughly 6 percent a year is forecast for the next several years. With inflation at that level, while it's a vast improvement over the recent past, most economists feel that interest rates will not decline from current levels—such a decline would greatly increase the chances of a real boom.

One way to predict future economic trends is to use what are called leading indicators. These consist of 11 statistics such as stock prices, building permits, the length of the average work week, and others which in the past have been shown to move up and down ahead of business activity. Well, the composite index of leading indicators turned up sharply in early 1975, but for the last six months they have been relatively flat.

So there are both pluses and minuses. Obviously, the economy is fundamentally more sound today than it was a year ago and yet the recovery clearly isn't a boom and probably won't become one.

Figure 8 shows their forecast of GNP and Personal Consumption Expenditures for 1976 and 1977. What these data indicate is a real growth in economic activity and in personal consumption expenditures of about 6 percent in 1976 and 4 percent in 1977. The primary reason for the higher rate in 1976 is that this is an election year, and folks who want to be reelected tend to spend more and tax less. Inventories have been reduced and need replenishing. Consumers are beginning to go into debt.
FIGURE 7

DEFLATED SALES AND INVENTORIES OF FURNITURE AND HOMEFURNISHINGS,
ANNUAL 1968-1972; QUARTERLY 1973-1975

SALES OF FURNITURE AND HOMEFURNISHINGS STORES
(Deflated by the Consumer Price Index for Household Durables)

END-OF-PERIOD INVENTORIES OF FURNITURE,
HOMEFURNISHINGS AND EQUIPMENT STORES
(Deflated by the Wholesale Price Index for Household Furniture)

FIGURE 8

REAL GROSS NATIONAL PRODUCT AND CONSUMER SPENDING 1975 (Commerce Dept. Estimates) AND FORECASTS FOR 1976 AND 1977 (From the Wharton Model)

GROSS NATIONAL PRODUCT IN 1972 DOLLARS

PERSONAL CONSUMPTION EXPENDITURES IN 1972 DOLLARS

again after a period of above average savings and a general reluctance to spend. All these factors give the economy a short-term shot in the arm which won't be repeated in 1977. Further, the forecast calls for interest rates to remain at recent, fairly low, levels (6.5 to 7 percent prime rate) through 1976. The forecast calls for a prime rate of 8 percent during 1977, however.

In Figure 9 you see the forecast for housing starts and personal income expenditures for furniture and household equipment. The housing recovery looks impressive, indicating a rate of 2.0 million starts per year in the second and third quarters of 1977. While the recovery looks good, one should remember that housing starts exceeded the 2.0 million rate in the years 1971, 1972, and 1973. Obviously, there is a pent-up demand for housing, but the key question is not, "Do people want a new house?"--it is rather, "Can they pay for it?" In spite of all the cost increases in building materials in recent years, the largest cost of a new home is interest cost. If interest rates can be held down, people will buy houses and eventually fill them up with furniture. If not, people will buy smaller homes, live in mobile homes or apartments— and eventually buy less furniture.

Summary. In the South forest product prices are normally associated with timber products and are generally market-determined prices. Thus, forest product prices are very much affected by the business cycle and hence the last recession. Improvement in the demand for housing and furniture will be quickly translated back to forest products and forest resource prices.

In comparison to other industries, forest product firms are less concentrated and highly competitive. These firms are more often price takers rather than price leaders. Concentration in resource ownership by forest industry in the South is limited on a regional basis and its primary purpose is to safeguard the acquisition of raw material. Price stability in real roundwood prices is associated with supply increasing technology that has allowed the substitution of lower priced raw materials, rather than with administered prices.

Given the general improvement in the economy, a trend is again underway for increased prices. The question seems to be "How high will they go this time?"
FIGURE 9

NEW PRIVATE HOUSING STARTS AND REAL CONSUMER SPENDING FOR FURNITURE AND HOUSEHOLD EQUIPMENT, 1975 (Commerce Dept. Estimates) AND FORECASTS FOR 1976 AND 1977 (From the Wharton Model)

PERSONAL CONSUMPTION EXPENDITURES FOR FURNITURE AND HOUSEHOLD EQUIPMENT IN 1972 DOLLARS (Left Scale)

NEW PRIVATE HOUSING STARTS (Right Scale)

LITERATURE CITED


BREAK-EVEN PAYOFF LIFE AND TIME VALUE

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Today all industry is faced by the needs for greater productivity, pieces per man-hour. At the same time costs for investment capital are high, whether company funds or bank credit line. Improved productivity usually requires additional investment in capital equipment, and therein arises the conflict of opposing needs for money and for equipment.

Therefore, the field or plant manager and his chief engineer are subject to increasing requirements for cost justification and/or optimization techniques when new capital funds are necessary. These needs have acted as the stimulus for management engineering optimization techniques in the forestry industry. Such applications have included use of linear programming in transportation analysis, queueing theory in mill operations, and re-assessment of the economic statistics of difficult logging sites. All of these operations research techniques have at times proved useful to the forestry industry.

Nevertheless, behind these and other techniques is the absolute requirement of a proven cost justification of investment capital. The common experience is that the company "financial books make" the final cost decisions. This is partly true because of two considerations: (1) the availability of capital or a credit line of borrowing, and (2) the many alternative uses for any available funds.
Because of the above, engineering economic break-even studies are made to support the justification of a project. There are a number of such approaches including advanced techniques. This paper, however, will limit itself to a correct theory structure, but arranged in a practicably structured form. It can be used then to demonstrate project feasibility in the clearest terms of visible presentation to management. The technique is the oft-overlooked one of Payoff Life Break-Even.

Why this approach for management presentation? It is because it includes both the parameters of the company's cost of capital and the project's predicted savings versus costs. It naturally presents a picture of the costs which reflects the rate of new technology changes in processes, energy, and material (also labor costs) for assistance in the final step of intangible considerations in decision-making.

It is this last area which is of concern to decision-making with regard to the intangibles. The semantic difference between "obsolete" and "obsolescence" has to be considered. Competitive changes and developments in technology frequently make equipment economically uncompetitive, obsolescence, far earlier than its physical life, obsolete. The problem, then, is to consider different alternatives with regard to this factor. In other words, that equipment alternative which will pay for itself in a short duration is the better, though the second alternative is equally competitive in other regards. This is especially true today when cost factors of an external nature are getting more out of control or less predictable.

What about the rising costs of capital? First, the high-school fallacy of break-even needs to be demonstrated. The high school version, incorrect, is usually like this:

\[ N \text{ years} = \frac{\$ \text{ Investment}}{\$ \text{ Net Savings/Year}} = \frac{1000}{100/\text{yr}} = 10 \text{ yrs.} \]

Propose any project and the boss asks "How long will it take to pay off?" Unfortunately, he frequently gets an answer as just calculated. Obviously, it is wrong because the (particular)
A Company Investment Versus Annual Savings Cash Flow Graph.
company's cost of capital is ignored as a parameter. The best way to demonstrate this fallacy is to consider a bank which lent $1000 for ten end-of-year payments of $100. Obviously, their interest (rate of return on capital) would be 0.0%. However, the advantages for the consideration of obsolescence are evident here.

The key parameter overlooked is the company's cost of capital (internal or external) --- time value of money, or equivalency, as used in an engineering-economic text's tables. When using this value do not compound the error by using local bank rates. Use your own company's rate of return for, say, the last fiscal year.

With just these fundamental conditions in mind an example of a chipper might be used for demonstration. Assume that a small, manual, logging outfit is considering the purchase of a chipper with a capital investment cost of, say, $100,000. Given expected annual receipts of $50,000/year and annual operating disbursements for labor, maintenance and fuel of $20,000/year (N.B. absolutely no depreciation costs are included), then the net annual savings (R-D) are $30,000/year. This is like Figure 10. Assume that the obsolete physical life is 15 years.

By fallacious high-school techniques the break-even payoff life is $100,000/30,000 = 3 1/3 years. This is "correct" if the company desires to make a 0.0% equivalent annual return on its capital investment of $100,000.

Now a reference can be made to Figure 11 graph. It is in a form useful to management (N.B. in this example the graph is based on equivalent annual rate of return before federal taxes). This graph has the advantage of being read from either axis. (See Figure 11.) If obsolescence is a key factor in some process equipment then read the abscissa of a reasonable, competitive life, intersect at your company's rate of return, and the ordinate value will tell you how much has to be saved net/year. On the other hand, if the uniform net annual savings are known, then intersect at your company's rate of return, to determine the number of years to break-even payoff life. If intangible considerations of technology change are less than the life indicated, the proposal could be rejected.
$A = R - D$
as uniform net annual savings over varying $n$ and for specified $P$.

N. B. Graph applies to data in given paper's problem.
As an overall guide, a before-federal-tax rate of return is likely to be 15% to 30%, and not typical savings bank rates. Roughly, one-half of this value for an after tax rate of return.

The basic values necessary to compute a point on this graph are:

\[ P = \text{capital investment} \]

\[ n = \text{years} \]

\[ i\%/\text{year} - \text{rate of return of your company} \]

\[ (A = R - D = \text{Uniform savings over costs taken end-of-year (No depreciation costs)}) \]

and the use of the capital recovery factor-uniform series from a text like Grant and Ireson, *Principles of Engineering Economy*, Ronald Press. The approach shown is relevant to a graph for a problem only like Figure 10.

For example, for a given problem where \( i = 20\% \), \( P = 100,000 \), with a 5 year payoff life specified as desirable, find necessary \( A/\text{year} \). Then

\[ A = P \left( \text{CRFUS, } i = 20, n = 5 \right) = P \left( \frac{(1 + i)^n}{(1 + i)^{n-1}} \right) \]

\[ A = 100,000 \left( 0.33438 \text{ directly from table} \right) \]

\[ A = $33,438/\text{year}. \]

In straightforward talk, this says that if the savings are $33,438/year for 5 years, then it would pay for itself and make an equivalent 20%/year return on investment for your company.

This is the easiest way to construct the graph whether \( n \) or \( A \) is given. (For a problem like Figure 10 , the \( A \) and \( P \) parameters can be multiplied by the same multiplier, if so, the Figure 11 graph is so constructed that the same graph can be used later by you).

A little more computation is required when the graph is not uniform like Figure 10. For example, the net savings might decline; a major overhaul might be required every two years; and a salvage value might exist. Figure 12 demonstrates this.

See Figure 12.
A Simplified Analysis Reflecting Periodic Costs.
In this case by reference to other time value factors in the suggested text a more lengthy equation would be necessary. For the above example:

\[ S_0 = - P - \text{Overhaul (present worth factor, single payment, } n = 2) \]

\[ + \text{Salvage (present worth factor, single payment, } n = 4) \]

\[ + \text{Net Savings } (\xi_{1\text{present worth factor, single payments}}) \]

The \( i \% \) is homogeneous throughout, so by systematic trials of \( i \% \) for different \( n \) years of life, respectively, appropriate points can be plotted for a given \( P \). Of course in this case, the ordinate intercept would not reflect an uniform annual savings.

However, it might be more direct to simply calculate the rate of return value per each successive \( n \)-life graph for respective comparison to the company's rate of return. A management form of presentation could be like Figure 13.

See Figure 13.

Some final notes of advice are pertinent:

(1) Use your company's rate of return!

(2) Regardless of how financed, the physical design's rate of return should be used first to measure the competitive efficiency of the engineering design (Figure 14 portrays this principle). After obtaining this value, it is the correct rate of return on equity capital, or, the bank credit line rate can be subtracted to establish the company's return on the equipment investment after credit costs.

(3) Work closely in consultation with your industrial engineer for after federal tax rate of return. The same type presentation graphs can be used, but the added computations are more complicated as tax laws like investment tax credit, etc., have to be considered in the calculation of a project's rate of return.
A Management Form of Presentation for a More Complete Break-even Investment Analysis.
Fig. 14

A simple machine:

\[
\text{Eff} = \frac{\text{Output}}{\text{Input}} \leq 100\%
\]

But the overall efficiency of a full-scale engineering design and management is:

\[
\text{Eff} = \frac{\$\text{Output}}{\$\text{Input}} \geq 100\% \text{ (hopefully)}
\]

where \( \text{Eff} = \% \text{ Rate of Return on capital investment} \)

Measure the Competitive Efficiency of the Engineering Designs First.
In summary, the typical payoff life, or years to break-even, calculation is completely erroneous. The parameter of rate of return must be incorporated lest a project "breaks-even" at a zero return on investment. It is the inclusion of this rate of return value which is the primary objective of this paper.
TIME STUDY METHODS IN FORESTRY

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For more than 60 years, forest economists have used time studies to determine the costs of logging, milling, and other forestry operations in the South. The time study concept was originated in 1881 by Frederick W. Taylor, an engineer. Taylor used time study to set work standards in applying principles of scientific management, which he developed with Frank B. Gilbreth, who was primarily interested in motion study. Later, the two methods these men devised were used jointly by engineers to find faster ways of completing jobs. The combined term—time and motion study—refers to the orderly analysis of work systems.

Of the two main components of time and motion study—work measurement and methods design—forest economists have adopted time study almost exclusively. This paper describes several time study techniques and discusses their application to cost determination for managerial decision making. These simple but effective methods can be applied by practicing foresters.

Cost Measurements

Many problems managers face can be resolved on the basis of costs. Fewer managerial problems involved costs in the past, when the main task of forest management was fire protection; labor was cheap and abundant; timber was plentiful; stumpage was inexpensive; and most logging operations and mills were managed with a minimum of capital investment. Today, a greater knowledge of costs is required because of intensive
forest management, highly mechanized logging, and heavily capitalized mills.

Managers are using time study to solve problems involving both cost control and cost forecasting. Some time study techniques are useful in reducing costs by measuring the proportion of downtime, which results in costs whenever work might have been performed during the time lost. There are additional costs when the downtime of one machine idles others dependent on its output and when costly emergency repairs are necessary.

Time study methods are also useful for forecasting production costs, a necessary prerequisite for decision making. Cost forecasting requires a knowledge of the relationship between costs and its determinants. For example, a manager might have to choose from among several harvesters the model best suited to his typical logging conditions, or he might need to decide under what conditions he can profitably operate his present harvester. There are several time study techniques available. Each manager should choose the one best suited to his problems.

Continuous Timing and Work Sampling

Managerial control of downtime to improve efficiency requires a knowledge of the work patterns of men and machines, information obtained by observing work and nonwork activities during production. Two techniques for collecting this type of data are continuous timing and work sampling. In continuous timing, an observer uses a stop watch to determine how much time is spent on productive and nonproductive work. For example, an observer timing the operation of a headsaw records the time when a change occurs from sawing to a nonproductive activity, such as a breakdown or delay, and the time of the change back to sawing. The proportion of downtime is then easily calculated from the record.

Continuous timing is costly because it requires the constant presence of a skilled observer. Furthermore, the observer's presence may annoy the workmen, who might deliberately invalidate the data by altering their normal work patterns while being timed. For these reasons, work sampling is often used instead of continuous timing. In work sampling—also called the ratio-delay method—neither men nor machines are timed directly; rather, their work and nonwork activities are noted at random intervals
during a shift or a longer period. The percentage of time spent on nonproductive activities can then be calculated from the tally.

Gross and Detailed Time Studies

To forecast production costs, economists employ either gross or detailed time studies. Gross time studies measure either the production of a machine or work system during a given period such as a shift, or they may measure the time needed to complete work on plots of a given size. For example, the gross time study technique was used in comparing the number of man-hours required to produce a cord of pulpwood by various harvesting systems. In the study, plots of equal volumes were set up; felling, limbing, and bucking on each plot were then timed as a single work activity, and stand factors such as the number of trees cut were found for each plot. Finally, the relationship between the rate of output and factors thought to affect it was tested for significance.

The cost of collecting gross time study data is low because little manpower is needed, and the timing need not be precise. However, a lengthy period is required to accumulate a sufficient number of observations; the estimates are only approximate; and it is never known whether the results apply under conditions other than those investigated. Hence, gross time studies are most helpful in showing where detailed studies are needed.

Detailed time studies are costlier than gross time studies, but a detailed study provides data for production equations. In making a detailed time study, the individual elements in a production system are timed independently. Elements timed might be the headsaw in a sawmill, a feller-buncher or skidder in a logging operation, or a lathe in a plywood plant. For an element to be timed, a unit of observation must be selected. In harvesting, for example, the unit might be the work cycle from felling one tree to felling the next. The output during the work cycle is also measured, and operating conditions thought to influence the rate of production are selected. When studying the productivity of a feller-buncher, for example, tree diameter and height, soil conditions, and topography are among the stand conditions considered. Least square regression methods are then used to obtain an equation giving production per unit of time as a function of
operating conditions. This equation can be applied to forecast productivity for any set of conditions within the range of the data. The production equation is combined with economic and financial data to develop a cost equation that can be used in forecasting costs to facilitate managerial decisions. After each element in a work system is timed separately, the resulting equations can be combined into a set to forecast total production costs for the entire system.

Conclusion

Although time study is uncomplicated, it can be expensive. Some techniques incur greater outlays than others, and some are more disruptive to production. For these reasons each manager intending to make a time study should carefully define his problem to determine the information needed and to select the most appropriate time study method. If problems are approached in this manner, practicing foresters—whether they be forest, logging, or mill managers—will find time study a valuable aid in cost control and decision making.
DISCUSSION

Question: Is there more likely to be damage to the site with higher speed machines than slower operations? (S. T. Lowry)

Answer: It is a cost that is not going to be a spin-off from the system itself. The measurement of this cost, however, would not be a kind of measurement you could get with time study information. This is a cost that would have to be introduced into your analysis more or less separately from the time study side. Time study, in general, simply gives you a basis for measuring rates of output over a given period of time. This information can then be converted to cost.

Faster isn't always better, and time study makes no value judgments in this respect. I think that the decision is going to have to come from outside. Other factors should be considered. For example, there is not only the cost of damage done to the stand but also the problem of operator fatigue and other social or psychology factors.
I imagine that most of the papers that have been presented on taxation have somehow referred to the inevitability of taxes and death. Why should I be an exception? Some of you may have seen the recent Wizard of Id comic strip in which the king declared this inevitability. One of the peasants proudly says, "Sire, last year I didn't pay my taxes." In the next frame a huge guard appears as the king is saying, "Take him away and put him to death." This is a matter to reflect on since this is April 15.

The inevitability of taxation arises from the theory that the existence of government is a necessity; that government cannot continue without means to pay its expenses; and that this gives government the right to compel all citizens and property within its limits to contribute. The property tax is one of hundreds of taxes levied in the United States, but traditionally it has been used to finance local governments. Ad valorem is the term usually used to describe the property tax and simply means "according to the value". Various indirect taxes such as general sales, gasoline taxes, and fees are also sources of local revenue, but they are generally earmarked for special purposes as are revenues from excise or privilege taxes and licenses.

Most of us do accept the inevitability of taxation - what we don't accept is the inevitability of its allocation. And that's really what I am discussing today - a way that's been used to change the rules so that the tax burden that is allocated...
to forestlands is reduced. I'm going to talk about a method of achieving this reduction that's known as the use valuation concept. A prerequisite to the understanding of this concept is an understanding of the way that ad valorem taxation works.

Two steps are involved in the determination of the amount of ad valorem tax. The first is the appraisal or assessment of the value of the property, and the second is the application of the millage or overall tax rate to the assessed value.

Assessments for ad valorem tax purposes have traditionally been based on fair market value or a percentage of that value. Fair market value is the price that would be arrived at between a willing buyer and a willing seller, neither of whom is under any compulsion, acting with full knowledge of all the uses to which the property is adaptable and needed or is likely to be needed in the future.

The fair market value of a property is based on its highest and best use or "That use of land which may reasonably be expected to produce the greatest net return to land over a given period of time. That legal use which will yield to land the highest present value." 1

Real estate appraisers have traditionally used three different approaches in estimating the fair market value of a property. These are:

**Market Data** - A process of comparing prices paid for similar properties, concerned with the principle of substitution which holds that typical buyers will not purchase a property at a higher price than the prices of similar properties having comparable capabilities.

**Cost** - (Sometimes known as "depreciated replacement cost" or "depreciated reproduction cost" or the "sound value"), this approach is based on the doctrine that the value of any commodity under competitive conditions tends in the long run to equal costs of production. (Thus, the cost of the land improved is added to the depreciated reproduction cost of the improvement to obtain the unified value of the two elements together.)

1 Appraisal Handbook.
**Income** - An appraisal technique in which the anticipated net income is processed to indicate the capital amount of the investment which produces the net income.

In many jurisdictions the assessing officer is required to use the market data approach in arriving at the value to be used for assessment. Implicit in this approach is a value based on highest and best use.

Procedures vary in the determination of the actual tax, once value is reached. Some states require the application of a uniform percentage to the fair market value to determine the assessed value. The millage rate to be applied to the assessed value may be fixed by law or an open-ended situation may exist. The assessing officer may sum up his appraisals of all taxable property in the county or other local taxing unit and determine the millage rate by the percentage that his budget is of the assessed value of all the taxable properties in the county.

A large proportion of our forestland actually has other higher and better uses. Appraising such land on the basis of those higher and better uses may result in a tax that is greater than the income from the land and may speed up its conversion to another use. Conversion of timberland to a non-agricultural use results in the frustration of two public policies.

1. To have continued timber production.
2. To retain open space.

In short, we have a reluctance to kill the goose that lays the golden jobs and we are repelled by a landscape filled with motels, shopping centers, fast food outlets, tax return preparers, and cheap (or expensive) subdivisions.

The assessment procedure with respect to timberland presents two problems, one concerned with the nature of timber and one with the nature of the land itself. Timber is a crop that requires many years to attain maturity, hence the taxing of the market value of the trees each year results in the taxing of each prior year's growth back to the origin of the stand. (For example, a plantation grown for 30 years will have had the first year's growth taxed 29 times, the second year's growth taxed 28 times, etc., at the time of liquidation.) This favors shorter rotations because of
the penalty involved in growing trees to maturity and also forces conversion of timberland to more lucrative uses.

Many authorities concur that the ad valorem tax treatment of the timber crop should be identical to that of other crops. One of the earliest was a New England governor who more than 150 years ago wrote to his legislature:

Timber and woodland may ... be considered as capital of which the interest and profits are deferred for periods of from 20 to 100 years. If taxed annually, the rates ought to have reference to the remote periods at which the income will be received; it being certain that an excess taxation would accelerate the destruction of timber and wood and occasion ruinous mischief.

A number of states have recognized that the "open space" furnished by forest lands must be retained. The case for preservation has been well stated in the preambles to the "open space" laws of California, Connecticut, and Maryland. The following statements were paraphrased from these laws for specific application to forest lands:

(1)...The preservation of a maximum amount of the limited supply of productive forest land is necessary for the conservation of our economic resources and is necessary for the maintenance of the economy of our state...

(2)...The discouragement of premature and unnecessary conversion of productive forest land to urban uses is a matter of public interest and will be of benefit to urban dwellers themselves in that it will discourage discontiguous urban development patterns which unnecessarily increase the costs of community services to community residents.

(3)...In a rapidly urbanizing society, forest lands have a definite public value as open space, and the preservation in forest production of such lands...constitutes an important physical, social, aesthetic, and economic asset to metropolitan areas...
(4)...The preservation of forest lands is a prerequisite to the following public objectives:

A. The maintenance and enhancement of natural resources including those primarily valuable for aesthetic purposes.

B. The protection of natural streams, water bodies, or water supply.

C. The promotion of soil conservation through the maintenance of reserve crop and pasture areas and watershed protection.

D. The protection of potential park sites.

E. The enhancement of previously publicly dedicated parks, forests, wildlife preserves, natural areas, or other open spaces.

F. The preservation of hunting and fishing areas.

G. The preservation of other outdoor recreational opportunities.

(5)...For these reasons it is in the public interest to retard or perhaps eliminate the conversion of forest lands to non-open space uses as a result of economic pressures caused by their assessment for ad valorem tax purposes or values inconsistent with their economic values as forest land.

Taxation preference may be granted in the rate that is applied to the market value to produce the assessed value or it may be granted by using some value other than fair market value for the assessed value. Classification is an example of the first method. Under this system a different percentage of market value is applied to the several classes of property. The basis for the classification philosophy arises from the use of the ad valorem tax to support such local activities as police protection, schools, and hospitals. This philosophy recognizes the ad valorem tax as essentially a payment for services rendered or services to be rendered. The tax is allocated in the proportion that services are required. Forest lands produce no children that have to be schooled, patients for hospitals, or even anyone to read the books.
in the libraries. Neither the 14th amendment to the Federal Constitution nor the equality and uniformity requirements of the state constitutions prohibit state legislatures from making reasonable and natural classifications for the purpose of taxation. State constitutional provisions requiring taxation to be "uniform upon the same class of subjects" have been construed by the U. S. Supreme Court as expressly recognizing the existence of the power to classify in matters of taxation.\(^2\) Relative abilities to bear the burden of a tax have also been recognized as reasonable grounds on which to base classification in tax measures.

Minnesota was one of the earlier states to use classification of lands for ad valorem tax purposes and amended its constitution in 1906, striking out the uniformity clause and substituting the words, "Taxes shall be uniform upon the same classes of subject".

There are 16 classes of property and the classifications applied to them run from 5 to 50 percent of their market values. The owners of the 50 percent property are thus paying 10 times as much tax on the same value as the owners of the 5 percent property.

Use valuation, the second method of granting ad valorem tax preference, permits basing the assessment on other than the highest and best use, by assuming a specified use, such as growing timber. A use resulting in benefits to the public is the basic qualification for a preferential assessment. Use valuation assessment usually requires a penalty if the use is changed by the landowner within a certain period of years—referred to as the roll back. This tends to discourage speculators from claiming use valuation assessments for properties which have been expressly purchased to hold for development for a higher and better use.

(It has been suggested that the market data approach to value might still be applied by using only sales in which the anticipated use of the land is for continued timber production. This idea is highly theoretical as land is not sold on the basis of a single use.)

\(^2\) Texas Co. v. Brown 258 U. S. 466.
The reason that the use valuation concept necessitates a departure from the market data approach to some form of income approach is because the income approach does imply a single use. In the pure form the income approach arrives at a value by capitalizing a net income stream. This requires:

- The projection of revenues.
- The projection of costs.
- Obtaining the year-by-year difference between the two.
- Discounting net revenues.

This procedure has the advantage of relating the assessment directly to the financial return from the land. The disadvantage is that the assessor is burdened with determining the annual yield for each property, the costs incident to establishing and maintaining the stand, stumpage prices for various products and establishing a discount rate.

We can again cite Minnesota to provide an example of the use of the income approach. The modified rate law called the "Tree Growth Tax Law" was enacted in 1957 although it has been amended seven times.

The owner of 50 acres or more (suitable for planting, culture, & growth of continuous forest products) makes application to his county board for classification, simultaneously submitting a forest type map (9 different forest types are recognized).

The application and approval by the county board constitutes a covenant running with the land. The timberland must be operated on a sustained yield basis and must be open to the public for hunting and fishing except during periods of high fire hazard and except within 1/4 mile of a permanent dwelling.

Land and timber are taxed each year at the rate of 30 percent of the value of estimated annual growth. Temporarily non-productive land is taxed at 5¢ per acre per year, provided owner reforests according to agreement. If there is non-compliance, the tax is 15¢ per acre. Permanently non-productive land is taxed at 5¢ per acre per year.

Owners of plantations (maintained fully stocked) may receive a credit of 50¢ per acre per year against taxes on other lands (credit may not exceed the taxes) up to 10 years after planting.
Average annual growth rates are determined by the county board at 10-year intervals from information from the Minnesota Division of Lands & Forestry and the North Central Forest Experiment Station. Stumpage values for each species are based on average sale prices received by the state at 2 year intervals.

If the property is declassified, payment for back taxes is required and penalties are on the basis of ad valorem taxes effective in the area (with credit for taxes paid). After the agreement has been in effect more than 10 years, assessment is for only 10 years prior to the declassification upon expiration of the contract period.

Maine provides another example of how the income approach is used to arrive at an assessed value. In 1971 Maine repealed its 20 year exemption law in preparation for the "Tree Growth Tax Law" of 1972. The law is mandatory on parcels of 500 acres and up of forest land. Forest land is defined as land used primarily for growth of trees and forest products. Lodge, marsh, swamps, and water and other areas not suitable for growing a "forest type" are excluded even though they are located within the boundaries of the "forest land".

Owners of forest land desiring to bring it under the act must submit a schedule to the assessor identifying the land and listing by location the number of acres of each "forest type." The types are hardwood (75 percent of stand), softwood (75 percent of stand), and mixed wood (neither hardwoods nor softwoods comprise 75 percent of the stand but are in a combination of both). Steps in the determination of forest values are:

1. The average annual net wood production rate (the estimated average net usable amount of wood one acre is growing in one year) for each forest type in each county calculated from Federal and State timber growth surveys. Survey growth rates are reduced by 30 percent to reflect expected growth to be extracted on a sustained basis. The initial wood production rates are to be reviewed at 10 year intervals beginning with 1974.

2. The average stumpage values for each forest type for each county is to be determined at two year intervals.
3. The "value of the annual net wood production" for each forest type is capitalized at 10 percent to find the full valuation per acre for each forest type for each area. The revenues are the values of the annual survey growth rates by acres of forest type multiplied by the stumpage values. Costs are reflected in the 30 percent reduction. The discount rate is the 10 percent capitalization used to determine the full valuation per acre for each forest type for each acre.

The Florida application of the use valuation concept is described in its Property Manual that was approved by the Governor & Cabinet 1/11/72 and which is recommended for use by assessors, but is not mandatory. An annual growth increment is based on SI yield tables. Lands must be zoned as agricultural. The following is determined by assessors on a local basis:

1. Productivity of soil (expressed as SI or woodland suitability group).
2. Prevailing local stumpage prices.
3. Cost of site preparation and planting & annual recurring expenses.

Then the assessor establishes value tables for each site index found in the county for both planted and natural stands. In arriving at value the county property appraiser (the new name for the assessor)

1. Determines the yields that can be obtained from a properly managed timber operation for the various site indices within the county on a cord per acre per year basis (from yield tables * by # years in rotation).
2. Determines expenses associated with yields on a properly managed operation excluding property taxes.
3. Determines land improvement costs necessary to put land in various states of improvement.
4. Determines local stumpage prices.
5. Multiplies yield for each SI by appropriate stumpage price & subtracts appropriate expenses to give a net income per acre per year.
6. Capitalizes these net incomes.

A 7 percent minimum capitalization rate is recommended for the net income capitalized annually. This spreads the property tax expense over the life of the tree. Woodland thus bears its share of the property tax base through the use of an accepted method of valuation consistent with statutory requirements.

Florida's Agricultural Zoning law known as the Greenbelt law requires that all lands within the county be zoned "agricultural" or "non-agricultural" annually by the assessor. A return must be filed by the taxpayer before March 1 of each year, stating that such lands were used for agricultural purposes. The taxpayer may be required to establish that such lands were actually used for a bona fide agricultural purpose.

Agricultural purposes include farming, pasture, grove, or forestry operation, according to the decision in Greenwood v. Oates. This opinion also contained the state supreme court's sanction of the Agricultural Zoning Law.

In a 1972 opinion by the First District Court of Appeals, the Judge held that property used in a bona fide forestry operation was entitled to an agricultural classification for tax assessment purposes, notwithstanding that plaintiff and a group of investors had purchased the property for the primary purpose of holding it for future real estate development.

According to the 1975 Timber Tax Journal:

26 states have modified assessment laws which include timberland - all based on land use (22 of these states have roll back provisions - penalty for change in land use).

3 states exempt standing timber as a crop.

1 state exempts young growth & seed trees (period not stated).

3 states exempt planted timber.

14 states exempt growing timber but require a yield tax at harvest in lieu of ad valorem taxes - (two of those are optional plans).

3 Greenwood v. Oates 251 So. 2nd 665.
4 Smith v. Parrish 262 So. 2nd 237.
Use Valuation Concept and Application in Ad Valorem Taxation

1 state exempts growing timber but substitutes severance tax for yield tax (has specified rates for products but is paid by the operator. One-half of the collections go into a Forestry Development Fund).

5 states have modified rate laws (flat per acre amount of tax) on timberlands.

In one state a special tax based on acreage is added to the ad valorem tax and is earmarked for forestry uses.

In several states the landowner has a choice between two or three ad valorem tax laws giving preferential treatment to timberlands. There are auxiliary forest tax laws, outdoor recreation, or park land laws which may carry a minimal tax, but these usually require that the lands be committed for a considerable length of time and open to the public for recreational use.

Alabama is one of the states that exempts timber from ad valorem taxes, and timberlands are assessed at 15 percent of fair market value. Residential property is assessed at 30 percent of fair market value. This difference in classification is an example of a recognition of the services demanded.

The Texas legislature has passed a bill providing that the value for ad valorem tax purposes of open-space land used to support the production of forest products shall be determined on the basis of the capability of the land to produce forest products using accepted income capitalization methods applied to the average net income. This bill does not become effective until a constitutional amendment is adopted. If this amendment is adopted in the November 1976 general election, the effective date of the law will be January 1, 1977.

A general election will be held in South Carolina to consider whether or not to adopt a classification system in that state.

Georgia's future use valuation ad valorem tax law is still in the proposal stage. This proposal is based on the measurement of the productive capacity of forest land by site index. The state is already divided into three major resource areas by USDA
Soil Conservation Service. The State Revenue Department assisted by a committee of assessors, appraisers, foresters, and soil scientists, is to periodically calculate a range of assessed values to be assigned to each site index class for each of the three resource areas. General market conditions and area locations would be considered in setting these values. These tables would be published and recommended for use by local assessors. Specific locational factors within the county which would influence the basic land value would be determined by the assessor within the published range of values for a specific site index.

For a good many years the forestry sector was a single voice crying out to prevent our timber growing capacity from being taxed out of existence. We may not truly have been crying out in the "Wilderness" but in many cases in lands that someone would like to designate as wilderness.

Then we were joined by the "quality of lifers" who wanted to preserve open-space. We are now being reinforced by the economists and urban planners who are recognizing the real cost of "sprawl". The February 2 issue of Business Week carried a thought-provoking article by Jack Patterson from whom I borrowed the following quotes:

"Spread consumes more energy. Suburban Suffolk County uses one-third more energy per capita than urban Queens County, part of New York City."

"A study by the Real Estate Research Corp. 'The Costs of Sprawl' shows that low density growth costs more to develop than concentrated growth. When a 70-acre office campus replaces a one-acre sky-scaper, suburban lands, much of it valuable farmland, is being squandered."

"William H. Whyte once hammered away against sprawl as being 'bad aesthetics, bad economics, bad for farmers, bad for communities, bad for industry---. ' Since he wrote that, sprawl has accelerated."

If you know anyone else who would like to add their voices, there are openings ranging from bass to soprano.
USE VALUATION CONCEPT AND APPLICATION

Sources:
(1) 1968 Timber Tax Journal
(2) 1974 Timber Tax Journal
(3) 1975 Timber Tax Journal
(4) Ad Valorem Taxation of Timber & Timberlands (Jan. 1975) - Draft
(6) The Productivity Concept in Forest Taxation by Williams & Canham from Forest Science (1972)
(7) The Florida Tax Manual
(8) American Jurisprudence (State & Local Taxation & Supplements)
(9) Proceedings of the 1975 Property Tax Forum, International Association of Assessing Officers
(10) The Assessment of Land Value
Daniel M. Holland
Proceedings of a Symposium Sponsored by the Committee on Taxation, Resources and Economic Development - 1969
The new Louisiana constitution provides for a new system of advalorem taxation. It states that bonafide agricultural, horticultural, marsh and timberland as defined by general law, shall be assessed for tax purposes at 10 percent of use value rather than at fair market value. The reason for inclusion of the term use value in the new constitution, or for that matter, the fact that the new constitution provides for a different system of assessing property in the state can be traced back to 1969. In that year, Mr. Victor Bussie, head of AFL-CIO, filed suit against the State of Louisiana charging that the system used by assessors in assessing property in Louisiana resulted in inequitable treatment to not only property owners, but all tax paying residents of the state. He proved that assessments ranged from a low of 7 percent of market value in Lafayette to a high of 35 percent in Caddo Parish. He argued that three basic inequitable situations resulted from this. First, the state at that time was leveeing a 5.75 mill statewide tax. Property owners in those parishes with high assessment ratios were paying more of the 5.75 mill tax than residents in those parishes with low assessment ratios. For example, property valued at $30,000 would contribute approximately $55 to the state property tax fund if located in Caddo, while it would contribute only $12 if located in Lafayette Parish.

The second inequity Mr. Bussie argued, involved state funds provided to parish school boards to assure a minimum educational program for each parish. Mr. Bussie pointed out that these
funds were dispersed on the basis of an equalization formula that took into consideration assessment levels and amount of local support produced from a 5 mill tax. Because of the wide disparities in assessment levels among parishes, the result was an inequitable distribution of funds from the state treasury. For example, if all parishes had assessed property at 20 percent of sales value in 1969, Caddo would have received an additional $375,000 in state grant education funds and Lafayette Parish would have received $191,000 less.

The third argument Mr. Bussie used was in regards to homestead exemptions. He pointed out that local government units were reimbursed from the state property tax relief fund for the taxes which they would otherwise have collected from the owners. With the disparity in the assessment ratios, less property in Caddo Parish would qualify for homestead exemption than property in Lafayette Parish. As a result, the local government in Lafayette Parish would receive more funds from the property tax relief fund than the local government in Caddo Parish.

Needless to say, Mr. Bussie won his suit and the judge ruled that all properties must be placed on the tax roles at 100 percent of fair market value as stipulated by the old constitution. Governor Edwards then stepped in and appealed to the judge to delay his ruling. He indicated that he would have the 5.75 statewide tax repealed, that he would change the method of supplementing parish school funds and that other supporting funds being contributed to local government would be set up on a revenue sharing plan. He also pointed out that the state was in the process of writing a new constitution. He assured the judge that the delegates would develop a system of assessing property that would be equitable to all property owners. On the basis of these assurances, the judge agreed to postpone his ruling to January 1, 1976. That ruling is still outstanding and I assume could be reinstated at the discretion of the judge.

The Louisiana Farm Bureau in cooperation with the Louisiana Forestry Association and other land holding organizations were able to persuade the delegates to the new constitution to consider and accept the use value concept as regards agricultural land and timberland. Immediately after passage of the new constitution the Louisiana Farm Bureau and the Louisiana Forestry
Association formed committees to hammer out a bill that would define the concept and detail the mechanism or methods that would be used to determine use value.

What I am going to present to you today is the result of those two committees efforts. I might point out that this proposed bill has not been considered by the legislature; in other words, at this point in time it is only a proposal.

The first task of the committee was to define eligibility for use value assessment. To be eligible the applicant's land must be at least 10 acres in size or have produced a gross annual income of at least $2,000 from agricultural, horticultural or timber production for each of the four preceding years or is under state or federal agency contract restricting its use for agricultural production. Second, it must meet one or more of the following additional requirements: (a) the land must have been devoted to one or more of the four designated uses for the four preceding years or (b) the land owner or operator must have received at least 50 percent of his annual income from agricultural, horticultural or timber production for each of the four preceding years or (c) the land owner must sign an application for use value classification certifying that for four years the land will be devoted to one or more of the designated uses.

To become eligible for use value assessment the bill specifies that the owner must (1) file an application with the assessor certifying that the property is eligible, (2) must apply every four years, (3) must notify the assessor within sixty days if the property loses eligibility and there will be penalty for false application and it will be equal to five times the difference between the tax under a market value assessment and the tax under a use value assessment.

The development of this part of the bill was relatively easy, but when the committee began to consider the assessment procedure the going began to get a little bit tough. The committee soon discovered that whatever was developed had to meet certain basic criteria. The bill had to be politically feasible. It had to have the support of all individuals involved and the bill had to be easy to administer. Assessors are elected officials and generally are not trained appraisers. Most have very small staffs and anything developed that would be complicated
most assuredly would not be administered correctly.

The bill had to have the mechanism to protect agricultural and timber interests. While assessors are using a classification system, it is not defined in the old constitution and is therefore not legally defensible. It was decided that if a classification system was to be used specific definitions that would stand up in a court of law had to be developed.

The next problem of the committee was to define use value. Economists define use value as that value determined on the basis of the productivity of the soil or putting it another way the ability of land to produce a sufficient quantity of produce to pay for itself. If you translate this definition to mathematics you come up with a formula used by most rural appraisers (Table 7). As most of you well know this formula simply discounts the sum of the future stream of income back to the present.

With this definition as a basis to start from the committee had to determine how do you:

1. Come up with an estimate for a net income for timber.
2. Determine what is an appropriate capitalization rate.

To determine net income for timber it was decided to use the annual growth figures reported by the U. S. Forest Service for Louisiana and multiply this times the value figure obtained by determining a weighted average value from the severance data reported by the Louisiana Tax Commission. From this would be subtracted management costs to give net income. All of this would be based on four-year averages as the constitution requires a reassessment every four years.

The next decision to make was what do you determine net income for; i.e., pine, hardwoods, cypress, etc., and how do you account for differences in productivity levels? Here is where the committee found that some political reality had to be built into the bill. When the average annual income was determined for hardwoods it was kind of a shock (Table 8). It would have meant on the basis of the capitalization rate the committee determined that hardwoods would go on the assessment rolls at a $1.40 per acre. Everyone on the committee knew that a figure this low would not be politically acceptable. After much discussion by both the Farm Bureau Committee and the Forestry Association it was decided
TABLE 7

Determination of Use Value

\[ V = \frac{a}{r} \]

Where

\[ V = \text{base value} \]
\[ a = \text{net income} \]
\[ r = \text{capitalization rate} \]
TABLE 8

AVERAGE ANNUAL INCOME - HARDWOODS
1970-73

Total dollar value \[ \frac{29,725,207}{\text{Cubic feet severed}} = \frac{480,246,033}{\text{}} \]

$.061896 value per cubic foot

Average annual growth - 26 cubic feet x .061896 =

$1.61 net income per acre
to go with a classification system that would not delineate between pine and hardwoods (Table 9). There would simply be a Class I in which all timberland capable of producing more than 85 cubic feet per acre would be classified and Class II in which all timberland producing less than 85 cubic feet per acre would be classified.

Using this kind of classification effectively blends in a sufficient amount of less productive pine land with hardwood to bring up the low hardwood net income. Our calculations, again using four-year averages, show a net income for Class I of $9.63 per acre and Class II $7.41 per acre.

Now that the committee had a net income figure or method of determining net income, the next step in the process was to determine the capitalization rate. There are three recognized methods for determining this rate. These are the band of investment method, the summation method, and the Society of Rural Appraisers method. For the proposed bill the committee selected the factors used by the Society of Rural Appraisers. A rough calculation using these factors indicate a capitalization rate of about 11.5 percent.

With a method of determining average net income for each class and a capitalization rate, the committee was then able to determine the use value for each classification. This was accomplished by dividing net income by the capitalization rate and multiplying the results by 10 percent. The use value for Class I properties, based on the calculations just presented, is $83.74 and the assessed value would be $8.37 per acre. For Class II the use value is $64.43 and the assessed value would be $6.44 per acre.

The next step was to address the problem of administration or how assessors with small staffs and in many cases inadequate training could handle this procedure? To solve this problem the committee came up with a concept of the Use Value Advisory Board to the Tax Commission. This board would consist of (1) the Commissioner of Agriculture, (2) the President of the Louisiana Farm Bureau Federation, (3) the President of the Louisiana Assessors Association, (4) the President of the Louisiana Forestry Association and (5) the Chancellor for the Center of Agricultural Sciences and Rural Development at LSU. This board each four years would do the
# TABLE 9

## AVERAGE ANNUAL INCOME BY CLASS

1970-73

<table>
<thead>
<tr>
<th>Class</th>
<th>Annual Growth (cu. ft.)</th>
<th>Value Per Cu. Ft.</th>
<th>Gross Income</th>
<th>Less Cost</th>
<th>Net Income Per Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>73.9</td>
<td>$.1472</td>
<td>$10.88</td>
<td>$1.25</td>
<td>$9.63</td>
</tr>
<tr>
<td>II</td>
<td>50.3</td>
<td>$.1472</td>
<td>$7.41</td>
<td>N.A.</td>
<td>$7.41</td>
</tr>
</tbody>
</table>
following: prepare and publish in a handbook essentially all of the tables I have just presented. The advisory board would also have the duty of revising this information at four-year intervals.

Very briefly to cover open land agriculture, the bill provides four basic classifications with an upper and lower subclassification. The classifications are based on the first four classifications of the Soil Conservation Service. The same formula used for timber will be used for open land to determine use value. Net income will be determined by taking into consideration all the major crop and livestock enterprises produced in the state. The same capitalization rate used for timber will be used for open land. Our calculations using four-year input costs and output prices indicate assessed values for open land would range from a high of about $38 per acre to a low of about $12 per acre.

Gentlemen, what I have just presented is essentially what is in the proposed bill developed by the Louisiana Farm Bureau Federation and the Louisiana Forestry Association. The basic calculations indicating what we think would be the impact if this bill was enacted are relatively rough, but I believe well within the ball park.
Question: What happens to the Louisiana severance tax? (Leon Hargreaves)

Answer: We still have severance tax in Louisiana. If this legislation passes, Louisiana will have a use value assessment in addition to severance tax.
TIMBER AND FEDERAL INCOME TAXES—STATUS OF CAPITAL GAINS LAW

William K. Condrell
Forest Industries Committee on Timber Valuation and Taxation
Washington, D. C.

Standing timber is a capital asset and, as such, is eligible for capital gains tax treatment when sold. This has been the case for as long as the U. S. has had a capital gains tax system.

But timber transactions differ somewhat from other capital transactions, and for that reason—which is discussed later in this article—provisions have been incorporated into the Internal Revenue Code to meet those special requirements.

For a perspective on the capital gains tax as it applies to timber, let's compare it briefly with a more typical form of capital investment—not because it is directly comparable to the capital gains taxation of timber but because it illustrates the capital gains tax in a more widely understood application.

When a taxpayer buys an apartment house, he has also acquired a capital asset. The purchase price is the "tax basis" upon which future capital gain or loss will be determined. If the owner adds a new wing to the building, the cost of that construction is added to the capital account and increases the tax basis. The owner's operating expenses, such as painting and other maintenance costs, janitorial services, property taxes, depreciation, mortgage interest payments, etc. are all deductible each year from income derived from the apartment house, or from some other source of ordinary income.

If the property is sold a few years later, the seller is taxed at the capital gain rate on the difference between the "tax basis" (original cost plus any ensuing capital improvement in the property) and the selling price.

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1/ This was not the paper delivered at the Symposium; however, the author felt that the subject matter was better covered in this article he prepared for publication in the Journal of Forestry.
The justification for the lower capital gains tax rate on the sale of the apartment house rests, among other factors, on three assumptions:

(1) that the investor sacrificed the option of spending his initial investment on something which might have given immediate satisfaction—travel, a new personal residence, new car, etc.—in exchange for something of tangible long term importance. In this respect he saved rather than consumed and his saving or investment provides the capital in facilities necessary for jobs and higher productivity;

(2) that he took the risk of possible losses if the investment failed to measure up to expectations or if there was an economic downturn; and

(3) that all of the eventual "gain" from sale of the property would likely not be true economic gain, but would instead reflect the higher replacement costs resulting from the inflation which occurred over the period the asset was held.

Thus, if a special capital gains rate were not applicable, there would likely be an economic disincentive for such investments since there is no early return from them. Even with capital gain, it is possible that the taxpayer will end up with less "capital purchasing power" than was represented by his original investment.

How does this concept apply to investments in timber growing? There are some significant differences. If the investor buys property which already has standing timber, the cost of the timber at the time of purchase is its tax basis. If planting is required, the cost of site preparation and planting is capitalized, and this represents the tax basis for the timber assets.

The expenses of maintaining the timber investment are treated much like the comparable expenses of the apartment house owner. Property taxes, interest costs, forestry consulting fees, fire protection and the like are deductible in the year in which they are incurred. Unlike the other investor, however, the timber owner is not eligible for annual depreciation deductions. The depreciation or cost recovery factor for timber (called cost depletion) cannot be deducted until the timber is sold or harvested.

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2/ Note. This is not even a close cousin to what is known as percentage depletion.
It is important to note also that the capital gain rate applies only to gain in value of the standing tree. Any gain subsequent to harvest—from manufacturing, sale of logs, etc.—is treated as ordinary income. That is why the average effective tax rates of forest industry corporations is substantially above the capital gain rate; and is also well above the average of other resource-based industries which have been the subject of Congressional study.

As mentioned earlier, timber assets have always been treated as capital for purposes of taxation. But prior to 1944 the capital gains laws were very narrowly applied to timber—in a way which discouraged sustained-yield management. If the timber owner liquidated an entire stand at a lump sum price, thus demonstrating no intention to renew the stand for future timber sales, the proceeds were then subject to the capital gains tax rate. If, however, the owner sold only selected trees from the stand, or if he replanted and otherwise managed the timber property for future yield, or if he harvested the timber asset gradually as it matured for manufacture in his own mill, the proceeds (or the gain in value in the latter case) were subject to ordinary income tax rates. In other words, if the timber owner managed his timber for long term growth and maximum yield, he was penalized by the tax law. The rationale for the different treatment was that timber being managed for sale and regeneration was "stock in trade" rather than a capital asset. It doesn't take much analysis to conclude that such a disparity in treatment of a capital asset, based largely on the method of disposal, was at odds with the avowed national policy of encouraging the perpetuation of productive timberlands.

Therefore, in 1944, stimulated in part by the realization that well managed private timberlands were vital, the Congress eliminated the tax bias against sustained-yield management by making the capital gains treatment apply to timber transactions which are compatible with good management practices.

The 1944 provisions are now incorporated into the Tax Code as Sections 631 (a) and (b). Under these sections, the holding period for timber is stricter than for other capital assets, and the method of valuing timber for tax purposes differs to facilitate IRS administration and supervision. Except for these differences, however, an investor in timber no matter how he disposes of it is now on relatively equal footing. The owner can reseed or replant a harvested area without being penalized with higher taxes than if he allowed natural regeneration; can sell or selectively harvest only the marketable trees, leaving the residual stand for future production; or can manage the timberland to help provide a continual raw material supply for a manufacturing facility operated by the timber owner—all without suffering the adverse tax consequences which prevailed prior to 1944.
The results of this equitable treatment are apparent in the dramatic reversal of the pre-1944 historic decline in private forest growing stock. Annual plantings on private lands have jumped from practically zero to over 1,000,000 acres per year. Between 1944 and 1970, the nation's total growing stock increased by 175 billion cubic feet. While other factors have also contributed to this record of improvement, it is indisputable that fair tax treatment of timber investments has been one of the most significant.

Congress and/or various committees of Congress have reviewed the impact of Section 631 capital gains treatment on numerous occasions—specifically in 1954, 1959, 1963, 1969, 1971, 1973, and during the 1975-76 tax reform hearings—and the value of timber capital gains in terms of both tax equity and economic benefits has been consistently reaffirmed with each revenue law revision.

In spite of the overwhelming evidence in the public record and in spite of the visual evidence in every region of the country that fair tax treatment of timber has contributed greatly to the nation's timber supply and to the encouragement of professional forest management practices, there are some who, for one reason or another, single out timber capital gains for criticism. Fortunately, the economic and environmental arguments in favor of tax equity for sustained-yield management are so conclusive that this criticism has been rejected.

But this does not mean that the questions upon which criticism are based can be ignored. As is the case with any provision in law, timber capital gains is, and should be, subjected to periodic scrutiny to determine if it is fulfilling its intended function.

It would be well to herein examine some of the most frequently heard criticisms.

Have you ever wondered if it is true, as sometimes said, that the larger timber owning companies receive the greatest benefit from capital gains treatment? Well, it is true. The purpose of the incentive is to stimulate timber production, and it is natural that the distribution of benefits will be in proportion to the volume of production. A more meaningful indicator of the validity of the tax treatment would be the fact that amounts greatly exceeding the capital gains benefits are being plowed back into the resource by the major timber producers.
The question of who benefits has become a favorite game of the critics, presumably because there is some political magic in setting small against large, or individuals against corporations. But this writer has never heard a tree farmer say that capital gains should be available to individual tree farmers and denied to corporations large or small. Nor have smaller timber growers been heard to say that equitable tax treatment should not prevail for all growers, small and large alike. In fact, Congressional hearing records are replete with appeals from small growers and small forest products companies urging retention of timber capital gains.

It has been said that capital gains represents a "tax subsidy" and that, as such, it exceeds the cost of direct assistance programs rendered by USDA and the Department of Interior to preserve and improve timber supplies. Analysis of tree growing incentive programs in the U. S. as well as in other countries demonstrates that tax treatment to reflect the long growing period and the risks inherent in timber growing is more effective than direct subsidy programs. The direct subsidies require high cost of administration and while useful have proven much more costly in timber output per dollar of revenue invested. While direct payments are apparently necessary at present for the smallest and least productive landownerships (as provided under the existing Forestry Incentive Act), they can in no way be considered a substitute for the capital gains treatment accorded producers of the major volume of privately held timber being produced for future markets.

It has also been mentioned that small companies (under $50,000 of pre-tax earnings) do not benefit from timber capital gains because they are already subject to a lower corporate income tax rate (22% as opposed to 48% for earnings in excess of $50,000). The reality is there are few corporate timber owning corporations below the $50,000 category but the fact that these companies are already paying less than the 30 percent corporate capital gains rate does not at all diminish the justification for treating timber comparable to other capital assets for those companies with greater earnings.

If the present tax treatment provided a "marginal" advantage for large landowning corporations over smaller landowning individuals and corporations, the expected result would be a major trend to concentration of ownership. Such has not been the case. There is today less land in major company ownership in relation to their timber production than when timber capital gains was enacted in 1944.
In the application of timber capital gains to individual taxpayers, it has been suggested that "small" growers benefit less than "large" growers because the prevailing capital gains rate (50 percent of the rate on comparable ordinary income) means less to those with lower incomes than to those with large incomes. A recent critic, for example, said:

For individuals, capital gains treatment means considerably more to taxpayers with high incomes than to those with low or middle incomes. For example, a taxpayer in the 20 percent bracket for ordinary income would, if he has timber capital gain, be taxed on that gain at 10 percent. Capital gains treatment, therefore, increases his after-tax timber income from 80 percent to 90 percent of his before-tax income, an increase of only 12 percent. In contrast, a taxpayer who pays 50 percent on ordinary income, pays only 25 percent on timber capital gains. The special tax provision thus increases his after-tax timber income from 50 percent to 70 percent of his before-tax income, an increase of 40 percent.

The argument is specious and is a direct challenge to our progressive income tax system. No matter how you slice it, individuals with large capital gains pay a higher rate of tax than those with lesser gain. The fact that the differential between the rates on regular income and capital gain is also greater in the higher brackets is inherent in the progressive income tax system. It makes you wonder if the critics might be suggesting, in order to increase the "benefits" of capital gains for those with limited incomes, that their ordinary income tax rates be increased to the point where their capital gains differential will be equal to that of high income individuals. It is doubtful the affected taxpayers would welcome such help.

So it can be surmised that the "small vs. large" arguments have evolved more from the political needs of the critics than from the realities of timber economics.

Another issue we occasionally hear about is the so-called "mismatching" of expenses and income in timber growing operations. This has to do with the deduction against ordinary income of the annual costs of maintaining timber assets—assets which ultimately will receive capital gain treatment. In this respect, timber is treated no differently than other capital assets. The fact that expenses of timber operations must be borne for so many years before there is an
economic return provides the strongest argument for maintaining equal treatment with other forms of capital assets. The deductible expense of painting an apartment house or the investment advice one might require to manage an investment or the maintenance expense of any other capital asset is comparable to the maintenance expense of a forest. Expenditures for fire and disease protection, rodent control, etc. should by no means be treated as a capital improvement, as is suggested by those who make the "mismatching" argument.

Have you ever heard it charged that the integrated forest products companies deliberately inflate the price of timber they purchase from other sources in order to squeeze additional advantage from capital gain valuation of their own timber? On the surface it seems plausible. But an accountant's sharp pencil will quickly show that the practice, if used, would be a costly exercise in futility. The extra cost of outside services can easily exceed the possibility of gain from such a practice. In the first place, it is the responsibility of IRS appraisers to monitor true market value for purposes of capital gains calculations, and many factors other than outside purchases by the taxpayer are considered. Secondly, in the unlikely event the taxpayer was successful in fooling IRS 100 percent of the time, his purchases of inflated value timber would have to be less than one-third of his total timber utilization before the first dollar of offsetting benefits would be realized—and the companies who pay the highest price for timber generally do not fall within such a range. Every study of this matter has concluded that the companies paying the highest prices for timber are those who could not possibly benefit from raising the values of timber they may cut from their own lands.

In a surprising statement, one critic wrote recently that the Society of American Foresters does not have a clear policy in support of the timber capital gain provision. While the document known as statement of policy of the SAF is intended to be general in form and not involved in specific legislative issues, it is clear from repeated testimony of the Society on several occasions before Congressional committees that the Society has a clear policy favoring timber capital gains and is strongly supportive of timber capital gains as a means of encouraging greater investments in the nation's private forest.

Relevant sections of past testimony are as follows:

1963—The (Council of the Society of American Foresters) emphasizes that revenues from increases in timber growth and value obtained through sale or cutting of timber should be
eligible for taxation as long term capital gains, rather than as income, if the system of taxation is to recognize the true economic nature of forest production. Moreover, such classification is of fundamental importance in encouraging and maintaining private investment in the management of forestlands.

1969--The treatment of revenue from timber harvesting as capital gains has been in effect since 1944 and has played a major role in encouraging the application of intensive forest practices on private lands throughout the nation. The Society of American Foresters, therefore, is pleased to have this opportunity to advise your committee professionally that the timber tax system which has served the public interest so well should be continued.

1973--The (Society of American Foresters) urges that tax treatment of revenue from the harvest of timber recognize the unusual risks associated with long term investment in timber production. In the opinion of the Society, the capital gains treatment of timber income is an effective technique to encourage investment in private forestry and thus help meet the nation's wood needs. We believe it should be continued.

From personal knowledge of the Society and its diverse membership, this writer is confident that these positions were not arrived at lightly and without full consideration of the alternatives. Nor do they in any way disregard the other factors which are important in the promotion of sound management practices on the nation's private forests.

Anyone who has undertaken the task of nurturing a new forest from seedlings to maturity would be astounded by the claim made in a recent criticism of timber capital gains that an investment in timber growing is no more "long term" than investments in such other enterprises as "railroads, shipbuilding and utilities," or that the risk factors are any different. In fact, there are few private enterprises, if any, characterized by as long a period of illiquidity, high risk and heavy investment as the timber industry. The other industries singled out for comparison have generally acquired a public utility nature, with one or more government programs available to bolster or sustain them--guaranteed markets, guaranteed rates of return, or heavy direct cash subsidies. And--lest the critics should forget--capital investments in those industries are also subject to capital gains taxation.
The risks in timber growing are high. Historic rates of return are below the average of other industries, leaving little margin of protection from the natural threats of fire, insects, disease and storm. And, again contrary to the views expressed by occasional critics, casualty insurance is not available to cover such losses.

Finally, we come to the classical argument that "market factors" should be allowed to work in the timber industry, whereby higher prices would be a substitute for capital gains treatment in securing increased timber supply. There are severe drawbacks to total reliance on the market to stimulate new forest production. This is due to the many years lag time between increased market demand and fulfillment of the tree growing cycle. In the final analysis, it is timber harvesting which responds to market price, not timber supply. Prices would have to be unacceptably high for too long a time to make this an efficient method of compensation for the long investment period and the prolonged risks involved. The capital gains incentive works independent of price factors by assuring the investor that, regardless of market conditions or price, when the investment matures the return will be taxed at the favorable capital gains rate.

It is important to emphasize that the objections to timber capital gains treatment, as represented by the various arguments cited throughout this article, are not widely held. They do surface occasionally, however, and when they do answers should be forthcoming. For out of the process will hopefully come a heightened awareness of the role of taxation in the investment decision process, and its particular significance to the economics of timber growing and to the encouragement of improved silvicultural practices on private forestlands.

As stated at the beginning, standing timber is a capital asset—a fact unchallenged by even the most ardent critic. By objecting to the "special" treatment provided in Sections 631 (a) and (b), a critic is simply arguing a return to the pre-1944 days when the tax laws encouraged liquidation of existing timberstands and penalized the practice of sustained-yield forestry. That would be to undo the most significant tax reform ever enacted for the benefit of the nation's renewable forest resources.
OTHER COSTS IN TIMBER PRODUCTION

Richard A. Kluender
American Pulpwood Association
Jackson, Mississippi

In sawlog logging and the production of pulpwood there are a number of cost items that do not relate directly to the costs incurred in growing, harvesting, and transporting trees. These "other" costs are applied against and can be considered a part of the cost of production:

1. Land taxes
2. Gasoline tax
3. Truck licenses
4. Truck sales tax
5. Federal highway tax
6. Social Security costs
7. Workman's Compensation
8. Tax on tires
9. Costs incurred because of OSHA

In order to view the picture in perspective, a hypothetical situation of a medium size pulpwood logger is presented below. For this example, assume that the producer runs the following mechanized prehauler pulpwood operation in a central Louisiana parish.

The producer has 3 employees. One operates a prehauler while the other two cut, prepare and pile wood (if necessary). The producer, in addition to supervising his workers, performs logging work or drives the truck as required. Trees are cut with a chainsaw, are felled, limbed and bucked where they fall and gathered into piles of 2-5 pulpwood lengths.

The prehauler is driven through the woods and the hand piled pulpwood is loaded onto the prehauler with the knuckleboom loader. The wood is then moved to the landing where it is loaded onto the producer's truck, a tractor-trailer. The loader on the prehauler is used to load the truck. The trailer will carry 9 cords of wood. The woodyard is 18.5 miles from the woods operation.
Further, assume the following:

A. The land grows 1 cd/acre/yr.
B. The crew produces 5 cd/manday.
C. The crew works 200 days/yr.
D. Production per crew - 3000 cds/yr.
E. Tractor and trailer tires - 20,000 mile life.
F. Wages paid - $6.00/per cd. labor cost.
G. Producer's earnings - approximately $10,000./yr.

Now, the specific costs faced by the pulpwood producer are as follows:

A. Land and Severance Tax

\[
\begin{align*}
\text{LAND* (ad valorem)} & \quad - \quad .41 \text{ cd.} \\
\text{SEVERANCE} & \quad - \quad .35 \text{ cd.} \\
\text{Total} & \quad - \quad .76 \text{ cd.}
\end{align*}
\]

Land tax may be included in stumpage and severance tax is paid by the purchaser of the pulpwood. Regardless, the total production cost eventually reflects these items.

B. Gasoline

\[
\begin{align*}
\text{FEDERAL TAX/GAL.} & \quad - \quad .04 \\
\text{STATE TAX/GAL.} & \quad - \quad .08 \\
\text{Total} & \quad - \quad .12 \text{ gal.} \times 5.16 \text{ gal/cd.} = .62/\text{cd.}
\end{align*}
\]

A recent fuel survey by APA revealed that it required an average of 5.16 gallons of fuel, either diesel or gasoline to produce a cord of wood from stump to a collecting or mill yard. It should be noted at this point that if a producer buys a large quantity of fuel for offroad use he is not required to pay tax on it. Tax on any other fuel that he purchases and uses offroad can be claimed as a deduction on his income tax.

C. Truck & Trailer License

\[
\$200. \text{ per year} \div 3000 = .067/\text{cd.}
\]

D. Unemployment Tax

\[
\begin{align*}
\text{FEDERAL TAX} & \quad - \quad (.005 \times $4200. \times 3) \div 3000 = .021/\text{cd.} \\
\text{STATE TAX} & \quad - \quad (.030 \times $4200. \times 3) \div 3000 = .147/\text{cd.}
\end{align*}
\]

* Approximate figure, depends on local assessment rate.
The Federal Unemployment Tax rate is 0.5% of the first $4200 of payroll per employee. The state rate ranges from .9% to a high of 3.3% of the first $4200 of payroll depending on the experience of the employer.

E. Sales Tax on Truck & Trailer

\[
\begin{align*}
26,000.00 & \quad \text{Purchase Price} \\
.03 & \quad \text{State Sales Tax} \\
$780.00 & \quad \text{State Tax} \\
26,000.00 & \quad \text{Purchase Price} \\
.01 & \quad \text{City Tax Rate} \\
$260.00 & \quad \text{City Tax} \\
\end{align*}
\]

Total Tax = $1040.00

\[
\frac{1040}{10 \text{ yrs.}} = $104.00/\text{yr.}
\]

\[
\frac{$104.00}{\text{yr.}} = .034/\text{cd.}
\]

3000 cd/yr.

F. Social Security

\[
\begin{align*}
$6.00/\text{cd.} \times 3000 \text{ cd.} &= $18,000.00 \\
\text{EMPLOYEES} \times .117 \times 18,000 &= 2,106. \\
\text{PRODUCER} \times .079 \times 10,000 &= 790. \\
&= \frac{$2,896}{3000} = .97/\text{cd.}
\end{align*}
\]

The rate for the producer is 7.9% on the first $15,300. The amount of Social Security Tax (11.7%) for the employees shown is the total paid, half by the employees and half by the employer.

In considering the total cost we have included both of these since they must be paid and are a part of cost of production.

G. Workmans Compensation

CODE: 2705 HARVESTING PULPWOOD = $1.62 cd.

This is the Louisiana manual rate for Workman's Comp. converted to a per cord basis.

H. Tires

\[
\begin{align*}
140.00 & \times 18 = $2520.00 \\
\text{Federal Tax} &= .05 \\
\text{State Tax} &= .03 \\
\end{align*}
\]

\[
\begin{align*}
\frac{0.08 \times $2520.00}{(20,000 \times 9)} &= .041/\text{cd.}
\end{align*}
\]

(9 cds/load; 20,000 mi. tire life; 37 mi. round trip)
I. Prehauler

No additional costs, other than fixed and variable operating costs are encountered with the addition of a prehauler.

Tires should last the life of the machine. There is no sales tax on manufacturing equipment. The APA fuel survey showed that the average 5.16 gal./cd. figure was valid over a wide range of operation types.

J. Direct Cost of OSHA

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 hard hats</td>
<td>$28.00</td>
</tr>
<tr>
<td>4 prs. safety boots</td>
<td>80.00</td>
</tr>
<tr>
<td>First Aid Kit</td>
<td>20.00</td>
</tr>
<tr>
<td>Water jugs, paper cups</td>
<td>20.00</td>
</tr>
</tbody>
</table>

$148.00 Total

$148.00 \div 3000 = .049/cd.

K. SUMMARY & TOTAL

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land/Severance</td>
<td>.760</td>
</tr>
<tr>
<td>Gasoline</td>
<td>.620</td>
</tr>
<tr>
<td>Truck license</td>
<td>.067</td>
</tr>
<tr>
<td>Unemployment tax</td>
<td>.147</td>
</tr>
<tr>
<td>Sales tax/truck</td>
<td>.034</td>
</tr>
<tr>
<td>FICA (Soc. Security)</td>
<td>.970</td>
</tr>
<tr>
<td>Workmans Comp.</td>
<td>1.620</td>
</tr>
<tr>
<td>Tires (Fed. &amp; State)</td>
<td>.041</td>
</tr>
<tr>
<td>OSHA</td>
<td>.049</td>
</tr>
</tbody>
</table>

TOTAL 4.31

NOT INCLUDED: Truck driver's license, sales tax on chain saws, axes, and work clothing. Also, Federal Highway Use Tax, and applicable, public and vehicle liability insurance must be paid.

The total attributable to "other" costs per cord is $4.31. These are costs of producing pulpwood.

Published Forest Service figures report the average delivered cost of wood is just over $30.00/cd. across the South. After the subtraction of "other costs" the producer is left with $25.69. From this he still
has to pay labor, stumpage and equipment fixed and operating costs, receive earnings for himself and squeeze in a profit commensurate with his investment.

The pulpwood producer is indeed in a cost squeeze. The "other" costs are a significant part of his operation and not just incidental as the word "other" might imply.
Question: I am interested in the intensity of the OSHA inspections and the number of inspectors.

Answer: Let me give you a little background first. About eight months ago the OSHA Division was adding 22 new inspectors for the prime reason of checking up on woods compliance. In the past, OSHA inspectors have not looked at the small operators. They have examined a few company woodyards and larger dealers. The IRS thing is a little bit different. I would say that over the past three or four years there has been several hundred cases where people have been brought into court for non-compliance or tax evasion. Our own amnesty program with the IRS has been turned down. We will be launching a massive IRS legal compliance program within the next three or four months. It will be a state by state education program trying to get dealers and producers to examine some of the problems of compliance. Most companies are taking immediate steps based on the IRS decision to not grant amnesty to insure that they are not buying illegal wood. That is wood that has been produced in compliance with the applicable laws.

Comment: Figure for labor was $10 a cord and using the rate for Louisiana pulpwood it is $40.54 for $100 payroll. Labor costs by present law in Louisiana is $4 a cord. In Mississippi it is $3.60; in Arkansas $3.60; in Texas $4.00. (Crothers)

Answer: Yes, it is astronomical. In Mississippi, where I worked at this problem for the company over there $1.37 or 137% rather Workman's Comp. rate is $26.96 per hundred dollars. Louisiana presently has the highest Workman's Comp. rate in the U. S. for pulpwood; it is $27.05.