

David M. Smith
and
The History of Silviculture

An Interview
conducted by
Harold K. Steen

Forest History Society

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INTRODUCTION

In 1956 David R. M. Scott began teaching silviculture at the University of Washington College of Forest Resources. He had earned his Ph.D. at Yale and had studied with David M. Smith; the text he used at Washington was *The Practice of Silviculture* by Ralph C. Hawley and David M. Smith, 6th edition. I was a student in that first class.

Life takes twists, and over two decades later in 1978, the Forest History Society held its annual meeting in St. Louis in conjunction with that of the Society of American Foresters. I had been employed by the Forest History Society since 1969, joining it following its move to Santa Cruz, California, from New Haven where it had been housed in Yale's Marsh Hall. At close of the 1978 meeting, FHS Board member Herbert I. Winer (Yale Ph.D. who had been a student at the same time as David Scott and David Smith) and I joined with SAF'ers on a brief Mississippi River cruise. In the crowd was David Smith; Herb introduced me to his longtime friend and colleague.

Still another decade, and Herb Winer and Dave Smith stopped off in Durham, where the Forest History Society has been headquartered since 1984 in affiliation with Duke University. It was the end of a Yale forestry field trip. We had breakfast at their hotel and chatted about a range of topics. Later, Herb and I agreed that Dave should be interviewed on the history of silviculture. While Herb was attracting the necessary financial support, Dave and I swapped a series of letters in which we developed an outline for the interview that follows. Also, former students and present colleagues enthusiastically suggested lines of query.

The interview took four, half-day sessions, conducted mostly in the cupola of Marsh Hall, one of the three buildings used by the Yale School of Forestry and Environmental Studies. Following transcription and very light editing for basic clarity, Dave Smith reviewed the pages and made minor corrections and added clarifying statements. Then I smoothed syntax here and there, but what follows is what he said and the way he (and I) said it. The conversational style, rather than the formality of written prose, is itself a quality of oral history. Future readers with agendas that we cannot predict will read this interview about the history of silviculture, turning to the published literature to fill in with official facts as needed. The interview will have provided shades of meaning, nuances of relationships, insights, and wisdom--and more than a little humor.

David Martyn Smith was born in Bryan, Texas, on March 10, 1921. Shortly thereafter, his family moved to Rhode Island, and he graduated from the State University in 1941 with a degree in botany. Following a four-year tour in the Army Air Force during World War II where he rose to the rank of captain, he began graduate studies at Yale. Even though he wouldn't earn his Ph.D. until 1950, he was appointed to the forestry faculty in 1946. He would retire forty-four years later in 1990 as Morris K. Jesup Professor of Silviculture, a chair that he had held since 1967.

By any measure, Dave Smith is a--if not the--dominant figure in American silviculture during the last half century. His book, *The Practice of Silviculture*, which he inherited after five editions from Ralph C. Hawley but definitely made his own in the next three, has been used by literally generations of students. And his former graduate students teach silviculture or conduct silvicultural research across the United States and around the world. He has spent most of a lifetime trying to understand the forest stand and its mechanisms, and typical of those who form our thoughts, he has learned enough to be able to simplify. He can see the forest for the trees.

Many have contributed to this interview with both ideas and funds, and I hope that this sterile listing properly conveys our gratitude: Herschel G. Abbott, John R. Bassett, Susan H. Bicknell, Richard J. Campena, Edward C. Childs, Theodore W. Daniel, William C. Davis, Ralph H. Griffin, Peter R. Hannah, Frank L. Howard, John A. Helms, Deborah Brooks Hill, Ernest A. Kurmes, Bruce C. Larson, Roger Milliken, New England Chapter, Society of American Foresters, George R. Staebler, Gordon F. Weetman, Herbert I. Winer, Robin W. Winks, Edgar P. Wyman, and the Yale School of Forestry and Environmental Studies.

Harold K. Steen
Durham, NC

DAVID M. SMITH: We are in Marsh Hall, the first home of the Yale Forest School when it was founded in 1900.

HAROLD (PETE) STEEN: Well before Sage Hall.

SMITH: Yes. In fact, the building had been the residence of a famous paleontologist named Marsh who gathered dinosaur bones and items of Indian culture out West and got his rich uncle to set up the Peabody Museum. He died in the late 1890s and left the land for a university botanical garden, and I guess Yale didn't know what else to do with the building. When Henry Graves and James Toumey came from Washington, D.C. to start what was called the Yale Forest School, this was the building they used. In fact, some of the two-person faculty, and some of the students lived here. Then about twenty-odd years later, when Henry Graves came back from being chief of the Forest Service to be dean, he or James Toumey got the money to build Sage Hall. Then we quit using Marsh Hall until we doubled the size of the faculty in the middle fifties. In the meantime the federal forest pathology outfit had been here. We've occupied it ever since, so the oldest forestry school left in America is one of the few still using its original building.

STEEN: The Greeley lab; did the industry contribute to that?

SMITH: The money came from all sorts of sources. We had a short-lived arrangement with the Hartford Foundation (based on the A & P fortune---it mostly supports medical research). We used a field establishment that was on John Hartford's farm in Westchester County, New York. After we had a falling out with the people that ran the Hartford Foundation, we got a big alimony payment out of the deal. Some of the money went into building Greeley lab. Some came from the forest industries.

STEEN: What kind of lab is it?

SMITH: It's where we have our science labs and so on, adjacent to Marsh Hall.

STEEN: Timber testing and so forth.

SMITH: That's what we used to do there, but we no longer have that work. When the Forest History Society was here during the 1960s, they (Woody Maunder and Joe Miller) had a couple of rooms down on the street level floor of Marsh Hall.

STEEN: I'd like to reconstruct this, because I never could quite visualize the physical plant for the society---where the library was. Woody brought about five ranges of library shelving out to Santa Cruz. I don't know if the library was in this building or not.

SMITH: It probably was.

Early Years and Education

STEEN: I put together an outline based upon your ideas, a few I had, and some of your former students wrote to me. How did you go from Bryan, Texas to studying botany in Rhode Island?

SMITH: I left Texas before the age of two. My family comes from New England. My father was an agricultural chemist who was a graduate of Tufts College in Massachusetts. The first job that he had at the time of the first world war was at the agricultural experiment station at what is now the University of Massachusetts. My mother's family comes from Amherst, where the university is. I still own some of the family woodlots there; my grandfather and great-grandfather in Massachusetts at various times ran sawmills. My grandfather knew some of the first foresters who were at what is now the Forestry Department at the University of Massachusetts. My father soon got a similar job at the Texas A&M agricultural experiment station but was there only about three years. Then he got a better job at the experiment station in Rhode Island, and that's where I grew up. I went to the University of Rhode Island, and I majored in Botany. I'd

always been interested in forestry, and I did all my graduate work here at Yale. I tell people I was going to go out west and be a forester and I got all of eighty miles.

STEEN: General botany, or were you a morphologist or what?

SMITH: It was very general and unspecialized. One of my classmates recently retired as the director of the National Arboretum in Washington.

STEEN: When I was a freshman, I took my first botany courses. It was fascinating.

SMITH: I had a certain amount of sales resistance from my father, who rather sourly told me once, "I went to college to get out of the woods." He'd grown up in the rural areas of northern New England---Vermont and Maine. I found later that part of his antipathy had to do with the fact that he knew the two foresters who were at Texas A&M in the early twenties. For some reason he didn't think very much of them. I later found out who they were. One of them was somebody you probably know, or knew, Gordon Marckworth.

STEEN: Yes.

SMITH: He was dean of forestry at the University of Washington.

STEEN: When I was a student he was the dean.

SMITH: Remind me to tell you about something quite unrelated that Gordon Marckworth told me once. It has to do with the history of forestry itself. It was when he was at LSU. Marckworth was a Yale graduate. The other one was a Harvard Forest graduate named Lenthall Wyman, who was on the faculty later at North Carolina State and was an expert on naval stores industry and its technology. I once told my father that he'd made a bad judgment about these two individuals. Anyway, after I finished in Botany in Rhode Island just before the second world war started, I came here. Except for military service during the second world war, I've been here ever since.

STEEN: When you were in the military you were in meteorology. Was that planned?

SMITH: I was going to be drafted anyway. In fact, there were three of us who were students here at the school who managed to become involved in this, we all went to New York University, which had a training program. One of them was somebody you may know, Paul Burns.

STEEN: I know the name.

SMITH: For a long while he was head of the forestry school at Louisiana State. The other was a man who didn't stay with forestry. He's Edward Adelberg, now the deputy provost at Yale looking after "biomedical" things that involve the medical school, biology, forestry, and so on.

I got some encouragement from my chief mentor here, Harold Lutz, who had independently learned an awful lot about soils. I remember he'd made it clear to me that knowing about the aerial environment was important too, so I figured well, if I've got to go out and do something else for a while to keep the military happy, this was something useful to do. So it was with some deliberate intent that I went into meteorology.

STEEN: Where was Hawley?

SMITH: Mr. Hawley was on the faculty at the time. He didn't retire until 1948.

STEEN: But you worked under Lutz.

SMITH: I studied with Lutz, and probably Mr. Lutz was the person chiefly responsible for my being appointed to the faculty here as Ralph Hawley's successor.

STEEN: Were you in the program with the intention of earning a Ph.D.?

SMITH: Not originally, but when I came back after the war, that's what I decided to do.

STEEN: It still wasn't that common then.

SMITH: No, but the numbers were increasing fast at the time. For example, in the year when I completed the doctoral work the number of people in forestry with doctorates in the country increased by 50 percent, which was something like going from fifty to seventy-five. I remember looking at the statistics. Six of us who were Harold Lutz's students finished in the same year. One of them was Steve Spurr.

STEEN: Was Spurr in school with you?

SMITH: Yes. It was when the people who had started doctoral work after the war was all finished, and that was why there was a big blip in the numbers of people. And it's of some significance perhaps, that in the original faculty of this school there were none who had doctorates or had engaged in preparation for scientific research except perhaps for Toumey.

STEEN: I thought Graves had a Ph.D.

SMITH: He had an honorary doctorate. But doctorates weren't anywhere near as common in any field in those times.

STEEN: I know. I was an undergraduate during the fifties, and at Washington probably only half of the faculty in forestry had a Ph.D.

SMITH: Just after I finished here, I spent a summer working for Leo Isaac in the Pacific Northwest Forest Experiment Station. Some of the guys I worked with had serious discussions about whether it was worth getting a master's degree, even though they were in research.

STEEN: That's interesting.

SMITH: They'd gotten to the point at that time that such people were supposed to have masters' degrees. But to get back to the meteorology business, this was something that I pursued quite deliberately, because actually my initial interest was not in silviculture. I wouldn't say I was disinterested in it, but my interest was more in forest ecology in a broad sense. In those days, that meant everything from soils to physiology and I thought it should have a meteorological dimension.

STEEN: Was Duke a competitor for your attention then? They had Korstian and Oosting, which fit with your interest in ecology.

SMITH: Maybe it would have been if I had known about it.

STEEN: The school started in '38.

SMITH: I'm not sure that I knew about it. In fact, one of the things that astonishes me is the imperfect spread of information about such matters. I had planned to go into forestry but I got dissuaded from doing it. I'd planned to do undergraduate work in it, and I started to apply to the New York State College of Forestry at Syracuse and also the University of Massachusetts, partly because the campus was almost next to my grandparents' farm. I didn't even know about the school at Yale, although it is only a graduate school. It wasn't until I was well along in my undergraduate work that I learned about the school at Yale, sort of by accident. The head of the Botany department there actually taught a course in forestry, and he knew about the Yale school. In fact, he was acquainted with Toumey. But for some reason it never occurred to him to tell me that there was this opportunity. I learned by some other route. Perhaps if I'd known I might have applied to Duke, I'm not sure. Part of it was that initially I wasn't that much interested in ecology, and I wanted to be

a practicing forester. Going into the scientific aspects of it or teaching didn't really occur to me. That came later.

Appointment to Yale Faculty

STEEN: It sounds a little bit undiplomatic, but I was surprised looking at your vita that you were invited to be on the forestry faculty so early. You were just getting started in graduate school.

SMITH: I don't know why. I was thunderstruck when Harold Lutz suggested this idea.

STEEN: Was he dean then?

SMITH: No. Mr. Lutz, incidentally, is 89 and is retired and lives in Michigan. I saw him just a couple of weeks ago for the first time in fifteen years and had a very interesting discussion with him. He told me a little bit about some things I'd wondered about, but he didn't take up the question you just asked.

STEEN: You didn't have a doctorate yet.

SMITH: No. In those times there were few people who did. For example, at the time that I was studying for a doctorate here and wandered into being on the faculty, there were a couple of more senior faculty members who were doing the same thing. One was Eugene Zumwalt who later was, in effect, the chief forester of the Bureau of Land Management in the Department of Interior. And Fred Dickinson who was later head of the University of California Forest Products lab. There was a real shortage of people, and the profession was small. Our pathologist, John Boyce, had been to a national meeting of the SAF sometime in the late 1940s, and he came back with some apprehension and nervousness. I heard him tell somebody else "There were people there whom I didn't know." Somebody told me once that the SAF used to have its national meetings in conjunction with AAAS. They'd meet in one end of a room, while some other group met in the other. It was that small. During the first decade of the century, I suspect that almost half of the foresters in the United States were graduates of this school and had studied in this building.

STEEN: Sure.

SMITH: There were just so few. I remember around the early 50s I was impressed with the fact that Hardy Shirley, who was then dean of the New York College, came here and asked me very soberly and seriously who I knew in various fields around the country. He took careful notes. It was quite clear that what he was on was an exploratory trip to look to see who they could use to populate the faculty at Syracuse.

STEEN: So there was a real demand then for faculty-quality people, unlike now when there's a glut.

SMITH: It goes up and down. I've sometimes suspected part of the reason I got hired was I was young, and they figured they didn't have to pay me as much as some of the others. In those days appointments to the faculty were on a different basis, partly because there were so few people. Instead of advertising for applicants, and since the faculty figured they knew everybody, if they wanted young people they'd search around and ask the people they knew if they had any students coming out. Sort of by knowledge and reputation, you'd pick a target and go after the candidate. There wasn't this business where you'd advertise and get applications. I know that when I was hired, they had a long laundry list of people they were after. Harold Lutz briefly showed it to me, and I thought gee, I'm not in the same category as that crowd. Then the thought occurred to me, because of what I knew of the school's budget, that they could afford only about a third of those anyway.

But there's something more to it than that. I suspect Lutz wanted someone more scientifically inclined. In the times up until 1940, forestry instruction was much more didactic than it is now, and it was far less scientific. It was predicated on the basis of the idea that there were procedures that you followed, and rules that you carried out. I can remember discussing this with some of my fellow students. Some of the instruction that we had was so didactic and so based on rote memory that we regarded it as an insult to our

intelligence. I had a discussion like this with Hamlin Williston, who was one of my classmates. As you may know, he's made his career working for the Forest Service, its extension work in the southern pine country.

STEEN: I think I've seen the name.

SMITH: He lives in Mississippi, and he's done much writing, including a history of the Yazoo-Tallahatchie Conservation Project in northern Mississippi.

STEEN: Maybe that's where I saw his name.

SMITH: He'd majored in biology at Harvard, and I remember he and I discussed this matter and agreed that the didactic instruction was pretty bad. There were some exceptions like the work we did with Harold Lutz. It was clear that the people who were teaching here, and at various other places had, in effect, reasoned a subject out, or knew the science of it, and even had developed quite a bit of it. But it was not regarded as necessary for students to know in an analytical way how you did things. However, the profession was becoming more scientific. I think part of the reason that Harold Lutz wanted me to take over was that he wanted to push this and he knew that I was in favor of it too. A whole generation was moving into this. It was quite clear Ralph Hawley wasn't opposed to the idea. I've often wondered why they decided to appoint me instead of quite a few other people whom I could mention, but I didn't argue with them about it. It was not something I had planned.

STEEN: What was Spurr majoring in?

SMITH: Let's see, Spurr at that time was at the Harvard Forest. As you may know he is a very remarkable person. He majored in forest ecology but everyone was more generalized then.

STEEN: Well, I used his photogrammetry textbook and for a long time thought of him as a photogrammetry expert.

SMITH: I've been very well acquainted with Spurr over the years; he's somewhat older than I am. He had been a student here before my time in the early 40s. Because of health problems that may have caused him some difficulty but certainly have not gotten in his way, he spent the second world war on the staff at the Harvard Forest. He was about the only one left, becoming acting director. He was working on camouflage research, how you make camouflage imitate foliage, and that's where the photogrammetry came from.

STEEN: I see.

SMITH: Then he was involved in something which is a history by itself, the business of trying to keep the Harvard Forest alive as an entity. While he was there, the university tried to close it. Spurr told me how he outmaneuvered the president of Harvard University by building interest among the social science departments and, in effect, outflanking the Harvard biology department. He won his battle but he became *persona non grata* and lost his job. But he had a five-year appointment there, and he used part of it to come back here to get his doctorate which was in forest ecology.

STEEN: Okay.

SMITH: At the end of his period at Harvard, his interest turned briefly to mensuration and studies of growth and yield. In fact, there was one summer when your friend Herb Winer worked as a technician for him up there. Spurr produced a very good book called *Forest Inventory*.

STEEN: I know that one.

SMITH: It had a lot of innovative ideas about mensuration. Spurr, on the basis of that book, was hired to teach forest management at the University of Minnesota. In fact, I think the inventory business and that went together. Then he went to Michigan to deal with forest ecology and silviculture. Quite typically he dived into a

field, learned a lot about it, produced some innovative ideas, wrote a book and got out. Spurr and Barnes produced *Forest Ecology* and then he went into university administration.

STEEN: In Texas.

SMITH: He told me once that the next thing he was going to do was to deal with forest policy, which was later what he did in one way or another. When he went to be president of the University of Texas he carefully got himself appointed as a professor of natural resource policy so that he would have a fall-back position.

Early Forestry Faculty and Programs

STEEN: You knew a lot of remarkable people, famous names to me like Toumey and Hawley and Lutz and Chapman. Give us little sketches about those people.

SMITH: I knew most of the original members of the faculty of the school. Toumey and Bryant were gone before my time. I heard a lot about both of them, but I didn't know them directly. I've seen a lot of Toumey's stuff since the school's still got a lot of it around. Henry Graves was a very versatile, keen person with tremendous administrative ability. He was the real organizer of the school, and as you may know he was Gifford Pinchot's chief lieutenant in Washington.

STEEN: Right.

SMITH: The establishment was deemed to be of sufficient importance that when the school was started, Pinchot sort of deputized Graves to come to New Haven to run the school. Mr. Toumey had been the chief botanist and scientist of the old Bureau of Forestry, and he was persuaded to be the scientific member of this two person team. Mr. Toumey came from Michigan I believe and at one stage of the game he was head of the Botany Department of the University of Arizona and apparently was beginning to be an expert on cacti. But somehow Pinchot persuaded him to go to Washington. Then, when this school was started, Graves and Toumey came to New Haven to run it. In fact, Mr. Graves used to live in a house no longer standing that was across the street. Toumey used to live in a house up beyond the Divinity School.

Mr. Graves was quite successful in finding the financial resources to expand this school. The chief expansion came about a half dozen years later. I think it was around 1906, when he obtained enough resources to appoint several other people, most of whom had been students of the school. There was one who had not been. Ralph Bryant was a graduate of the forestry school at Cornell. He dealt with logging and lumber manufacture and harvesting. Then there was Herman Chapman, of the class of 1904, who dealt with forest management administration and probably economics. I'm not sure about the latter, maybe Mr. Graves handled that. Ralph Hawley was one of Chapman's classmates--they didn't always get along. He dealt with silviculture, fire, and forest protection, which was mostly fire control. Then there was Samuel Record, the wood anatomist.

STEEN: I was going to ask about him. Was he at the school?

SMITH: Yes, he was and was also a graduate of the school. I don't know if I have them all or not; see it makes six. I can't really think of anybody else. It wasn't until John Boyce came in 1923 that there were any more. There were some other people who would be here for short periods of time.

STEEN: So George Garratt is young compared to this . . .

SMITH: Yes. George Garratt was part of the next generation. Well, let's see. Much of what I know about that period is what Harold Lutz told me. If you want to, he could probably tell you something about it now. I got quite an earful, he told me a lot just a couple of weeks ago when I was out there. Much of it I had heard before. Mr. Toumey was kind of the old, grandfatherly sort. In fact he was the only one I never heard any criticism of. Everybody liked him, respected him.

STEEN: Where was Austin Cary?

SMITH: He was somebody whom these people knew about and cooperated with, but he was not involved. I suspect he may have come here to lecture occasionally or something like that. They did collectively have a tendency to elbow out some of the immigrant foresters like Schenck, but they probably didn't have the muscle to deal with Fernow. There was some sort of antipathy between them and Schenck.

STEEN: Any particular reason, or just a . . .

SMITH: I just don't know, Pete. I could conjure up or imagine a number of reasons, but without knowing exactly what they were . . .

STEEN: Pinchot and Schenck didn't get along too well, and that was enough perhaps for Yale.

SMITH: People like Herman Chapman could cultivate antipathies pretty fast. But, the best way to describe it was Graves was a statesman, a man of very considerable vision, and he had to know how to get started on the way to achieving the vision. He could see so far ahead that sometimes he wasn't necessarily very good about what was right under foot at the moment. But, you always had the impression he could see fifty years from now where we were going to get to and what effect it would have. I had some conversations with him at the end of his career. This was after he retired, and the last thing he did was to be quite heavily involved in the organization of what is now the forestry part of FAO. I remember he was participating in this, writing a few things.

STEEN: Pinchot was involved in that, too. Pinchot wrote some letters to FDR suggesting something along that line. Of course Pinchot died in '46.

SMITH: There's something interesting here and I don't know the reason for it, Pete. Pinchot, through his whole life, was carried as sort of a nonresident member of the faculty here. However, I think the last time he was here was in 1940, and it was quite clear that he was no longer much interested in the school; even his interest in forestry had become somewhat distant. I suspect that what had happened was that his interest had turned to other things. He was very much interested in public hydroelectric power developments, akin to TVA. However, I do not know that he had anything directly to do with TVA. However, he wrote some books about what he called "giant power."

STEEN: I don't think I knew that.

SMITH: It was something to do with a kind of socialistic control of what he deemed to be the important energy source of society--hydroelectricity.

STEEN: I know he was very concerned that private utilities were getting power sites below cost. He felt they should pay for that.

SMITH: This apparently had become bigger in his interests than forestry. In fact, once in a while I'd ask the old faculty, "somehow Pinchot is never around here, why?" and they'd just clam up. I inferred that it was because the people of the Chapman/Hawley vintage had become quite conservative politically, and they were much opposed to things like federal regulation of forestry practice. Much in favor of private sector forestry. Oh they got along with the public forestry people, but I think they had perceived that Pinchot had become sort of a left-winger. And I suspect this may have been part of it.

STEEN: That could be.

SMITH: In fact, one of the things that always sort of puzzled me was that from the turn of the century until about 1925, the school had its summer field session at Pinchot's estate in northeastern Pennsylvania, at Milford, where Gray Towers is. This came to an end in the 1920s. The school really didn't have any really well thought-out place to go to from then until 1930. They used, sort of as guests, an engineering field

instruction camp that Yale had in eastern Connecticut. It wasn't until we were given what we now call the Yale-Myers Forest in northeastern Connecticut that we again had a field camp of our own.

STEEN: But you had field trips to Urania.

SMITH: Okay, those weren't in the summer. Our summer instruction was mostly in surveying and mensuration. The work in the South was something which was instituted way back in the beginning as kind of a clinical instruction period at the end of the two year curriculum. Traditionally it was in forest management and harvesting and manufacturing, which then pretty much meant the lumber industry. Actually they started at first up in the White Mountains at Waterville Valley before the national forest was established.

It was in the spring when the snow was practically head deep. It went on for about two years and then they decided that this was rowing upstream in a big way. In 1908 they instituted the policy of doing this session in the South. Generally, they'd go to logging operations where people were dealing with logging in virgin timber. It was mostly in the western South, because the eastern part of the South had been cutover.

STEEN: Right.

SMITH: They'd go from one place to another, the Missouri Ozarks, East Texas, and it was a roving establishment for a while. Alabama. But then starting in 1917 they settled down at Urania, Louisiana, on the land of the Urania Lumber Company. The chief reason for that was that the owners were a family named Hardtner, you probably know about them.

STEEN: Right.

SMITH: It was an old German family, and they were beginning to be quite interested in a permanent forest industry there. It was sometimes thought they were too conservative. It was dangerous to move west, so they were just going to stay in North Louisiana and grow trees and run their mill. This was something which certainly greatly attracted our people, and Herman Chapman and Ralph Bryant were the people who ran the springtime instruction we had there. In fact, they had from the beginning of the southern instruction, and part of the reason Bryant was involved was because they wanted to be at places where there was timber harvesting and sawmilling going on. Bryant conducted studies of logging and time studies of sawmills. Herman Chapman dealt with instruction in planning and management, but he soon also became very much interested in southern pine silviculture. That went on for years. It was just after the second world war, after Herman Chapman retired, it was moved to Crossett, Arkansas, where they had already been doing a lot of work. In fact, Bryant started to work at Crossett partly because Crossett had a much better sawmill than the Urania Lumber company.

STEEN: The forestry students were learning harvesting as opposed to silviculture on that fieldtrip.

SMITH: Well, it was both. We used to joke that Herman Chapman taught silviculture and called it forest management and Ralph Hawley taught forest management and called it silviculture. But Hawley was always here. When the school was started they didn't have any forest to use or manage, but they made an arrangement with the privately owned public utility that provided water to New Haven and the suburbs to use their lands. The first area they managed (your tape recorder can't see it) was out on that hill; it was and is part of the old New Haven Water Company land. If the visibility was better, even before your eye gets to the horizon you see a hill with some evergreen foliage on it, and those are some of Hawley's first plantations on the Maltley Division of the Eli Whitney Forest. The land, twenty-odd thousand acres of it, is within nineteen miles of here; up until 1948 the school actually managed it, and Mr. Hawley was the company forester. They used to claim it was the oldest scientific forest management program in the country. Probably partly true. So, Hawley taught silviculture and stayed in these parts. The forest management and logging field instruction were in the South. But not surprisingly, particularly Chapman, became very much interested in silviculture, and had a lot to do with developing silviculture in longleaf and loblolly pine, the prescribed burning business which I hope we can discuss later.

STEEN: We should. Art Nelson, who you may know, class of '39, gave us all his photographs of the spring trip. Chapman appears in more than a few.

SMITH: Chapman retired in 1942, I believe.

STEEN: How did the profession ever get a Chapman and a Fritz at the same time to holler at each other across the country?

SMITH: Those people were quite strong willed, idealistic crusaders. I never could figure out what it was that Chapman and Fritz had fallen out about. I learned some about it when Emanuel Fritz's daughter was in touch, phoning me a year or so ago when Emanuel Fritz died. I look after alumni affairs and Emanuel Fritz was the oldest living graduate of the school. I don't know what it was between them.

STEEN: During the depression Fritz was editor of the *Journal of Forestry* and he wanted to keep forestry in the woods safe from all the New Deal politics. He thought that foresters should not be involved in all the social aspects of the New Deal. That was to keep forestry in the woods. Now I don't know what Chapman . .

SMITH: I'm sure Chapman would have agreed with him about that. I'm sure, Pete, that wasn't what their falling out was about. I never knew what it was.

STEEN: Chapman was president of SAF and Fritz was editor of the *Journal*, there could have been just some . . .

SMITH: It was probably "likes repel likes" or something of that sort. They were cut from the same cloth. When I was young and over in Rhode Island, there was a man who was another agricultural scientist who was the father of one of the guys I went to school with. This man had been a classmate of Herman Chapman's at the University of Minnesota. Some years after I was down here, I saw this old gentleman; with a smile he asked me, "So you were at the Yale Forestry School? Did you know somebody named Chicken Chapman?" I told him sure, I knew somebody named Chapman, but I never heard anything about this chicken stuff, fill me in, what's this all about?

He said when Chapman was studying agriculture, I guess he was probably in the class of about 1895 at Minnesota, this man, whose name was Stene, told me that Herman Chapman was much greatly carried away with poultry husbandry, and so much that jokingly his classmates called him Chicken Chapman. Also he told me about what happened to Chapman afterwards, and I heard this from Chapman too. When Chapman finished in agriculture at Minnesota, being a bright student, he was hired to run their agricultural field station up in a place called Grand Rapids, up west of Duluth in northern Minnesota. Herman went up there and after six months of the richest kind of experience he decided that one of the most important things about agriculture in northern Minnesota was it was a pretty stupid idea, and they'd better call the whole thing off and grow trees instead. He went around the countryside telling everybody about it and he got fired. That was how Herman Chapman got into forestry. In fact, at that field station there's a red pine plantation that Chapman established as sort of an experiment.

STEEN: There was a plantation up in the Aleutians, was it Chapman?

SMITH: No, that was David Bruce. Anyway, Chapman was very a combative person with lots of good ideas, but he always had a tendency to use his good ideas as clubs to beat everybody else over the head with.

STEEN: We have the SAF records in our archives, and when Chapman was president he was a very voluminous correspondent, he wrote letters constantly.

SMITH: Did they all smell of sulfur?

STEEN: He's a fascinating guy when you think of him in the sense of leadership. He didn't just teach class, he was on a national scale.

SMITH: He did the same thing here in Connecticut, caused big controversy over the state forests. Part of the fallout was that one of the state foresters got fired from being on Chapman's side, when it might have been better for him if he hadn't been. One of Chapman's attributes was, it was sort of a psychological thing, that he could be very abusive in the stuff that he wrote, and talked to people on the telephone. If he was talking face to face, he was an altogether different person. He was much easier to get along with. I think that if he didn't see somebody in front of him his attitude would change.

STEEN: Tell me about Record. Does it make sense that he had his collection of tropical wood here?

SMITH: Record was a graduate of Wabash College in Indiana and a botanist. He decided that he was going to try to improve forest management in the tropics, and the first thing to be done was to learn who the players were. It was going to be necessary to identify the woods to figure out better ways of utilizing them and to identify the trees. This was a kind of applied botany that he spent his whole career pursuing. It must have started in this building, but when Sage Hall was built it was deemed of enough importance that the whole top floor of the building was devoted to it.

STEEN: I've often wondered, was the botany advanced enough? You can't identify the wood unless you know what the tree is.

SMITH: It used to go back and forth. In fact they had a big herbarium that went with it. Mr. Record pursued this very assiduously and expertly. He never went to the tropics very much. Harold Lutz told me that Sam Record went to the tropics only once, went somewhere in South America and got some kinds of diseases and many insect bites and so on. I guess it wasn't very good for him and when he got back, Ralph Hawley, who was always quite brusque in telling everybody else what they ought to do (this is Harold Lutz' story) said, "now look Sam, you went down there to the tropics, you got all of these horrible diseases and you come back here all covered up with bumps and bruises and so on, and you're just not up to that sort of thing. You can get plenty of adventuresome types to go down to the tropics to gather wood specimens, and you can stay here in New Haven and look through your microscope and identify the anatomy." Lutz said the most astonishing thing about this was that for once Record followed the advice, and never went back.

STEEN: He certainly would get enough interest in the tropics today, he was way ahead of his time. What happened to that collection?

SMITH: Like so many collections, it's most useful in the hands of the people who knew what it was gathered for and used it. Subsequently, Mr. Record had an associate, Robert Hess, who is still alive, lives in Florida, who helped finish the work after Record died. After Graves quit being dean, the other faculty persuaded Mr. Record to take the job. Apparently they tried to get Henry Schmitz from Washington, but he wouldn't come and they didn't know quite what to do. Actually poor Mr. Record was kind of miscast in this. I was a student here briefly during the time when he was dean, I took some of his courses and also those of Bob Hess's. Anyway, they'd gotten to the point where they could cast up a balance on what they'd done, and they published this big fat book called *The Timbers of the New World*. One of the things that Hess did was that he was a good enough wood technologist that he used the information with what Sam Record had been gathering to determine which kinds of wood they might be able to promote for utilization.

Record and Hess were wood anatomists, but Fred Wangaard who was a wood technology-type, started a big program which oddly enough was financed by the Navy, to do the engineering tests on these selected species. I learned about this when I was a student, I thought gee, it sounded like all of this is aimed just at exploitation of the tropical forests. Somebody ought to be thinking about some kind of silviculture, and I got Bob Hess to agree that he would produce a grade if I did kind of a library oriented study of the potential silviculture of some of these species. I rather speedily narrowed it down to the moist part of Central America. He gave me a list of the species that were on his list, and I gathered a lot of information, such as I could. There was some silviculture going on in the old European colonies there like what's now Belize, the French colonies, Guadalupe or the French and British Guianas and Trinidad. From those botanical descriptions I put together sort of an account of Central American silviculture, which I get out once in a while and show people interested in the tropics, and say "well take a look how much of it is holding up, how much of it isn't." Anyway, it was a big, very successful program, it had a good journal called *Tropical Woods*. But then . . .

STEEN: Hess left.

SMITH: Hess left, and he went into industrial forestry. At one time he was the head of the products research for, I think Georgia Pacific. He's retired, lives in Florida, and I hear from him once a year. Very forthright, interesting person. He always used to come and tell me what I ought to do, and he was always right. But when he left, the collection sort of bumped and squeaked. It was hard to get somebody to come and run it, and we began to wonder whether we should be running it or not. In fact the care of old collections is a problem that universities have.

STEEN: Sure.

SMITH: We've faced it time and time again here at Yale. This was one of them, and one that had left a legacy. Occasionally we would revive it. There was a botanist named William Stern who ran it for a while. Arthur Koehler of the Lindbergh ladder fame was here for a while, a very interesting man.

STEEN: Kaylor, so that's how you pronounce it. I've seen it written, but I've never heard it pronounced.

SMITH: Well, that's how he pronounced it. But then finally the kind of international wood identification service that went with it got to be a burden. Our interest in wood anatomy went over to "well, why does the anatomy come out the way it does in a biological sense." We had hoped to parlay it also into studies of pulp and paper technology but our technology program got abolished before we got to that. And so the collection was getting to be more and more of a burden, and finally, since the Forest Products Lab has this wood identification service, we made a deal with them for them to take it over. They still have it as a separate entity, and it's certainly a very valuable research tool. At least it isn't sitting around here gathering dust and cobwebs.

STEEN: I would assume that in these days people would be going back to it.

SMITH: Yes. In fact, I tell students now, go and find the big book by Record and Hess. What you need is there.

STEEN: I picked up a copy in a used book store and hoped to learn something. Five dollars for the big book.

SMITH: You probably could peddle that in certain places for much more than five dollars now.

STEEN: I'm sure.

SMITH: Now the interest in tropical forestry is more tied in with the forestry that serves those localities. It isn't something which is predicated on the assumption that all there is to it is shipping cabinet woods to the developed world.

STEEN: You've been talking about the history of the school.

SMITH: Well, it all started when you asked me about my own history. I've been at the school most of my adult life. I've never really left except for being a military weather forecaster. The school's history falls in distinct phases. The first purpose, and this is the one that Gifford Pinchot had in mind, was providing foresters for the public forest service. When he started he hadn't even gotten his hooks on to what are now the national forests; that was five years after the school got going. But starting this school and starting the SAF were part of an agenda, and he was lucky that his friend Theodore Roosevelt became president a year later. Pinchot was a very forthright, ambitious, imaginative, visionary person. In fact, when the school was started and Yale took it on, it was reported that one of the members of the Board of Trustees said, "Gee, we voted to allow the start of a school for a profession that doesn't exist." It was actually an experiment. In the first fifteen years, it was almost completely aimed at providing foresters for federal and state forest services. The interest in industrial forestry is the next thing that came along. For example, one symptomatic event took place when William Greeley quit being chief forester and went over working for the Industrial Forestry

Association in the Pacific Northwest. He figured that it was important enough to do this big mid-career change. It's also of some significance that Mr. Greeley was, I think, the first president of our alumni association.

STEEN: Is that right?

SMITH: The laboratory building is named after him. He took a very active interest in the school his whole life. I could tell you about dealings with him. Actually much of the attention of the faculty of the school switched to industrial forestry. In fact, I think they began to be a little at odds with the U.S. Forest Service people over this point. It certainly was what Chapman and Bryant were pushing down South. They were doing everything they could to get the southern pine industry over to a sustaining basis. Having these field sessions there was probably tied in with it. Well, Sam Record spent most of the time in his wood anatomy lab. Quite a few things happened in the ten years when Mr. Graves was away being chief of the Forest Service. While he was gone Mr. Toumey was in charge. It was actually then that the school was permanently organized, Toumey and not Graves was technically the first dean.

STEEN: Is that right?

SMITH: Up until then, Yale apparently regarded this as sort of an experimental program, and it had the rather quaint name of the Yale Forest School, and Mr. Graves was the director of it. While he was gone, the thing became permanent, organized as one of the professional schools. There's something else has to do with the original history of it. I don't know what all the reasons were, but we never had any undergraduate work. Part of the reason was that, at the time the school was started, the Yale administration was fighting a battle with some of the other existing professional schools, such as Law and Medicine, which were running on an undergraduate basis. Apparently they didn't want to fight this battle all anew with a new upstart outfit. They gradually switched all of them over, often kicking and screaming. They never have quite ever done it with engineering which recently sort of lapsed back.

STEEN: I assumed that Law and Medicine had always been only a graduate program.

SMITH: It was around the turn of the century that this battle was being fought or just had been fought.

STEEN: The turn of the century is an exciting time. You think of what's going on in science, Asa Gray and Darwin, all that controversy there. Gilbert in geology, America set the world pace in geological science. I wondered how Yale started the scientific educational program. Today with all the search committees and all of the tenure processes, I guess it was easier then to start a program if the Pinchot family endowed it.

SMITH: I've heard rumors that even though Pinchot was a Yale graduate, for some reason he tried to interest Princeton in it first and they wouldn't bite. It never occurred to me till this instant, it might be that Princeton was closer to his estate at Milford than Yale, but I'm just grasping at something there.

STEEN: I never heard that.

SMITH: Anyway it was set up at Yale, and I think part of the reason why he wanted a graduate program was, in fact his book sort of hints at this, that he figured he could produce new foresters in two years rather than four.

STEEN: Why not, sure.

SMITH: Since then we have tried to pursue it with the notion that as within other professions it's a good idea to superimpose professional instruction on the liberal arts kind of background. We haven't always pursued that notion, but sometimes backed and filled on it.

STEEN: Does the school offer undergraduate instruction on an elective basis?

SMITH: We do now, but it's only quite recently. For a long while we didn't, but once in a while there would be an undergraduate or two taking a course. I've had some, but usually not very many.

To return to the narrative, industrial forestry was the second point of major emphasis. The next thing that was added was the forest science program. It didn't happen all at once. Probably the first major step was hiring Jack Boyce, who had been the first director of the Northeastern Forest Experiment Station. He had spent the first part of his career in the Pacific Northwest and never quite got over it. He always used to do a lot of work out there. That was in the 1920s, then they instituted a doctoral program. The first forestry doctorate awarded in this country was to Walter Meyer, later on our faculty. George Garratt was about the same time.

STEEN: I knew Meyer, and of course George Garratt.

SMITH: Walt had been on the Washington faculty in the 1930s; he had gone to the Northwest in Forest Service research. He claimed he left the Forest Service because he was looked upon as a volume table/yield table machine for them.

STEEN: He was the Meyer in Chapman and Meyer's mensuration text that I used as an undergraduate?

SMITH: Yes. Mr. Garratt was in wood technology, but they began to get somewhat more . . .

STEEN: Did Garratt pick up intellectually from what Record was doing? I guess he wasn't trying . . .

SMITH: I'm trying to think. No, let's see, Mr. Garratt was appointed to start our wood technology program. It was pretty much a new program when he started it probably in the late or middle 1920s perhaps. Then he took over some of Bryant's position when Bryant died, which was in about 1937. Mr. Toumey died in 1932; he was older than the others.

STEEN: The textbook, Toumey and Korstian, Korstian was the junior author who revised Toumey's textbook.

SMITH: Yes.

STEEN: They weren't actually collaborators.

SMITH: I'm pretty sure they did collaborate.

STEEN: Because he started Duke Forest in about 1932 or 33, after leaving the Forest Service.

SMITH: He'd been in the Forest Service, but he'd maintained some sort of contact with Mr. Toumey. When I saw Harold Lutz recently, he told me that when he was appointed as Toumey's successor, like me he said he often wondered why they appointed him. But he named others he was pretty sure they were considering. There was Clarence Korstian, and Lutz said probably Korstian cost too much, and they figured they weren't going to get him. Lutz said another possibility was Percy Barr who was on the Berkeley faculty then or later.

STEEN: I recognize the name.

SMITH: I used to know him because I was weather forecaster in an Air Force headquarters in Italy, and in North Africa. Percy Barr was up in the higher echelons, but I knew who he was, and I talked to him once in a while. He was the head of the intelligence section. The other chap is one of our older alumni, Henry Baldwin, up in New Hampshire.

STEEN: Henry Baldwin writes to me once in a while.

SMITH: When Mr. Toumey died that was the first direct replacement. When I replaced Mr. Hawley, that was the end of the replacement of the original faculty. Hawley was younger than the others.

STEEN: During my freshman year at Washington at the orientation course, we were told that the Washington faculty was good because every member of the faculty had at least one degree from Yale. And I still remember that because Yale was the place you went to school if you really wanted to get to be something.

SMITH: But that was in an earlier time when there weren't so many schools.

STEEN: This might be a little hard to deal with, but I was thinking about the transition, all these very prominent names. Does having a faculty of grand old men like Yale had before World War II make it difficult to sustain the program when they're gone? I mean, their leverage across campus with the university administration, their prominence in the profession, is something lost that you can't regain?

SMITH: In first place, they never had a heck of a lot of leverage on the Yale campus. The best thing we had in that respect was when Henry Graves was brought back here as dean, that wasn't the only thing he did. He was the first provost of the University, when they first had one.

STEEN: I didn't know that.

SMITH: I don't know how long it was, but he was closely tied in with the whole establishment. I don't think anybody else really was. The position which Yale had in those days was partly because it was so close to being the only one. Cornell had been abolished, and some of the students left over there came here as kind of refugees I think. I don't know exactly when Bryant showed up, but I don't think he came here as a student; maybe he did but Cornell gave him a degree. The Biltmore School folded when Vanderbilt had lost interest in it. For about ten years there really weren't many other such places. There weren't very many places where they offered graduate work, and we started taking graduates from the other schools almost as soon as they appeared. We used to get parades of them from these other places, usually lasting until these schools could institute their own graduate programs. They'd keep all of the good students, and those were the only ones we could admit.

STEEN: Were they admitted to graduate school here or were they in a professional program?

SMITH: The school was always separate, it was not in the graduate school. The school has always been like the schools of Law and Medicine. While it may be a little confusing, only our Ph.D. program is under the aegis of the graduate school. Our Doctor of Forestry program isn't.

STEEN: Okay.

SMITH: And the master of forestry never has been.

STEEN: But, do you have a master of science that. . .

SMITH: If somebody wants to get one we can set that up in the Graduate School. Usually we don't recommend it, but there have been expedient purposes. In fact, there was a period when the master of science program was a way we had of having women students. It wasn't until the middle '60s that we started to admit women directly to this school.

Women students at present have conjured up the idea that there was a long hassle, but there wasn't. The old faculty who would always sort of squelch any such idea all retired. In the middle '60s there was a big upheaval going on that changed a lot of our programs. There was a long-drawn-out faculty meeting where a lot of this stuff was voted through. Toward the end of the session, Al Worrell, who is retired but still around, said "well we've changed everything else and I think it's about time we got rid of this idiotic restriction against admitting women." Somebody said, "what about housing accommodations on our field trips and field sessions." I said, "I've been taking student wives and girlfriends on field trips for years, and I can tell you there isn't any problem." So I seconded Al Worrell's motion, and everybody voted in favor. The time it's

taking me to tell you about it was the total extent of the beginning and end of the whole debate. There wasn't any.

STEEN: So, there was an official restriction.

SMITH: Yes. It was limited to males until this change. However, there were a few women students whom we had, including one or two before my time. The way they were gotten into the fold was that they were students of the graduate school, and not forestry school.

STEEN: And now a third or half of the student body is women?

SMITH: Half. It's been running 40 percent, sometimes it's been more than half.

STEEN: Are they more into the environmental management side than forestry?

SMITH: Only somewhat. Now we have situations where it's easier for women to get jobs in forestry than it is for men, particularly in government service.

STEEN: Sure.

SMITH: One of my doctoral students was just in here, and she told me she's just gotten a job doing forestry research in Micronesia. She had been working in Puerto Rico.

STEEN: There's another side to this same question, about this generation of prominent people. Looking back, is there a tradition that makes it hard to change your curriculum? If you had a younger faculty, would there be new subjects offered earlier?

SMITH: Yes, there's something that ties in very closely to what you just said, Pete. There was this push into more scientific programs which was building, building all the time. We'd get considerable sales resistance because our master of forestry curriculum in general was a very rigid one with lots of required courses. One of the things that was involved was this spring field session in the South, which had become sort of a sacred cow. Sacred cows are hard to kill. It was interfering more and more with our program in New Haven, because all the final-year students would leave and they'd be down South with only two members of the faculty looking after them. It made it very difficult to conduct education in more scientific things. There were moves to curtail the length of it and that sort of thing. It literally wasn't until there were some retirements that we managed to achieve that change. Then it was something which, as usual, went too far. There was that kind of resistance. But it wasn't widespread. During the transition after the second world war, our instruction was very much more changed over to where forestry was looked upon as applied science and not as cookbook stuff.

In the middle '50s we suddenly got lucky rather briefly. I was heavily involved in it; I was assistant dean helping Mr. Garratt. Harold Lutz and I had been itching to have more scientific people on the faculty than we did. He and I had a long discussion in which we decided the problem was we didn't have enough clowns in the circus. We got wind of the fact that there was some mysterious outfit that had some land in Westchester County that they wanted us to use. Since I was in charge of the Yale Forests, I was sent down on a winter's day to look at it. We knew it was the foundation, which was the company, and he showed us this farm that had belonged to the deceased John Hartford after whom the foundation was named. He said "Is it possible to use this place for a scientific laboratory." Sure it is, but we don't have that kind of money. "Oh well, we'll provide the money." I came back to New Haven and I figured okay, here's our chance. I told them about the mad scheme that Harold Lutz and I had developed which was literally doubling the size of the faculty. We tried to do it without increasing the number of courses.

It came to pass, but the financial support didn't last very long because of problems in the foundation. They were doing some things which shortly after Congress decided were illegal. Earlier I mentioned the alimony payment that built so much. But we kept the faculty and we managed to get in on the federal post-Sputnik money, fixed it so we kept this scientific arm going. But a lot of it was to make forestry more

scientific, and I guess we did. That's why, for example, I quit teaching forest meteorology and we hired Bill Reifsnnyder to do it, he'd been one of my students. Harold Lutz quit the forest soils business, we got somebody else, Garth White, to handle that. In the process we had to reoccupy this building because we didn't have room for everybody at Sage.

STEEN: How much influence is the job market? In the old days in the Forest Service, you passed the junior forestry exam in order to get a job and first you had to learn all this technical stuff.

SMITH: That was the tail that wagged the dog in those days. It's long gone, but it used to be very important. I don't whether it had anything to do with this rather didactic approach to things or not.

STEEN: But essentially no one else was hiring. I mean Weyerhaeuser hired one or two foresters . . .

SMITH: Some of the companies were beginning to start long-term forestry programs. However, one of the awkward things about some of the earlier industrial employment, particularly paper companies in the Northeast, was that they had forestry departments, but all the forestry departments were allowed to do was keep track of land lines and do timber cruising. They weren't allowed to have anything to do with managing the forests. The woodlands department did that. One of the things which happened, particularly after the second world war, was that people, mostly in my generation, were hired by these companies to take over the woodlands departments. They elbowed the old bull of the woods logging bosses out of the way and got more forestry into the programs that had been there before.

You'll still find companies that have forestry departments that look after land lines and the inventory work while the woodlands department does the forest management. Certainly the job requirements have, in lesser and lesser degree, affected what we do. Although one thing which has always ranked pretty high in that is students' perceptions of what the requirements are. And that vacillates back and forth. We've had times when it was very hard to get students interested in anything other than the first job they might have. There've been other times when they wanted to save or run the world, and weren't very much concerned about what they'd do the first year on the job. We compromised on this. I have often asked students in their first year, "what is it you want to do when you've been out five or ten years? That's what we'll aim at in constructing your program for you." It's been some years since I've heard "well, the XYZ company has this kind of job as a starting level and that's the one I want. I don't want to hear about anything that doesn't have to do with that."

STEEN: I suppose also after the war, with the increased demand for faculty, that the legitimacy for more science for the program was because you had to teach the people to do research.

SMITH: Yes. The doctoral programs grew, but almost everything lives to get overdone. In the middle '60s there was an effort to change the school almost completely over to doctoral education. It was partly because there was so much demand, but it was a change that never took place because what happened was that the post-Sputnik research money dried up. I was not very happy about the business. I figured, sure we'd build up the science program, that's fine, but let's not abandon education of practitioners. I thought this partly because I didn't think there were enough science jobs out there, and there weren't. In many of these fields, there may be four new jobs in the whole country in a year, and if you've got five people to fill them you've got unemployment, if you've got three you've got a shortage of people.

STEEN: I had lunch yesterday with a Duke forestry professor who had this anecdote which may or may not be true. The dean of forestry at Yale and dean of forestry at Duke exchanged correspondence when McIntire-Stennis was being debated, and neither dean felt it was going to be really important. Does that sound true?

SMITH: It's true.

STEEN: Why wouldn't they have wanted that?

SMITH: I think there probably were two reasons, George Garratt and Scotty Harrar.

STEEN: Okay.

SMITH: I think part of what they figured was there isn't going to be enough money in it to make it worthwhile. I'm quite sure that one of the things that affected George Garratt was that he was so head over heels in this industrial business that he figured it's government money and that's tainted.

STEEN: Government money's tainted?

SMITH: Yes.

STEEN: That's a switch.

SMITH: That was his way of thinking, although he could be somewhat ambivalent about it. When he was first dean in the late 1940s, the money had all dried up and in a rather discouraged way he told me, "I don't think we can exist unless we can get some government support." The university periodically appoints committees to do very thorough studies of particular parts of the university. They don't have them all the time but they instituted one on the School of Forestry about 1950. While it was headed by a Seattle real estate developer named Charles Clise, the mainspring in it was William B. Greeley. Bill Greeley came here and delivered a speech. I remember one statement was that Yale "has lost its leadership." Subsequently Harold Lutz asked, if we lost leadership, when did we lose it? Herb Winer and I being brash young faculty members told him, it was in 1933, which was the year he was appointed to the faculty. So for the next decade we razzed him about how everything went to hell in a basket in 1933. But anyway, one thing Greeley did was to say, well if you want to have a school you'd better go out and raise some money. He got George Garratt to go out on the road and raise money, and once George decided to do it he was pretty good at it. It was chiefly from industrial sources. I can remember when Garratt seemed sort of blasé, about this McIntire-Stennis business, I remember figuring gee it's probably a mistake, even though Connecticut's allocation may not be very much, you'd better get in on it. He was not somebody you argued with. I'm pretty sure it was from having gotten head over heels into this industrial bit. There had been the conflict over federal regulation that poisoned things, even to the point where for years nobody wanted to start it again. We didn't talk about it much because it split the forestry profession so badly.

STEEN: At Duke the consensus is that the private forestry school can't compete in the hard sciences with the state forestry schools, like at NC State. So their role is policy, economics, management, the professional route.

SMITH: I've heard that idea.

STEEN: Labs are expensive and the state . . .

SMITH: So this other stuff is cheaper and you blow hot and cold about it. I've heard that idea. Sometimes I think if your money is short, you might just as well pursue it.

STEEN: I don't know enough about the Yale forestry school to compare it to Duke's forestry school in terms of how much science versus how much policy.

SMITH: I think at present we've got a lot more science than they have. It hasn't always been true, in fact, they were very strong in it at one time. One of the problems, about which I tried to tell someone there once, was that in some of the fields where they were trying to hire people, they were producing most of them. Their policy of not hiring their graduates was getting in their way, as in tree physiology and soils.

STEEN: Ted Coile came down from Yale to teach.

SMITH: Clarence Korstian put together an excellent faculty but for various reasons it didn't hold up. I don't know all of the reasons why. I can tell you a story that I've been told about it.

STEEN: Alright.

SMITH: What I was told was that "Scotty" or Elwood Harrar became blind and instead of giving into this handicap, he got people who could help him, who were willing to help him. They were brought in, but they weren't very good and he depended too much on them, so they took over. If he had bowed out and been replaced by somebody it might not have happened, but I don't know. Another problem that they had at Duke is that it was set up with university funds; it's not like this establishment. The endowment funds earmarked for the Yale forestry school exceed those of some freshwater liberal arts colleges. We're completely financially independent of the university. It's official now, we have to finance ourselves. This degree of fiscal independence has always existed in some degree, so that if we want something it's understood that we can have it if we pay for it.

STEEN: Korstian wanted the forestry school at Duke to be independent financially of the university, and he made money buying and selling Duke forest land, timber and so forth. Probably it backfired ultimately because it was never really resolved how the school and forest were related to the university. It's intriguing that there's two private forestry schools of the 50 or so that are accredited.

SMITH: Having our own endowment is probably the chief reason we're still here.

STEEN: It started with the Pinchot family and of course, Graves raised . . .

SMITH: Graves raised some, Toumey got some. Then there was sort of a hiatus during the depression, and it wasn't until 1950, when George Garratt got out on the road again, and it started to build. George Garratt's successor, Francois Mergen, raised a lot. Mergen managed to get some of the people that Mr. Garratt had been talking to over the years to actually make the donations. The endowment of the school doubled during Mergen's ten years as dean.

STEEN: That's interesting.

SMITH: Mr. Garratt raised quite a bit and Mergen even more.

STEEN: But it's instrumental in the life of the school. One could speculate that if it weren't for the endowment the school might have been closed.

SMITH: Yes, exactly. Somebody would have figured out a reason, it would be easy, because it's costing so much or something like that.

Yale Forests

STEEN: I know that you're also interested in the role of university forests in forestry education, especially with Yale Forests.

SMITH: I'm in charge of them. The first one that we had, we now call the Yale-Toumey Forest. It was one that Mr. Toumey started to acquire. It was originally called the Yale Demonstration and Research Forest. What he wanted was a place where research could be done in silviculture and particularly forest ecology, applied forest ecology, where you could set up experiments that wouldn't be disturbed. The other purpose envisioned in 1913 had to do with the fact that very little conscious forest management was going on anywhere in the country so they wanted places to demonstrate how you did this kind of thing.

STEEN: The word demonstration was in the title?

SMITH: Yes.

STEEN: As early as 1913?

SMITH: Yes, that was the first title. It was Yale Demonstration and Research Forest, I never can remember which came first. I've got the faculty now to call it the Yale-Toumey Forest. They picked a location in southern New Hampshire that was on a major highway to the White Mountains. It's right beside Route 10, which is no longer the major highway to the White Mountains, but it was a place where they figured they might get some walk-in or drive-in trade to see their demonstration work. Another forest was given to us in 1924. It was a tract in Vermont that had belonged to an alumnus, James Bowen, '17, who was killed in the first world war, and his family gave it to us. I guess we probably accepted because we couldn't graciously refuse it. We still have it. Then as you perhaps know, the Pack Foundation became interested in having demonstration forests run by universities, and they approached. . . I never figured out exactly who. I know the Pack Forest in Washington near Mt. Rainier; SUNY Syracuse has one that I used to visit very often in eastern New York. I think there are others.

STEEN: I think there are five of them altogether. There's a biography of Pack in the works.

SMITH: I talked with the woman who was writing it, but I never got an answer to the question, "where are the others?"

STEEN: They're listed in the book.

SMITH: I found that NC State's Hill forest isn't one of them, at least not according to her. Anyway, Mr. Graves told Pack Foundation, "you don't need to buy a forest for us, I know where I can get one." So they put up an endowment fund to run the thing. And what he acquired . . .

STEEN: Pack put it up?

SMITH: Yes, the endowment. The forest is in northeastern Connecticut. It's about 7,800 acres. I keep telling people it's the biggest physical possession of the university.

STEEN: That's as big as Duke Forest.

SMITH: Yes. It had been put together by a member of our first class, a wealthy man named George H. Myers. In fact, he had started to acquire the forest that we have in New Hampshire, but he was buying cutover land and young, old-field white pine. The reason that this locality was seized upon for the Yale Forest in New Hampshire, later the one in Connecticut, and also the Harvard Forest, was that the locality then had lots of old-field eastern white pine and seemed attractive to commercial forestry. It was the center of the American container industry, because everything that now comes in the brown corrugated box came in a pine box.

Pine is not very strong but has a very good ratio of strength to weight, and a very labor-intensive industry grew up to make wooden boxes. The old-field pine stands had high growth rates; while the quality was wretched, however, the labor-intensive industry cut out the knots and crooks so that it didn't matter too much. In every other part of the country, except for this well-watered corner, there were so many forest fire problems that it was hard to get any real forestry going. We had problems enough with fire here, but it wasn't so bad that you couldn't do something. In the South everything was burned almost religiously every year, in the Lake States and West they were still having these horrendous fires that might burn over almost half a county at a time. So central New England looked very attractive to these people, and they started these demonstration forests. What we now call the Yale-Myers Forest, after the name of the donor, is our Pack Forest. We no longer have to use the endowment fund to operate it. The fund wasn't completely earmarked for the forest but was a more general one. It was initially used for it, but now the forest produces enough income. Our forests actually pay for themselves and a little bit more.

STEEN: Is that right? That's timber harvest and . . .

SMITH: Yes.

STEEN: Forestry works, huh?

SMITH: I conducted sort of a crusade to make it that way. This was partly because when I took over the forests people told me it was impossible and we should get rid of the big one in northeastern Connecticut. Now they can stop that talk. Making the forests pay was partly at the expense of some research and instruction we might have been conducting. But anyway, they don't cost us anything. In fact, we have started acquiring more.

STEEN: There has to be an instructional value, otherwise you have to pay taxes.

SMITH: We pay taxes on the forests.

STEEN: You do pay taxes. It is an actual revenue producing . . .

SMITH: They produce revenue, so we pay property taxes.

STEEN: I see, so it's more than education.

SMITH: We probably produce one school teacher's salary from 10,000 acres.

STEEN: How about research and education?

SMITH: Part of the education now is that we hire students to run them.

STEEN: NC State went through this. They lost their tax exemption because Champion was managing their Hoffman Forest.

SMITH: I think they leased it out.

STEEN: They leased it out and lost their tax exemption, and they realized that they weren't able to do that, so they brought back . . .

SMITH: Part of the reason why we pay taxes is (1) because of the demonstration forest function. We didn't want somebody to claim, "oh you can do this because you don't have to pay taxes."

STEEN: Okay.

SMITH: The other was that in order to get tax exemption in New Hampshire, we'd have to be organized as an educational institution in New Hampshire. In Connecticut it was because we had a rotten borough legislature before one man-one vote. In New England the town is the unit of government. Each Connecticut town, large and small, of which there are 169, had two representatives. Union, where much of the Myers Forest is, still has the lowest population of any town in Connecticut, but it used to have two representatives and so did New Haven. We didn't want the rural legislators ganging up with those in New Haven about how Yale should pay taxes in New Haven. But anyway, with current-use valuation the taxes are not too bad.

STEEN: They didn't have a forest land category?

SMITH: We've got forests in Connecticut, New Hampshire, and Vermont, and every one of them has a provision under which forest land is taxed on the basis of its value for the use to which it's put. New Hampshire had one of the first favorable tax laws, and it was when Sherman Adams was governor that a lot of it was pushed through. In fact, in the early days Herman Chapman and Toumey used to do a fair amount of educating about the very destructive tax laws which would bankrupt forestry. If you followed the letter of the law in the case of forest crops it was as if you taxed a potato crop every week. It took a fair amount of political maneuvering to get this treatment allowed.

STEEN: It also makes Yale a good neighbor in that county for the tax base, you are paying taxes. One of the things happening in Durham, is that the counties are threatening to zone Duke Forest. And Duke is challenging that and saying this is a unique situation and it shouldn't be zoned for . . .

SMITH: Oh, the counties want to zone it so they can't do anything but grow trees on it. Oh my.

STEEN: After you zone it as open space.

SMITH: Every place is different with regard to this. Sometimes we've entered into an unplanned conspiracy with these outfits to hold down the school population. Here in Connecticut, all these municipalities and towns have learned that having residences is a losing proposition because they produce more children than revenue. I've had some discussions with town officials, who are very keenly aware of this. They'd kind of like us to use the land for industry or other things, or for housing for the elderly, but not for ordinary residents because that means school children.

STEEN: During the '60s, with all of the upheavals, ecology became a household word. Was there any reaction among Yale students about not cutting anything on the school forests, or were they really aware of it?

SMITH: My goodness. I guess they chiefly weren't aware. There was a little bit of it. Most of our students accept the idea of sustainable timber production. In fact, the chief reaction we've had is going on right now. We allowed deer hunting on the forest in Connecticut.

STEEN: You had a choice of not allowing it?

SMITH: In Connecticut you can't hunt deer on any land unless you have the permission of the land owner. It's not like the other states where we'd have to take overt action to prevent it. So the animal rights people, every year for the last five years, have picketed the president's house and get in the papers all over the country. What a cruel place Yale is, and sometimes what an evil character I am for permitting it. In fact, just yesterday I wrote a long rebuttal piece and am arguing with Bruce Larson about whether we should send it direct to the newspaper or compromise by sending to the university public relations office. We haven't heard much about "no, you shouldn't cut anything," although the deer people say the only reason you want to control the deer population is because you want to grow timber. They say that if you didn't want to grow timber it wouldn't matter that they are eating up all the regeneration.

STEEN: What sort of land is around the school's forests in terms of providing . . .

SMITH: Oh, for timber?

STEEN: I can't visualize this. Is there a stand of timber out there?

SMITH: Connecticut is nearly covered with trees. Eastern Connecticut was settled last and abandoned first, it's very rocky and we're surrounded by state forests. The most civilized land we have is actually the first forest in New Hampshire, which was deliberately located on a route of travel, quite close to the small city of Keene which is the booming center of southwestern New Hampshire. We've even had to fight off putting an enclosed shopping mall on part of it. We have some plans for leasing a sylvan industrial or office building development. The real estate boom has eased off, so it probably isn't going to happen for a while, but it gets kind of awkward when you know that the land base is in the order of \$20,000 or \$30,000 an acre and you're growing pine trees on it. In fact, in that case all the developments are being put on filled wetlands, while we're sitting growing trees on dry land a quarter of a mile away.

STEEN: You can see at Duke private developers are putting in housing projects up against Duke Forest, using the setting to enhance their . . .

SMITH: And the realtors say, "Duke will never cut anything, they'll never sell the land!"

STEEN: Duke's sitting on--pick your number--between \$100 and \$300 million worth of land. The pressures are building.

SMITH: We hear some of it, although in the case of this forest in New Hampshire, once in a while we point out to people, "hey, look at the map. We've got fourteen hundred acres, which is equal to the area that the built-up part of the city of Keene has come to occupy since 1730. A parcel was sold right across the highway from our land for \$106,000 an acre, for a car lot. I checked the land records recently. I don't think the transaction's gone through and I think that, if it sells, it's more like \$50,000 an acre. But nearby is also land that we could have picked up on a tax sale recently for \$150 an acre.

STEEN: Wow.

SMITH: And it's only a mile from one to the other.

STEEN: What more do you want to say about Yale Forest?

SMITH: When we acquired the forest in Connecticut, the problem was that it was a vast area of heavily cutover land. The previous owner, George Myers, had a large collection of people working there. It was during the depression. It wasn't regarded as good form to fire these people, so the whole thing was a money-losing proposition. While the income from the Pack endowment carried the operation, it wasn't working very well. It was quite independent of the school's program and the Pack Foundation became unhappy with it. The faculty were unhappy with it; in fact, they were unhappy with it before it started. They warned Dean Graves not to accept the gift, but he went ahead and accepted it anyway.

STEEN: Why is that?

SMITH: The chief thing they knew was that we would be trying to demonstrate that you could make money growing trees, but with all this cutover land it was a hopeless cause, or would be for quite a long period. And they were right. The man who was appointed to take charge of the forest spent a lot of time on the politics of local and state government. He was a member of the legislature. Seemed to be minding everybody's business but his own, and he kept repelling any instruction or research. The activity was separate from the forest in New Hampshire, which he didn't have anything to do with. In the middle 30s he was replaced by a young faculty member who was beginning to get things straightened up and working right. He got clobbered when two things happened. We had a bad tropical hurricane in 1938 that blew down a lot of what timber still remained.

STEEN: Ah-ha.

SMITH: It wrecked the forest in New Hampshire too. The other thing that happened was the wooden box industry was fading. People began to wonder, "well why have we got these demonstration projects anyway?" By then, there were beginning to be more public and private forest management enterprises setting up around the country anyway. In fact, the idea of having demonstration forests was one that excited attention only for a short period.

STEEN: I've never seen any numbers, how many people actually pulled off the highway to take advantage of the demonstrations?

SMITH: In every case there have been highway relocations that got in the way, but actually it worked for a while. In New Hampshire, Henry Baldwin and the state set up another demonstration forest which worked much better. We sort of backed out of the function. Well with the big forest in Connecticut, we had this bad hurricane and then Henry Graves retired. The faculty, who had been opposed to accepting it in the first place, got very frustrated when they found that there was an agreement with the donor under which they couldn't get rid of it; we were stuck with it.

Activity began to get curtailed; a lot of the workers left because the war industries provided better employment. But we had to have a forester there to fulfill the agreement. When I was appointed to the

faculty Mr. Garratt told me, "you are not to manage the New Haven Water Company forest the way Mr. Hawley has been doing, it's time they managed their own." I was not anxious to take on all of that. He also said, "but I'm going to make you chairman of the school forest committee; see what you can do about that mess up at Union (in northeastern Connecticut)." The attitude was we don't need it anyway because we could continue to use the New Haven Water Company land, which we have. We really don't need the Connecticut forest so let's get rid of it at the first opportunity. If we need a new forest we can always buy one; land is cheap anyway. I was not very happy about this and I knew they were tied to this agreement and couldn't get rid of the forest.

They had a resident forester up there (he is now our oldest living graduate). He was a Russian émigré who started out as a forester in Czarist Russia in 1913. He's now been retired for many years. He and I knew that if the school hung on a few more years the trees would grow enough to rescue the situation.

One way or another between the growing of the trees and cutting the expenses, I converted something which had been a cost to us to something which pays for itself and more. It also finally occurred to people that we didn't have another chance to get a big forest close by, that this was it. Now we've begun to accept gifts of land, both in New Hampshire and Vermont, to add to this system. We want to get interesting areas for research, and from some recent gifts we've got some much better hardwood land than we've ever had before. Also, we need to get a bigger base for somebody to manage so we can carry a bigger establishment to do it, to add to the income and spread the overhead over more land.

STEEN: What's the primary purpose? Revenue, education, demonstration?

SMITH: The primary purpose now is instruction. More and more the forests figure in our forest management instruction. The forest is actually managed by students, usually doctoral students but not always. We use it more and more for the kind of forest management instruction that we used to have in Arkansas and Louisiana, but it's closer by. It's a place where we can do research and mess up our land or our trees and not somebody else's, if that's what the research calls for. We pretty much abandoned the demonstration function, that's no longer necessary. I'm not sure it ever worked very well anyway. Another purpose is revenue production, which is chiefly growing and harvesting timber. Actually some of our research is done in the process of making timber sales.

STEEN: Has there been a study back to the original accumulation of the land on a cost-benefit basis, in terms of financing?

SMITH: They used to try. Some of these other Pack Forests did, but it got to be very hard to know what was going on. There was a lot of research of that sort in those days. I could name several establishments. For example, we used to try to do it on the New Haven Water Company land. Part of the reason I can't close my office door sometimes is because so many records were accumulated. A lot of it was trying to keep books at an equal level of intensity on every forty-acre compartment. It just sort of collapsed of its own weight. In fact, I was thankful that Mr. Hawley had quit trying to do it on the New Haven Water Company land before I replaced him. We started trying to do it on the forest in Connecticut.

As far as this kind of research was concerned, in the late 1940s the U.S. Forest Service started trying to do it on more systematic bases on their experimental forests. The projects were referred to as "compartment studies." One of the people who had a lot to do with starting them was Ed Crafts who was a Forest Service economist. They were symptomatic in a certain way of their time. What they would do was have these comparatively large areas where what they were really testing was various levels of investment in the amount of growing stock that you kept and the amount of money you spent on things like pruning or planting or other silvicultural treatment.

They kept changing names of the various levels of treatments. Sometimes the terms were pejorative and sometimes not. It was all predicated on the uneven age management business. That whole concept used to drive me up the wall, as it did other people around here. Chapman and Hawley didn't think much of it nor did Lutz and so on. Or Leo Isaac for whom I worked in the Northwest. With a high level of investment, you'd cut very frequently and very lightly, and you might also spend a fair amount of money on stand

improvement work of various sorts. You might spend a lot of money on planting up gaps in the forest. With a low level, it was almost deliberately destructive. You left no money out there in the woods, either in what you left in standing merchantable timber or invested in treatment. They had usually about five gradations of investment. Then, they'd keep very careful records on everything; everything they could they somehow put a value on it, what you did or what you left. The objective was to try to find out what the optimum level of investment was. These treatments were set up all over the country. In fact, I remember that when I was working for Leo Isaac in 1946 at Wind River, Ed Crafts came from Washington to look at the place at Wind River where this was going to be set up.

I drove him and his associate out to the place and we looked at it. I heard how all these ideas about uneven-aged management, which I figured were for the birds, were going to be demonstrated. As far as I was concerned it was like showing the devil where hell was going to be constructed. This was a kind of research into the economics of forest management and silviculture that was fashionable at the time. My silvicultural problem with it was that it was based on the assumption that all stands had to be uneven-aged if they were to be managed. The only kind of even-aged stands contemplated tended to be those allegedly devastated by clearcutting.

However, the chief variable was the amount of money invested either in reserved, uncut, merchantable growing stock or in silvicultural treatment. The two were usually confounded. A high-investment treatment would involve reserving a valuable growing stock with light, frequent cuts and spending much money on stand improvement work. However, even with intensive efforts it was seldom that the experiments called on spending money on regeneration. That was supposed to come naturally and automatically usually because the tinkering with q-values and J-shaped diameter distributions produced equations that said there would be regeneration. Usually the cutting areas were too small to produce much free-to-grow regeneration. One can always make the merchantable production look better, at least for a time, if one allocates too much area to merchantable growing stock and nothing to regeneration. However, if one means business about sustained yield, the piper must be paid later on.

Few of these experiments were ever carried to the kind of conclusions planned but unexpected things were learned. Sometimes the best stands are now where the initial cutting were seemingly the most devastating.

In those times, there were other kinds of economics research at some demonstration forests. For example, before my time there were efforts to keep financial records on every stand in the forests used or owned by this school. All harvests and all expenditures were recorded in fine detail. There were periodic inventories of each stand to keep track of growth, although the sampling intensity was such that the sampling errors must have been huge. However, nothing was being compared with anything else and it is difficult to tell what was being learned. Fortunately this effort collapsed of its own weight before my time and I have not been burdened with continuing it. I concentrated on improving revenues and not so much on keeping score on them.

STEEN: So today when you say that the forests generate revenue, you mean that there's more money coming in than going out, and you teach students and that's good.

SMITH: Yes. Sometimes the cutting is used to set up silvicultural experiments. However, a timber sale doesn't become economic research in itself. We set up the timber sale and put it out to bid and get it done and in the process we try to use the cutting to make the forest grow better or . . .

STEEN: How typical is the forest management on the school forest to other forest practices in neighboring . . .

SMITH: It's very similar to the best of it. We keep more growing stock on the land than most people, and we're doing at least as good a job as anybody else, however you define good. The age class structure is such that we're still temporizing with some problems. Most of the land is covered with stands about 80-100 years old that originated after very heavy cuttings early in this century. We want to replace them gradually with some semblance of the proper arrangement of age-classes. (However, I claim that the school needs a sustained yield of money or inflation-free buying power and not necessarily of amount of wood.) Especially

at the large Myers Forest the problem has been the deer population which eats small trees as fast as we produce them. It is a difficult situation because virtually all of our species of trees start as advanced regeneration and must build up under the old stands in the deer-browsing stratum. Until we control the deer we can't regenerate much of anything. In spite of the complaints of the animal rights people, we're trying to get the deer population down to where we can regenerate. The nature of our forests is such that if the deer haven't eaten it up there's regeneration every time you cut.

STEEN: What's causing the deer population? Lack of predators, or suddenly there's a lot of food?

SMITH: It's the lack of predators, mostly. Over the whole area the juxtaposition of open agricultural land and forest cover greatly encourage deer. Plus very little hunting pressure. We have laws here in Connecticut which are still a hold-over from when the deer were virtually extinct. They've got the same problem in Pennsylvania, and all over the northeast.

STEEN: I've read that the game managers of a generation or two ago were so successful in convincing the public that to shoot a doe was something bad that the hunters still believe it.

SMITH: Don't tell any hunters in Connecticut about not shooting does because if they're deer, they'll shoot them. Farther north there are places where there are trophy hunters, but in Connecticut, thank goodness, if it's brown they'll shoot it. They're a little more discriminating than that, but we don't have the bucks-only mentality. We don't have that problem.

STEEN: How is the state commission of game or whatever the agency is called involved in this deer population problem?

SMITH: We have them run the program, we don't. Many years ago we turned the administration of hunting and fishing on this forest over to the state.

STEEN: How does the school grant permission to hunt? Do you have a sign up, "Okay to hunt?"

SMITH: In Connecticut, we tell the state that they can run their program and we negotiate a little bit about how many permits they give out, but we issue them a blanket permit to issue.

STEEN: That's basically what the student is complaining about.

SMITH: It's more outside animal rights groups than students. There aren't very many but they make a lot of noise; they're out for the publicity. While the Yale Forest is managed for this purpose as if it were a state forest, they complain about Yale and not about the state, because Yale is a four-letter word for publicity. But that's a fairly small matter.

The problem from the forest management side is that until we control the deer population, until we get the state and hunters to do it, it's very difficult to regenerate anything. There is regeneration in places close to where other people have dogs or places that happen to be right along the roads and are favorites for the illegal jack lighters. In such places we are starting to cut the old stands and bring the regeneration along. In the other states where hunting is much more common we generally don't have these problems, although some of the lands in Vermont seem to be rather heavily browsed too. It varies from one place to another.

STEEN: A friend of mine who grew up in Colorado said that some years you could take two deer.

SMITH: You can here.

STEEN: Oh, I see.

SMITH: The hunters who have permits can take two.

STEEN: You've already answered about the predators, but does it suggest other things out of balance too, other species would be . . .

SMITH: We have too many beaver. They were extinct for 150 years, they moved back in 20--25 years ago and they very speedily became pests.

SMITH: I was thinking about all the culverts they plug up.

SMITH: Yes. They're getting very hungry.

STEEN: What's the likelihood of say Yale, as an educational institution, introducing predators? Is that . . .

SMITH: The chief predators of beavers are man, then probably diseases and so on. In the old days they probably waxed and waned, but now they have come in all at once and have quickly eaten up all their food supply.

STEEN: No money in pelts?

SMITH: Not enough to make people trap. We get trappers in where the beavers are plugging up spillways on dams. We don't want them to plug the dam and then get eight inches of rain and have the earthen part of the dam wash out because the spillway's blocked. We have let the beavers kill the wet parts of the forest. In fact we're hoping to start some research now to see if we can use the beaver kill to bring Atlantic white cedar back. We've always speculated as to how that ever got started. One hypothesis is that flooding kills the late-successional red maple leaving the slate clean for reentry of the intolerant cedar.

STEEN: We got a reference question about Atlantic white cedar because according to some legal definition if Atlantic white cedar grows there it's wetlands.

SMITH: That's certainly true enough. Your inquiry was probably from North Carolina. A lot of the pocosin land that Weyerhaeuser has was once Atlantic white cedar. There's an old bulletin by Clarence Korstian that maps where cedar was in the 20s before we got to the end of the cutting and burning. In fact, Aimlee Laderman who just joined our faculty is much interested in Atlantic white cedar. She edited a monograph about it. She is starting cedar research at the Myers Forest.

STEEN: Well at Duke they're about to announce the creation of a wetlands institute as a part of the forestry school, which is also considering a name change. Only about 10 or 15 percent of the students are in forestry. Yale must be about the same.

SMITH: We've got about the same problem now, because there's been so little employment in old line forestry recently, but it'll change. Now we're back in a situation if somebody calls up and you want to hire a forester, "sorry, they're all taken." Some of the students will move back into it. We've been through that before. In fact we've often had students who have come to study environmental stuff and stayed to be foresters.

STEEN: I was in Canada a month ago, Montreal and Quebec City, and talked to people in industry and on campus. With the new environmental legislation one of the biggest problems is a lack of talent. They don't have enough student body in the pipeline to staff the new environmental programs.

SMITH: Maybe we should send some of them up there. These things go back and forth. For example, as far as people in doctoral work, for a long while what doctoral students they had really weren't in silviculture, they'd be in tree physiology or something like that. Then all the people of my generation who were hired to teach silviculture after the Second World War started retiring, and for a while there were jobs all over the place in silviculture. I had doctoral students coming out of my ears. I've seen it time and time and again, there'll be jobs in something and people will flow into it, then they get to be too many of them, and people go into other fields.

STEEN: With the tenure situation it takes quite a while to rotate through a generation.

SMITH: You get ebbing and flowing in these things. In fact, engineering has been like it for years. Everything is completely out of phase. It may take four or five years to educate an engineer. If industrial operations are going good they are out of phase because four years earlier there weren't jobs for engineers so nobody studied engineering. We finally got there in forestry. Industrial outfits weren't hiring and public agencies were being cut off at the pockets, so they weren't hiring either. Small wonder we got where we did.

STEEN: It makes quite a jolt in the work load for faculty.

SMITH: For us it's helped to have the environmental program, sort of a surge tank that slops back and forth. A lot of students have silviculture and also the environmental program. It's hard to know what the environmental program is.

The Practice of Silviculture and Other Publications

STEEN: One last question about education. How does your text fit in?

SMITH: Academic silviculture is sort of a spectator sport. The textbook that I've written and tried to keep in repair is really a collection of various ideas about silviculture. Sometimes it's almost like collecting poems or stamps. Rather than being critical about choices of ideas I've often included practices that don't seem like good ideas to me. If you look around the world in different times and different places, people need ideas about how to treat the forest vegetation. If my textbook is what it ought to be, somewhere in there should be some preexisting idea that will fit. However, one of the problems has been getting away from the notion that says there is one best way to manage all forests on earth, or one way to manage loblolly pine or eastern white pine or red oak. There isn't any.

If we look at any particular species, it has a natural range and reasons that limit it. If it's toward the pole it gets too cold, toward the equator it's too warm. If, say, it's on one part of the continent, maybe in this part toward the east it may actually be too wet, or toward the west it may be too dry. And, therefore, if we want to encourage that species by silvicultural treatment, if it's on the north end, we need to make it warmer, if it's on the south end, we need to make it cooler. If it's the east end we need to make it drier, if it's the west end we need to make it wetter. So that whatever we do we shouldn't expect it to be the same, we should expect it to be different. In the middle it'll be different from all the edges. However, oak trees will always have big seeds and birch trees will always have small ones.

A few years ago I was at some forestry meeting in Vermont where somebody was telling us how you encouraged sugar maple and said, "well, you've got to keep it cool, it can easily get too warm for it." A chap from Ontario was there and he said, "you're out to lunch, that can't be. We found in Ontario on Lake Huron you had to do things to make it warm enough for it to grow." Suddenly a point occurred to me and I brought it up with all these people. We think of Vermont as being rather cool, yet for sugar maple we're at the end at the southern limit of the range where it grows well, and if you go too much farther it obviously gets too hot for it. On Manitowlin Island in Lake Huron, you're on the other end of the scale and you've got to make it roasty-toasty or sugar maple won't grow. You run into this often. Doug-fir for example is an altogether different beast to the east of the Cascades where it gets too dry. If you start looking you'll find that we shouldn't assume a species will always behave the same; we should assume that it will be different. Good silviculture is the result of analytical thought, not of cookbook rules about how you grow sugar maple or Doug-fir or loblolly pine.

STEEN: I'd like to talk about a couple of your publications [See Appendix B]. The "Economic History of a County"; now I would not have suspected that Dave Smith would write an economic history. That's your very first publication, a formal economic history, Kingston and Narragansett county, *Rhode Island Review*, 1941.

SMITH: It was supposed to be Narragansett Country, but some editor changed it. Actually that relates to what's shown here. I wrote it when I was an undergraduate.

STEEN: You're pointing to the diorama of Harvard Forest.

SMITH: Yes. In that case, rather briefly, somebody who was on the English department faculty at the University of Rhode Island wanted to have a literary magazine, and they rounded up what writing they could, and I contributed. It was an account of a situation common here in the eastern United States where land was cleared for agriculture and then for variety of reasons abandoned and the forests came marching back on it. I don't need to point out to you that's been a major feature in the whole forestry situation here in this country.

STEEN: Maybe today you wouldn't use "Economic History" in the title.

SMITH: Well, I don't know. It might be "The Land Use History," although it wasn't supposed to be. It was a literary magazine and not a scientific one, and it wasn't concerned with natural science.

STEEN: Why were you asked to review a book on French colonial history, in French? There was something about you that the editor saw, "I'll send this book to Dave Smith." It was in *Geographical Review*, the second one in your bibliography.

SMITH: Somebody sent it to Bob Hess, and it was at the time when I had been working on a special project with him about tropical silviculture. During the Second World War, I had spent some time in North Africa; but also I can read French. I remember I spent more time on it than I really wanted to, but it was an interesting chance to find out what was going on in tropical forestry in the French colonies of the time.

STEEN: The next thing on your list of publications is a review of Geiger's *Climate near the Ground*. I used some version of that when I was in graduate school in the '60s. Was that a pathbreaking book?

SMITH: Yes, oh yes. It was actually the basis of most studies of microclimate. It so happened that Geiger was on the forestry faculty at the University of Munich. He's passed on now, his successor is a man named Baumgartner. It was obviously the leading work in that field. It was so important that it was translated into English and I used the English translation of it as a textbook in the forest meteorology course that I started almost as soon as I joined the faculty. This was something that I and Harold Lutz thought ought to be done. William Reifsnyder's taken it over; he was one of the first doctoral students whom I had.

STEEN: I didn't know he was one of your students.

SMITH: Yes, both he and I, by coincidence, were in this wartime meteorology program. We both went to New York University but not at the same time, he was there afterwards. If you're going to teach a course, you need a textbook or certainly it helps tremendously to have one. This was good because it not only described the principles of microclimatology, but also many of its illustrations were from forestry. Though oddly enough, not much about fire. The reason for that is that fire is not very prominent in the German forests.

STEEN: Were there other books like Geiger that really had an impact on the teaching of silviculture?

SMITH: It was a variety of things that had to do with forestry; the role of damage to the forest, for example. I did a meteorological study of these tropical hurricanes which destroy so many forests around here. I never was able to get it published because, and this is one of the problems you have in forestry, it was too much forestry for the meteorology journals and too much meteorology for the forestry journals of the time. I think it would be different now.

The physics of fire behavior is mostly a meteorological phenomenon. The microclimatology is very important in governing the regeneration of the forests, because the seedlings have to live in this strange climate down near the surface of the ground where most of the ground rules that we're familiar with don't apply. Much of the research that I and my students have done has revolved around that aspect of it; I claim that understanding this is the scientific basis of regenerating forests. In fact, one of the current doctoral students, Nora Devoe, is just finishing a very good study of the role of this kind of thing in the regeneration of

tropical forests. She's been doing the work in the Luquillo Experimental Forest in Puerto Rico. As far as the meteorological aspects of forestry, something like Geiger's book is one of the important keys to it all. In fact, some of the best research in the field has been done by this Baumgartner, who's the successor of Geiger. Another thing I did with that book was to use the German edition to study German when studying for the doctorate. In those days, one had to pass examinations to show you could read French and German.

STEEN: Yes.

SMITH: I read the German edition of Geiger's book. I remember it was known to the meteorology professors at NYU when I was a student there at the beginning of the war. The fact that they knew about it reinforced my interest in it because Harold Lutz had pointed out its existence to me.

STEEN: When I was in graduate school it was a preferred elective for graduate students in forestry to go to the meteorology department and take a course in microclimatology. And we used that textbook. But it's taught here in the forestry school. I don't know if Yale has a meteorology department.

SMITH: In fact, Yale does not have a meteorology department, they didn't then and they don't now. But in the last fifteen years or so, they've instituted meteorology in the department of geology and geophysics. There are a couple of meteorologists there now. Oddly enough some of the first scientific meteorologists in the country were at Yale back in the 19th century. And they halted the work somehow, as did almost all U.S. universities.

STEEN: After those first two items in your bibliography, it becomes clear that you're involved in silviculture. How did your authorship of Hawley and Smith come about? How was that decision made?

SMITH: Mr. Hawley had started this text book. There was an earlier one which Mr. Graves had written, it was called *The Treatment of Woodlands*. But Mr. Graves had gone on to other things, and Mr. Hawley started teaching silviculture, and incidentally, also forest protection--fire control. And he'd been doing it forty years and started this highly regarded textbook, which originally dealt with both silviculture and forest protection.

STEEN: Does that make sense?

SMITH: It seemed to in those times. Sometimes I think silviculture sort of looks on the bright side of things, the things that are growing, and with protection, you're looking at all the things that may hamper growing. Though I'm amused that my associate, Bill Smith, has now changed the name of his forest pathology course to forest health.

STEEN: Sort of like going from the War Department to Defense Department.

SMITH: Exactly. Mr. Hawley had started this book. It was widely used and it was obvious that it would be a good idea to continue it. Mr. Hawley had been teaching here for forty years or so and become rather weary of the business. Harold Lutz persuaded him that the best way to continue was to simply have me do it. It was not something approached easily, because Mr. Hawley was not very easy to get along with. He was quite irascible and very critical. In fact, I recall deciding, well I will try this and if I have too much difficulty with him, I will just quit.

As Harold Lutz and I finally concluded, Mr. Hawley was difficult to get along with about small things but not about big things. When I started to revise his textbook, I found that if I had the commas in the right places I finally concluded that I could have said the sky was green, and he would have gone along with it. This has to do with a kind of transition which was going on then and was deliberately being pushed, and it was not something Mr. Hawley opposed. It was to try to make the natural science of forestry stronger, or to make this part of forestry more scientific.

STEEN: So he defined the issues.

SMITH: If you look at those books of his, you'll find that they were quite didactic. They described ways of doing things, they were manuals of "this is the way to do it." And there was nothing, really, to say why.

STEEN: Did he know why?

SMITH: Yes, he knew why--that was very clear--but it was not important. In fact, I found in dealing with forestry students from other countries that there are some dimensions to this that were previously hidden from me. Throughout much of the world, forestry is kind of a military or police operation. The role of the forester is chiefly to guard the forests. Much of what we do still has this "made in Europe" label on it. In that case, the foresters were the agents of the nobility.

STEEN: And they wore uniforms.

SMITH: That may be part of it. Their chief role was to protect the forests from the people, or to protect the game from the people. As kind of a concomitant of this, the procedures were almost like close-order military drill.

STEEN: Did Hawley do research?

SMITH: Yes, and it was very good. It was in the category of "let's try this and see how it comes out." He supported the work of people who went about it more scientifically. In fact he was quite interested in some things, particularly statistical analysis. He set up very useful planting experiments with mixed plantations in the '30s; they were little squares of different species. I could describe in more detail why he did it, but that's not important. They were laid out in Latin square design. Later they were used by David Challinor, one of Harold Lutz's students, as a very sound scientific way of measuring the effect which different species had on the soil. It was laid out partly because Mr. Hawley had perceived that while he was laying out these little checkerboard plantations, it was his way of creating mixed stands. If he laid them out in Latin squares, maybe they could learn something else from it.

STEEN: Were there really any other silviculture textbooks that were competitors at that time?

SMITH: Yes, there were, in English. There were several others in this country. One of them was written, it still exists, by Frederick S. Baker at the University of California. Baker's book was a combination of the silvics, the scientific foundations of silviculture, akin to the one that Toumey and Korstian had done, and it had a section on the practice, akin to what Hawley was doing. Then there was a section which described what sometimes is called regional silviculture. These were all combined; probably it was trying to do too many things between two covers of one textbook. See, Mr. Hawley's book deliberately dealt only with the practice, and as far as he was concerned, Toumey handled the science of it. In fact they didn't get along with each other very well; Hawley was actually a little contemptuous of this scientific stuff. I don't know how much of it was personal antipathy. Then there was another book which was written by a professor at the University of Minnesota named Cheyney. The initials are E. G.

STEEN: He wrote novels too.

SMITH: He did?

STEEN: About foresters.

SMITH: I didn't realize that. Cheyney went about things the same way that Baker had. It was not used to any great extent, except maybe just at the University of Minnesota. It did have a fairly good account of some of the more important species. In fact, I used to have my students use it for that reason before the Forest Services' *Silvics of American Tree Species* came out.

STEEN: Would it be fair to say that Yale, being a private school, doesn't draw its students from Connecticut, but the state schools, like Minnesota and Berkeley, tended to have students from that area, so the interest there would be in the silviculture of that region more than at Yale. Is that . . .

SMITH: It's certainly been the case, although it didn't affect these textbooks. Baker's book was certainly very comprehensive. I had some discussions with Baker about this. He turned his textbook into one about the scientific foundations of silviculture. He dropped the stuff about the practice and the regional stuff. Once he rather ruefully told me that the practice stuff, Hawley'd taken that away from him, he couldn't win and he wasn't going to try. In fact, his book about the scientific foundations, published in 1950, was very good, so good I can't keep my copy. I wish I could get a copy of it, every one I had would get swiped. I think we've got one in the library but I don't dare go look. Even at that, Baker told me, the publisher had caused to be truncated. The part that was left was good, but I'd like to see the parts that were cut out. Some of his students have revived it, Ted Daniel of Utah State, and Baker's silvicultural successor at California, John Helms, put out a book which actually goes back to being somewhat broader than the 1950 edition of Baker's book. Once Baker, after my editions of the book came out, generously told me that he had wanted to write a really good book about silviculture but then when mine appeared he decided well, he didn't need to.

STEEN: I interrupted you by talking about other books. So the decision was made that you would do the sixth edition of Hawley's book.

SMITH: Yes.

STEEN: You were obviously very familiar with that, and the man; you sort of held your breath and revised it, and he accepted it.

SMITH: Yes. He almost didn't question anything. But most of the things he had in the previous edition were very good. All that I did, really, was to try to present the science behind it. Now see this was part of what was going on at the time, not just here but everywhere. We were finally at the point where we had the leisure to begin to bolster the foundations of silviculture.

It isn't just the natural science either. One of the things which I think was beginning, and we were certainly well aware of it, was that here in this country, we were not in the position of deciding what was done on the basis of being agents of the nobility or of a government that told forest owners what they ought to do. We had to argue with them and justify silviculture, and we haven't won the battle yet.

So there was this dimension to it, of trying to say "why" these things are done. We figured that it was necessary always to answer the "why" questions. In fact, one of the things which I did in teaching at the same time was something perhaps you could say was an overreaction. When Mr. Hawley was teaching, there was a tremendous amount of examination on the basis of rote memory. I used to be his teaching assistant when there was a big wave of students after the Second World War, and I got sick of grading these rote memory quizzes. The result was that when I started teaching a course, I almost never have used that. I tell the students here's the exam, bring anything you want, you can go and consult anything you can find in the library. However, if you see another student looking at a book at least wait until the student is done with it, don't knock him down and take it away from him.

STEEN: When I studied silviculture--this may be false memory--there were a lot of questions on the seven advantages and four disadvantages of some process. That was sort of the Hawley approach.

SMITH: Yes, that was the Hawley approach. I've forgotten which edition it was, but I deliberately omitted all of the numbered lists because I knew that in other places students were being examined on the seven of this and the ten of that . . .

STEEN: I remember that if I came up with six advantages when I needed seven, I'd divide one into two and get my seven.

SMITH: I see, a mnemonic device. I can't remember whether I was bold enough to dump those out in the edition in which Hawley and I were co-authors. I'd have to look. Even though I wrote that 1954 edition, he mostly edited it. But certainly by the one that came out in 1962, I figured I was going to make it difficult for these silviculture professors who were giving examinations of this sort that you just described.

STEEN: I used the 6th edition, because I took silviculture in 1956.

SMITH: Incidentally, Dave Scott of the University of Washington and I were here together as students. One year, I was the assistant to Mr. Hawley and Mr. Lutz and there was an entomologist named Friend. There was laboratory work in all these things, soils, entomology, the whole bit. Then I was appointed to the faculty and Dave Scott took the job over; he was ostensibly my assistant, though it was never quite clear who was assisting who. Anyway maybe I continued some of the rote memory, at least for awhile.

STEEN: Now that I think about it, it's in the book as a learning device. I remember it was on some of our exams.

SMITH: Then there was another problem with those lists and labels. They are all oversimplified. In fact, as far as silviculture is concerned, these silvicultural systems have come to be kind of a tail that wags the dog. You almost can't live with them, and you can't live without them. I tried hard to get across the idea you figure what to do and put a name on it afterwards. With the textbook, the thing which I have attempted to do was just not to tell what to do, but why. I also wanted to get away from the idea that there's just a bunch of set procedures, and you go out in the forest as though you have a bag of tools and you've got about ten wrenches in it, and you decide which wrench to use. In effect, you really ought to design a wrench for each stand, although that gets a little extreme.

STEEN: Barrett's book on regional silviculture. You wrote a chapter?

SMITH: Yes.

STEEN: Was that an idea of a publisher who saw a market? Why a book that just emphasized the regional aspects of silviculture?

SMITH: Well, I'm not sure.

STEEN: Because Hawley and Smith talks about thinning, or hardwood silviculture, or west coast species. There's a regional dimension to your book, obviously, but suddenly here's a book that really emphasizes the regional aspects.

SMITH: I had an interesting discussion with Mr. Hawley about that. He offered a course much like that, but it wasn't on a regional basis.

In those days there was an earlier regional silviculture book. It was written by a man named Rutherford Westveld, who was a graduate of the school, he'd been one of Hawley's students. He had a brother who was chief expert on spruce-fir silviculture. Westveld was at the University of Missouri. It was interesting that Mr. Hawley really liked the book but he didn't use it. The reason he didn't was, he told me, in effect, "look, there aren't any regional pat answers, there isn't only one way you grow loblolly pine." The way he used to go about it was that in an advanced course, he discussed the different tree genera. It started with spruce, went on to hard pines and soft pines.

We students used to joke about it. He'd conduct all of his classes by kind of a Socratic method. First, the students would ask questions, which he would answer. Then, if they ran out of questions, he would ask questions. Usually his questions were sufficiently inquisitory or torturing that the students would desperately ask questions just to keep him quiet, so he wouldn't get the floor. One joke used to be that if he asked what silvicultural system you should use for growing a species, if you said the shelterwood system, you couldn't miss.

STEEN: Shelterwood was the answer to every question you didn't know.

SMITH: It was like a political platform, there was a little bit in it for everybody. We joked about the Hawley Universal Shelterwood System. I kind of favor that idea too. The basis of his policy, which is one I followed,

was that we wanted to stay away from any sort of regional pat answers. The research that he did was mostly out on the water company land, and it was a case of trying this and trying that. I inherited a whole series of test plots that he had in which there were differences in treatment, but the variation was in time rather than in space. You could see where he tried one idea and, if it wasn't working very well, he'd modify it. In fact, it was quite interesting and significant that you could see how things changed as he learned more and more about what was going on. It was always interesting; he'd never admit that anything had been a mistake. But if it had been, you didn't find that he did it twice. Dave Scott and I used to have some amusing discussions about this, when we were working for him. There was one year when Dave Scott worked for him, and a year when I did. I looked upon this assistantship as interfering with my efforts to finish my doctorate.

STEEN: We were talking about silviculture textbooks.

SMITH: As far as books are concerned, they were the ones I described. There wasn't much of anything else in English, except for a very interesting discussion of silvicultural systems by an Oxford professor named Troup. There was one other, which we used to use. It was *A General Manual of Indian Silviculture* by a British forester named Champion.

STEEN: I never heard of that.

SMITH: It was a very comprehensive book. Forestry started in India before almost any modern forestry in the English-speaking world. It started in India in the middle part of the 19th century, long before it was introduced to Britain.

STEEN: That's where Brandis and those guys . . .

SMITH: Yes, Brandis.

STEEN: On your list of publications, for us generalists, the textbook is the most prominent. Are there a couple of other publications you'd like to talk about that you thought were pathfinding or turning points or watersheds?

SMITH: One problem I've had is that I've been doing so many things, I've never had the chance to do a lot of data gathering that's necessary for original scientific work. I've had some of my doctoral students do these things. However, I followed a policy which I inherited from Mr. Lutz, which is you don't put your name on the work your doctoral students do. It cuts into the publish or perish kind of business, which fortunately I managed to escape, probably chiefly because of the textbook.

STEEN: That's interesting. The textbook in a sense sheltered you from a lot of these pressures, because it was successful. It was a dominant book throughout the whole profession of forestry. Does it give you a latitude?

SMITH: Yes. If it hadn't been, I'd probably not have been reappointed. This is a problem which you have in instruction in forestry anyway, and I think it's getting to be a disease. People are getting confused between applied and basic science. It's not that we shouldn't be doing some of the basic science, it's necessary, but we need more recognition of the phenomenon such as you see in law schools, medical schools, or even business schools of the professor of the practice of this or the practice of that.

STEEN: Wouldn't that be more in vogue today at Yale in forestry than it was twenty years ago. "We've got a problem to solve, let's not cop out with more studies."

Mixed Stands, Tropical Forests, and Selection Forests

SMITH: I think it's going the other way. We've got to study it more rather than less. Most of the things I have published--I hadn't planned it this way--but most of them are commentaries on what's going on in silviculture and forestry. There is this scratching around for new ways.

The thing I've been most concerned about for a very long time is what I think is one of the most difficult silvicultural questions of all, and that's how to manage mixed stands. This is something which started with the episode of forty years ago that I mentioned earlier when I tried to take a hard look at tropical rainforest silviculture. It was actually rather frustrating because it's been so difficult to travel. For example, I couldn't travel to the tropics for most of my career unless I paid for it myself. Almost never have I had much chance to see it first hand. I'd read about it and that was it. I used to have lots of students from the tropics and I'd tell them, "well I'll be glad to help you and I'm interested in what you know. We can learn together. But remember, if a teak started growing in the front of the building, I'm not sure I'd know what it was."

STEEN: Yes.

SMITH: Recently, there's been more opportunity, but it's come rather late as far as I'm concerned. However, there was one key idea which I learned from this examination of the tropics, and that's where as they rather desperately try to explain the structure of the forest. They've identified this stratified structure where there are particular groups of species with different canopy levels in the forest. If there's any one inspiration I claim I ever got was, when I was reading that, I was also working around here and I happened to be on the some land up in Massachusetts that belongs to my family. (That particular tract now belongs to my brother, but I own another part of it.) This was a stand which had different canopy levels in it. They were easy to identify because there was the lower stratus was eastern hemlock; this was in the winter, it was evergreen. There was an upper discontinuous layer of emergent evergreen white pines. In between there was this layer of hardwood, which I subsequently found had several layers within it.

Suddenly it occurred to me, hey, I don't have to go to the tropics to see this, here it is right under my nose! These evergreens species waving, saying "hey, look at me."

Then there was something else that occurred to me, all these differences in diameter. The lower stratum stuff was small, the upper stratum stuff was bigger. I said, "look, I know this stand has to be even-aged because I know that my great grandfather, who was a sawmill operator, cut it completely flat probably about 1880. Then it occurred to me, we've got these stands with this structure all over this whole countryside, where we know because of the heavy demand for wood, everything had been cut so flat you could see across it. These things, this stratified mixture could be even-aged. Then the other thing which clicked was that they tended to have some semblance of the diameter distribution which is alleged to go with the all-aged forests. But the differences in diameter are not because the trees are of different age, it's because there are different rates of growth.

This ties in with something else. In those times there was a hassle over a widespread belief that all forests should be managed as all-aged forests. This was something which people such as Mr. Hawley and Herman Chapman--at least one thing they could agree on--stated was not a very good idea. But when we looked at various complicated kinds of forests and saw this diameter distribution, we wondered well, maybe these people have something after all. It suddenly registered on me that the reason why this attempt to manage mixed forests as if they were all aged wasn't working was because they weren't. They were even-aged. I could find stuff on the New Haven Water Company land where Mr. Hawley had experimented with trying to turn some of the stands into uneven-aged stands and decided it wasn't working. When I got this idea in my head, I could say, "Look, the reason it wasn't working was simply because the stands were even-aged." Some stands were developing in ways in which, in a certain sense, as time passed they became more even-aged rather than less. The smaller diameter classes were dying off fast. If you have one age class dominating, but want to create an uneven-aged stand, you have to take very forthright action to punch out holes to get regeneration.

STEEN: So there are certain very specific principles one can apply from temperate to tropical forests.

SMITH: Yes. There are all kinds of ways that forests develop. Now we've begun to try to identify as many different patterns of stand development as we can. In the usual magnificence of hindsight it can be seen that many of the interpretations we placed on the development of forests were predicated on the notion that they're all pure, even-aged aggregations of trees. The Norway spruce plantation is looked upon as the norm.

If you scratch very deeply, you find everything is predicated on this. In fact, the idea of the all-aged forest with a J-shaped diameter distribution is really nothing more than the single-canopy even-aged structure served up in a different light. It describes a series of little, single-canopied even-aged stands of the whole range of age-classes, evenly distributed.

STEEN: All these bulletins that Forest Service turned out in the 30s dealt with the concept of a normal forest, right?

SMITH: Yes. As a matter of policy, the Forest Service was trying to use this basic idea to manage every kind of forest there was. In fact, uneven-aged stand management was official policy.

STEEN: I'm just speculating now, I hadn't thought about it till I listened to you talk, but certainly we were in the empirical stage of forest management, nobody really knew what the full life of . . .

SMITH: Yes. Subsequently it registered on me what some of these people were trying to do. The best face you could put on it was that if you're in some situation in which society isn't ready to spend money on regenerating forests, you postpone the evil day when you have to, and you just take the stand you have and stretch it out as long as it will last. What had happened was that what was a provisional approach was becoming a way of life. Some of the arguments, perhaps in hindsight we can say, is that the various parties to it didn't necessarily always see what their opponents were concerned about. For example, as far as I was concerned, and people of my own vintage like David Scott shared this, this so-called selective cutting was one of the typical mistakes of the elder generation. Although here, the elder generation were opponents of the same idea too. However, I can remember Mr. Hawley had some sort of half-hearted try-outs of it and found it wasn't working. This was in some of the hardwood and hemlock forests.

STEEN: I don't know how big the issue seemed during the '30s, but Gordon Robinson the Sierra Club forester renovated it, the idea to selectively log Douglas-fir. That came out of the experiment station in Portland.

SMITH: I learned quite a bit from that because just after I finished my master's work here in 1946, I got an opportunity to spend a summer working for Leo Isaac at the Pacific Northwest Station. This was a time when Leo Isaac was in the Forest Service doghouse because he opposed this policy.

STEEN: Kirkland. He was the director of the station, wasn't he?

SMITH: No, it was Thornton Munger. Thornton could sort of be on both sides of this conflict. I used to discuss it with him. In fact, you know Thornton Munger grew up in New Haven, and his parents lived in a house right across from where Sage Hall is. There's a locality out east of here which is Mungertown. He spent his whole career in the Northwest.

STEEN: Brandstrom and Kirkland wrote this bulletin on selective logging of old growth Douglas-fir.

SMITH: And that was holy writ. It was in 1936 it appeared. Back in those days, foresters were really sort of desperate because they wanted to be sure that forests were perpetually productive. They knew we needed to regenerate them, but in general our society wasn't ready to spend the money to do the things necessary. In many cases, also, the foresters were sort of nervous about whether they even knew how to do it if somebody gave them the money.

This partial cutting or selective cutting was devised as a way of temporizing the situation, stretching out the cut and postponing the evil day when you had to regenerate the forests. In fact, I tried to figure out where this idea came from. For example, it's very clear that much of the silviculture that was being practiced--being taught about--nothing was practiced very much, in this country had this "made in Germany" label on it. I've studied the European textbooks of the time, and the things that they describe do not really include this kind of cutting, the so-called selective cutting. I've also looked at the writings of Schenck and also Henry Graves, which are the first two books about silviculture done in this country. It's very clear that this mode of operation was something invented to fit the circumstances here.

STEEN: In the interview with Thornton Munger which we did about twenty-five years ago, he talks a bit about the study. This was the depression, and it was a way of legally high-grading Douglas-fir.

SMITH: That was part of it, but it wasn't all of it.

STEEN: Well, he was a little bit cynical by this stage, and this was thirty or forty years later, he could look back at the episode which was painful to him. And he characterized it as high-grading of Douglas-fir.

SMITH: I remember he told me, "well it worked sometimes." He said, at least it worked well in the ponderosa pine country, even though badly in the coast Douglas-fir types. One of the ablest exponents of this was a Forest Service researcher named Ashe. W. W. Ashe was writing about selective logging in the teens, and he operated in the South. In fact, quite a few minor plants named after him, this and that *asheii*. There were also writings by Ralph Bryant, some of the bulletins of this school. One is called "Prolonging the Cut of Southern Pine." The idea that they based this on was something on which they'd done enough studies of logging cost to know about, but which loggers and landowners were only vaguely aware of. And that was, if you harvested trees that were too small, you lost money doing it. You couldn't afford to handle the small stuff. The first thing they said is, "Look, if you can't afford to cut anything less than thirteen inches DBH, it's best not to cut it." This was a fairly easy idea to get across. Then the next thing that they started to do was say, "well, if you're going to leave some stuff out there to come back to later, then it's not really logical to leave only these zero margin ones that won't pay their way out of the woods. There are some trees that are merchantable now, but they're still so small that you'll earn more leaving them to grow, like money in the bank, than you will if you cut them. So they began to do the financial maturity analyses, and to use this as a way to justify leaving something out in the woods.

STEEN: These equations, Hanzlik Formula and so forth, for calculating the rotation age, is that . . .

SMITH: No that's a different concept. The financial maturity concept they used chiefly depends on selecting a compound interest rate and looking on your growing stock as kind of a savings bank account. It's a fairly useful idea if you don't get completely carried away with it. For example, in managing the Yale Forest, I've tried to follow the principle if a tree won't earn as much as Yale's endowment portfolio, I'd better cash it in. That's our alternative investment in a sense. I've tried to point out that the forest growing stock is an inflation-proof investment but stocks and bonds aren't; certainly bonds aren't. It so happens that after the Second World War, we used to do our spring southern field work on the lands of the Crossett Company in southern Arkansas. At Crossett there is an experimental forest of the U.S. Forest Service which was then presided over by a very influential and perceptive person named Russell Reynolds. R. R. Reynolds.

STEEN: I recognize the name.

SMITH: We used to argue with him about this, since the field session was a glorious chance not only to see what was done but to discuss it with the people who were promoting the idea. Reynolds was advocating (as were many people) this idea of uneven-age management of loblolly pine. What he was really trying to do was to stretch out the growing stock. What had happened in much of the western South was that in the railroad logging era it had become fairly customary, it certainly was on the lands of this Crossett Company, to leave everything that was 13 inches and less. So you had these somewhat stunted trees that had recovered, they once had been the lower stratum. It could be argued, well if you cut them down and planted new ones, the new ones would grow faster.

I remember discussing it with Reynolds, and he said, if what you want to do is to grow pulpwood, clearcutting and planting is the logical way to do it. However, if we wanted to keep our lumber industry going, we have to do it this way. I wasn't astute enough to understand what it was he was driving at. Also, he looked upon it as a permanent way of life and not a temporary stratagem.

What it really came down to was this, that the stuff he was leaving, wanted people to leave, were trees that had grown rather slowly and had therefore had small branches. In those times, there was something which almost doesn't exist in southern pine now. There was a good, well-developed market for finish-grade

lumber with either small knots or no knots, and there was a premium paid for this slow-grown old growth. It was referred to as Arkansas soft pine, and there was a big sales push on it. He laid great emphasis on the point you've got to leave these trees because they're the source of the high paying quality lumber. Also, if you cut them all down, sure you may have a whole bunch of seedlings, saplings, and poles growing like mad out there, but you'll have cashed in everything you've got to run the sawmill with. In fact, keeping the sawmills going, regardless whether it's high quality or low quality, was part of the game. I then never could quite see that this was where he was coming from.

STEEN: By growing high quality wood you're going to face compound interest rates. I mean, can you actually grow . . . ?

SMITH: Oh, he was an economist, he could justify it.

STEEN: Was that right?

SMITH: It was very clear that I couldn't argue with him about that.

STEEN: Okay. I haven't read the stuff.

SMITH: In fact what's happened now is that the Forest Service has gone back to the studies of these things. They abolished what he was doing for a while, then they went back to it when it finally registered on them that what a paper company can do is not something that a private landowner can do. One of the problems is that in clear cut and plant there is the heavy front-end load of the establishment costs.

STEEN: All this bragging about 40-year rotations in the South is kind of one sided.

SMITH: There's nothing too wrong with the 40-year rotation, but one thing that has happened in the South is that this high quality lumber that he was so anxious to keep producing isn't being produced.

STEEN: I know, the lumber yards today. . .

SMITH: And you run around the South now and you see houses being built with frames of Canadian or northeastern spruce.

STEEN: Yes. Go to a lumber yard in Durham. I've picked through, to try to find a stud that's straight enough to use, you pick maybe one out of three. It's bark on two corners, it's junk. Canadian stuff is good.

SMITH: Some of it comes from Maine and the Lake States. Actually, in parts of Maine there's some stuff that goes to Canadian mills from Maine and then comes back.

Anyway, what Russell Reynolds was advocating, in retrospect, is something which was a good provisional way of dealing with a situation while one got over to more even-aged management. What's the Crossett Lumber Company now belongs to Georgia Pacific. The foresters there, in effect, switched over to shelterwood cutting. However, I've discussed it with them enough to see that some of the ideas they learned from the Reynolds business still affect what they do. They haven't gone completely to clear cut and planting. They do some of it, but they still keep track of their overall growing stock in terms of the diameter distribution. Now, as it happened in this worm's eye view of my experience with it, it was in the spring of 1946 that I was at Crossett and saw this uneven-age management approach; I figured it was for the birds. It was mostly because it seemed so hard to believe that trees that had been stunted could grow fast again; actually often they can do better than we think they're going to.

I went from there right straight to Portland. I had this summer job working for Leo Isaac. I knew that he was agitating against this selective logging in the Doug-fir region. I remember once that I trotted out the publication of Kirkland and Brandstrom to which you referred, which had a whole series of arguments in favor of this. The map was the map of the Wind River Experimental Forest or part of it, where they were proposing to do this, and I was working there. The names were changed.

The person I was working with you may know, he's partly retired now, he became the chief geneticist of the experiment station, Roy Silen.

STEEN: Yes, I know him.

SMITH: Leo'd come from Portland. We'd been measuring some of his regeneration research plots at Wind River, and I thought I'll find out what Leo says about this. I was kind of a devil's advocate because I thoroughly agreed with him. I asked him about every one of Kirkland and Brandstrom's arguments as to what's wrong with them, what do you think about them? He never seemed to remember that I didn't disagree with him, I was just trying to find out what he thought. He finally got mad, and he says, "if you think this stuff is so good, it so happens that the experimental plots that Brandstrom set up to test this, the ones in western Washington, need to be measured this year. I'm going to have you and Roy Silen go on every one of these things and see how it's turning out." I hadn't planned it that way, but I got to see all of this. One of the theories that these people had was that if you kept the diameters up, if you cut to a 32-inch diameter limit, every thirty years or something like that, you'd cut 32-inch trees from now until the end of time. That incidentally was a very appealing idea to the logger's unions.

STEEN: I can see that.

SMITH: That's part of the reason why Anthony Wayne Smith (then of the woodworkers' union and now of the National Parks & Conservation Association) was pushing it then and he still does. One of the principles also was that if you kept the average diameter up, that you'd also keep up the current annual increment of board foot volume. This is a game that some of these advocates of this approach still play. They played it more then, and today they may not understand it quite as well as they did. This meant that the periodic annual increment and therefore the allowable cut was going to be 1,500 board feet per acre per year, which is probably roughly three times what's generally sustainable.

We went out and looked at these plots, and it was the discouraging disaster that we probably already knew about. What was happening was as Munger indicated in his interview with you, the only trees that were getting cut were a few of the big Doug-firs, which we inferred had probably been left from the last fire regeneration episode. Ironically, they were still the healthiest, best trees in the stands. The hemlock and red cedar and true fir, that had come up underneath them and were now often dominating, were already very old and decrepit, very rotten. What was happening was that there'd be a lot of blowdown. It seemed as though going in and tampering with these stands just sort of opened Pandora's box. Much of what Doug-fir remained was being killed by bark beetle attacks, from beetles building up in the slash. There was a fair amount of logging damage. And various rots, including *Fomes annosus*, were getting into particularly the true firs. Most of the hemlock was already rotten anyway, and what was happening was that these stands were being caused to fall apart at an accelerated rate.

STEEN: Because of the logging of the larger Douglas-fir?

SMITH: Yes. This was pretty much all that had been done. The western red cedar was quite interesting. I've often wished somebody would look into it more. We had to do increment borings to see how good or bad the growth was. Western red cedar, the big ones, were dying at the top and growing like mad in the region of the butt swell. To this day I've wondered why.

I kept track of this afterwards, and by the early 1950s the Forest Service changed their whole silvicultural policy abruptly. I don't know the historic background of it, I'm told that a timber management chief in Washington, Ira Mason, was responsible for the change. It was 180 degree change, that suddenly this selective cutting was dropped and they went madly in the other direction. That was the start of the clear cutting and planting routine which later got them into so much trouble.

STEEN: If you look at the cut from the national forests, it goes up orders of magnitude between 1940 to 1960.

SMITH: That was a result of something different and unrelated. Up until the time of the First World War, the national forests were mostly sort of back of beyond. There was even opposition to cutting anything on them because the timber markets were glutted with stuff from private land. For example, that summer when I worked at Wind River on the Hemlock Ranger District of what's now Gifford Pinchot National Forest there was a little bit of timber sale activity. There was a mill in the small town of Carson. I remember visiting it once and they were running old growth logs through it. I calculated they, to keep that mill going, had to cut sixteen trees a day. That was the only outlet that the Forest Service had. I remember Thornton Munger came up once and sadly talked about "poor gerrymandered Skamania County." It had very little tax base, it was a poverty pocket. As far as the national forest was concerned there was virtually no cutting. I went back there twenty years later and there were roads all over the place, lots of stands regenerated, and every county road was paved, and they had nice new schools from the money from the 25 percent that comes out of the national forest cut. Just after the Second World War was when, in effect, the timber industry finally needed the national forests. That's why their cut went up. It wasn't. . .

STEEN: What I was thinking about when I said that was you can't turn out that volume taking every other tree. They wanted the wood, and they got it.

SMITH: Several times I had interesting discussions with Ed Cliff about this. I'll tell you what he told me. He said that at various times, a lot of it during the Kennedy administration, it was thought that part of the reason for the housing shortages was high prices of timber. Cliff said the White House told us, "get the timber out; we'll reduce your appropriations, but get the timber out." Ed said the only way they could do it was to step up the clearcuts. He said in retrospect he shouldn't have done so much of it. But to go back a ways to 1950 when this policy changed, I remember my reaction was, "Boy, I'm glad they've changed but now I'm afraid they're going to go too far the other way." It's a sample of this fallacy that there's only one way to do anything in silviculture. This quest for the one universal system. There isn't any.

STEEN: I have a flimsy theory of Forest Service mentality at that time. We interviewed Chris Granger who was assistant chief, a timber management type. As a matter of fact, it might have been his policy.

SMITH: It could well be.

STEEN: What the Forest Service always wanted to do and has never really succeeded was to generate enough revenue to meet the appropriations. It was very important to them, a sort of pride, that the Forest Service turns a profit. The chance to earn some money really started a business mentality in a kind of strange way in the agency at that time. I don't know, revenues maybe half of expenditures now in the Forest Service, or less because of all the other things that the agency does. This would have been a catastrophe in the '50s psychologically for the agency to have revenue down so low and expenditures so high as they are today. They wanted to sell that timber.

SMITH: In point of fact, as far as the timber management is concerned, there are certainly plenty of places where a clearcutting and planting routine is fine. I've spent a lot of time arguing in favor of it, but never with the idea that this is the only way to do it. I get in trouble with people by pointing out that "hey look, Douglas-fir isn't like gray birch or something else that will thrive only if you start it out in the blazing sunshine." If you do, it's apt to get killed. I worked with Isaac and he had plenty of evidence that Douglas-fir seedlings needed some protection.

Well anyway, to get back to the business in the Northwest. Finally, this policy was changed. My friend Leo Isaac, whom I said had been in the doghouse for opposing it, once told me he'd spent his whole career correcting the false notions of some of his predecessors. These included the seed-storage-in-the-duff business that Hoffman (the Hoffman of Hoffman Forest) had concocted before he went to North Carolina. Finally the results of the selective logging study that I had worked on became available. This may sound a little too dramatic, but it was true: the object was to have a perpetual periodic annual increment of fifteen hundred board feet per acre per year. What happened was this. The first five-year period there was an annual loss of five hundred board feet per acre per year, the second five-year period there was an annual loss on the average of a thousand board feet per acre per year, and in the third five-year period they finally got to the fifteen hundred per year, but it was minus rather than plus.

STEEN: Not very successful.

SMITH: No, it was a fiasco. In fact, it's very hard to find any of these stands today. I know where there's one and I visited it a few years ago. It was the one where partial cutting worked the best because it wasn't as old as the others. It was on some land on the Olympic Peninsula near Cushman Lake on the east side of the peninsula that had been blanketed in to the Olympic National Park in the '30s. When Roy Silen and I went to measure the plot we had to get permission from the Park Service to venture on to their territory in a Forest Service vehicle to do this study.

STEEN: National Forest or national park?

SMITH: It was on the national park. That's why it hasn't been cut, and it's still there. But it was working a little better there. I remember sitting out in the woods writing out a note to stick in the file pointing out that there was Doug-fir regeneration. The stand was about 125 years old when it was treated. I also tried to call attention to the fact there was a little experimental clearcut on the same south-facing slope where clearcutting wasn't working; the natural regeneration was only where it was shaded around the edges. But anyway, what had happened was that selective cutting was such a fiasco that on a lot of the stands where it was tried got clearcut. Now, as you intimated a while ago, the world has forgotten.

When the study came out it appeared as a rather obscure mimeographed publication of the Pacific Northwest Station, it was 1955. I remember writing to Leo and saying, "Hey Leo, why don't you give more prominence to this." The response I got was this, "Gee Dave, they've quit this partial cutting and thank goodness they have. Let's not rub salt into the wounds."

STEEN: But Gordon Robinson's book, *Excellent Forestry*, has been around for about twenty years. It's just been reissued by Island Press and uses the Brandstrom-Kirkland model to demonstrate that clearcutting is not necessary.

SMITH: This was the kind of thing I was worried about when they didn't give more prominence to the denouement of the Kirkland-Brandstrom business. It got swept under the carpet.

STEEN: I don't know how many people that book persuades today, but I've heard Robinson give talks on "excellent forestry."

SMITH: He can be quite persuasive; the Kirkland-Brandstrom thing could be quite persuasive too. Only problem is the ideas they have are sort of like perpetual motion. There appeared to be some credence behind this and the advocates of selective logging would often invoke European silviculture, the German silviculture of the time, usually without knowing what was going on. Mr. Hawley told me once that he thought that the German-reading ability of many such "experts" on German silviculture was limited to perhaps *Guten Abend*.

In those times in forestry in Germany there were very few places where true uneven-aged management was being done, usually as a kind of a stunt. I later found visiting there, that the only places they were doing it were very remote forests where irregular stand structure had developed because of a history of high-grading. In fact, my friend Peter Burschel, who is a silviculture professor at Munich, took me once to *the* selection forest near the Czechoslovakian border. He took me out to a remote mountain village to find the village forester (Herr Meyer). Peter, who is not a Bavarian, asked some children where we could find Herr Meyer. As we drove away he said "I only got about half of that; they speak a kind of German I don't understand very well." When we saw this forest, I could see it was the selection forest. However, Burschel carefully pointed out to me it was only part of the village forest and was there because of the ancient high-grading. About the same time I was in Switzerland. I went to the forestry school in Zurich where the famous silviculture professor Leibundgut was. He rather sourly told me, "Your visit is too short; there's not time for you to go and see *the* selection forest in the Emmental Valley.

STEEN: *The* selection forest.

SMITH: Yes, *the* selection forest. And the reason, he says, it takes a day to walk back in there. And all the other stuff was even aged. There was also one very interesting forest which I read about, but maybe nowadays one could not see it. It was in the part of East Prussia that's now part of Poland or the Soviet Union, I don't know which. A place called Barenthoren. The forester who managed it was quite successful with maintaining irregular forests, however, I've seen other places like this in Germany and also in this country. We've got some of them in the Yale-Toumey Forest. They are very dry, sandy soils. Some of the cases I know about is glacial outwash sand. In fact, are you familiar with Steilacoom Plains near Tacoma where Fort Lewis is?

STEEN: Yes.

SMITH: With those great irregular stands of Doug-fir? It's the same situation. They're very dry near the surface. It's very hard for anything but a few specialized species that are quite drought resistant to get started. Often they are pines. I'm pretty sure that in the case in east Prussia, that the dry soil acts like a valve. It lets in, in that case, what we call Scotch pine. It's not hospitable to the broadleaves. Once the trees get their roots down in a bigger and bigger moisture supply, they actually grow quite well. Also, it rains in the summer, in fact that's different from the Steilacoom Plains, so that regeneration of the drought-enduring species is quite easy. You just go out and cut, and, bang, thousands of seedlings come up. You could go and cut the forests in the shapes of stars and you'd get star-shaped stands. So it was easy to do, and there was a tendency to figure it was a way of life, and that anybody can do it anywhere. Really it's a peculiarity of this kind of site. I've seen some like it since then in northern Mexico where the summer precipitation is heavy enough. But there was the idea that this was a good idea because it was the way everything was done in the German heartland of silviculture, and it just wasn't true.

Silviculture and Silviculturists

STEEN: I have a couple of definitions of silviculture. One 1898, Fernow, and 1983 from Smith and I'd like to compare the two, and then we'll get into some specifics. This was in Fernow's last Bureau of Forestry report, he says "Forestry is the art of wood production, which is divided into silviculture and economics. Silviculture comprises all the detailed instructions that are necessary to create and grow the wood crop to perfection. Silviculture produces material, economics produces revenue." Do you take any great exception to that now?

SMITH: Oh yes. Very definitely. You can't separate activity that way. Silviculture cannot be conducted in the defiance of either natural principles or the economic, the kinds of social considerations that reflect the objectives of ownership, which incidentally aren't always things that can be measured in dollar signs.

STEEN: I don't know this, you probably do, does his definition reflect what was going on in Germany at the time? He'd been here almost twenty years when he wrote that.

SMITH: Yes, I think it does. In his time German forestry was much more influenced by a draconian economic or financial doctrine than it is now. The whole compound interest business was invented by a German forest economist named Faustman. I don't know when this ceased, but it tended to dominate German silviculture up until sometime early in the present century. It certainly dominated the time that Fernow was coming from there. In fact, he developed some antipathies to it. Nowadays, the name Faustman in German forestry is a dirty word. Although in retrospect he created a good analytical idea, but like all good ideas it got overdone. Part of the problem was that nobody could ever figure out some maximum rate or limit to set on the demanded interest rate.

STEEN: Did you read Heske's book. I read it long ago. Someone I guess here at this school translated it into English about 1937.

SMITH: Maybe Ralph Bryant did. It was published by the Yale press. I'm not sure who translated it.

STEEN: It reads like a Nazi tract.

SMITH: Yes. I remember reading it at the time.

STEEN: He certainly had rejected the notion of compound interest rates. You had forests because you need forests, that's why you had forests. They didn't have enough, so they'd go across the border and get some from their neighbors.

SMITH: I think that in retrospect, the reason they dumped the Faustman theory was mostly because the rates that they tended to require under this just had no ceiling on them. We've got the same problem today. You can't get any owner or economist to tell how much is enough, although they'll say "well, your alternative rate . . ." In my textbook I bring out an illustration of the value of land in Manhattan Island in which you find that at 6 percent compound interest the Indians that sold out for \$24 were the real smarties in that deal. Of course they took the \$24 and drank it up; they didn't see it as capital. About once every ten years there'll be a story in the newspaper about the assessed value of property on Manhattan Island--astronomical! You compound the \$24 at 6 percent since 1624 and it comes out to even more. Anyway, one of the problems that one has in connection with the economics of this is that to conventional economists any time period longer than about three years is ludicrous. It isn't economics at all, as far as they're concerned.

One of the problems we have in the timber production component of silviculture is that we're engaged in a kind of financial investment that has probably a longer time frame than any other kind of human endeavor. That isn't true of some of the other things that we do in silviculture, or in forest management. Wildlife management usually has a time horizon equivalent to the reproductive cycle of whatever animal it is; it's certainly longer for elephants than it is for deer mice. Recreation and protecting the watershed, those in general are benefits available year by year. But in timber production forestry, that's where we face the forever time dimension more critically than just about anything that the world does. No wonder we have problems of getting the world to understand it. Concerning the stage on which silviculture is played, I finally decided the best way to describe it was that the world of silviculture is the stand. In what's academically called forest management, the stage is the administrative unit called the forest, and part of what you do in forest management is put stands together into forests under management programs. However, in practice the two things aren't divorced. It's been pointed out to me that in Munich, Forest Management was taught in the Silviculture Department, thank you. I remember Burschel told me once, "it's too important to leave to those other people."

STEEN: Let me plug in another definition, based upon your response to Fernow. This is Henry Graves, three years later. "Forestry is a branch of botany." You'll appreciate that, being a botanist. "Silviculture is the establishment and care of woodlands, it teaches us how to produce forests, it is what distinguishes forestry from lumbering." Is that different? He's American but he studied in Europe.

SMITH: Yes.

STEEN: It certainly sounds different than Fernow.

SMITH: I certainly come closer to agreeing with Graves, although I think that definition overlooks the point that the most important economical tool we have for manipulating the vegetation is the act of harvesting useful products (such as but not limited to timber). This is one thing that's very hard for the rest of the world to understand. That in silviculture we're manipulating what sort of vegetation occupies the growing space. We're usually trying to change it or replace it, or at least to guide its development. We can't reallocate growing space without making vacancies in it. We've got to go and kill something to do it, to put it bluntly. The most economical way we have of killing vegetation is to get somebody to buy the product to put it to some use. It was said a long time ago that the forest was built with the ax. I think it was said in German, I don't know what the German would be for those words. Another thing that the world has difficulty appreciating is that one of the characteristics of life is death, and if there weren't death, there wouldn't be room for new life.

STEEN: I've read some figures about how populated we'd be with . . .

SMITH: If the world didn't want wood, which is very unlikely, we would still have to kill the trees to manipulate the forests to meet the other demands that the world places on this kind of vegetation. And it would cost big money.

STEEN: In 1983 you and Spurr co-authored an article on the history of silviculture for our encyclopedia. I took the first couple of sentences, and I don't know if you wrote this or if Spurr wrote this. "Silviculture is the theory and practice of controlling the regeneration, composition, and growth stands of forest vegetation." I didn't know if the word "vegetation" has a significant meaning there, things other than trees.

SMITH: No, no. It's deliberate. Most of the definition is something that Spurr cooked up. He said it occurred to him when he was going to sleep; he woke up and wrote it down before it got away. The idea of stand, that epitomizes the statement I just made that we, for academic convenience, limit ourselves to the stand. Speaking of vegetation is deliberate because we're not just manipulating trees; there's all this other vegetation--the shrubs, the herbaceous plants. I'd say the whole ecosystem. When forestry got started in this country most of it was at a time when there was a fear that we were going to run out of wood.

STEEN: Yes.

SMITH: I don't know if that's true or not. Then you got swept away with this one thing. There are plenty of cases where it's the only way the landowner can derive any revenue from the forest. There was an earlier time in European forests when other uses took precedence. They were chiefly game management. I remember once Francois Mergen, who came from Luxembourg, said that he thoroughly knew from the old country that originally forestry was a multiple use kind of thing, that there'd been a period when it had gotten heavily obsessed with timber production. He said it's probably now moving more back to what it had been, that wouldn't mean the timber production ceases to be of high importance but it isn't the only thing they're pushing. Fernow was sort of mirroring this concern about timber, which I think was probably as much American as European in his time. In fact, there's an interesting analysis of this situation coming early in the present century by Raphael Zon with succinct prediction of timber shortages. The reason he gave was population will grow and grow and grow. I think his estimates of future population of this country might have been a little low.

STEEN: Yes.

SMITH: It is going to require more and more agricultural land to feed them all. The only place agricultural land could come from is the forest. He didn't anticipate the effects of the agricultural revolution. That we'd get more and more food from less and less land.

STEEN: During the Eisenhower years we were planting trees on marginal agricultural land.

SMITH: Then we have plenty of other places where it just came by itself. I've heard the stories about boll weevil pine in the South. We might take a look at the Harvard Forest diorama; a hundred and fifty years ago you could see across it. In fact, agricultural land abandonment and fire control is what kept the timber famine from hitting us. But as far as the definition of silviculture goes, I'd have to look and see what I finally used in my book, but I probably would have been better off in using the one you just cited.

STEEN: The next sentence in the definition is, "It's also been defined,"(you guys don't say by whom),"as the art and science of cultivating forest crops based upon knowledge of silvics for the study of the life history, characteristics and ecology of forest trees." That sounds like something you would say.

SMITH: No.

STEEN: No?

SMITH: No, even though a lot of my background is in botany, the world of the stand has to consider the social requirements. What you do depends first on figuring out what ownership wants from the forest. Foresters and silviculture have gotten themselves in all kinds of problems from assuming what these things

are. There's even sort of a psychological analysis in which it is often necessary to cross-examine owners to find out, "what is it that you want?" And not to figure well there's one way to grow eastern white pine or eastern hardwoods and they are supposed to go along with it whether they like it or not. Sometimes it is hard to get them to understand this, they'll say, "well, what we want is what's good forestry."

STEEN: Yes.

SMITH: The forester may have to tell them "well, what's good forestry is what meets your requirements." However, one may also have to tell them, "what you want is not attainable." There'll have to be some back and forth on that. That's some of what the controversy is over the national forests, over "what are the objectives of ownership?" You've got so many owners.

STEEN: Vocabulary, we're all caught up in it. It's interesting to watch in the abstract when suddenly out of nowhere this term "ancient forests" is on national news. It's everywhere, "ancient forests." Anything over two hundred years old, I guess is an "ancient forest." It changes the whole way you look at that, whatever your position is.

SMITH: With this business in the Northwest, I remember there were several things that I wondered about. Where are there going to be old forests just as museum pieces. One interesting thing that Leo Isaac showed me that time forty-five years ago when I was working for him, something I've visited since. It is a natural area west of Quinault Lake on the western side of the Olympic Peninsula. In 1946 there was mile after mile along that highway of 200-foot tall trees. They weren't in the national forest, they were in the Quinault Indian Reservation; they've since been cut. But there was a national forest area right around the junction of the road that goes into Lake Quinault which Leo had gotten set aside as a natural area and carefully pointed out to me, "it isn't just one old growth stand," he said, "there are younger stands next to it so that there will be a perpetual supply of old growth, natural area stands right there." He was quite proud of it.

STEEN: I wonder if that survived.

SMITH: Oh yeah, I was there four or five years ago, but I hadn't been there for years. I also tried to find some of the nearby sample plots of the selective logging study I'd worked on but I was not surprised to find that the partially cut stands seemed to have been cleared off. Dense natural regeneration of hemlock had replaced them.

STEEN: They're on the national forest, not on the Quinault Reservation?

SMITH: Yes, they were, there was some national forest land. Anyway the natural area is still there, and preserving natural areas for scientific purposes or inspiration of the public is different from the wilderness business. The wilderness are mostly inaccessible areas where probably wouldn't be economical to manage the timber anyway. I worry sometimes about some of this difficult terrain where you can buy your way in from the fat of the old growth but you wonder if the second growth forest will ever pay the costs of making it accessible. I think the Forest Service has recognized that and deliberately backed off timber management on some such areas. The technology of access may change, but . . .

STEEN: I worked in timber management for a year, it doesn't make me an authority, but we put in very high quality roads, six-inches of crushed rock, all weather permanent roads. Must be unique to American forestry practices to have that quality roads and expensive culverts and bridge systems, the idea that they would be around to harvest a second rotation.

SMITH: Wasn't some of it for recreation and that?

STEEN: Well, I don't really . . .

SMITH: When was it?

STEEN: This was in the '50s.

SMITH: In the '50s. I was involved in President's Panel on Timber and the Environment in the early '70s, I remember being told that a lot of those roads were set up by the standards of the Bureau of Public Roads, and that one of the things that used to enter into the calculations was the logging trucks could go faster and the stumpage prices were higher.

STEEN: Yes.

SMITH: There was something in the formula.

STEEN: Sure.

SMITH: It certainly is a big problem in that region. When you get right down to it Pete, silviculture is actually been heavily controlled by the nature of problems of particularly of logging, the nature of logging machinery, and also the access problem. If you examine what's actually going on in silviculture in this country, very frequently you'll find it's been controlled by the logging machinery. With clearcutting in the Northwest, the high lead and skyline systems, well certainly the high lead systems, the only reason they wound up as clearcuts was mostly because of shifting the cables and destroying what was left.

STEEN: I had quite an experience driving along for the Forest Service. I looked up on the ridge and I could see, of all things, a little stand of second growth. Must have been an old fire. I hiked up there to see what it was, and it was about 70 year old Douglas-fir, a nice little stand. I proposed to the ranger we try some selective logging, try a little silviculture, because we were pretty much clearcut, burn, and plant. He said the operator would not know how to do that, he'd knock everything down just getting into it. "All we can do," he said, "is clear cut. The loggers don't know how to selectively log." The ranger was an experienced person, I assumed he was correct.

SMITH: Probably nobody had anything but a cable yarding systems. Did they have skyline system or it was it skyline terrain?

STEEN: Probably.

SMITH: Safety requirements. I'm not closely familiar with it but what's going on in this part of the country now is heavily influenced by rubber-tired skidders, desire for tree-length or whole-tree skidding. Insurance and safety considerations are militating against the use of hand-held power saws in favor of feller bunchers, and it's almost surely going to fix it so most partial cutting will have to be done in straight lines or something like that. You can't ignore it, although in the case of the partial cutting business one can encourage all the shopping around for Finnish and Scandinavian equipment designed to thin and not just to clearcut.

STEEN: The capital investment in forest management, when you've got to buy one of these feller bunchers as opposed to a couple of chainsaws and a small truck, changes the nature.

SMITH: At least it appears that people are more inclined to invest in big machinery. I sometimes wonder if it isn't that every logger's got to have the biggest machine.

STEEN: I suppose.

SMITH: I've heard that logging equipment dealers will get in some new big machine and park it right out in front of their sales yard, and every logger in the locality has to have one. It's been pointed out to me with the German farmers who use their farm tractors for logging that it's got to be the biggest tractor.

STEEN: I'm sure there's something to that.

SMITH: It's often something big enough to handle the biggest log we come to every month. But the main point is that the silviculture has to be tied in with logging and whatever socioeconomic requirements there

are. Devising the silvicultural treatment has to have as much ingredient of that as the botanical requirements for regeneration.

STEEN: Given what you just said about the integration of silviculture with the other things like management and harvesting, is silviculture still central to forestry education? It was what forestry is all about when I was in school. We finally got to silviculture in our junior year, that was forestry. Would a student feel that way today?

SMITH: I guess the only people who figure it isn't are those who figure that all that we protect and manage forests for is untouched natural preserves.

STEEN: How about the timber beast type, that the only thing we do is try to make money? Are they still around?

SMITH: Oh yeah, they aren't as prominent as they were, partly because more and more people recognize that the forests often isn't just for timber production, and whether you like it or not you have these other demands. For example, part of it's because there's less and less acceptance of the idea that the rights of private ownership are absolute. They never were.

STEEN: That's right.

SMITH: More and more, society has taken upon itself the right to use private forests and influence how people use the land. Now we see the biggest extreme on the publicly owned land. Certainly one thing that has happened to do that the rate of urbanization of our population, and the one man one vote business. I can remember when that opinion came down from the Supreme Court, it says in there somewhere trees don't vote, and boy we're in for trouble from now on because we won't have so many rural legislators at the state level who understand something about this resource. It's no accident that the most extreme public regulation of forest practice in the country is in the states that are most urbanized which are California, Washington, Oregon and I think Massachusetts. They're having problems of the same sort in Australia, which is the most urbanized country in the world, or most urbanized big one. Areas that are reputed to have a lot of rural interests are really politically dominated by urban areas.

STEEN: Do silviculturists rise to leadership positions?

SMITH: I don't think as much as they did. It might be well to identify just who is a silviculturist. Most are people like myself who teach in school or who are researchers, but are not in basic research. Now there is one kind of silviculturist who has appeared in recent years, and he's the staff silviculturist, particularly in the Forest Service and in some companies. Usually they are not in administrative positions. In fact the staff silviculturists in the Forest Service have deliberately kept out of administration. They're exempt from the Forest Services' transfer policy which is wonderful for everything except silviculture. They perceived that it was, but nobody ever stayed around long enough to learn about mistakes or capitalize on successes because they never were there long enough to see how it turned out. Actually it's a rather specialized group of people.

Since it's been deemed that in forestry schools, if you don't have silviculture you don't have forestry, it's often meant that some of the administrators tended to be silviculturists, but it's certainly not universal. There used to be a time when it was, because the only professor was a silviculturist. I'd become aware of this and on doctoral level work we have students get doctorates in silviculture and keep wondering what exactly are they going to do when they get out? Most of it is teaching or there have been quite a few in the extension jobs recently. Then there is more and more the phenomenon one way or another of the staff silviculturist. But it's somewhat specialized. It does happen to be one of the academic specialties that has the higher degree of versatility than a whole bunch of others. The main point is that there's clearly more to forestry than silviculture, but it's still a very central.

There's an interesting observation a few years ago made by a very astute forester named Harry Kusick who was the state forester here in Connecticut, where we've got heavy urban influences. There was once

some discussion session somewhere where somebody asked Harry about urban forestry and advanced the opinion, "well probably silviculture isn't very important in that." Harry thought for a little while and he says, "no I think you're wrong, I think silviculture is more important, more difficult in urban forestry than it is if you're just growing saw timber." I think he was right. I sometimes run urban forestry field trips here. It's the one time when I don't have to sign out a school van to be able to take the students out in the woods. I just go up the street. It takes a whole half a day. I go up this street for several blocks and down to a more heavily traveled street and come back. There are more problems with soil and trees and shrubs, litter, and various kind of vegetational treatment or land management than you can shake a stick at. Sometimes before I get to the end of the circuit it's time to accelerate and bypass things. There are problems all over the place. It's a really rough environment.

STEEN: I know George Staebler and his research work at Weyerhaeuser. Where in the management side of a company do they hire a silviculturist to come up with management plans, or do they bring in consultants?

SMITH: Weyerhaeuser does it pretty much on an in-house basis. You named one good silviculturist they hired, namely George Staebler.

STEEN: How about the general list?

SMITH: Now, Weyerhaeuser still devotes a lot of attention to research and while their general approach to silviculture has been plantation silviculture, they examine it in very close detail and they're always looking for better ways of doing it. I've been out on some of their experimental triumphs where they are continually probing to try to figure out "now what fits our purposes best in this particular place." On the basis of the policy they follow, which is pretty high investment, it's really quite refined, sophisticated, and variable and their silviculturists, whatever you call them, whatever title they have, are guiding it.

STEEN: These people wouldn't be a general forester with a bachelor's degree in forestry. They bring in specialists who really have this . . .

SMITH: Yes, it's gotten to the point where it's most foresters with some responsibility at least have been educated to the master's degree level.

STEEN: But we don't hear about these people because they don't publish. That's the only way . . .

SMITH: I think Fernow quoted somebody or there's something in the German literature way far back, I think maybe (in Hartig) that "the foresters who practice don't write, the foresters who write don't practice." It's very true. There are even impediments to that. I remember once some years ago, I set up a symposium at a meeting of the New England section of the Society of American Foresters about spruce-fir silviculture. A national forest supervisor gave a very good account of the spruce-fir management on the White Mountain National Forest, what they did and why. The head forester of International Paper Company did the same in regard to some of their activities in Maine. Their objectives were different, and they told what they did and why. Under the circumstances it seemed very clear to me what they were doing was sound.

After the session was over I went up to each one of them and I said to each one of them that was a wonderful paper, and I think you ought to get a few pictures and publish it in the *Journal of Forestry*. The man from the paper company said, "No, Dave, I'd have to clear it with the New York office, I'm not sure that it's company policy. Somebody might not like it and maybe some of our good ideas are company secrets. So I really can't do it." I went to the national forest supervisor, and I did sort of the same routine. "Dave don't bring that up. I've got problems enough without getting it cleared in Philadelphia and checked out in Washington." I managed to get them to sneak the papers into the news quarterly of the section, but that's as far as it got. In other words, there are impediments to this.

STEEN: Sure.

SMITH: The company-secret approach or bureaucratic policy. Then there's the fact that if a practicing forester publishes something he's more likely to get in trouble than to get promoted. There's a limited role for

people like myself to write. You see, I've been managing Yale's forest for 40 years, or heavily involved in it, and I don't do much consulting work but there's one project I've learned quite a bit from. There's an episode when I went out back to the Pacific Northwest again for a summer of kibitzing that I saw what various owners were doing, and learned quite a bit from it. In things like the textbooks that I write, there's a vehicle for getting some of the results of practice across. It's not all stuff that you can find in the published literature.

STEEN: There has always been a complaint with the *Journal of Forestry* that it's always college professors and Forest Service experiment station people. The folks aren't doing the practical work, but the practical work people won't or don't or can't or something.

SMITH: When I was out in the Northwest, it was in 1966, on that particular summer I was working for the Northwest Station as kind of a roving kibitzer. One of the fights I learned about (well they didn't just complain to me, they also complained to the chief of the Forest Service) was that people who run the national forest were unhappy with the researchers because the researchers didn't know what their problems were and weren't doing research on them. The Forest Service researchers had been very wary about coming up with solutions. And one of the questions you have in your outline, Pete, was "have there been influential silviculturists other than they academic types?"

STEEN: That's what we're talking about now. Is anyone outside of the academy really identified as a silviculturist?

SMITH: I'm beginning to wonder now, but there was an earlier time. We've discussed one of the people, Leo Isaac was an outstanding example of a number of people of his generation working for the U.S. Forest Service. They didn't have many people, but they tended to have one very good silviculturist assigned to every important timber type and region. It was somewhat influenced by where they had national forests, but not exclusively.

I couldn't begin to name all of the people, but these were the people who were primarily responsible in their time for developing the silvicultural practices. They were the leaders. In education here I desperately tried to get the publications of these people, and to keep them where the students could get them. They're getting rather old now. There was Leo Isaac in the Northwest whom you know about. In the other corner of the country was somebody whom we knew quite well, (he used to have his office in the building across the street when Northeastern Station was here) his name was Marinus Westveld. He was the expert on spruce-fir management in northern New England. There was a northern hardwood expert named Victor Jensen. Further south in Pennsylvania, Hough. In the Lake States with the hardwoods there was Windy Eyre, who was later a good editor for things in Washington. And there were some others there. I've mentioned Russ Reynolds in the South.

They had a policy where there was somebody assigned to almost every locality. They functioned not just as researchers but as also kind of an extension function. Time and time again you'd find that just by going to visit someplace and discussing your problems with them, they'd have an effect on what was going on. Then they did publish things that were accounts of silvicultural practice. One of the best such publications that I know about was one which came out in 1948 by Francis Eyre and Paul Zengraff which dealt with red pine management in Minnesota. It described current practice, mostly on the national forests of the time, but also traced the evolution of the practice. It was a sample of the effect of these people, and much of the important silvicultural literature of the time was the writings of these individuals. There were some professorial types, but they'd be burdened with teaching eight courses or something like that. I can remember when we had a seven-person faculty here and I thought I had a pretty light teaching load.

STEEN: But it's not that way now. Has the pendulum swung back to the academic leadership in silviculture? Or not?

SMITH: Or not? I don't know where the leadership is. You have to distinguish between ideas and what is done. There's often a lag between the two. I've sometimes worried a lot about silvicultural practice in Maine. I used to go up there and argue with people in paper companies about how they really ought to do it this way and not that way. They'd tell me, Dave, "you never can do it that way, it costs too much, where do you get all

these impractical ideas." I'd go back in seven years and find they were doing it, often because they thought it over and the circumstances changed and they decided it was an idea they'd had all the time anyway. And maybe I got it from somebody else. I used to facetiously tell people that in Maine "never" is a period seven years long. It keeps changing, but it's not always for the best.

But you do have to distinguish between what's done and what the ideas are. Hopefully if they're good ideas, they're inevitably ahead of the practice. I'd almost go so far as to say that if the ideas that I or some other silviculture professor tried to get adopted are looked upon as being unwise, that might be a good sign that they are wise and are ahead of their time. Actually, things move faster than you think. I remember when I was a weather forecaster, I found that if I figured something was going to happen in twelve hours or six hours, it was because it already was happening.

STEEN: Yes, a meteorologist once told me that he never looked out the window. He said, "the thing that's going to affect your weather is too distant to see."

SMITH: But you look out the window and see whether the forecast is coming out right.

STEEN: My impression is that silviculture would be defined as an integrative science. Maybe there is no such thing as silviculture, it's a combination of science and examples of genetics, physiology, climatology. In the academic world in particular with the tension over promotion and tenure, people involved in silvicultural practices would tend to be pulled away from the central core because that's where the action is, you've got to be a pure physiologist or whatever.

SMITH: We discussed earlier what to me is more and more obvious that we need professorships of the "practice of," and we can't leave it to the pure science approach. It's something that's made it very difficult, not just for forestry schools but professional schools in general. If you go near a biology department, they're quite contemptuous of anything to do with medical business, even though they're so utterly dependent on that financially, it's a kind of hypocrisy.

Now the idea of silviculture as a separate topic is something which exists only for academic convenience. What goes on out in the forest you can't really distinguish from the rest of management, and for good reason or bad this is part of why I've decided we've got to put limits on it. Silviculture sure as heck isn't all of forestry, never was and never will be. However, there's no genius around who could teach it all.

I found that if I just limited it to the applied botany, it created a situation in which the people who say "we know about money" would run away with the ball game every time. Their knowledge of the very complex biological processes underlying production is very naive and unsophisticated. They'll often act as though something in an equation with only two terms in it will tell you what's going to happen. The little world of the "stand" was one limit, there was a geographical limit we could put on it. That the question of how long the rotation should be or when you cut the stand, or what you used it for was up to somebody else. I did figure we had to start from the premise that the objectives were not set by some silvicultural specialists, instead, the silvicultural specialist had to know what the objectives are or what relative priorities to attach to timber, water, wildlife, or whatever. I've tried to make the position you can have one forest on one hill with a property line down the middle of it, and the optimum silviculture would clearly be different on both sides of the line. Laying out the program for treating the stands, once objectives are set, is silviculture.

STEEN: I remember Hank Vaux telling me how difficult it was for him at Berkeley to get his forest economics students through the system, because the economics department would chew them up. They weren't pure economists. Silvicultural specialists must have the same problem in the academic environment.

SMITH: Yes, either we have more or less, partly because sometimes we have heavy interaction with the pure botanists or more often now the pure physiologists or pure geneticists and so on. It certainly is true of economics. I remember once being the chairman of a search committee where we were trying to hire somebody in forest economics, and I had to take a candidate down to be inspected by some person who was in the economics department. The whole discussion, which I sat on the edge of, was "well, what was forest economics? What kind of economics was it?" They finally decided maybe it was a kind of welfare

economics, but I didn't know what welfare economics meant. I asked about it since, it isn't the welfare of the public dole. But mostly it was decided, well, it really didn't fit anything, so as far as the guy in the economics department was concerned, it really doesn't even exist, it was kind of trivial. The whole episode made me pretty sad. Some of it really is over something mentioned earlier, economists, so-called professional ones, have no time horizon that exists beyond about five years. That's real long-term stuff.

One sign of appropriate change in this country is that in recent years a lot of forest land has been acquired by pension funds and so on. Some of the biggest players are not American pension funds, they're European ones. One of our graduates has been heavily involved in acquiring and managing lands for these pension funds. I've even helped him, tried to help by going to Britain and lecturing about hardwood investments in this country. Some British investors were attracted by the fact that hardwood land was cheaper than southern pine or Douglas-fir, at least it used to be cheaper. Recently I had another discussion with this chap. He said "we've got a dozen British and European clients and one U.S. company that's investing in this." He says, and this is interesting, "I spend more time handholding with the American firm than we do with all of the others put together." It's mostly over this time horizon business. Our country has gotten so in the grip of the quarterly return, which has to be more each time, that it's really killing industrial forestry.

STEEN: I would have speculated that the difference was that in Europe the concept that "we're not making any more land" has been out a long time, but it's still hard for a lot of Americans to accept. The lack of the wide open spaces.

SMITH: That's some of it, but a lot of it is also the well-demonstrated history of the returns that flow in year after year after year, there's not much up and down in production, that it has a stability. What bothers currently with the American pension fund is what they perceive as illiquidity.

Part of the reason I bring this up though is that we can't devise intelligent silviculture without an appreciation of these things, therefore it can't be just applied botany. All of forestry is an interdisciplinary kind of thing and this doesn't thrive in pure-discipline departments. Like here at Yale I claim that ostensibly it's a liberal arts place and yet most of the departments tend to be mostly concerned about those undergraduates who are going on for doctoral work in that field. At the Forestry School we are practicing what they preach. Although we've got to the point in forestry where we try to educate the students in a number of different fields, and then we hope to God they can put it together when they get out, because nobody on the premises is necessarily doing it.

STEEN: I don't know how we get around the problem of getting tenure for the generalist or the practitioner. It would seem that the students will more and more insist upon the concept of interdisciplinary work, such as environmental studies, where you cut across the spectrum.

SMITH: As far as the tenure process, it depends on peer review. It's what the other people in the field think about it. One of the solutions is to be sure that the peer group which is doing this exists, and in the case of most universities it isn't a case of trotting to the botany department when you want to determine whether somebody in silviculture is eligible for tenure or something, you want to go to the other silviculturists elsewhere. I've been acutely aware of it here at Yale, that just as soon as you put "forest" in front of something like meteorology it becomes beneath the salt to a pure meteorologist. All this means is that there has to be a peer group of forest meteorologists somewhere. If what somebody is doing looks good to them, well that's what is the criterion.

Forestry has such a high content of natural science that we're always on the fringe of somebody thinking, "oh well, it's just another kind of botany department." I sympathize with that, I was once a botanist, hope I still am, but that isn't the only thing. In fact, one of the things that's both interesting and maddening about forestry and silviculture is everything is applied to the forest, there is virtually no kind of human knowledge of which you can be ignorant, especially history. So you're spread all over the place and there's risk of being accused of being pretty shallow or something of that sort. Yet it's inevitable, in fact I sometimes thought that they don't operate this way in the art school. That an artist is not somebody who specializes in

the chemistry of the pigments that are applied to the canvas. Maybe it would help if they knew more about it than they do.

STEEN: In the old days artists used to go out and break up rocks and mix their own. The artists do in fact have some practical knowledge of pigments.

SMITH: They probably still do to some extent, but it's not looked upon as chemistry or geology or if it's some plant-origin thing. In art schools it's the phenomenon of the designed solution. What we're dealing with in forestry is somewhat like that. In silvicultural practice I claim we'd be a lot better off if we tried to be sure that things didn't look so bad. Foresters have a trained incapacity to appreciate that any area where there's been logging looks like a tornado just went through it. Or leaving logging debris around. You don't buy very much if you say, "nobody will pay us for it, we can't utilize it." All that suggests is that we're not very good salesmen or technologists about utilizing it. But appearances are important.

STEEN: Certainly.

SMITH: A couple of years ago when I spent a summer in Munich, I went out in a forest with a fine forestry statesman, professor of German forestry, Richard Plochmann.

STEEN: I know who he is.

SMITH: He's here very often. He took us to a private ownership which he'd been involved in managing as a consultant. The people with me, there was Peter Hannah from the University of Vermont, and John Beutter who was then at Oregon State.

STEEN: I know John.

SMITH: And it was a place where an area had been clearcut and replanted with spruce. But along a narrow road through the stand, instead of planting spruce they planted a strip of hardwoods. And we asked Dick Plochmann "what's that for?" He says, "that's a protection strip." "Okay Dick, what are you protecting against, are you worried about wind getting in, or is it to break up the continuity of the spruce so that diseases, rootrots can't spread, what's the reason?" We got sort of a vague, "well no, it wasn't that, it's protection strip." We went and looked at other things and we came to another area where there was a somewhat older stand, and in this strip of hardwoods a couple of cherries had been planted. He casually mentioned that those had been planted because "they blossom in the spring and people like the blossoms." So then I asked, "Dick, I think I know what your protection strip is for, isn't it to protect you from criticism?" He laughed and said, "Yes, that's what it's for."

STEEN: Sure.

SMITH: There are more cases where it would be well to hide some of these logging areas with a partially cut strip along the road or something like that. Then we've got to regenerate the area behind and take the strip off. Sure it's more expensive logging and so forth. New Hampshire's got a law that almost requires that. I'm amused that they call it the Basal Area Law. What it is is that if you cut within 150 feet of the road, you have to leave half the basal area.

STEEN: Same thing in California.

SMITH: Yes.

STEEN: It's basal area. Of course if you've got old growth redwood nearby, you're in pretty good shape.

SMITH: It's maybe an excessively arbitrary solution to a problem but it's mostly aesthetic. There's still lots of foresters, "we shouldn't be ashamed of what we're doing." We should be ashamed of going and smashing our head against a stone wall every day.

STEEN: There was a debate during the chief and staff meeting of the Forest Service in 1924 on this very issue. We should be proud of what we're doing. We should clearcut right down to the road so the public can see good forest management. And there were other people saying, "no, the public won't accept this." This argument about foresters are doing something that we should be proud of has been around for generations. People go to Europe and they want to see cathedrals and the works of man, people come to the United States, they want to see works of God.

SMITH: Greeley was chief. He had timber management people and recreation people and watershed people, and they were talking about this issue of clearcut, and the public's reaction to it, and it could be going on right today.

SMITH: That's interesting because that was in the era when the Forest Service was switching over to the partial cutting or shortly before it, I guess it was still in the time when all they had was high lead logging. The big tractors and heavy trucks that opened the way for selective cutting hadn't been developed yet.

STEEN: Also the year they set aside the first wilderness, so there were a lot of things going on in 1924, and we're still trying to sort it through.

SMITH: While it might sound like a cute evasion, I think one virtue of the wilderness business is it's a way of keeping silviculture from starting prematurely in areas where the terrain and the economics and so on won't support it. This is something which has registered on me that has been true of the way most forests have been treated. Actually the idea of constant long-term management starting with the virgin forest is decidedly the exception. That the kind of thing we see in the West, there's virtually no other place that I know of in the world where there's been an opportunity to do that. Usually what has happened is, and we see it going on time after time, that in the beginning the virgin forest is just barely accessible. Somebody can struggle in with an ox or with stream driving or something and high grade it, that only the biggest and very best tree will pay its way out of the woods.

Often what has happened is that the policy has not been to maintain a forest anyway, sometimes we see it nowadays in the tropics, the logging roads become the way the shifting cultivators come in. They clear the forests off for agriculture or for grazing. In fact grazing for centuries and on a world-wide basis has been the main alternative use. The forest becomes destroyed. The foresters don't get called in until society has decided, we've got to put it back together again. The result is that silviculture or forest management at the fringe of accessibility is economically pretty hopeless policy. It also means that most forestry is really started with rehabilitation and not with the virgin forest.

Much of the forest in the East is on land that was pretty near devastated. There are some exceptions. It certainly always hasn't been the case where it got converted to agriculture, there've been plenty of places where it was heavily cut or heavily cut and burned. It's true in the Lake States or in Maine where it was heavily cut. A lot of it never went out of forest but in much of the rest there we've had the phenomena of the old field conifer stand, often natural.

I used to think that in Germany that the forests had been well-managed from back in the Middle Ages. Well maybe there were a few cases where they were, but in general that wasn't true. What had happened was that around 150-200 years ago most of the countryside looked like Scotland does today. It had been cut and burned and grazed so that there were heaths and a kind of moorland vegetation. For various reasons about which I don't know they decided they had to put it back together again.

One interesting way they did it explained something to me which I mentioned last night when we drove past the crooked Scotch pine. I was told that they gathered huge quantities of Scotch pine and Norway spruce seed and just broadcast it across the countryside. If the soil hadn't been too much bugged out by compaction, litter removal, and other indignities, the Norway spruce would take hold. But if the soil was really poor, if anything grew it was the Scotch pine. The important point was they had long since destroyed many forests and the forests they have today are very artificial. I've been told they are even doing pollen research to figure out what was the natural forest there. I remember Burschel pointed out to me that all the spruce in the Bavarian part of the Alps had replaced a forest that had lots of beech. The reason it was

replaced was because it's in the salt mining district of Salzburg, Austria; Salzburg means Salt Castle or something like that. The pans they evaporated the salt in were very crude ones made of cast iron, and the hot fires from beech wood burned out the bottoms of the pans. So they replaced beech forest with a spruce because it didn't burn so hot. Now it's all covered with spruce, it's all artificial. I just brought that up to indicate that even in Germany, that the forestry was rehabilitation.

Incidentally, the reason for the crooked Scotch pine was that the easiest way to gather pine seeds was to find crooked, malformed trees and climb them. Fortunately there weren't enough crooked, malformed Norway spruces for this foul purpose. The result was that France and Germany got all full of crooked Scotch pine from this disgenic selection. I used to think that all Scotch pine was this crooked French and German stuff like what got planted out along Lake Whitney.

STEEN: They have some in Seattle all crooked like that. I thought that was what Scotch pine was like.

SMITH: In Germany there are places where there are patches, extensive districts with sandy outwash. The natural forest was Scotch pine; while it's not really recognized now, they probably have an ancient fire history. The trees were all nice and straight, they're very dense, and it's easy to get natural regeneration. They never went through this disgenic selection. It's become apparent too that many of our successful tree improvement programs have not really been so much improving on nature as on improving upon the effects of unwise selections of seed to sow in nurseries. I think that's been true of a lot of the loblolly pine business, too; much the case where the nurseries were getting whatever seed they desperately could get. I think we've got some planted white pine around this locality which was seed that came from the Lake States. Its genetic material that may be very well adapted to Wisconsin and Minnesota but not to Connecticut. I'm not sure, we don't even know for sure where they got the seed.

The point is that most forestry has been started with rehabilitation. This doesn't mean that's the only kind or that we should figure, well we've got to destroy all of our virgin forests so we can start over again in the way everybody else did. We've got a good chance to avoid such unwise approaches.

STEEN: Let's shift gears a bit. A lot has happened in meteorology since the Second World War.

SMITH: There are some things that have been learned about meteorology during the last forty years. I had an acquaintance that stayed in it who told me that in spite of all this, forecasts are only somewhat better. The causes of some phenomena about which we used to wonder have been explained. Satellites would have helped a lot with the meteorology I was most concerned with, which was cloud conditions over Europe. Now I could get pictures that show these things and it's not anywhere near so indirect.

Silviculture around the World

STEEN: You've hit on some of this already and I thought maybe you'd try to identify it more; the differences in silviculture, or the definitions of silviculture in various countries. You said that in Europe, particularly in Germany, it was different because of the more authoritarian situation. They didn't have to explain the rationale the way the American silviculturists had to. I'd like to expand on that a little bit. Is there material difference in definitions in the U.S., Europe, Asia, Africa and so forth, or is silviculture today silviculture?

SMITH: I'm not so sure that it has to do with the definitions; it's what goes on that's pertinent. It's not the legalistic definition of what a treatment is but what it does. One approach to silviculture which is perhaps most completely epitomized by what goes on in German silviculture (I think you'll find this is true of Weyerhaeuser silviculture too) that it tends to be guided by empirical yield tables, which define the mensurational characteristics that stands are supposed to have at various stages of development. In the European model it usually involves a prescribed mode of thinning, which is not merely the method of thinning, that is, whether it's low thinning, high thinning, or crown thinning. It is also the levels of stand density that are maintained. It's very clear that in the eyes of some foresters the stands must be made to fit the yield table.

I find it quite interesting and a little saddening that it's very hard to penetrate to what the goals are of these various yield tables (in the present day we'd call them stand models). Usually you don't have to scratch them too deeply to find that one of the tacit assumptions is that the cubic-volume yields have to be kept up at a very high level. This, for example, militates against securing the good rates of diameter growth which I claim are at the heart of getting a good economic return from timber production. The important point is that there is a brand of silviculture in which the prescribed model is something which one is supposed to fit. For example, I recall going on field trips with the silviculture classes at Munich. Every time they went to a stand, the first step was to lay out some fixed-area plots to determine where the stand stood in relation to the yield table. If it didn't fit the yield table, well there was something wrong, at least in the eyes of the students. However, it was perhaps significant that the professor was not so sure of this.

The phenomenon that bothers me about yield tables or other numerical guides is not the idea of having them but the ways in which they are too often developed and misused. It matters not whether the shortcoming exists in Europe, America, or Asia. Most thinning yield tables are based on the tacit assumption that the economic objective is to maximize cubic-volume growth without regard to tree size. That misses the point that an important objective of thinning is to grow fatter trees in less time. Furthermore, there is no good reason to have one standard thinning table for any one species and region. The product requirements and economic goals of different owners will call for differences in intensity of thinning. A good forest manager and silviculturist should devise modified yield or thinning tables to fit the circumstances. It is tempting to say that the cut-and-dried numerical guides are for technicians but I have long since observed that really good technicians who actually mark the trees know enough to modify the rules as they go from tree to tree.

More generally there are problems with the whole idea that silvicultural education is learning canned "systems" and following numerical guides. "Don't ask me to think about the biological engineering of growing trees because all I was ever trained to do was to measure them. Give me a book of rules to follow so anything that goes wrong will not be my fault." No country has a monopoly on this mind-set. Silviculturist-foresters should formulate silvicultural systems to fit the circumstances and devise numerical guides where necessary to carry them into effect. Neither the systems nor the guides really should be selected from some book without analytical thought.

STEEN: Who made the yield table originally, was it a silviculturist or mensurationist?

SMITH: A combination of the two. One of the considerations that was built into the system was income taxes that were related to these yield tables. Oddly enough, it was generally understood that the yield tables underestimated the actual yield; this was kind of a game that was played with the German income tax. We have the same kind of infatuation with numerical guides today in this country. There are foresters who accept the idea that stands are supposed to fit some kind of yield table model or stocking guide. The yield tables are not as rigidly prescribed and they're not just for even-age stands. Another manifestation of it is in the attempt to fit stands to the diameter distributions of de Liocourt's hypothesis, which is supposed to describe the condition of an all-age stand. If I could expand on this more, that particular model is really the same old single-canopy stand structure model that goes with the pure plantation and that sort of thing. The only thing that's different about it is that the diameter distributions theoretically fit what you'd have if you have a whole series of single-canopy stands. You may remember earlier in this interview, I attempted to point out that it was my contention that many mixed stands might appear to fit this when they were actually even-aged.

STEEN: Historically what was the first step? In the colonial situation in India or Africa the forester had to go in and make up a yield table based on something. In order to manage.

SMITH: There's no evidence they did. What you're referring to there is management of forests by the concessions system, which you find plenty of evidence of in some of these old European colonial systems. The silviculture involved in them was somewhat like what was prescribed in the selective cutting approaches, guided by diameter limits, which have played such an important role, for better or for worse, in forestry in this country. Now when I was speaking of this rigidly prescribed mathematical model kind of thing, I didn't want to leave you with the impression that foresters always were able to get things to match these,

but it's been looked upon as an ideal objective. The quality of the silviculture in the eyes of these people might be measured by how closely you approach these models.

STEEN: Is it the same as a "normal stand" concept?

SMITH: There's some definitional problems here. I'm not sure exactly what you mean by "normal stand."

STEEN: I remember Bulletin 201 by McArdle in Douglas-fir. . .

SMITH: Okay, the so-called normal yield tables for stands were anything but normal in the conventional sense. The statement about those was fully stocked, which is very difficult to define. These were an American phenomena because in this country there was no history of thinned stands. What had happened in Western Europe was that it had become almost universal that all stands were thinned. The yield tables that went with those are the so-called empirical ones which had a certain thinning routine assumed and built into them. In fact, one of the problems with them was that once you were on the track of these yield tables you weren't supposed to vary the method of thinning. Almost invariably what they prescribed was low thinning. When people attempted to bring this concept to this country, they pragmatically observed, well we don't have any thinned stands, besides we're not sure we can get anybody to do anything anyway. So the yardstick we will use is not a thinned stand, but something which they hoped would be a universal case, and that was a stand that was completely full of trees.

STEEN: It's by site indexes too.

SMITH: No there'd be different tables for different site indexes. Why it ever was called normal is beyond me, because it was very hard to find a fully stocked plot. For example, you were mentioning the McArdle-Meyer yield tables for Douglas-fir. Meyer taught courses when I was a student here, and he was here on the faculty for a long time. I knew him very well and had many discussions with him. One of the things he often pointed out was that to find these so-called normal stands, they had to go and find little twentieth-acre plots, and they were few and far between. They figured if stands had only 50 percent of the normal basal area, they would have only 50 percent of the volume and 50 percent of the growth. Actually it didn't work quite that way. This was the American substitute for the empirical or thinned stand yield table. Now all of these yield tables are for pure stands. So far nobody has been able to make. . . (well there is one exception in this country, there is some even-age yield tables that Luther Schnur developed for mixed oak stands, it's not clear that they worked very well) but in general the yield table approach has been one in which the stands aren't pure, we can't play. I think this even had some tendency to encourage the plantation monoculture approach, which is partly to get something that will fit the bookkeeping that we know will work. Now one of the reactions that's taken place when people have gone to these more pioneering forestry situations has been just that. There was not even any hope of getting to the plantation approach, and they wanted some very simple ways of doing things. It's very common with these concessions systems in management where one simply sets some kind of diameter limit, and allows the concessionaire to cut to that diameter limit. It is tacitly assumed that the little trees will grow to be big trees and you can keep on doing this indefinitely.

STEEN: I have a bachelor's degree in forestry some thirty years ago. I don't think I had enough silvicultural skills to do anything other than what we did. What you're saying to me is very sophisticated, the ability to interpret a stand and make decisions. I don't think the average, using myself as a model, the average bachelor's level forester could do that. Do you think that a forester could do what you're saying ought to be done, to put these tables aside and go out and make their own judgments of stands?

SMITH: The problem is the tendency to use these numerical guides as substitutes for thought without even considering whether the outcomes fit the circumstances. Part of it the solution is having different kinds of tables to fit the different circumstances. Now we've gotten to the point where the mathematical manipulations are such that we should be in a better position to set up models in which one might specify different rotational lengths or different thinning intensities. In fact, we are beginning to see some of these kinds of things. Actually, much of this mathematically driven kind of forestry was hog-tied because of the laborious nature of the calculations. Many of these yield tables were originally constructed by methods of analysis that were simply graphical analyses. It was chiefly people like Schumacher at Duke and Walter

Meyer, who was here at Yale, who developed the techniques of substituting the use of mathematical equations for graphical analysis. It wasn't just yield tables, also volume tables. The first volume tables based on equations were some that Walter Meyer did for Connecticut hardwoods. But the forests are so complex that we have never yet gotten to the point of any meaningful yield tables for the mixed stands involved. But there has been that approach, and I don't intend to knock it or anything like that. So far it has worked best with pure stands.

Part of what I wanted to get across in discussion was that it also had tended to create a situation in which the people have come to believe that if they can get the stands to fit the yield table everything is okay. Sometimes they don't ask what is the criteria of that particular yield table. They presuppose that your objective is to maximize cubic volume production of wood, when it may be that what you want to do is maximize board-foot volume production, or to achieve a better compound interest return on the value of the growing stock. One of the problems I've always had is trying to penetrate as to what the goal was, and I can't even find out, other than maximizing cubic volume. Where that idea comes from is ancient history. Look at what's happened in silviculture where most of the ideas of present-day forestry were born, in Germany or parts of central Europe. Thinning is a very good example, it even ties into the yield table business we were discussing.

In the medieval times the foresters were gamekeepers, and they operated a system in which the nobility were concerned about hunting wild animals. The peasantry were concerned about fuel wood, and there was heavy demand for fuel wood, modest demand for construction material. In many cases the law was that the peasantry could have all the dead wood for fuel or anything they could get out of the trees by hook or by crook, at least that's the English version. It became customary for them to be granted the right to cut the trees that were either dead or dying. Apparently it was observed that if they did this, then there wasn't so much in the way of the arrows when the nobility came out hunting deer. It also became empirically observed that somehow if one did this, taking the small trees when they were almost dead or dead, the total yield of fuel wood was increased because they were capturing the mortality. And this is how low thinning started.

For a long time, it was a matter of lore and not of carefully measured scientific analysis. It was tacitly accepted that interrupting the canopy was a no-no. The reason was because it reduced the total yield of wood in a condition where every sliver you could produce was regarded as valuable. This idea has had a powerful influence on what's happened, even today. In Germany there's a great tendency not to thin very hard. The reasons have changed some, sometimes now it's playing games with income taxes, but it's a powerful ancient tradition. What happened along the way was that gradually this business became more scientific. It was mostly at various times in the 19th century when more analytical thought began to be applied to these matters. This is a tendency which has grown since. But the idea of the prescribed yield table has always been very powerful, in fact it's sometimes hard to get people to do such things as go over to managing mixed stands simply because they're uncertain as to what the yield will be.

This business where foresters have been educated to go out and measure trees, the mensurational approach; part of the reason you want to do this is because you've got to get the stand to fit these prescribed tables. There's even a tendency to figure there ought to be laws that require people to follow these tables. It is true to the extent that in some of these European countries, it is assumed you have to manage stands so that you do not decrease the volume below the optimum mean annual increment in cubic meters, that you can't regenerate a stand until it's gotten to the maximum mean annual increment, and you may be required to replace it then. That is a hold-over from the idea where they wanted to produce every sliver of wood they could in a given country so they didn't have to buy it from somebody else.

STEEN: What I think you're saying is the differences between U.S. and European silviculture are far fewer today than they were at the turn of the century.

SMITH: Ideas have evolved in both places, not necessarily the same.

STEEN: Are we a leader now in world silviculture? Do people turn to us to learn the way we turned to the Germans a century ago?

SMITH: Maybe there's some tendency in that direction, but, in general, no. One tendency that I have heard observed is that we are recognized as having a very well developed research capability, but our capacity to apply it in intelligent silviculture is not highly regarded.

STEEN: A graduate student, when I was at Washington, told me from his observations in Germany, this was the early '60s, that they were just beginning to apply statistical analysis to their plots. Something that had been routine in the States for a long time. Is that an accurate assessment?

SMITH: Yes, although there's an interesting background to it and that is that statistical analysis, or what we speak of as statistics, is usually ways of measuring statistical variance. The attitude of the people in Germany is much like that of people in physics, that all measurements are exact, there is no variance.

STEEN: A 100 percent sample.

SMITH: You put your finger on it there. Part of why they don't do it in some of the mensurational work is it's expected you go out and measure every tree. If you aren't sampling, if you measure the diameter of every tree, you can tell yourself that if you want to calculate the average diameter or the diameter of the tree of average basal area, you know what it is, you don't have to fret about the variance. Although they tend to hide the fact that there may be errors in the way you measure, there may be measurement errors.

STEEN: There's still a lot of treatment and control plots.

SMITH: Yes, they have. But again it's not just foresters or some particular group. In certain kinds of physics laboratories, it certainly was true when I was a student, if you want to measure something, you measured it three times and rejected the measurement that was farthest away from the other two. Now somebody concerned with the statistics of sampling would laugh at that approach. What the kind of statistical analysis one was referring to here is handling the phenomenon of variance, which is very large in biological phenomena, which are not as simple as physical ones. There is almost a psychology of this, and that certainly tends to be part of the mentality of Germans that all measurements are very exact. If you try to tell them, well it's possible that there was some error in this, this is an insult.

Not everything always stays the same, it's not just Germans who entertain this idea. The idea of this sort of statistical analysis probably started in Britain in the 1930s by people like Ronald Fischer. It was his writings that brought this to our attention, but there were some earlier developments of other people. It was very quickly grasped by foresters, particularly because of their sampling problems in a country like this with these vast forest areas. If you told somebody you want to find out how much timber there is in the Gifford Pinchot National Forest (I guess in those days it was the Columbia National Forest) but you have to go out and measure every tree, it would blow you away.

STEEN: I was amazed to read the testimony that John Wesley Powell made to Congress in 1890 on the methodology of the Irrigation Survey out west. He was picking typical streams, and he had a sampling technique. Obviously you couldn't measure every stream to get the total amount of water available for irrigation, so he was sampling. He was explaining to Congress the concept of sampling, and I thought, gee, that must be pretty early.

SMITH: It certainly was. Actually that's a manifestation of the point that there are lots of ideas that are not original, there are often kinds of simultaneous discoveries. Harold Lutz told me once "never get the idea that you have any original thought; probably you've subconsciously forgotten where you got the idea." What we've been talking about is this very precise silviculture by measured prescription.

One of the things we keep starting to go into and keep backing off from in our discussion is this regulation of forest by what basically comes down to diameter-limit cutting. People have in various degrees of sophistication recognized that big trees are useful and small trees aren't useful or aren't useful yet. There are plenty of schemes, especially in complex forests and very often in the tropics, or especially in things like the complex mixed deciduous forest of eastern North America, in which in one way or another people have embarked on this principle that there's something about big trees that you can cut and pay the government

for them. Oh, another manifestation of it was in this part of the country in the Broad Arrow law which all eastern white pines bigger than 12-inches in diameter were theoretically reserved for the crown.

In the British Commonwealth countries, what little bit I know about from Canada and Australia, the basic principle is in general the land belongs to the crown. In Canada it means it belongs to provinces and in Australia it means it belongs to each state. They lease out the harvesting and management rights for moderately long periods to concessionaires who are supposed to manage the forests according to general rules that are laid down by the government in each case. Very often the rules have this diameter-limit cutting approach built into them.

Another place where the diameter-limit approach is built into law is Mexico. The last few years we've had quite a few Mexican students, and I've become very familiar with this law which is almost holy writ that subjugates the foresters and all. It's for the birds, but they're still stuck with it. That's a case with a very different ownership system. The Mexican Forest Service manages everything, and there are communal ownerships, some private ones, or outright public or state or federal ownership. The silviculture is prescribed by law in the form of diameter cutting. They keep trying to break out of it, and to tell the truth I don't know how completely they have.

STEEN: That is partly to enable somebody with modest technical skills, even at bachelor's level, to go out and make easy decisions. All you need is a diameter table, and you can find a size and cut it. You don't have to really understand the stand.

SMITH: Yes. It's awfully simple and simply awful.

STEEN: I can remember growing up in the Forest Service; we had a piece of plywood cut with a 8" notch and a 16" notch and anything that would fit in there we marked for thinning, pre-logging. There were no decisions to make. Forestry was a physical profession.

SMITH: Was this before or after the Bitterlich point sampling?

STEEN: This was before. Bitterlich was around, but he was still controversial.

SMITH: I try to point out to students that if you don't have one of the prisms you hold up a penny. I show them how if you hold a penny at a certain distance, that's good for ten square feet of basal area per acre. Partly as a joke, I also provide German pfennigs which held properly are two square meters per hectare. One of the uses of these pure stand yield tables is that they tend to push one into whatever intensity of thinning is desirable. They found if you don't have this kind of numerical guide the thinnings are never heavy enough. But to get back to this diameter-limit approach, some of it isn't ease of management as much as a very rudimentary way of hoping that the forests will last even though we don't do anything directly to regenerate it.

STEEN: Thinning from above or something, in effect, take out the big trees.

SMITH: I'll have to watch out for that word thinning from above, thinning of dominants or selection thinning. Thinning from above actually refers to crown thinning in which you tend to remove the next to the largest trees to favor the biggest ones and hope the little ones grow or go away or something. The selective logging business in this country, and in certain others, was an attempt to formalize the diameter-limit approach, although in our case it had not started under a concession system.

When forestry was brought to this country from Europe, it was necessary to adopt this kind of rather provisional approach to things, where you cut the big trees and left the little ones. You may recall that I mentioned in our first interview session that I have gone as far as I could into things like the German textbooks of the time. They've got every option you could think of but not this one; it is not really mentioned there as one of the turn-of-the-century approaches. If I looked at what Schenck had in his book, and in Graves' 1911 *Treatment of Woodlands* book, they did describe this but they say almost in so many words that until we can do something better, we can struggle along with this approach. Schenck, who like Graves

was a visionary person, even forecast that by 1970 things will be much better. He even forecast that prices of timber would be as high in 1970 as they are in Germany in 1900. I don't know if it's caught up enough yet, but that's somewhat beside the point. But they did look upon this as something which you did until you could do something better. Sometime subsequently people formalized this selective logging approach.

For example, this is what the selective logging movement of the 1930s, 1940s was all about. They attempted to marry it to the idea of uneven-aged management, but there were people who screamed that what you're doing isn't that. I've been doing that for a long while myself. When I revised Mr. Hawley's book for the 1954 Hawley and Smith edition, I really took this uneven-aged management system over the bumps hard. It coincided with the very time when the Forest Service decided it was all a mirage and abandoned it as a universal policy, when they went perhaps too madly over the even aged management. Both what they did and what I had in that textbook was an over reaction. I've revised the thing since then to cool it down a little bit, and I'll tell you the reason. The stumbling block with this kind of approach to things is the attempt to make the individual stand into a self-contained sustained yield unit, which is virtually impossible. However, the advocates of the system would absolutely insist on this. As far as arguments are concerned, it's going into them with a millstone around one's neck.

STEEN: Isn't this related to the evolution of the working circle concept the Forest Service used? They were sort of sustained yield units. I was never quite sure exactly what a working circle was but in my mind it was the management unit. In the district I worked in, we had two working circles.

SMITH: Yes. Each one of which was supposed to be a sustained yield unit.

STEEN: That was my understanding.

SMITH: And they were quite large.

STEEN: Oh yeah, 150 thousand acres each.

SMITH: If you look at the sustained yield business that this selective logging movement contained, its advocates wanted to make every 20-acre stand a sustained yield unit. They were going to approach sustained yield from the bottom up; if you achieved it in every stand you'd have it in the whole forest. If they could have made it work, certainly they would have come out where they wanted to. But it often meant light cuts, with regeneration patches spread all over the place. It simply wasn't working. Something I tell my students about this approach is that if you look at sustained yield it works best by the area-regulation method, most simply by absolute even-aged stand culture which probably started in the early days. In medieval Europe with the coppice system, where every village was dead, if they didn't have a fuel supply. Then you couldn't move fuelwood far, even today you can't afford to move it much more than a dozen miles.

STEEN: With sustained yield you have to address the issue of cubic versus board versus whatever.

SMITH: Certainly you've got all kinds of problems, but if you approach it stand by stand, this is from the bottom up rather than the top down. I used to tell the students that this approach was like making a beautiful boot and putting it on your head rather than on your foot. People have come to recognize this principle; it's embodied in the National Forest Management Act of 1976 in which Congress, at the behest of the Forest Service, says the sustained yield unit is the national forest. If the national forest is too small you're allowed to put two of them together to get, what is it, 150 thousand acres.

STEEN: I'm not sure what that figure is.

SMITH: It's some figure like that, and what that means is that Congress, in effect, and the Forest Service have said we're going to approach sustained yield at that level of geography rather than anything smaller. Some people say, "oh, let's just approach it on a national basis" (I haven't heard world-wide yet). But as far as the advocacy of this approach is concerned, it finally registered on me that the insistence that the stand be a sustained yield unit was simply a stumbling block and that if you subtracted that requirement and you

had some management reason to have several different age classes out there, you might as well go ahead and do it and keep the books of sustained yield at a different geographical level.

National Forest Management Act

STEEN: The National Forest Management Act, that's sort of legalizing silviculture in the sense that we never have done before in this country. Many things were defined and it did have the effect of taking some things which had come to be part of the U.S. Forest Service policy and making legislation out of them. Here you have a law adding half a continent in forest management, is that even a logical thing to do? I mean, it's . . .

SMITH: I don't think that the National Forest Management Act has much of anything in it that greatly restricts what is done. The basic principle of it says ultimately the secretary of agriculture or the Forest Service decides what to do. I guess there's some limitation on the sizes of clearcuts. There is this requirement for diversity which is very hard to interpret. That probably is the most restrictive part of it. A procedural restriction is that it has provisions in there where anybody who doesn't like what the Forest Service does can go to court, and they've so far managed to use it to keep a lot of management plans tied up in court. Someday there will be an end to that kind of business. Much of it is a conflict over assignment of land use priorities.

STEEN: Were you involved directly in the Management Act?

SMITH: Only to this extent, that a couple of years earlier, chiefly at the behest of Steve Spurr, I and also a forest soils professor, Earl Stone, who was then at Cornell, were asked to serve as consultants to the Advisory Panel on Timber and the Environment. This was set up almost as the words indicate to deal with two problems that were eating on people at the moment. It was during a period when there were deemed to be shortages of timber on the market, particularly for housing. You know we have these chronic ups and downs in that business, and this was a time when timber was perceived to be in short supply. Then there was more and more concern over environmental matters, particularly effects of things like clearcutting and so on. Actually that was really part of this conflict over land use. Finally there was an inquiry into things like clearcutting. Initially it was Steve Spurr, who was a member of the panel, persuaded them to have me be a consultant about silvicultural matters, and originally also about things like the environmental effects of clearcutting. But then they decided they'd better expand it a little more and they got Earl Stone who is a very competent soil scientist to join the thing. He and I sort of worked together on this. One other person who was the overall director of the preparation of the report was a former dean of the New York State College of Forestry, Hardy Shirley, who was one of the graduates of this school, incidentally.

There were lots of economic studies and that sort of thing but there was also this inquiry into silvicultural practice, which I conducted. Earl Stone dealt, and I think very well, with questions of what cutting timber does to things like watershed phenomena, erosion, that kind of thing. And I dealt with the silviculture. I produced a report, which among many other things, laid considerable stress on the point that silviculture's best done by foresters, not by edict of legislative bodies or corporate offices of industrial outfits. It's best prescribed by foresters with their feet on the ground. That idea as far as I'm concerned comes from Ralph Hawley. And not just from him, but from lots of other people. Physicians don't prescribe for patients without seeing the patient.

STEEN: Yes, I understand.

SMITH: The first resolve of that inquiry in legislation was the RPA business. That was more a matter of economics or that sort of thing. I remember wondering if it was such a good idea when we went into it to have the RPA cover the whole national forest economy as distinct from that represented by the public forests. It struck me they were biting off a little more than they should chew. Then afterwards when things like the Monongahela business showed up, the report that I had prepared became a useful document for some of the people concerned with this. For example, as you may know probably better than I do that Hubert Humphrey decided he was going to go to bat for the Forest Service on this. I've often wondered if it

had anything to do with the fact that both he and John McGuire were graduates of the University of Minnesota.

STEEN: I don't know if they knew each other at all.

SMITH: It would be interesting to find out. Anyway, much to my astonishment, when Hubert Humphrey presented his version of the bill, there were two supporting documents. One of them was my report and the other was a resolution of the construction workers union.

STEEN: Strange bedfellows, but politically honest.

SMITH: Not necessarily. You could see a certain connection. The construction workers were concerned about timber supplies. I recall that Humphrey indicated that when we spoke at some SAF meeting, a national meeting in Washington.

STEEN: He was a keynote speaker at the 100th anniversary of AFA.

SMITH: Oh, that's what it was.

STEEN: I was there too. I heard his talk about the Monongahela.

SMITH: You may recall that he said he was going to move heaven and earth. He had to compromise to a limited extent but the principle, I think, was established. It seems to be that the foresters prescribe what's done and those who don't like it can squabble about it in court, but I don't think it's going to be endless. It seems to be if the reports, the management plans, have to be revised every ten years they seem to go to court about it every ten years. But so many of them haven't been accepted yet. However, the clearcutting controversy is largely a tool which is used to advance people's interest. One of the things which I find sort of ironic about it is that the clearcutting approach isn't my own personal favorite way to handle forests. However, if somebody says that it by itself is lousing up the environment and that sort of thing, that's baloney.

STEEN: You had suggested we talk about even-aged versus uneven-aged. Is that clearcutting or are you talking about more abstract issues?

SMITH: There are many approaches; these things are not absolute. For example, you can have even-aged management, and you can have uneven-aged management without having every stand a sustained yield unit, as I mentioned here a few minutes ago. (Parenthetically, I don't think you can have true sustained yield on a stand basis.) You might come fairly close sometimes, but actually the uneven-aged management will work much better if it wasn't hog-tied by that requirement. In this textbook of mine, I've tried to point out that if you subtract that requirement, then uneven-aged stand structure can become much more rational, especially in cases where there's some objective of ownership which requires that you always have big trees in the stand. It's the only way you can do that. I tried to develop the point that this diameter distribution analysis, while it may not have much place stand by stand, can be very useful in manipulating sustained yield on a forest-wide scale where you don't have all simple even-aged stands which you can control by this area-regulation method.

Now with even-aged management, there's not just one way of going about that. For example, one common approach to it is one you see very often in this corner of this country. Here there's very little regeneration by planting and more and more regeneration by the kind of, you can hesitate to call it clearcutting, it's heavy removal cutting which releases advanced growth, things that sprout, and now and then some stuff that comes up anew from seed. In the eastern hardwood forests in many cutting operations, if you go by the so-called standard definitions of cutting practice, they're true clearcutting to the extent that new regeneration say of things like birch and yellow poplar come up from freshly germinating seed after cutting. They're coppice cuttings to the extent that the regeneration comes from sprouts which are incidentally much better sources of regeneration than they used to think they were. Then they're many various forms of advanced regeneration, that's already there, and for the eastern hardwood forests that latter

is the most important mode of regeneration of all. In fact there are some species that won't even regenerate unless they're already there when you crop.

It's not just hardwoods, for example, it's very true of the spruce-fir forests in Maine that I've been messing around with off and on for quite a while. With the complex forests in various parts of this continent and in the tropics, if anything we should learn from them is that we almost haven't begun to figure out all the ways to handle them, but there is this conflict. Well, I won't say it's a conflict, but we do have the options of whether we go to the simple straightforward approaches epitomized by clearcutting and planting or whether we deal with these complexities. The complicated kinds of forests are one where you can be almost sure there isn't any one way of dealing with them, and yet I think we can observe in forestry practice that sometimes there's been a tendency to replace complicated kinds of forests with simple ones simply because we can understand them better.

Just last week we had a visitor here from Brazil who is a forest ecologist or ecological forester, I'm not quite sure which. He had some interesting observations about the Jari project. It's a case where a natural forest was taken down and replaced by the tropical wonder tree of the time, introduced from southeast Asia. He said that most *Gmelina* plantations at Jari are pretty sick now. One observation he made about it is, in effect, whether it's a good idea or a bad idea, whether it works or not, it's so expensive that he didn't think they could afford to manage forests that way.

STEEN: The Jari project. Maybe this is too easy in retrospect, but I don't see why anyone's surprised it didn't work.

SMITH: Yes. There was plenty of evidence there of very strong-willed management.

STEEN: Mr. Ludwig.

SMITH: It was sort of a way of redistributing the wealth. There were cases there where he decided what to do and if any forester came up with another idea, he got fired. That epitomizes silviculture laid on from the corporate office. It is not just in other countries; we've got plenty of silviculture prescribed from the New York office.

STEEN: There is a fascinating book on the history of the efforts to grow rubber in Brazil, and how they failed. The same situation where Mr. Ford felt that this was something to do and they went down and just did it. Even though there was ample evidence available that whatever disease it was would take out the pure stands in Brazil, and that's exactly what happened.

SMITH: You know, Pete, I think, part of what happened there was that when they moved rubber away from Brazil, they left some of the diseases behind, but I'm not sure that they did. If you look at that sort of business, there are some interesting arguments in favor of quite artificial approaches. With the introduction of species, it appears to me that so long as you don't change the habitat, especially the climatological basis, that the more flamboyant the rules are the more likely they are to be successful than the short ones. That if you move something across some barrier that the species has not been able to traverse, and you go to a favorable habitat, which is often the kind that it grew up in, that it will work very well. Often it works better, because at least temporarily you can leave some of the pests behind.

These apparent differences in viewpoint that we get are usually to resolve different experiences, emphasis on different observations that you can almost tell where somebody's going to come out, you know, where they started from. Part of the disagreements we have sometimes are the result of the fact that something which is very apparent to one party, or one group of observers, is not apparent at all to another. And the first group can't understand that their questioners don't perceive it. I've run into that problem repeatedly. I'll go someplace and they're doing something and I can't imagine why they are. If I ask questions I don't get answers. After a while, if I keep my mouth shut, keep watching and listening, I find out what it is that the reason was so apparent to them that they couldn't see that I didn't see what it was. It's just a matter of my own opinion, but I think it's desirable to look upon everything we do as provisional and not to

have theories but to have hypotheses, partly so that if we find we have to abandon them we can do so much easier.

STEEN: I don't know how to ask this without getting immersed in detail. In a generic sense, the major differences--regional differences--in the U.S., are these largely biological? Like loblolly pine versus Douglas-fir. Or are they products of the economy, terrain, and marketing systems?

Fire Adapted Species

SMITH: Ownership patterns as well as the things you mention certainly induce differences. However, there is one other important essentially climatic difference which has finally registered on me, although it's a borrowed idea. In ecology now there's better recognition of the role of lethal disturbance. Only about 10 years ago they finally got it through their heads with regard to forests that they didn't stay there the way they were indefinitely. However, from almost the beginning of ecology studied by foresters, it's been recognized there were disturbances.

In our silviculture, I think it's very important to distinguish between species which are fire adapted and those which are not. Most of the species that we have in the world I think are probably fire adapted. The reason that I say this is, if we look at the land surface of the world from a climatic standpoint, we find somewhat to the astonishment of people like us who think about forests and stay in the forests, that only about a third of it is hospitable to forest growth. There are areas of deserts and grassland vegetation, or tundra and that kind of thing. It's of some significance that a lot of the land surface of the world has rivers that don't flow to the sea, they evaporate before they get there. So we're dealing with only the well-watered third, and much of that is so dry seasonally that we have an important seasonal phenomenon, namely fire.

There are lots of species out there that are adapted to regenerate after fire. For example the coast form of Douglas-fir. Not the interior form but the coast form. Most of the pines are in one way or another fire adapted and it's not always the same way. The other category of species, fire kills forests from the bottom up. It tends to kill seedlings more than the big trees, there is a complicated effect of inducing sprouting. But there's another category of species which is naturally adapted to regenerate after things like windstorms or pest outbreaks that are more likely to kill big trees than small ones. Now this goes on with the climates where there's plenty of rainfall. If there are fire seasons, they're very short, and so that the species which tend to appear there wants to start underneath the stand and sit around waiting for something horrible to happen to what's above them. They tend to be advanced-growth dependent.

I mentioned the eastern hardwood, and most of the eastern hardwood species are in this category. We found out in recent years that true clearcutting will defeat them. There's some exceptions like the birches or yellow poplar and a few others, but most of them have to start in partial shade. One of my students has recently very well established this with regard to many of the longer life species in the Puerto Rican rainforests. We even had Hurricane Hugo show us what some of the natural things were. In that connection, the important thing which we've learned, to my astonishment, is that Hurricane Hugo uprooted very few trees. It defoliated vast areas and broke a lot of trees. This was in the Caribbean National Forest just a couple of months ago. This finally shows us the reason why something in the general nature of shelterwood cutting is what most of the species are adapted to. There are also pioneers that come into the openings.

Anyway, there's this distinction between the fire-ruled forest and what you might think of as the wind-ruled, or the insect-ruled forest over the difference between relying on things like advanced growth or the post-disturbance regeneration. Now the ones where the forest is destroyed from the top down goes with well-watered climates, as far as this country is concerned. This corner here is, and it would be easy to get this idea simply because it fits so well. Sure we have fire-ruled sites here, but it's one of the few parts of the world where it rains about the same amount every month. Part of the early forestry I told you about that started on places like the Yale and Harvard forests was really hiding behind a situation in which fires were not too difficult to keep in check. I think that the experiences derived from this have affected a lot of silviculture. Much of western European forestry is conducted in an environment in which, in the present day, fire is practically unheard of. When they have them, they don't know exactly what to do about it.

STEEN: They must have electrical storms in Europe.

SMITH: Yes, but they don't start fires. It's so humid and it rains so much. Now that you bring it up, I'm not sure I've ever heard of a lightning caused forest fire in places like Germany. Maybe there are, but see they don't have that long dry season. Probably there are lightning fires in the Mediterranean countries, they've got plenty of fire there. Anyway, there is this important distinction, and if we look at silvicultural practice, it helps to remember that the trees have been around a lot longer than we have. And that often what we are doing is aping some natural disturbance. My mentor, Harold Lutz, did as much as anybody to lay out this general idea, particularly about things that had to do with the effects of fire. Also here at Yale, Herman Chapman almost literally and figuratively breathed fire in connection with the ideas that he promoted about southern pine management. There was a major collision over that business.

There's something else I might mention that may be somewhat aside from the point connected with fire and education. You remember I mentioned that when the school was started, that the instruction in silviculture and forest protection were combined. The early editions of Mr. Hawley's textbook included both. Later he separated the two. There was a subsequent period in which there were two books, one on the practice of silviculture and one which he and Paul Stickle wrote which was called *Forest Protection*. It was mostly fire control because by that time, what had happened was that forest entomology and forest pathology had become well-established disciplines, even somewhat separate from forestry. For example, for a long while, the federal research in forest entomology was in the Bureau of Entomology and Plant Quarantine, and not in the Forest Service. The forest pathology work was in the Bureau of Plant Industry; incidentally their regional headquarters for this region were in this building. During the time we weren't using it.

In any case, instruction and research in those two fields have always been much more specialized, tended to be somewhat separate. As far as the instruction that Hawley had here, when he separated the things in that book there was a separate course in forest protection and it was almost entirely about fire. When I took over his teaching duties, it was not just in silviculture. Probably the meteorological background I had was part of it, because I also taught the fire courses and started the forest meteorology business. The two, as you know, are very closely related. Later when we could expand the faculty, I turned all those things over to Bill Reifsnyder.

One thing that used to amuse me, well it also saddened me, at the time he took it over was that many of the students of the time were the sort who were more concerned about the first job they would have after they got out. I figured that while I might be more interested say in silviculture or parenthetically meteorology, the practical thing they were interested in was fire control, because we were still in the situation where a lot of forestry was, or recently had been, fire control. Certainly it was true on the national forests; the national forest administration was dominated for years, especially in the West, by the fire control people.

STEEN: Every year we refought the Tillamook Burn, never forget the Tillamook Burn.

SMITH: I remember once, it was the time I was kibitzing for the Pacific Northwest Station, one of the soils people and I went to visit one of the forests in southwestern Oregon. It was over on the site where there was ponderosa pine. They clearly had ponderosa pine forests that were heavily dependent on advanced growth, and they were doing slash disposal, burning up the advanced growth. I remember asking the district ranger, "Well, if you're having trouble with regeneration, but when you already had it you've burned it up. What do you do that for?" He said, "we do it because of fire control." Then I asked him, "do you mean the difficulty of controlling fires once they start, such as building fire lines through logging debris and that kind of thing, is that what you meant? Or did you mean the fire control people in the Portland office?" He laughed and he said, "I mean the fire control people in the Portland office."

STEEN: Sure.

SMITH: At least when I started this business, fire control was important. Timber you found in the woods. I used to think that a lot of the forest inventory work was a systematic way of finding timber in the woods. You

found it and you cut it. If it regenerated accidentally, that was fine. But even part of the selective logging business was that while you assumed that you didn't have to regenerate because you had lots of little trees around, it used to appear to me that it was believed that American forestry students should study silviculture in the same sense they might study French literature, that it was intellectual exercise--but don't get any ideas that you're ever going to practice any of this. In retrospect it's clear that the times were already changing. However there is one other thing which I might mention that affected what we do, or what we did then, and as far as people like myself are concerned, still does. And that was, there was this powerful effort to move heaven and earth to make it profitable.

STEEN: Sure.

SMITH: We knew we were faced with people who owned forest land who wouldn't have bought it unless they could make money doing it. This led to the heavy emphasis on timber production, since that was the only thing that would pay the bills. I find it astonishing that anybody should dream of timber management on the national forests which is an independent, a separate function, if it's not profitable. With RPA you didn't look to see whether the government was making or losing money on timber management, you should look to see whether it had an overall benefit to the national economy. And you can get mixed up over these things like recreation and mining where they're sort of giving the resource away.

STEEN: That's right.

SMITH: You get a big return because it's so good for the overall economy. Anyway, there was this crusade to make it profitable, but now there are some who would argue "well what are you doing that for?"

STEEN: This concept of regionalism, like Barrett's book, is that an artificial construction where you have twelve chapters on twelve regions, or are those real chapters, in a sense?

SMITH: Actually I think what is very good about those is that they do represent description. In fact, the concept of the book that Jack Barrett edited really wasn't to present some regional pat answers to silviculture, it was to describe the region so that people could understand what was going on in the natural sense. There was a deliberate attempt to make it as timeless as possible. Now the ideas about what people do crept into it.

There was a very interesting and useful session of an SAF meeting in California before that came out. All the people that were involved were together in a room, and it was very clearly indicated that this wasn't to be a manual of practice. What has happened, there have been two editions of it and some of the chapters are by different people. When I have my students use it I tell them "look at both editions, don't just look at the most recent one" because, for example in descriptions of the forests of California, John Helms was the second person and first was Fred Baker. It was a very perceptive and useful account of Baker's ideas, particularly about the Sierra Nevada forests. Times have changed a little bit, they've learned some things, but there were these ideas and my role was rather peculiar.

There had been this earlier book by Rutherford Westveld, in which one of the regions was called the sprout-hardwood region. It was this part of the country; there's a belt along the Atlantic coast where there's long been a high population, and an ancient history of coppice cutting for firewood. I finally concluded that it wasn't a natural region, it was just a result of what's now called the Bos-Wash megalopolis, it's just too many people, heavy fuel wood demands in the 19th century. Yet the forest was kind of a kaleidoscope, it extended from the edge of what's called the northern hardwood forest getting fairly close to the coastal oak-pine forest. At a meeting in San Francisco, (to tell the truth I wasn't particularly anxious to get involved in this project anyway) I told the group "I don't think there is any such thing as a sprout-hardwood region in the context that you're following." You've got your northern hardwood forest and your southern pine and sort of an intermediate one which I claimed is misnamed the central hardwood forest. Well they finally agreed as I was on my way out of the room. I got lured back to write a general introductory chapter, partly to "explain all those complex eastern hardwood types."

STEEN: My question is how much is biology, how much is economy. You responded initially by saying fire regenerates, I can't remember the terminology.

SMITH: Fire-ruled.

STEEN: Fire-ruled. Are there principles of fire-ruled forests on the West Coast and East Coast that would make their silviculture similar, even though initially it would look like they're very different because the species' difference?

SMITH: Yes. You can find fire-ruled sites here, some of the very dry sites. Oddly enough, one of the most extremely fire-adaptive species in the whole country is one that occurs here, the pitch pine which sprouts. It has every known fire adaptation, serotinous cones, the whole bit. But it's confined to very dry areas, it happens there's a lot of it in fire-ruled southern New Jersey. Within ten miles I could show you some of it on some sand plains near here. It applies everywhere, and in very dry areas--I've observed things that look very much like an eastern hardwood forest along the banks and streams of central Arizona. If you're in the middle of them you might just as well be in the bottomland in Massachusetts, the species are almost the same.

STEEN: I always assumed until maybe a few minutes ago that coming from the West Coast as I did that I had so much to learn in the South. But maybe not because of basic principles.

SMITH: If you operate on the basis of the principles, I claim that you might be able to do better after a while. One of the problems of this regional approach is that it gets so limiting. I keep telling students if you're interested in southern pine, go and look at the Finnish literature which is mostly in English and read about *Pinus sylvestris* in Finland. You can't help but learn something that you would not otherwise learn if you studied loblolly pine until hell froze over.

STEEN: You described earlier the geographical range of a species with a northern extreme and a southern extreme and the eastern and western extremes--very different conditions--and there shouldn't be a technique to manage a species. It's naturally different throughout its range. What has always been in my mind a regional approach, you've sort of cut the pie in much different ways.

SMITH: As far as I'm concerned, I recognized and even decried the business where we have all these regionally oriented schools. Part of the reason I decry it is that if all one looks at is what is known from that region you're cutting out major external sources of ideas, knowledge, technique.

STEEN: I'm distressed by the regionalization of the *Journal of Forestry* into regional journals. Anyway, you said mechanization was so significant in silviculture, and I certainly can see it where in a favorable terrain in the South you can use machinery that you can't use in the slopes of the Cascades.

SMITH: I tell my students that they have two techniques. One of them is to hitch something to an ox and drag it over the ground, the other technique is hang a hook in the sky.

STEEN: Yes.

SMITH: As you indicated, it is partly a response to the terrain. But if you know about all the different modes of logging that there are, you begin to see where one fits and where one doesn't. For example, the differences in the Northwest you get in the High Cascades where the countryside is all covered with volcanic deposits that have made it a smooth and gentle terrain, and you can use the tractive ground skidding approaches that would be impossible a few miles away where it's awfully steep.

STEEN: Right.

SMITH: In fact, as far as the logging is concerned, a few years ago one of the students who I had managing the Yale Forest happened to be somebody who was primarily interested in logging. I deliberately had him look after the forest for a while to come to better terms with the logging community of the locality. He comes from New Hampshire. When it came time to look for a job, much to his astonishment, he was asked to come

and be interviewed for a job at the University of British Columbia. He came to me with some agitation, and said "I don't know anything about this high-lead, skyline logging except what I read in books." I said "well there's probably some reason why you want to go, and why they want you to come." So he went out and he found what had happened was that at least half the logging in British Columbia had moved into the level interior, and they needed somebody who knew about rubber tired skidders quite badly and they didn't have anybody. He's there working there today on the UBC faculty. Now that's a sample that has to do with logging where you need this collection of ideas, and this partly is deliberately in this textbook of mine, I've tried to make it independent of geography.

One thing which blew me away was that the first edition that I worked on was deliberately aimed at having something that could be used in the United States and Canada. Period. Some Spanish botanist translated it into Spanish, and I found that it was being used, and still is, as a textbook in Mexico. White pine translated into *pino blanco* and the whole bit. I was appalled, because it wasn't written for that purpose. It even got to the point where it would bring students here from Mexico. Even now they talk about producing a Spanish edition for use in Latin America. In the meantime I found this book was being used in other places.

I finally got it to the point where it's no longer limited to U.S. and Canada, but it's set up in such fashion that if somebody wants to use it in Australia, it isn't going to hurt them too badly. There's this attempt to deal with the principles and not the details of regional geography. The most recent edition really doesn't have a, except examples, regional approach, and part of the reason for that is foresters move around more than they did. If you look at the forestry schools in this country, some of those which have been most successful have been ones that weren't married to some kind of geography. Iowa State for example.

STEEN: Iowa State.

SMITH: It produced a chief of the Forest Service and all kinds of good people. I claim that some of it's because there aren't many forests in Iowa and they've always had to be ready to export people. In fact, the whole northeastern quarter of the country is somewhat that way. There's a big human population, and the various forestry schools that are within it have long recognized that the people weren't going to be able to stay there. Even the University of Maine, which is in the middle of one of the biggest forest economies in the country, deliberately maintains a program which is not married to Maine.

Comparisons with Canada

STEEN: Given the difference in the federal governments and provincial versus state governments in Canada and the U.S., and also the influence of society's needs on silvicultural practices, is there any distinctive difference with silviculture in Canada and the U.S.? It's often the same stand of timber--say Douglas-fir runs across the border and so forth--can you tell you are in Canada by looking at the stand?

SMITH: In the eastern part I can. From what little I know about it I don't see as much difference in the Douglas-fir region. But in the eastern part, it certainly shows up. With the provincial ownerships and the concession system they've been struggling with something where responsibility for long term forest management is dispersed. It's not the same in the different provinces, but one of the difficulties has always been that the lease periods are shorter than the rotation, and it shows up mostly in regeneration. The province says the concessionaires should pay for the regeneration, the concessionaires say the province should, and the result is nobody does. The forests have been cut very heavily.

Some of it has to do with the fact that the provincial forests--the crown lands--started as a revenue source in a situation where there was precious little other revenue sources. It's one thing that still heavily shows through, but it begins to change now. In fact, in New Brunswick they almost seem to have gone over a system where it's tacitly accepted that the province is going to pay for all the regeneration, and they aren't going to charge enough for the timber to pay for it. What they're really doing is subsidizing their forest industry. But they've arrived at the point where they've cut everything hard.

For about twenty years I've been involved in advising a big non-industrial private ownership in eastern Maine, and it's right across the border from New Brunswick. Part of what's going on there is production of medium-size sawlogs that go to mills to Canada, because there isn't anything there to supply them. It's weird, but the weirdest part of all this is farther to the west; the Quebec border is lined with sawmills. You can tell where the international boundary is. If you go to the boundary up in Vermont, New Hampshire, and Maine between the United States and Canada and look into Canada, behind you is this vast forest, ahead of you are farms and very little forest.

It's hard to penetrate to what it is, but there's some economic circumstance which makes it favorable to establish sawmills just across the line and feed them with logs from the U.S. They pay bigger prices than the U.S. mills can, and the stuff comes back into the U.S., it's one of the sources of the so-called Canadian spruce that you see going into the frames of houses; in the Carolinas there should be major concern over that business. Some of that Canadian spruce actually grew in Maine or Vermont or New Hampshire.

STEEN: Perhaps it's the southernmost agricultural land in Canada, usually it's more valuable for farms. But for us in the States we have our southern areas for agriculture.

SMITH: In Quebec there's a very interesting sociological phenomenon that has to do with the almost besieged French-Canadian society, which is a world of its own. It's overpopulated, and a lot of these farms are rather marginal. It used to be that one of the big sources of woods labor here in the Northeast was a seasonal one. People would farm and raise hay during the growing season, then there wasn't anything they could do, and they'd pack up and come and work in logging camps in Maine or elsewhere in New England, even this far south. There was quite a bit of actual immigration also. I grew up in Rhode Island, I can remember when there were French Canadian political machines in the northern part of the state and political speeches in French. That doesn't happen anymore because the Quebec economy is now much more industrialized, and there's plenty of work in Quebec and they don't have to do this so much. They're very good woods workers, excellent loggers. I can remember on the Yale Forest I'd have trouble communicating with the workers because they couldn't understand my brand of French.

STEEN: I've heard that people from France don't get along too well in French in Montreal.

SMITH: It's certainly not the same. I don't know how we got on to that.

STEEN: I was asking the difference between Canadian and U.S. silviculture, could you really tell that you were in Canada by what you saw on the ground, and you said yes. At least in eastern Canada you can see the difference.

SMITH: I don't quite understand what the reasons for it are. A lot of the Canadian silviculture is now much more oriented to the idea that trees don't grow unless you plant them. That's an extreme contrast to what you see it right across the boundary in Maine, that most of the silviculture in Maine is predicated on the idea that the regeneration comes from advanced growth. There are times when I think they began to forget this.

The wood-based paper industry started on the assumption that you could make wood out of spruce and not out of anything else. So the first wood-based paper industry in this country was here in the Northeast where there was spruce, and the forest management was a kind of selective logging if you will. The species are very shade tolerant, and it's kind of a magic forest where you cut the big trees and the little ones respond. It just sort of continually wells up from below. They got themselves some problems by pretending the forests were all aged when they weren't, but that's a side issue.

For the first half of this century it was tacitly accepted that on particularly the very wet sites where only spruce and fir would grow, the regeneration was accepted as very dependable, but the production rates were low. They were very conservative about what they'd be, a tenth of a cord per acre per year was the magic one which was used. Sometimes you'd find that a tenth of a cord wasn't what the production was, that was all they needed. Typically it was more like a quarter of a cord. There was even a tendency to spread this idea around to hold your taxes down and keep the competition out. But it was dependable.

As the technology of making paper improved, and they could deal with the pitch problem so you could start making paper out of southern pine, a lot of these companies began to move south. But their ideas about forestry were that land will produce a certain amount of wood kind of magically and you just go out and skim it off in the form of the bigger trees periodically. When they went south, many of the people who went with it started in this advanced-growth-dependent kind of forest with the shade tolerant species and the magic forest that wells up from underneath. In the South it was going to be better, the production rates were higher, instead of a tenth of a cord per acre per year, it was going to be a cord per acre per year.

I recall forty years ago going to the lands of one of the big paper companies down that way. They'd acquired a tremendous amount of forest land and they were going to sit back and collect this increment from it by skimming it off the top, and they were going to do it at the rate of a cord per acre per year. They had hired Wackerman from Duke to run the timber inventory and growth determination on this large amount of land that they had. The awful truth was that they were getting only a quarter of a cord per acre per year with what they had, and the reason why was fairly obvious. You'd go out and look at the land and it was grass and stumps to the horizon on a lot of it, it had been cut over burned and burned, and grazed and grazed, and that they had grasslands rather than forests. Then what happened, not surprisingly, was a whole generation of foresters went to work planting it all up. They would scare the people from the New York office, when they'd come down to the mill they'd peek from the window and say "see that big pile of wood out there, it's there to feed the mill. If you don't give us money to plant trees you're going to come down here and that pile of wood isn't going to be there."

STEEN: Which company was that?

SMITH: It was what's now Union Camp, it was Union Bag. They had built the biggest pulp mill in the world--I think it's still the biggest pulp mill in the world--in Savannah, and they'd acquired a million acres to help feed it.

See Union Bag was in Savannah, they moved from upstate New York. Union I think meant it was an amalgamation of various small companies. In the history of what happened in the South; first they planted up the grassy cutover, burned over lands and the abandoned agricultural lands. The boll weevil pine on abandoned agricultural land, mostly from the '20s, was what was actually carrying the mills for a long while. Then, to enlarge the pine production, the next thing they went into was clearcutting degraded or high-graded stands that had gone over mostly to hardwood. Planting those up with pine meant heavy-handed site preparation. Then something which was almost predictable happened. I was sort of braced for this. As people retired and many of these companies had holdings in both places, we began to get the effect of foresters coming from this fire-ruled kind of silviculture in the South and also in the West. One case I could mention where it was not someone from the South but was from a fire-ruled part of the West. They would want to start engaging in scorched-earth silviculture of a kind in which trees don't grow unless you plant them. They tended to displace the people who had been there a long time and who had complacently accepted the idea that you go out and cut and the spruce and fir just keep coming up. There were actually some disasters that resulted from this, including an eruption of concern about herbicides that was really the result of somebody trying to use herbicides to do this heavy-handed vegetation control.

It somewhat subsided, but it was a glorious case of (and this is something else which is a problem in silviculture) of people transferring ideas from one place to another, from a place where they fit to where they don't fit. It helps to transfer ideas, but it has to be done with a certain degree of discrimination. There was an episode up in Maine where somebody was trying to grow lodgepole pine. Nobody ever tried to plant slash pine because they obviously knew it wouldn't work. But in the case of the lodgepole it wasn't so obvious.

Spruce Budworm and Gypsy Moth

STEEN: I'd like to get back to this part of the country for one quick question. The heavy emphasis on spruce production for the paper industry, did that kick off the spruce budworm on the residual true fir?

SMITH: Like so many other phenomena, the budworm problem is a very complicated one. It should be called the fir budworm.

STEEN: That's right.

SMITH: I am reasonably sure that there have been places in the eastern forest where heavy cutting of spruce and the leaving of fir has aggravated the problem. It isn't a uniform situation. If you look at Maine, for example, every fifty-mile belt parallel to the coast is a different ballgame, even though it may spruce and fir. Some of my students and people I've worked with in Maine ran onto this. Much of the budworm research has been in Canada and spruce there is white spruce. In Maine spruce is red spruce; the species are different, so that what applies in one place doesn't apply in another. Definitely the proportion of fir has been increased. This isn't what caused the outbreaks, but it aggravated them. You get into a syndrome where budworm outbreak kills fir but favors fir regeneration.

STEEN: Was '49 the first real outbreak?

SMITH: No. There's a history of outbreaks every thirty to sixty years as far back as anybody can tell. Marsh Hall is undergoing some renovation work and it's occurred to me that the building was built in 1870s of spruce from Maine. I've saved some of the timbers to see if we can date some earlier outbreaks from the range. I'd like to be sure that the timber came from Maine, I need to check with Herb or maybe the other David Smith up at the University of Maine, and test out this hypothesis.

There have been repeated outbreaks. The worse one here in the eastern part of the range, the first really bad one, was 1912 to 1920. Some of the ideas developed from observations of that guided my own thoughts about the approach to these sporadic outbreaks. Many years ago when I was a student reading up on the conclusions derived from the 1912 to 1920 outbreak, there was a researcher, Marinus Westveld, who was a source of much of this, one of the Forest Service researchers of the group that I mentioned earlier. There was a big outbreak in New Brunswick and Quebec around 1950. There was a false start of it in Maine. It alarmed the big industrial owners enough that it caused them to do something that they had been dragging their heels about, getting the U.S. Forest Service to come in and do more research. They had wanted to keep them out. Part of it was a feedback from the controversy over federal regulation, but the threat of the budworm outbreaks scared them enough that they set up a federal experimental forest at the Penobscot Experimental Forest. An acquaintance of mine, Tom McClintock, was brought in to run it.

Marinus Westveld was actually headquartered here at New Haven, the smaller version of the Northeastern Forest Experiment Station up until the Second World War. He had his office right across the street but the building isn't there anymore. They would sort of tolerate him. But they did set up this research program. When that outbreak didn't amount to anything in Maine, it kind of fizzled. Once they start they tend to last for about eight years. The most recent one, at least in Maine, started in 1976 and lasted until 1984.

STEEN: What causes the collapse?

SMITH: Some of it is just eating up their food supply. Some of it is weather changes, wet weather in the spring. One of the things which I've been involved with for the last twenty years is partly a means of trying to become involved in the management of this very important kind of forest. We don't have any of it here and I've been running up to that country and closely observing what happened for a long while. Some of my classmates, oh one of them is a Canadian who is now the editor of the *Forestry Chronicle*, Cameron Place, had been a Canadian Forest Service researcher in New Brunswick, and I've hobnobbed with him occasionally. But about twenty years ago this big non-industrial ownership, the Baskahegan Company wanted somebody to help them with a procedure where some other entity was managing their land and they needed somebody to police it. One of our faculty who did a lot of consulting work, Zebulon White, took it on, but he wanted me to help him. Then Zeb White went back down South and I've been looking after this ever since.

Well it was a case where the Baskahegan Company and the Dead River Company which was managing for them were among the few who had been getting ready for this budworm business by cutting fir

hard and cutting spruce lightly, because the spruce tends to be more resistant than the fir. I remember ten, twenty years ago telling the Baskahegan ownership people that they should look at the merchantable fir they had and figure that it was going to be gone in twenty years. What I was really most certainly worried about then was that the species has a very short pathological rotation. Balsam fir grows very fast, but very often they get about 10 inches DBH and then get heart rot. At that point they grow fast on the outside and are apt to rot fast on the inside. And the wind will break them off. It's unwise to let them get much bigger than about 11 or 12 inches in diameter. If the rot did not get it there might even be a budworm outbreak that would. The alternative was harvesting it for pulpwood, although at that time the market for chip'n-saw logs had not developed.

So the Dead River Company, which was managing the land, set forth and moved a tremendous amount of fir off the land. They cut plenty of spruce also. And when the budworm outbreak hit, the Dead River Company went in and this Baskahegan land which they were managing was practically the only big unit of the territory in the state of Maine where there was a low fir population, helped by the fact that it had always been low. We even got out of some tax for spraying for the budworm because of the reduction in fir. Somewhere along the line, the Dead River Company disposed of their land in the settlement of the Indian claims business. In fact, they are still managing land they once owned for the Indian tribes. They're no longer looking after the Baskahegan land, it finally has its own forestry group. The policy that was followed on Baskahegan land was that we refrained from very much spraying.

I remember telling them, don't spray until there's a threat of losing spruce. There was about one year when they did but the outbreak about collapsed then anyway. But I told them you've cut enough of the merchantable fir, there's no point in chasing that, let the budworm kill it. The stands are overcrowded anyway, the budworms will do the pre-commercial thinning that you haven't been able to see your way clear to spend money on. So now they've got a big amount of spruce, red spruce. We now find some of it to be a red-black hybrid that's come through the budworm outbreak. In the meantime I've had some of my doctoral students do what I think is very significant research, not only with the budworm business but also with the management of the forests.

STEEN: Is there any kind of silvicultural treatment for gypsy moth? I never hear about anything other than the spray.

SMITH: People have tried desultory efforts at reducing oak, but that smacks of controlling the Douglas-fir bark beetle by eliminating Douglas-fir. It would be very difficult to do. There is a kind of combination approach which at least I have argued for, but I don't think anybody does it. I've discussed it with some of the forest entomologists.

We've got an introduced insect which is certainly heavily favored by oak, the populations have to build up on oak, birches sometimes figure in. I think I can detect places where the outbreaks start on the basis of concentrations of oaks. (Steve Spurr was a person who had as much as anybody to do with elucidating this). On the dry sites the gypsy moths feed in the trees at night in certain instars, and then they'll come down to the ground except on dry sites where the ground is hot. On the good sites they'll come down to the ground where the mice eat them up. This tends to keep the population down. On the dry sites, the ground isn't hospitable so they'll hide, very typically underneath branches, especially if there's been an ice storm and some broken tops up there. The mice can't get at them. Now there's a weird phenomenon, the strain of gypsy moth that got introduced in this country, the females don't fly. The original moth which has a range from literally Vladivostok to Morocco in oak areas in Eurasia has plenty of strains where the females fly. If we had any of those, we'd have worse troubles. We get this phenomenon where we appear to get these build-ups on dry sites, and it's tempting to conclude well, the insects moved.

Some researchers in the Forest Service, notably a guy named Robert Campbell (who later went out and worked on the tussock moth in the Northwest) uncovered one of the phenomena that was going on here. You get an outbreak in these dry sites and other predators of the insect, various black birds would flock to these areas because the pickings were easy. This meant that the pressure was off the other areas where there were only small populations of gypsy moths so the moths would then build up there. Here we had

been looking for a phenomenon to spread in one direction and missing one that was going in the opposite direction.

STEEN: It's spreading, it's not in North Carolina yet but it will get there in ten years, and what are we doing about it, what can we do about it?

SMITH: Some of the control can be partly silvicultural and partly insecticidal. I claim that using things like *Bacillus thuringiensis* will get around the problem of people fretting about organic phosphorous insecticides. In places I think gypsy moth can be held partly in check by blocking outbreaks on the dry sites with insecticides and also converting the dry sites to conifers. For example, if it gets down in the Carolinas, one thing that will block it is if you get rid of the oak and grow pine, which is a fairly common approach to life in the Carolinas. That will stop the thing in its tracks, because the first two instars of this insect don't have mouth parts that can cope with conifers. So it's a case of fairly sophisticated management, primarily the oak population.

STEEN: So it's reasonable to assume that if it becomes serious enough that--in places it's already serious--but there are silvicultural treatments that we understand that could be applied.

SMITH: Right, it's more something suitable for integrated pest management. I can conceive of silvicultural things that will help, but it's usually in combination with something else. And it's been pointed out to me that there are lots of different circumstances. Dave Houston of the forest insect disease lab here in New Haven has pointed out that the idea may work pretty well in places, say in southern Vermont where stands of oak are isolated on south facing slopes. He said, on the other hand, one of the worse cases he could conceive of is suburban areas where the epicenter of gypsy moth build up is in individual oaks surrounded by lawns where the lawn has defeated the mouse population. Too many cats and not enough cover. But he's pointed out it may work again in the ridge and valley country of Pennsylvania where the gypsy moth goes down the ridge tops like it was a railroad line with gypsy moth getting off the whole way. It's a very interesting and difficult problem to deal with, it takes a certain amount of sophistication to figure out what to do. Going out and clobbering it with the first weapon that comes to hand isn't always the best way.

Naturalistic Silviculture

STEEN: Natural stands are theoretical ones without human influence. "Naturalistic" silviculture is simulating what we believe to be natural processes. You suggested discussing naturalistic versus artificial stands, in terms of silviculture. What do you mean by natural stands?

SMITH: One of the things which has become very prominent now, particularly in the tropics, is what is called natural stand management. The simplest difference is between regeneration by artificial means and natural regeneration. That's what I meant by that. Of course there are all sorts of gradations. If you look into the history of this, there was an idea which was very prominent particularly in the 1930s and 1940s and it went along with selective timber management. It had something to do with the theories of plant ecology. In those times plant ecology was dominated, at least in this country, by the theories of natural succession espoused by Frederick Clements, who was a grassland ecologist at the University of Nebraska. His ideas had a powerful grip on all of the plant ecology and also the naturalistic school of forestry.

Much of what was behind this was a case where Clement's disciples oversimplified his ideas. The basic idea was that after a disturbance you'd have sequences of vegetation in which one kind of species succeeded another. Species --"A" would be followed by species of stages "B," "C," and "D," and then by the time you got to some end or climax stage it would then spin around and just stay in that stage, the so-called climax vegetation. The extreme naturalistic school of silviculture took the position that this stage would be stable, there would be fewer problems of pests and so on, and that what silviculture should be was something where you figured out what the climax vegetation was and got there as fast as you could and stayed there. Any regenerative cuttings would be very light, you'd cut only small holes and would deliberately maintain shade-tolerant vegetation. Now if you match this up, say, against West Coast Douglas-

fir silviculture, what this meant was that you grew western hemlock, Pacific silver fir, and western red cedar, and forgot about Douglas-fir.

STEEN: Did people actually advocate this?

SMITH: Yes. You didn't have to scratch the idea very hard before you saw that's where it was leading. This was the kind of thing that drove Leo Isaac up the wall.

STEEN: I can understand that.

SMITH: Certainly anybody interested in Douglas-fir. I guess I'd back up a little bit. It was inferred that if there was some Douglas-fir in the old growth stands that somehow it would always be there. In fact, one of the problems that was most apparent, when I went at his behest and looked at those selective logging plots, was that in general there was zero regeneration of Douglas-fir. In general there was not much regeneration in anything else either because the cuttings weren't hard enough. On the one I mentioned at Cushman Lake on what's now the Olympic National Park, there was a little bit of Douglas-fir regeneration.

Well, this idea had a powerful grip in the naturalistic school of silviculture and also in pure plant ecology. In both cases, I think people have gotten over this. For example, in forest ecological circles (which are distinct from those concerned with silviculture) there's been a rejection of the Clementsian approach, a rejection of the idea of succession. People have begun to distinguish between what they call *relay* floristics, which is the successional idea of plant community development, as compared with *initial* floristics. The initial floristics tie in with some of the things that I claim to have observed in mixed stands. I think what it comes down to is that you don't get succession in different stages unless you start with some comparatively severe disturbance like fire that wipes the slate fairly clean of all vegetation. But the initial floristics are more predicated on the idea epitomized by what we see in the more successful modes of regenerating mixed hardwood stands here in the East, where we get the advanced growth which is there initially. You have a disturbance which leaves the small stuff, and then they all fight it out after that.

Now even in ecology, people argue over which of these ideas is the correct one. As far as I'm concerned they're wrong both times because both things apply, it depends on what the nature of the disturbance is. At least in ecology, we're now at the point where the people recognize that lethal disturbances play a very powerful role in the development of the natural vegetation. There was an earlier time when the pure ecologists concerned with forests would reject the idea that the destruction of the forest by fire or any sort of wholesale destruction was anything but an abnormality. In fact, I got exasperated with some of them once and told them if they figured they could learn all about ecology in old growth stands, it was like learning about life in the old folks home. They ought to look at what happened when these started, but since that would involve lethal disturbance, they rejected the idea that it could occur. It was a very strange kind of notion that they had.

STEEN: This term "lethal disturbance," is that a published term?

SMITH: I've got it in my textbook.

STEEN: Maybe not in the sixth edition, the one that I read. Anyway, "lethal disturbance," this is a standard ecological term?

SMITH: If it isn't it ought to be. You know the fancy word it goes by now is "patch dynamics."

STEEN: Patch dynamics.

SMITH: That's a very strange term, but that's the buzzword. I claim it's the same sort of studies of stand development which foresters have been doing for years. It's predicated on the notion that new stands start in little open patches, and I think we're beginning to find that many species don't start there, but just outside those little openings with side light. Some doctoral students, notably Chadwick Oliver, who is teaching silviculture at the University of Washington, runs pretty hard with this ball. He and Bruce Larson are writing a

book about stand development or stand dynamics, and basically looking at all the developmental patterns that forest vegetation has. It's based on the idea that in a certain sense most of what we do in silviculture is to aid things that have happened in nature.

STEEN: I had the sense that naturalistic was aping nature.

SMITH: Yes, although in a certain sense if you clearcut and plant Douglas-fir you are aping the effect of severe fires for which there is historic precedent. Part of the reason it works so well is because there is historic precedent for it. However, Roy Silen told me once that about the only complete kill you've got in forest fires in that region is when the fires would crown at the heads of the slopes.

STEEN: I've heard the argument that part of this is a rationale from the timber management people to justify clearcutting. Isn't clearcutting much more severe in terms of eliminating shade for seedlings than a fire?

SMITH: Yes. For example, the contention that Douglas-fir won't regenerate without severe disturbance isn't true. It may be true of red alder. Douglas-fir certainly does well with clearcutting, but it doesn't require it. I think a lot of the work that Leo Isaac did is best interpreted as suggesting that Douglas-fir seedlings need some sort of initial protection from sunlight, and if they don't have it they're dead ducks. However, much of the protection comes from herbaceous plants and non-living shade.

Roy Silen did some work some what after that which can be interpreted as indicating that after a typical clearcut, with broadcast burning, that something less than 1 percent of the land surface is hospitable to Douglas-fir seedlings. However, that's enough. In fact, if 100 percent of it was, and seed landed on it all, you'd have stands of a million Douglas-firs per acre. Big commercial thinning problem. There are ways in all of this which I claim that at least what we should do in the science of silviculture, just to get up close to the problem, break it down into pieces and analyze it in terms of ecology, physiology, soils, genetics, or whatnot and develop the solutions.

STEEN: Is silviculture too much oriented toward trees and timber, as opposed to stands? Has timber management institutionalized silviculture in ways to advance its cause?

SMITH: Yes. Well, let's see, that question seems to have two things mixed into it. On the one hand there's always been this difficulty about distinguishing between the tree and the stand. You can't tell the trees from the woods or the woods from the trees, or can't see them. Somewhat different is the question over emphasis on timber management and emphasis on the other purposes society has for maintaining forests. I can remember Samuel Dana making a very significant observation many years ago that possibly society could get along without timber but it couldn't get along without forests. He didn't say they could get along without timber, he said maybe they could. In fact, most of the substitutes seem to come from an oil well.

But certainly timber has tended to dominate, not just silviculture but forestry in general in this country, and concern about timber supply is part of it. Another major part of it is our crusade to bring long-term forest management to industrial holdings, where the justification was almost entirely timber. This is a situation where they're almost not allowed to derive income from anything else. They may look with longing eyes as other forest owners do at using land for various kinds of residences or something like that. I claim that's a type of forestry too. In fact, this Conwood outfit that I direct and preside over is managing the grounds of the IBM's headquarters in southwestern Connecticut, attractive surroundings for an office building. As far as I'm concerned, that's silviculture.

STEEN: Sure. Maybe that question's related to another one I have here, let's expand. What are the differences in silvicultural practices on public lands and private lands. Also since most of the public land's in the West, does this compound regional differences?

SMITH: Certainly public ownerships are more capable of multiple use management than private ones. It's not absolutely true, it all depends on what the owner wants and what the owner's ready to pay for or what the owner is ready to forego in the way of very direct financial returns. I'm not arguing against the idea of dollar return, but there's a return also which many owners get from just seeing attractive vegetation on their

land, which is hard to put a price on yet it controls what they do. But, on a simple basis, yes, there's that difference between public and private. Forest economists tend to follow the principle that everything people do is regulated by Adam Smith's doctrine, if it can't be reduced to money nobody's interested in it. People don't behave only that way. One analogy I've often drawn with the students is this, that in economic sense one of the least productive things we do in the modern society is to have children. It's not like subsistence agriculture where children were a labor force. If you analyze it financially, it's now "uneconomic."

STEEN: Yes.

SMITH: We have sustained yield in forests because we produce children; it's posterity we're worried about. Maybe the sustained yield management we should look at in financial terms more severely than we do is the repopulation of the world with children.

STEEN: A single example that I think of, and I don't know if one can generalize on the public/private lands, is where I worked on the Snoqualmie National Forest. It was railroad land-grant country and every other section was privately owned. When you drove down the logging road you could tell whether you were driving through Forest Service land or private land, because the cutover Forest Service land was barren and the cutover private land was thriving--they didn't burn the slash and kill all the seedlings. The Forest Service burned everything, no matter what, while the private owners were willing to accept the risk of not burning the slash.

SMITH: In that country with these different policies about slash disposal, I sometimes concluded that the Forest Service wasn't practicing silviculture, they were practicing slash disposal.

STEEN: I've burned slash in four-year-old reproduction, waist-high silver fir. And then we planted.

SMITH: That epitomizes that artificial approach, although they weren't planting Scotch pine or Norway spruce but a native species. In Britain, you would have planted Sitka spruce or lodgepole pine.

STEEN: It was always 80 percent Douglas-fir, 20 percent noble fir. Some concept of not having a pure stand for ecological stability.

SMITH: Have you been back to some of those areas to see which grew faster?

STEEN: No.

SMITH: I think they stay about equal. I had looked at some of the natural mixtures of that and I sometimes have gotten the impression the noble fir might grow a little bit faster, but I'm not sure. It depends on which site it is.

Anyway what you've just described, Pete, is the epitome of the artificial approach. In fact, one of the things that used to interest me was the contrast between the approach followed by the people at the Harvard Forest and the ones here. Herman Chapman and Ralph Hawley were very typical inner-directed people. In general their attitude about Mother Nature and the forest was that you decided what you wanted to do, and you went out and kicked Mother Nature right squarely in the teeth and inflicted your ideas on the situation. It wasn't completely artificial, certainly Chapman's ideas about fire were in a sense naturalistic, but there was this idea about "full control" of what happened. Often you grew softwoods and not hardwoods.

I used to take the students up to Harvard Forest to hear about it, naturalistic silviculture. Some forest ecologists for a while espoused this doctrine, and I can remember when Steve Spurr did. The idea was that you followed succession to the end. Part of the background was that at the Harvard Forest, when the place was started, they had the idea that they were going to get a lot of their financing growing what we now know was old-field white pine, rotation after rotation. It was very productive, and they had a well-developed box industry to buy the pine. This was started around 1908-1910, and at that time they didn't recognize--nobody did--that the pure stands of white pine that they were dealing with were an artifact that appeared on

abandoned agricultural land. It was like boll weevil pine of the South of the later time. At the Harvard Forest they started where the production had been the best, on the best sites. What they found, to their sorrow, that the best site was where the hardwood competition was the greatest. They found that they could not, with the small amounts of money that economic doctrine would permit them to spend, regenerate white pine. So they switched over to encouraging to the hardwoods. It was sort of a case of making a virtue of necessity.

Their attitudes became very naturalistic, and that meant in their time, following the natural succession. While at the same time, coincidentally, we had this operation going on very close by at the Yale Forest in southern New Hampshire. There was a site difference. Although Harvard Forest does have some dry sites, it so happened that the land we had in southwestern New Hampshire was almost half dry sites. In the case of the forest we had in New Hampshire, it had been acquired very parsimoniously, cutover land or young old field stands that had been purchased cheaply. Almost by accident, the cutover land that we had had been cut so young that there wasn't much advance growth under them. There was not a lot of late successional hardwood coming up, there was only the pioneer birches, particularly gray birch, that was close to a city.

Even though gray birch is one of the poorest forms of fuel known to man, it was very useful for fuel in the summer. You could put the wood in the old iron stove and get just enough heat to fry some eggs and percolate the coffee and the fire would go out and not overheat the kitchen. It was close to this community and a lot of the gray birch got sold off for firewood and it released the understory white pine sitting around underneath it. So what they were doing was speeding up the succession. The Harvard Forest people were hitting natural succession from the other end, trying to slow it down, and it wasn't working very well. Then there was this psychological difference between whether you followed nature or you fought on a mind-over-matter basis. In fact, later at the forest in New Hampshire, when quite a few white pine stands blew down in 1938 we went from speeding up the succession by eliminating what counted as hardwood, to reversing it. Continued it without necessarily paying a tremendous amount of attention to the change in what we were doing, until perhaps the 1960s. In a lot of that locality as far as the market was concerned, if it wasn't white pine nobody wanted to play. It was a rather extreme difference between an exceedingly naturalistic approach and a somewhat artificial one, except not much planting was involved.

STEEN: I don't know anything about Harvard Forest other than Ernie Gould and he was an economist.

SMITH: Ernie Gould was not simply an economist. Ernie was an all-around forester with a very good knowledge of ecology. He did heavily emphasize the influence of social and economic doctrines, particularly those of land use. He used to heap some scorn on the idea of spending money to grow white pine, but that I think was mostly a case of failing to appreciate the point that with that particular species, the wood quality varied from stupendous to utterly worthless and ridiculous. The quality and price difference in eastern white pine is so great, that I used to say to some people, you grow it well or not at all.

Now what happened at the Harvard Forest was the people there abandoned the naturalistic approach. There were two things that influenced what they did: Earl Stephens did some ecological research into the history of stand development. (Chad Oliver helped get a lot of it published long after it was done.) Their ecological research revealed the powerful effect that severe but very infrequent windstorms had on stand development. At the same time that they were working there on that, Hugh Raup, the director, who was very much interested in forest ecology in places like the Yukon, became tremendously impressed with the role that fire played up there. In fact to them and many of the ecologists of the time, it suddenly registered that the idea of climax vegetation depended on freedom from severe disturbance. They went madly, in the case of the people at the Harvard Forest, they went madly to the other extreme. They said the disturbances are so frequent that climax vegetation was kind of a theoretical mirage which can never exist. It was an almost 180 degree change in their thinking. I remember Hugh Raup told me once, you can do anything you want to without violating some ecological principle.

STEEN: You've talked about this in certain ways, but you suggested that we discuss silviculture in degraded forest land versus that starting in virgin forests in western U.S.A.

SMITH: I did go into that. It's mostly the idea about the problem where the first entry usually involved high grading. My chief point is that most silviculture that's practiced in this world really doesn't start until the

forests are in very poor condition. Often it's where everything's been cut very hard, where you've got the high-graded remnants of decrepit vegetation or, even more extreme, the forest has been cleared for cultivation agriculture or grazing. This, unfortunately, is usually where things have started. It's sort of like not calling in a doctor until you're sick. What we see in the West, where there's been a lot of virgin forests and public ownership, there's a fighting chance to start intelligent long-term management, almost the beginning of any use. That's the unusual thing, not the usual.

One of the biggest differences between the West and the East is that an awful lot of land in the West isn't suitable, on the present economic basis, for commercial timber production, too steep, too dry, or too difficult of access. There are also differences in topography, some of it in climate. In the East, conditions are much more uniform horizontally. In fact, the phenomenon we have in the eastern United States is this huge forest area with reasonably favorable rainfall conditions that is very different from the rest of the world. The similar climatic zone represented by China is mostly devastated by overuse for centuries.

Water

STEEN: Fire is a big topic and it goes in all kinds of directions. So does the role of ideas about watershed management. The Wagon Wheel Gap study is an example.

SMITH: There was a very interesting study done perhaps thirty years ago by a political scientists named Schiff.

STEEN: Ashley Schiff.

SMITH: Ashley Schiff, a book *Fire and Water*. He came by here not merely to look at Chapman's papers but to talk to Chapman, it was when Chapman was still extant. It certainly is a fascinating book on the effect of action agencies doing research.

STEEN: Yes.

SMITH: Schiff told me that he was getting trained up to take on the old Atomic Energy Commission. Unfortunately he died not long after *Fire and Water* was written, and he never got around to dealing with AEC, but that epitomized the phenomenon he'd happened on to. Well the Forest Service has corrected part of the problem by their research entity being more and more divorced from National Forest Administration. On one hand, National Forest Administration complains about it, but it does get them out of the phenomenon where there are ideas that you don't espouse because they contradict the action of the . . .

STEEN: There's some confusing vocabulary. There's fire prevention and controlled burning, early practices in the Sierra versus prescribed burning for silvicultural purposes in the South. Silvicultural site preparation as opposed to eliminating fuel.

SMITH: Yes, certainly if you look at prescribed burning it's necessary to break it down as to what are you doing it for. There can be all kinds of different purposes. It used to strike me as very ironic that the Forest Service was against prescribed burning in the South but it was holy writ for slash disposal in the West.

STEEN: According to Schiff the fire control people didn't want to confuse the public by admitting that any fire was good.

SMITH: You can understand this attitude, "let's keep it simple and not confuse the public." In fact, the whole water business is an even more extreme phenomenon.

STEEN: Let's talk about water.

SMITH: I can enlarge upon it a little bit. If you look in Geiger's *Climate Near the Ground*, there's something that was actually mistranslated when it was put into English. At the beginning of one of the chapters where it

first starts talking about forest meteorology he said that in the 19th century forest meteorology was a phenomenon of politics but now in the 20th century it is a phenomenon of natural science. What he was referring to was all this business about how, if you cut the forest, it stops raining or if you leave the forest alone it rains more. The Wagon Wheel Gap was the experiment set up to prove something, namely that clearcutting caused floods at one time of the year and drought at another time. That didn't happen, and so they put the results back in the drawer.

There's even some stuff about thinning research where people experimenting with thinning were trying to show that this would increase the total production of timber. They kept finding it didn't, in fact what they kept finding was if you wanted to count every sliver it quite clearly reduced the production. So they quietly slide around that. That's when Steve Spurr wrote his forest inventory book, one of the things he was working on, he had Herb Winer help him, was to examine a lot of this thinning research. It showed quite clearly that it would reduce the total production, but its purpose really was to increase the utilizable yield, and the two aren't the same thing.

With the water business there, and it still goes on now, people claiming that heavy cutting in the Amazon basin will reduce the rainfall there. What I think I know as a retired meteorologist is that this just isn't so. They're mixed up as to what the precipitation sources are. It's hard to get people to understand that the rainfall in the eastern United States depends almost exclusively on water that was evaporated from the Caribbean and areas to the east of it. There's one interesting exception that's going on this time of the year, via the Great Lakes. When they aren't frozen and cold air comes across and picks up water and dumps it mostly as snow within twenty-five miles of the lake shore. The cold air goes across Lake Erie and dumps forty inches of snow on Buffalo, then the same air comes here and three snowflakes fall out of it. But that's to my knowledge the only precipitation source in eastern North America . . .

STEEN: The Caribbean.

SMITH: The Gulf of Mexico, the Caribbean and the Atlantic to the east of it on the south side of the big Azores-Bermuda anticyclonic system. In fact you can trace the edge of the forest by the boundary of the rain-bearing winds that come up from the western edge of the Gulf of Mexico. It goes to the northeastward across Texas to Illinois and then it intersects where the effect of lower evapo-transpiration fixes it so forests will grow in Minnesota. The forest boundary's shaped like this, the point is in Illinois and it's north of there that lower evapo-transpiration makes a little rainfall go a little further and will be nourishing enough for trees to grow. Even today there all these unresolved doubts over the effect of carbon dioxide, climatic change, and so on which are tied in with the forest.

STEEN: Carried to the extreme, if you removed a forest and didn't let anything come back--it's turned into a plowed field as we've done in the Midwest--and change the albedo, couldn't there be some significant changes? Or are the forces of atmosphere so great . . .

SMITH: One slight change you might get would be some increase in convective activity. In fact, it has been shown that where there's a lot of heat introduced by places like Chicago and Gary, Indiana, that there are more thunderstorms there. But that's just sort of a localized precipitation of moist air.

The nature of it is this, Pete, you don't get precipitation unless a layer of air approximately a mile thick has been brought up to close to 100 percent relative humidity, and it is then lifted. In general the only place this can occur is where cool or cold air flows over a warm water surface.

In general there isn't enough water produced by transpiration to moisten a stratum of the air that way. If you were to fly over the Caribbean or the waters to the east of it you'll find it's almost continuously covered with little puffy cumulus clouds. They're associated with this moistening of cool air that's come all around the oceanic anticyclone west of Europe. Some of the European precipitation comes from cold air from Greenland going over the warmer waters of the Gulf Stream.

STEEN: Some of my confusion stems from early observations of farmers on the east slope of the Rockies. Deforestation sped up the snow melt, so they ran out of water coming down the streams by August, where

they used to have water in August. So there was a drought caused by deforestation, but drought related to snow melt.

SMITH: There are research efforts on snow pack manipulation, various cutting schemes like the ones they've experimented with at Fraser, Colorado, or even L-shaped, clearcut strips. I once had an interesting discussion with Harold Wilm who did a lot of that research about whether we could do similar things to step up water yield in the East. He told me he didn't think so because he didn't have any snow pack to manipulate. He said the problem we've got in the East is snow isn't melted by the sun as much as it's melted by warm rain. So shading by forest cover is not significant.

STEEN: Sure.

SMITH: The effects of cutting on climate at the microclimatic level can be very great.

STEEN: I understand that.

SMITH: With the macroclimate, I'd be more likely to figure that reducing the amount of sequestered carbon by reducing forests of any kind, including the tropical one, may have more effect than cutting does on precipitation. There used to be thought that increases in carbon dioxide would all get sopped up by the ocean, but, it doesn't appear they do.

STEEN: Didn't Wilm once speculate that if you want to increase water supply you should cut the trees, because you lose so much in transpiration. The trees actually waste a lot of the water.

SMITH: Yes. That's what you do with the water after it falls on the ground. I'm not sure where it started, but that idea even got pursued in some of these experiments where the Forest Service tried to determine how to squeeze as much water as they could off the land. Usually what they found is that if you go this far you begin to overtax the system. If you keep killing the vegetation annually then you start the kind of nutrient leakage that was observed at Hubbard Brook by Herb Bormann. I've seen the Beaver Creek watershed in northern Arizona where they kind of bulldozed it off and increased water yield, and also increased the sediment yield. But it's been very difficult to maximize water production to the limit in cutting down transpiration without causing some sort of overtaxing of the site.

STEEN: I saw the California Department of Forestry burning brush along the California coast. The day after the fire went through there was water running down the dry streams, so much had been lost to transpiration. It was a very dramatic thing.

SMITH: It certainly must have been!

STEEN: Hubbard Brook. I don't know anything about that. Is that something we should document?

SMITH: That's well documented. One of the members of the faculty, Herbert Bormann, has spent his whole career practically on a study there trying to measure every one of the variables in the whole system. It was expedient to superimpose it on U.S. Forest Service watershed management research. It's the Hubbard Brook Experimental Forest which is almost exclusively watershed management.

I think the watershed management research of the last few decades has sorted a lot of things out. Maybe people still imagine some of the things they always did. The forestry interests have tended to use the various threats of disaster to advance their purposes. Oh, I'm like everybody else, if the world comes to me with a problem, there's some way I can solve it by growing some more trees.

STEEN: I have this theory that most of us don't learn much after we get out of high school, with the exception of whatever our specialty is--forestry or whatever. Carl Hayden was probably educated in an 1890s high school, and was the first senator from Arizona. He was still running around in the 1960s, and he wrote to the Forest Service wanting more trees planted in Arizona to increase the rainfall.

SMITH: Yes. There was evidence of this, because people had done experiments where they set up rain gauges. They'd set up rain gauges out in the open country and in little openings in the forest nearby. The reduction of wind in the forest opening fixed it so that the rain gauges were more efficient in catching the rain that actually fell, whereas out in the open there was enough wind that a raindrop wouldn't come straight down. It wasn't until they put in the shielded rain gauges that were so ably developed at San Dimas that they began to get a handle on this.

STEEN: Sort of like Chicago's the Windy City because the anemometer was on top of a building.

SMITH: Yes. Or the phenomenon where temperature is a function of where you measure it.

There's one thing about the history of silviculture which occurred to me that might be well to cover.

STEEN: Okay.

Regeneration and Sustained Yield

SMITH: It has to do with things that are affected by the willingness of land owners to spend money on regeneration. Many of the things that were going on in the early days had to do with the fact that people would accept the idea that yes, the forest had to be regenerated, but let's not spend any money on it. Transitions to investing in regeneration come at different times and in different places. It's probably never going to come everywhere. Now there are cases where it's simply unnecessary, that's different. The selective logging business was often a way of temporizing, particularly in situations where regeneration might really be impossible. Generally it was sort of a holding action until people were ready to spend money and until we figured out how to do it.

Perhaps what one can see in industrial forestry in the South provides a good example of the various steps in this. In the 1930s and 1940s in general, or in one way or another, the selective timber management approach was looked upon as the way to do it. One could certainly look back on that and see that it was a holding action. If it is not possible to get regeneration it becomes desirable to stretch out the harvest of existing trees and try to bring every pine to maturity.

The selective cutting of pine in the South was also complicated by the controversy over prescribed burning. In those times, burning was the only promising way to reduce hardwood competition. However, if one was seeking to bring along what little pine regeneration was coming in sporadically with light selective cutting, it didn't seem rational to kill it with prescribed burning. However, to many it seemed that you could not get pine regeneration without controlling the hardwoods and you couldn't do that without burning. Therefore, those who advocated prescribed burning found that this generally led them to oppose the selective cutting procedures.

Perhaps the biggest bone of contention was the claim by selective-logging advocates that their method was automatically making each stand into a self-contained sustained-yield unit. Sustained yield without regeneration is to pine silviculture as perpetual motion is to physics. The advocates of uneven-aged management could make a far better case for the approach if they simply dropped their doctrinaire insistence that each stand become a sustained-yield unit. I might also digress to point out that if there is no attempt to make stands into sustained-yield units there is no purpose in complicating their partial cutting by playing numbers games with q-values and reverse-J-shaped diameter distributions. That kind of mathematical analysis and manipulation goes with large forest areas but is almost impossible to apply to small stands, except very crudely.

The selective logging fad of the period 1930-1950 also paid much attention to the idea that this was also a movement that was sweeping European forestry. That wasn't true although there certainly was (and is) much attention to the idea in European silvicultural literature. Perhaps I have told you that Ralph Hawley once observed that the German reading competence of many U.S. imitators of this idea was limited to comprehension of *Guten Abend*. One of the famous selection forests of Germany was at Barenthoren in

East Prussia (now part of Poland or the USSR). A forester named von Kalitsch conducted what was called the Dauerwald (literally "continuous forest") kind of silviculture there. It has since registered on me that this was a forest with sandy soil and good rainfall on which any vacancy fills with pine seedlings but is not hospitable to hardwood competition. Every cutting is sure to bring in pine seedlings almost automatically no matter what the cutting pattern is. There is a white pine area like that on a deep sandy outwash plain at the Yale-Toumey Forest in New Hampshire. We have a continuous, uneven-aged pine forest there too. Once they get their roots down the pines grow well but the hardwoods stay very feeble.

Anyhow, the idea that selective logging was "naturalistic" was decidedly conditional. In many cases it was simply high-grading done under circumstances in which there wasn't much alternative. There are plenty of places in the world in which this still is the case. The important thing is that foresters should not deceive themselves about what they are doing under any circumstances. With southern pines you could even find that there were efforts to wish away the hardwood competition problem. However, if you want to grow loblolly pine, you can do it any way you want provided that you control the hardwood competition. Well, as the industrial forestry approach began to take more and more of a foothold, probably the first step was that when they were ready to embrace various measures of hardwood control, they went over to using the seed tree method of cutting as a way of doing it. This was a very common approach in the 1950s.

The transition from that to other things was quite swift. There were all sorts of different patterns of leaving the seed source. In some places it would take the form of shelterwood cutting. Partly that was often in response to the idea that when they started leaving a few scattered seed trees as regeneration sources, they found that there were so few trees to come back to that often it didn't seem worth it. So part of the reaction was let's leave some more so they'll continue to grow and we will come back and get them after they've served their purpose. It was found in connection with these things that the source of seed wasn't really as much of a problem as hardwood control. If they controlled the hardwoods, they also did the almost inevitable site preparation that went along with it. Hardwood control was often done by burning with or without the use of herbicides. There was also beginning to be more and more mechanical site preparation. In fact for all sorts of reasons, the increase in mechanization was having its effect.

It's interesting to note that in much of the East it wasn't until 1950 that mechanization meant anything other than log transportation and trucks. Everything else was muscle powered, either human or animal muscles. The invention of the power saw in the late 1940s certainly had lots of effects. These began to feed over into things like mechanical site preparation.

In the South there was a quick transition for a rather brief period, which also went on to some extent in the Northwest, where direct seeding was used. If you were going to sprinkle the seeds on from an aircraft, there was no point in leaving a natural seed source. Direct seeding took large quantities of seeds, and there were chronic problems of regulating density. In many cases they found that the site preparation (which is chiefly controlling competing vegetation) that was necessary to make it work was about the same as would be required for site preparation for planting. You could find situations in which the direct seeding phase, which was in the 1960s, lasted until the genetically improved seed orchards came into sufficient production to provide enough planting stock. There was certainly a reluctance to sprinkle that expensive seed-orchard seed out of aircraft. And so there was this transition from the partial cuttings of the '30s and '40s to the seed-tree approaches of the '50s, the direct seeding of the '60s, and then into the planting routine, which was heavily influenced by genetic improvements. Now one thing which is very significant about this is that the willingness and capacity of the industrial outfits to make long-term investments, which is not uniform within them, has not been applied anywhere near as much in the small landowner sector. There you'll find that mainly because of unwillingness to make these heavy front-end investments in planting that there's still a lot of attention given to these older approaches, which from an industrial forestry standpoint are over.

For example, there was a revival of interest in uneven-age management. The work which the Forest Service had started with Russ Reynolds at Crossett, which they abandoned for a while, was reinstated about ten years ago, mainly because of seeing that it had a role in the small ownership forestry, and in the continuing interest in hardwood control by prescribed burning. The things that I have described often tended to have their counterparts in what was happening in the Pacific Northwest. The chief difference was that when selective logging was abandoned, in that case they went over to natural regeneration of staggered

settings and tried to cut down the size of clearcuts. There was even some seed tree cutting, which was the result of an Oregon law that required that you either plant or leave seed trees.

STEEN: There was another wrinkle, too. Along the same time, the state forest practice acts were tightened up. You only had to provide for reforestation under the original forest practice acts, in more recent times whatever you do has to work.

SMITH: Yes.

STEEN: I suppose that was an impulse for improving nursery stock and all sorts of things.

SMITH: It's hard to know whether it's the hen or the egg. The willingness to spend is often the desire for certainty of regeneration. One of the problems is that if one analyzes these things financially it's a little hard to tell whether it's going to pay out, especially with these draconian interest rate calculations.

STEEN: I don't know how typical my experience was, but we had what we called KV studies, after the Knutson-Vandenberg Act. We had to go back two years and seven years after planting to measure the success rate. Every place I looked was so much natural reproduction of hemlock and true fir you could never find the Doug-fir seedlings we had put in. Yet we still poked the Douglas-fir seedlings in the ground following logging.

SMITH: Where was this?

STEEN: It was on the Snoqualmie National Forest, westside Douglas-fir. The natural reprod was just overwhelming. Everything had trees on it, there wasn't any barren land. Did we have the right species, I guess, is the question.

SMITH: That reminds me of something else not necessarily connected with that but with things in general. The versatility of the utilization of species has increased considerably such that it's been less and less necessary (whether it's recognized as novel or not) to focus on one species. There are still plenty of places where this is almost regarded as inviolate policy, but one could cite plenty of others where the utilization infrastructure's been able to absorb it.

For example, the timber sales we run at the Yale Forest are like many others in this locality. There may be ten species that are being put on market, and between the loggers and the manufacturing complex, they find ways of utilizing it. The extreme I've seen in these parts is up near where Quebec, Maine, and New Hampshire come together. For years there've been places where you go out in the log landings and they'll be making fifteen-way sorts of products ranging from exceedingly valuable veneer logs to very poor hardwood pulp logs, and a tremendous price differential driving it.

The willingness to invest in regeneration has affected the kinds of silvicultural systems that people devise and propose, and it isn't something which is going on in the same way simultaneously everywhere. In much of this corner of the country, it's still heavily oriented to natural regeneration. It's generally accepted we have too many trees anyway. We have to avoid standard solutions or figuring that every owner in a given locality is going to do things the same way.

STEEN: When I took silviculture, I had never really seen hardwood except in the arboretum at the university, and I still don't know much about hardwoods. But my understanding was that it was a very sophisticated decision the forester made to make sure the right species of hardwood was regenerated following logging. The way you marked it had a lot to do where the next stand was. For example, the acorn was big and could only drop straight down, some hardwood seeds would blow a distance, and you were supposed to know all these things when you're selecting your silvicultural system. I remember writing exam essays where we pretended to understand this because we'd read about it, even though we had never experienced it. How cagey are foresters in getting natural regeneration of the right species? Pretty much stuck with what's there aren't you?

SMITH: In hardwood silviculture there is a general tendency in the U.S. to seek mixtures of species with natural regeneration. Otherwise it's not completely different from regeneration by planting. If you want to control the species you've got, whether it's by natural means or whether it's by natural regeneration of planting, you've got to be ready to spend money to do what's necessary to control the undesirable ones. Theoretically, and to some degree in practice, you can do things that will ward off the undesirable ones and some people are better about doing it than others. There's a forester who I visit every year who works for Georgia Pacific in North Carolina. He recognizes that his company isn't ready to spend a tremendous amount of money, and dollar for dollar he gets very good results, but some of his approaches are regarded as bewilderingly unconventional by everyone else around there. In terms of the amount of effort invested, I'd say the return is very much better than the ones that spend a lot of money, that's why I take the students to see the person every year.

STEEN: That's certainly a legitimate approach in terms of land management.

SMITH: Oh sure.

STEEN: There's no such thing as "good silviculture" and "bad silviculture" per se. Well, there's sloppy silviculture, but you make a decision on land management within the law and all the rest of it.

SMITH: There are plenty of ideas that silviculture is sort of a moralistic kind of thing. I can remember this very well and it still prevails to some extent, that the moralistic part of forestry is silviculture. Then the economics people will sneer at this, and imply it's just sort of up in the clouds business. That attitude is part of the reason why I've insisted that you can't divorce silviculture in these various social considerations, that it isn't just applying natural science knowledge and it isn't the sole repository of professional ethics. I suppose that pushing an attitude like this can be interpreted as making a kind of a moral position, but in this particular case it's concern for the long term productivity of ecosystems, including the productivity of things like endangered species and recreational benefits. The ethical or moral burden is on the landowners, and the foresters who carry out the work. It isn't something you can seal off in a little side pocket and say that's only silviculture so we can just forget about it and go on our way.

STEEN: What concept is sustained yield? Sustained yield of pulpwood versus the sustained yield of saw logs, it's much different silviculture. Yet we claim we have a sustained yield goal in this country.

SMITH: Sometimes it isn't important to reach them.

STEEN: Some economists I know spoof that as being a biological concept. You're growing trees as though that's what's important. They say that's not what's important, you grow trees for a purpose, and the market determines the value of what you've got.

SMITH: This I claim is the failing of the economics profession, not just that of the forest economics. What, in effect, economists do is observe that people are short-sighted, and this observation then becomes a law of economics. The next thing you'll find is that they are setting up mathematical models of the economy which say, in effect, since people *are* short-sighted, therefore they *should* be shortsighted and your behavior should be on a basis of shortsightedness. It becomes a circular line of logic. It proceeds from the assumption that long-term considerations are unreal, so the whole system need not be sustainable. In fact, there is the view that the resource is there and you should use it up as fast as possible.

STEEN: Use the capital to invest in IBM stock and make some real money or something. I remember my econ prof saying that irrational people were the ones that didn't fit the model. The model didn't work unless everyone was, quote, rational. But you say short-sighted.

SMITH: Yes, and short sightedness is interpreted as rationality.

STEEN: Sure.

SMITH: Blow it in now and let posterity fend for itself. In things like the management of the forest growing stock, we say we're not going to do anything for posterity except to the extent that posterity will pay us 6, 10, or 15 percent compound interest. In these matters involving silvicultural practices, that collision has been very apparent in what's been done.

Dealing with these mind-boggling time spans is certainly a very difficult problem. Part of the reason it gets so much associated with silviculture is that the silvicultural plans that we concoct and execute are ones where one is looking in very concrete fashion what is going to happen in the year 2045, which is fifty-five years from now. For many of our forests, that's a short rotation. We're doing things which commit us to various actions in the future and are looking at distant returns in an environment in which the rest of the world says, gee, that's like chasing a mirage. In forestry, people imply that if we didn't have all these silviculturists around to remind us of these things, the problem wouldn't exist.

STEEN: Let's continue on that same theme--a legalized morality. Let's talk about federal efforts at regulation and the rise of state forest practice acts. It seems to me that efforts at regulation really are efforts to impose silviculture on the forests.

SMITH: Yes, and there certainly are cases where this long-term view has been accepted and imposed on society. For example, in Europe the law requires one to practice some long-term forest management. There's no question but what the advocates of regulation were trying to secure this by their efforts at federal regulation, and given the U.S. legal system of the 1930s and 1940s, they figured that was their best handhold. They certainly recognized that constitutional requirements fixed it so it would have to be a case where the federal government merely required the states to have regulations.

There were other schools of thought that argued that making long-term silviculture economically attractive would produce the result automatically. It was also partly a kind of ideological collision. It's interesting that when Gifford Pinchot and people of his time initially started pushing the idea of forestry in the 1890s their idea was that private land owners would take this up. For example they put a lot of hope in people such as the wealthy owners of large tracts in the Adirondacks in New York. Pinchot, Graves, and the federal Bureau of Forestry spent a lot of time working with those people. The Biltmore Estate in the Carolinas was an example of the same thing, and there were some of the same kind of people in the Adirondacks.

What they were arguing was that timber will become scarce and prices will go up, so this is a good investment. What happened was there was a financial recession in 1893 and as a consequence of that a lot of these people lost interest. People such as Gifford Pinchot were in a hurry and concluded that these wealthy people aren't going to do anything, so let's give up on them. They weren't forest industry, they were big non-industrial private ownerships of a kind which we still have with us. That was when the Pinchots transferred their attention to the public sector and what became the U.S. Forest Service. Their next approach was trying to regulate the forest industry. Then there came a dichotomy within forestry in which some people, particularly in the Forest Service as a matter of institutional policy, favored regulation and other foresters didn't.

I don't know whether William Greeley quitting as chief of the Forest Service to go to work with the private industrial forestry organization in the Northwest was a symptom or a cause. Or whether any ideological problem was involved in his resignation. But I'd certainly say it was a symptom of what was going on. Here at the school there were people like Herman Chapman and Ralph Hawley, in fact most of the faculty, were ardent opponents of federal regulation. Herman Chapman used to claim that the advocates of federal regulation also wanted to impose this selective cutting business on landowners. You can find an article in the *Journal of Forestry* called, "Is Selective Logging a Panacea for Federal Regulation?" He figured this was a cute way of requiring landowners to keep merchantable growing stock out on the land without having it obviously be a kind of taking without just compensation. This was a fairly sophisticated idea, and I'm not sure that it had actually occurred to any of its advocates. What finally happened was that they compromised, that the big industries in effect said "get off our backs and we'll regenerate our land."

Weyerhaeuser started its planting program in the 1940s and invented the tree farm business with its Clemons Tree Farm, which was the tangible advertised indication of their willingness to start doing these kinds of things. By common consent the business of federal regulation of industrial forestry practice was quietly dropped in the 1950s. Since then there's been sort of an agreement in forestry circles not to bring federal regulation up again or to continue the argument. One of the things which was sometimes pointed out was that there would be public regulation sometime, probably when the big companies wanted to be sure that they've got their timber supply. It would be argued that the forest practice laws on the West Coast have some earmarks of this, certainly in Washington and Oregon.

Speaking of the financial aspect of this, Pete, there's something else which is very interesting. Part of the gradual willingness to accept the requirement that lands be regenerated shows up in the way the costs are accounted for. I used to be puzzled around the 1940s, 1950s, that in the West, the costs of slash disposal were not figured in as charges against the next crop. They were charges against the timber being harvested.

STEEN: That's the way the money's allocated, in the federal budget anyway.

SMITH: Landowners looked upon it the same way. The reason was it was required by law, it was not an option. Now that we've gotten more and more into a situation in which regeneration is either required by law or becomes fixed landowner policy, we find that it is charged against the crop that's harvested. All this hassle about below-cost timber sales on the national forests is partly the result of that, part of the cost is in regenerating, and it's not being looked upon as a charge against the future crop.

There are a number of things that go with this. I think sometimes that this attitude is a mark of the fact that all these compound interest calculations were invented as an analytical device; they don't show up in the accounting practices of anybody. If you started introducing discounted future returns on the balance sheet, the accountants would act as though that's only slightly more respectable than embezzlement. How can you count unrealized income? What the analytical devices really are, often, what they were invented for in the first place with respect to these problems, is that after you have decided that you are in this long-term forestry business, you need some analytical device that would help you determine what the optimum course of action is going to be over the next 80 or 100 years. It was not testing whether you should do it or not. Having decided you're in this business on a century-long basis, how will you figure out what's the best way to go about it? I claim that confusion over that point has been the cause of lots of misunderstandings.

STEEN: I listen to people debate the impact of capital gains in forest practices. I don't know if decisions are really made on the basis of capital gains, but the passions run strong.

SMITH: Some of that is over how you handle inflation.

STEEN: Sure.

SMITH: These are the things that I thought I ought to bring in as part of the history of silviculture. Some of what I told you is what I think happened, a lot of it's mixed in with my opinions about it.

STEEN: That's what the oral history is about--your opinions and observations and recollections.

SMITH: Anything that we do should be based on an analysis of what's going on, whether it's what's going on in nature or what's going on in our socioeconomic political system.

Forestry and Grazing

STEEN: Twice you sent me some ideas about grazing and you have touched on it once or twice here, making me realize you view it much differently than I would have anticipated. Let's talk about the "ancient and continuing conflict between forestry and grazing," as you refer to it.

SMITH: There are more forests on earth that have been destroyed by the teeth of animals than have been destroyed with axes. Fire and grazing often go hand in hand. The world over, grazing people have been burning the vegetation to make the grass green up earlier at the end of the dormant season. Some of this was also to get rid of the trees so there'd be more grass.

STEEN: Is there an intellectual relationship between prescribed burning, in terms of what I would think of as conventional forest practices, and swidden agriculture? To use fire to manipulate the site for human advantage. Are these two different topics?

SMITH: It is and it isn't. People have a variety of attitudes about forests. If you look at it over the sweep of history, people have figured that there are two important alternatives you have with the forests, both of which start with cutting them down or utilizing as much as you can. One of them is to convert them into grazing land, the other is to convert them into cultivation agriculture. Of course you can find places where it was some of both at the same time. Then there has always been the war between the farmer and the pastoral people, "don't fence me in." Often the forest is caught in the middle and is destroyed by both of them. There's certainly been this agricultural alternative. But as far as the grazing business is concerned, I think that's affected more land on a world-wide basis than agricultural use, some of which is shifting cultivation. Let's talk about the grazing part first.

Some of the very earliest interests in conservation in this country came from the writings of George Perkins Marsh, who observed what had happened in the Mediterranean countries as a result of the sequence of cutting, burning, and grazing. I'm not sure that he perceived what the sequence was, but it's a phenomenon that is very common. One of the ways traditionally in which people emerged from the hunter-gatherer stage was by depending on patient animals to go out and eat the plant production. In varying degrees there've been ways of encouraging this artificially.

Another exceedingly important historical phenomenon in Western Europe is epitomized by what went on in the British Isles in the various enclosure acts, where there had been subsistence agriculture. People managed to get control of the land, managed to chase the people off to enclose the areas for massive sheep pastures. This came about when landowners became concerned about a money economy and saw that there was more money in wool and mutton than there was in the meager rents they could get from subsistence farmers. Scotch and Irish people were pushed out and many people from England also were pushed out to populate many parts of the world. In that case the forests had long since been destroyed. A lot of it still is; the soil is damaged to the point where it's very difficult to get them reestablished and there's even opposition to reforestation because you're changing the landscape. Look at the whole culture, the Mediterranean culture, that came into Hispanic America, also Brazil from Portugal. This was partly a way of life which started in the dry Mediterranean country. There are plenty of places, particularly dry savanna regions or desert edges, where about the only way that people have of using a plant production is to send these patient animals out to harvest it one bite at a time.

STEEN: Patient animals, that's a new term to me, is that a standard term?

SMITH: No, it's not.

STEEN: But, it really describes . . .

SMITH: They've got a lot of time on their hands. There are plenty of places where there's a bunch of grass here and another one six feet away, and they can walk from one to the other. I tell you one when this came home to me. Back in 1946, I was in the redwood region in northern California just roaming around. I remember I stopped somewhere in a diner to eat and I talked to somebody at the diner, a local person. I asked him what he thought about the forests. He didn't know I was a forester, and he said, "It'd be great for this country if we get all these trees cut down and turn it to real good grazing land. That's what this locality needs to really become a decent place to live; that's what it's all about."

I didn't get back to the same locality until twenty years later and I conducted the same sort of survey. It wasn't a big sample. Some guy who was pumping gas told me "things are pretty bad around here, timber is

down and there isn't anything going on here but timber." I wouldn't say that what I sampled was the attitude of the people, but I was struck particularly by the first person. In fact there's something else along that line which I found very interesting, I don't know if I mentioned before, it's what Gordon Marckworth told me.

STEEN: You said be sure to remind you about Gordon Marckworth.

SMITH: He had been head of the forestry school at Louisiana State, which he had organized. He said that he had been exasperated in the 1930s at the attitude of the lumber companies that were still cutting through virgin timber. He said they wouldn't hire foresters, but they hired animal husbandry people to try to develop the use of the cutover land for grazing.

STEEN: Development of cutover lands was the major interest in the early part of the 20th century. There's even a journal called the *Little Logged Off Lands Magazine*. What to do with all this stumpland? The State of Washington developed powder factories in order to get enough blasting powder so people could get these stumps out of the way, so the land could be farmed. There was no notion it was ever going to go back into forest land.

SMITH: Now probably with these people in the South that Gordon Marckworth was commenting on, they'd given up the idea that the land involved was good enough to grow cotton or corn, so grazing was what was going to rescue their investment in the land. In those times, except for a few places like the Urania Lumber Company in Crossett, they couldn't wait to clearcut and get out and go to the Northwest. Now of course the conflict with grazing in the western national forests has gone on since the beginning, because when the national forests were set up, the grazers were already there.

STEEN: That's right.

SMITH: I guess the peak of overgrazing in the interior West was around the 1880s, and the forestry profession had to literally organize the range management profession to deal with it.

STEEN: Read *Breaking New Ground*. One of the biggest things Pinchot had to deal with right up front was getting Potter to come in and deal with the range situation, not the timber situation. The early years of Pinchot's administration were really range oriented.

SMITH: We think of logging and the national forests so much, but I think it's of some significance that a forester named Aldo Leopold had as much to do as anybody in making wildlife management scientific. People think mostly of his contribution to the wilderness business. Incidentally, he was a student in this building.

STEEN: I saw his picture down in Sage Hall. He's been resurrected in recent years.

SMITH: There's also been all the problems connected with shifting land to agricultural use. Shifting cultivation has various time dimensions or rotations.

STEEN: Somehow, old field silviculture doesn't fit into my idea of shifting cultivation, but it is.

SMITH: It is. Some of it has tended to go on in the South, in the Appalachians. I'm not sure but you might find that lands sort of went in and out of agriculture. In this region Harvard Forest provides an interesting historical example.

STEEN: Sure.

SMITH: In typical magnificence of hindsight, if in the settlement of these New England towns, the town had kept title to the land and leased it out for 99 years for agricultural use, they would have just about hit exactly the time during which agriculture was economically viable and useful. Then you could have leased it for another 20 years for sheep grazing. Then the public would still own the land as it went back to forests. A lot

of the farms are 40 to 70 acres, and we have ownerships that are left over from that pattern which no longer fit the size of the forest areas that may be hundreds or thousands of acres.

STEEN: It's been thirty years since I read Hawley and Smith, the sixth edition, with any rigor, so maybe I've forgotten a few things. But what I recall about grazing is that cattle eat seedlings and trample them, and so forth. While you were talking I was remembering that over half of the national forest system is officially rangeland. Over 100 million acres of Forest Service land is available for grazing, so it's a major silvicultural consideration.

SMITH: A lot of it got blanketed in because of the way they were set aside. A lot of it was up above timber line or included dry areas and so on. I think that the forestry profession always recognized this. What's in that earlier edition of the textbook has to do with the fact that woodland grazing, where you've got a situation where closed forests were developed, woodland grazing often is not very good land management.

It's of some significance that in the early studies of watershed management and different land uses that were done in Coweeta in western North Carolina, they found that absolutely the worst damage was not associated with clean cultivation agriculture, it was associated with woodland grazing. I remember that when I saw the experiments, I was really quite surprised. Of course one problem is the animals tend to eat up the regeneration, but the main problem was compaction from their feet. If the cattle density is low, you don't have so much compaction, but where there's a lot of vegetation produced then that situation can get worse. The places where trees and grass mix the best are in dry climates where this is a natural phenomenon. What we call prairies in this country, botanists refer to as savanna formations which are dry areas where there are few scattered trees and much grass. These tend to be fire-ruled. Those are the places where these two uses go hand and hand. If you examine it in a physiological sense, you usually find that the trees are living on a sort of dependable long-term moisture supply, and the grasses come and go on temporarily available water from seasonal rains. All the burning for grazing is tied in with this phenomenon.

STEEN: It might be too ambitious for a single question, but the relationship of silviculture to forestry and grazing to forestry is significant. During the '40s the SAF was systematically running everyone out of the organization who wasn't a pure forester. They ran out the range managers, the wildlife people, all the people they'd love to have back in their ranks now. Silviculture's in there somewhere, I'm not quite sure where, but wherever forestry is.

SMITH: That act was because of the heavy timber emphasis, and certainly it showed up in silviculture. One of our graduates was almost chased out of SAF, Herman Chapman told him he wasn't eligible because what he was doing was managing the vegetation on the banks of the Connecticut State highways. It was a magnificent job of applied ecology. The foresters at the time were so intent on timber for some reasons, good or bad, mostly coming down to this single-minded effort to get the timber industry to get on a sustainable basis. It colored everything, even to the point where it would be regarded as indecent to consider the use of the forest for anything else. A part of the problem used to be that any effort to reserve old timber for museum pieces was frowned on because it violated principles of financial maturity analysis.

STEEN: Did the *Journal of Forestry* editors ask for articles that reflected a certain emphasis on timber; did silviculture stay pretty much on its own keel and survive this? Is survive the right verb? It's sort of extreme.

SMITH: There've always been different opinions, it's now there's a more diversity or acceptance of different kinds of land use than there used to be. I can remember once going to a forestry meeting where we looked at a very well managed woodlot on the outskirts of Boston, a case where the land was clearly worth a tremendous amount of money for building lots. One of the leading foresters of the locality made a rather sardonic comment quite loudly. He said this is magnificent silviculture and timber management, but it reminded him of an observation about the charge of the Light Brigade by neutral observers, "it's magnificent, but it isn't war." That certainly reflected not just the timber management bias but I guess the economic bias that it was indecent to grow trees on land unless the trees would pay for it with timber.

STEEN: I guess it's not strange but it is a little peculiar that even with the public agencies is a need to justify forest practices financially. There's so many public services the government provides that aren't marketed as

such, taxes pay for these services. Managing the public lands conceivably could be considered a public service, as opposed to a form of revenue.

SMITH: A lot of the reaction to the Forest Service in their management in the 1950s and 1960s was criticism that industrial foresters had heaped on it, claiming they were a bunch of people wasting public money on uneconomic forestry.

STEEN: I understand that.

SMITH: A lot of the reaction was to push hard to generate timber sales and low-cost operations, and I don't think there's any question but that financial criticism had a powerful influence on this. The criticism often was you've got all this money, public money, tied up in old timber that's deteriorating faster than it's growing, that you're getting a minus 5 percent return on the value of your growing stock.

STEEN: I've heard the argument.

SMITH: Much of the what the Forest Service did I think was sort of an injured response to this viewpoint, and it shows up in attitudes about silvicultural practice.

Attitudes toward Fire

STEEN: Attitudes. Here's a question on attitudes. It's pretty hard to talk about silviculture without getting into fire, but what generically would you like to say about fire, prescribed burning? You touched on this earlier, the early dominance of fire control people and objectives of the Forest Service elsewhere in the South. Is there anything more to really say about that?

SMITH: There is one difficulty in detail and that is there are many different kinds of fires, they have very different effects and it's very hard for anybody to keep them all sorted out. For example we see the controversy recently about the Yellowstone fires and statements that this wouldn't have happened if they'd allowed fires to burn in the past. Now probably that really isn't very true. Probably you could find natural precedent for the same kinds of fires, but I think they're only every three centuries. But it's a far cry from the understory burning in the longleaf pine type in the South where you could let the fuel build up for three, four, or five years and then reduce it. The problem with the kinds of forests that occur in Yellowstone Park is mostly that their lodgepole pine forests are serotinous-coned like the jack pine forests. Sure they'll regenerate naturally by fire, but it's by crown fires. It's always been very difficult for anybody to be ready to sponsor prescribed crown fires.

STEEN: I can imagine.

SMITH: There have been some efforts at that. Some was done in the honor of maintaining the nesting habitat of the Kirkland warbler in the northern part of the lower peninsula of Michigan, and it was one fire that resulted in one human fatality.

STEEN: I've never heard of a prescribed crown fire, but I've . . .

SMITH: If you want to talk about natural fires in some of these communities, that's what it is. In Tasmania was one area where they were trying to reproduce *Eucalyptus regnens*, the so-called mountain ash, the tree that grows almost as tall as coast redwood and does so faster. They had found that it wasn't just any old little disaster fire that caused the regeneration, there had to be a real tremendous amount of fuel and they were clearcutting the *Eucalyptus regnens* and deliberately felling the non-eucalyptus understory to get enough fuel. Then if you got fires hot enough that they cracked the bedrock, then the *Eucalyptus regnens* would appear. Historically the natural regeneration of that wondrous species is dependent on really terrible fire years. In southeastern Australia I think the most recent one was 1983, and there were some terrible ones in 1939 that killed a tremendous number of people and led to new age classes of this mountain ash.

There are all sorts of different fire adaptations. I mentioned the burning which encourages grass. One thing which I found to my astonishment, however, was that if you get in real desert, burning discourages grass.

STEEN: My first experience with that was living in Portland where the farmers burned the farmland, the stubble in the Willamette Valley where you could hardly see to drive in Portland during those times. It was amazing. I'm sure they no longer do that, the air pollution people must have put a stop to it. It was really quite something.

SMITH: I haven't followed that one recently but I can remember once I was there and there was a combination of those fires and some very bad ones in southwestern Oregon in the forests and between the two we couldn't see very well.

STEEN: Apple growers at Hood River, Oregon, were suing the Forest Service, because smoke from slash burning was filtering out whatever it takes to ripen apples. They lost two weeks off their crop and they could calculate how many dollars that was.

SMITH: The slash disposal business is certainly a sample of one of the problems that one has that require intelligent solutions. More and more of the burning now is restricted in time to when there is good atmospheric dispersion. Of course in the West some of it has been solved by better utilization.

STEEN: If you hold the ranger accountable for a fire that escapes from unburned slash, he's going to burn that slash. You don't have to have a policy to burn slash, you just have to say if lightning strikes that slash area or if a hunter throws a cigarette in there, you're in big trouble. And that's the regulations they had. The ranger had no real choice.

SMITH: You know there's something else along that line about national forest silviculture. They have these guidelines about how you're supposed to do things. I observed the phenomenon in which, while the guidelines say you're not required to follow this mode of silviculture and can do anything logical, the general reaction is often that if guidelines exist and one follows them and the procedure doesn't work, then one can say "it isn't my fault, I was following the guidelines."

STEEN: Yes.

SMITH: It's a human response that is very difficult to deal with. There's a continual effort to shift responsibility up the line or down the line for anything, it's not just silviculture or fire control.

STEEN: The need to burn slash dominated all the Douglas-fir silviculture because all the cutting lines had to run strictly up and down hill, because you're really building a fire line. That was silviculture, since you're going to burn it you lay it out so you can hold the fire. That may or may not be ecologically intelligent, but that's the way the clearcut patches were laid out because of the prescription on burning. The fire control people would come out and wanted it burned clean. I mean if there was nothing left they were the happiest.

SMITH: The whole fire control business for not surprising reasons comes close to a kind of military organization.

STEEN: Absolutely.

SMITH: Many of the attitudes that went with it. In the early days in the Forest Service there wasn't much of anything else going on. Until after the Second World War, the only thing that was going on in the national forests was to administer grazing and keep them from burning up.

STEEN: I remember asking a fire control guy about the logic of the cutting line running through different timber types and not a natural area, and his answer was to look at me and snarl "do you want another Tillamook Burn?" Of course I didn't want another Tillamook Burn, but I didn't think that was the real question I was asking. But that was the answer you got in the '50s.

SMITH: I think it has changed.

STEEN: Impact statements must have put a lot of these things on the line that weren't on the line before.

SMITH: Yes. The business of thinking through what it is you're doing. If you look at what was happening with the fire business, in the early days there's small wonder we got the way we did. A lot of the start of forestry in this country had to do with the fire disasters in the northern Lake States in the latter part of the last century. It's interesting that it apparently has some similarity to the situation in the extreme north China and adjacent Siberia.

STEEN: Historians keep wondering how come Bill Greeley burned down Idaho in 1910 and got promoted. Usually in a stereotypical bureaucracy, if you're in the midst of a catastrophe somehow they hang it on you. He survived, he was a hero in one of the biggest forest fires in American history.

SMITH: I don't know.

STEEN: No one else has the answer to that question. Let's switch gears here, I don't even know if this is forestry or land policy, but the tropical deforestation thing is trendy. I'm sure it's a very significant issue, you hear a wide range opinions on how serious it is--there's global warming, the loss of genetic stock, producer of medicine, a whole range of things.

SMITH: What most of that is, Pete, is more clearing land for grazing in general. Sometimes it's for shifting cultivation, but actually it's the phenomenon where there are too many people, and wisely or unwisely converting forest land to grazing and shifting cultivation. It is almost literally a matter of public policy.

Tropical Forests and Introduction of Exotics

STEEN: Is that a forestry issue then? I mean should the Forest Service be down in Brazil worrying about this, or who should be down in Brazil?

SMITH: Certainly it would appear to me that foresters and ecologists can logically point out what the consequences are of it. I can tell you about something where I saw this close up, it was in Mexico. We've had a series of students from Mexico, usually at the level where they want to study for doctorates. One of these students, a man named Aurelio Fierros, was doing a study of some pine plantations in the Atlantic side of the state of Oaxaca in Mexico, the isthmian part of Mexico. The Mexican government had a partly publicly and partly privately owned paper mill, at a place called Tuxtepec, and they were desperate to get raw material for it. The pulp and paper technology was such that it had to be pine to run the mill. The wood was coming from way far off. However, the nature of the state or federal policy was that the foresters were allowed to grow these *Pinus caribaea* plantations only on ridge tops that were too poor for open-range grazing.

To go to this place, we started from Mexico City. When we got near the coast, first there were areas that had been in pasture for a long while and kind of worn out. As we came to every river it was pointed out to me that as a bridge had been built across the river, there was then a big wave of clearing of land for this poor grazing land, which very clearly wasn't going to last very long.

It was ironic that all the forests had been burned up and people were out gathering what few scraps of dead wood they could for fuel wood, when a few years earlier they would have been choked with it. Finally we got to these pine plantations on these little low ridge tops.

This is a sample of the problem in the humid tropics. I told these people to just sit tight, if you're lucky it'll be like it was in the southern United States, that after a while you'll have all this current grazing land to plant your *Pinus caribaea* on and the soils may be in poor enough condition that that's all you can do with them. The tropical rainforest species wouldn't be necessarily be able to come marching back, if the soil's been damaged. That's one of the places I've personally seen this happen.

STEEN: I suspect that tropical silviculture is in the same state of scientific sophistication that temperate silviculture was two generations ago.

SMITH: It depends on where it is. The part where silviculture has worked the best has been in Southeast Asia, particularly in Malaysia and India. In India it's partly helped by good markets for everything. They have worked out systems of management which are remarkably sophisticated. There's something called the tropical shelterwood system which was invented in Malaysia where they have lowland forests. Some of it was a result of observations of what happened to heavy cutting done by the Japanese during the war. It showed the foresters of those localities that very heavy removal cuttings were better than light partial cuttings. However, the system had been exported to other places to become a glorious example of what works in one place doesn't necessarily work everywhere. The latitude for using it in Peninsular Malaysia has disappeared because so much of the land was converted to rubber plantations. I've been told it doesn't work so well in highlands.

STEEN: But there you have a colonial government influence, too.

SMITH: That was part of it, but it isn't colonial anymore. In some degree it continues, depending some on the efficiency of the governments. Tropical silviculture works best in Southeast Asia partly because of the moderately well understood capacities of advanced growth of an important group called dipterocarps that are much akin to oaks. The success or understanding isn't as good in Africa as it is in Asia, and the place where it's dragged behind the most has been in tropical America. It may be of some significance that that's where the most of the tropical rainforest is today in Amazonia. Although there, there are beginning to be some fairly good approaches to dealing with that.

I had a very interesting discussion just a couple of weeks ago with a Brazilian, who suggested something which I thought was logical. He said that there are big areas in Amazonia that have magnificent iron ore deposits, most of which are being shipped abroad. To the extent it's used in Brazil, they don't have enough fossil fuels. So their iron industry, believe it or not, depends on smelting of charcoal. They've been taking the iron ore to the current traditional charcoal source in savanna forest close to the coast. He said it's ridiculous. He suggested they could make the charcoal in Amazonia and use some kind of coppice management. He said he was a little nervous about whether the nutrient supply would hold up under this, and we had some interesting discussions of the ways of trying to mitigate that problem. Elsewhere there have been some studies of strip cutting and they're beginning to find out some things about that.

Now one important change in the tropics is partly a political thing. It used to be that in the era of colonial times, the emphasis was on export of cabinet woods and that kind of thing. This was certainly true in Hispanic America also, even though a lot of them weren't colonies. The requirements of the local community always took a second-fiddle position. Now, partly as a result of independence and the end of the colonial era, what's become fashionable is what's called social forestry. It's interesting that now you begin to perceive that a lot of the forest services of the colonial time were actually police forces whose primary purpose was to try to protect the forests from the people. Rather incidentally this export business, in India for example, wasn't all overseas export. A lot of it was export from one part of India to another. When talking to the students from these countries, it suddenly registered what we're dealing with. They told us that when they went to forestry school it was like going to a military academy. Now the emphasis is on forestry for the people, and we begin to see much more attention to agroforestry systems. This is a very good compromise with the problem of these very erosive soils of simply keeping at least some tree cover on the land to produce enough organic matter to keep the soil fluffy.

STEEN: But sixty or seventy years ago Ford's rubber plantations failed, in part at least, because of bad science, or inadequate science. Jari failed last decade or so in part because of bad science. Is the science good enough that one could actually manage the tropical forests?

SMITH: I think certainly in the case of the Jari project, the science was good enough, and this strong-willed owner ignored it and lost an awful lot.

STEEN: I guess the question I'm asking does the Brazilian government have access to good enough science to deal with settlement of the Amazon basin?

SMITH: I don't know that they do, but with the Jari project Ludwig did. He hired some talent and deliberately ignored it, partly to show who's boss.

STEEN: I realize the Amazon basin must be an extraordinarily diverse and complex kind of ecosystem. How does the government establish the policy?

SMITH: It sure as heck isn't something that's going to be solved by some forester akin to a Iowa corn farmer who blunders in and says we've got to clear it all off and plant whatever wonder species is fashionable in the tropics this decade.

Every decade has had its wonder species. *Anthocephalus kadamba*, *Gmelina arborea* are maybe a little passé, now it's *Leucena*. I heard some interesting stories from one of our recent graduates who wandered into the job of being the chief forester of the Cook Islands. He fought a successful campaign to keep the chief from letting the nitrogen fixers plant *Leucena* or *ipl-ipl*. Sure it fixes nitrogen, but it's also an agricultural weed. If there's anything we should learn about these complex systems is that it often isn't going to work very well if we substitute a simple kind of forest just so we can understand it. We also must understand some of the diseases and so on that are apt to appear.

STEEN: It strikes me that Brazil has the same awesome problem that we had a century ago as a nation. A very large and diverse ecosystem and trying to have a federal policy that copes with it.

SMITH: In fact there's a policy. It's the one which is applied to southern Brazil where you cut the forest down and plant eucalyptus or American pine.

STEEN: Yes.

SMITH: Although they seem to be easing back from that. When the Brazilian was here recently, I was pleased to learn now they have quite a few plantations of *Araucaria*, which is the native pine of extreme southern Brazil. I didn't know they had any.

STEEN: I thought *Araucaria* was more in Chile.

SMITH: There's something called Parana pine which is in southern Brazil, northern Argentina and Paraguay and Uruguay, I'm not sure about Uruguay. There certainly is some in Chile. Incidentally I've been told that it was first introduced all the way northward in Mexico and California, along the Camino Real, by monks from Argentina. It's beautiful stuff, and that's a bit of history which would seem to be more than just speculation.

STEEN: How effective is the introduction of exotics? Monterey Pine is the hero that's worked so well in Australia, New Zealand, South Africa.

SMITH: That's one of the most staggering successes. What happened in that case was that there was a species which had almost been rendered extinct by geologic accidents. Monterey pine once had a much wider range in California and inland than it does now, in earlier geologic epochs before the coast ranges poked up and before the glacial times with their influence on worldwide climate. It's almost herded to extinction to a place where there was very little frost and it was moist enough. In the southern hemisphere there were tremendous areas of actually more favorable habitat. Furthermore they could leave the natural enemies behind.

STEEN: I never understood how anyone decided to try Monterey pine, of all the obscure species.

SMITH: Apparently what happened was at the time of the gold rush, sea captains and so on introduced it to New Zealand.

STEEN: That makes sense.

SMITH: People have always moved these things around, indeed the *Pinus radiata* planted in Australia originally didn't come straight from California, it came from New Zealand. It wasn't just in the southern hemisphere, there's quite a *Pinus radiata* culture in the similar climate of northwestern Spain. *Pinus radiata* has worked well in Mediterranean climates. There had been attempts to introduce it in other places where it hasn't worked.

For example, I was once on the edge of a very interesting discussion between one of our Mexican students, who was on leave from a research job in distant South Africa. The South Africans experimented very much with Mexican and also U.S. pines. There are about eight of them that they plant there and they're closely attuned to the climatic conditions. In South Africa the *Radiata* pine cultures work only around Capetown in the Mediterranean climate. Eastern South Africa has roughly the same climate as the southern United States and Mexico; it's summer wet, winter dry, not winter wet, summer dry. In the very southernmost parts of southeastern South Africa they plant loblolly pine. The introduction of Eucalyptus all over the world is another case. Australians have pointed out to me why eucalyptus grows better in California than it does in Australia. It's because they left behind some of these marsupial animals that feed on the foliage, koala bears and Australian possums. *Eucalyptus globulus* in California has weeping foliage. *Eucalyptus globulus* in Australia doesn't, it gets eaten off and the trees aren't able to carry as much foliage.

Then the introduction of western American conifers in the devastated forests of western Europe are partly the result of glacial extinctions where the repertory of species is quite limited. There are examples of successful introductions, but it's interesting that these are where there've been long jumps. In the cases where we've tried to widen the natural range of species, we've had trouble. Of course there've been some unwise choices of what was moved, but in general if something has moved from one place where it's adapted to another place where it's adapted it will work. Look at this from a climatic standpoint, in general if you stay the same position on the continent, the same latitude it's likely to work. You do have the option of leaving some of the pests behind although they're apt to catch up with you.

One of the corresponding problems is introduced diseases and weeds. For example, in this locality we have the climate like that of northern Japan and adjacent China, and we have oriental weeds. We also have success with planting Japanese larch, which is a rather rare, high-elevation species in Japan, very hard to get seed because it's so uncommon. The greatest enthusiasm for exotics you can see particularly in foresters from parts of the British Commonwealth where there's been tremendous success with exotics. I can remember once we had a student here from Ireland, and I learned many things from him about the ways they use planted Sitka spruce and lodgepole pine on moorlands in Ireland. We went on a field trip up in the Adirondacks, and I couldn't get him to believe that all those trees were natural, that very few of them had ever been planted. He was also convinced that the animals with the horns and the white tails were some kind of Japanese deer, because anything that was good obviously had to be an exotic. Now at the other extreme we've got almost a nationalistic attitude in parts of this country. The Pacific Northwest has never been very much interested in planting exotics, nature's been good to us, which is true, so why bother. In this country there've been no great staggering successes with exotics, but we've had some luck in this part of the country with introduced Eurasian larches and Norway spruce.

STEEN: The question in the back of my mind is that if you plant loblolly pine in eastern South Africa, what kind of silvicultural experience does one have? Do you use loblolly pine silviculture from the Piedmont as a starter and learn your way?

SMITH: In general South Africans applied some of the same things they learned from planting *Pinus radiata* elsewhere, it's just the seeds were different. It's been a straightforward plantation silviculture routine. I gather they've been greatly baffled by what natural forests they have, they don't seem to grow very well, and it's not clear why. One of the problems of tropical forest management is that it's very hard to know how old anything is.

STEEN: The annual ring situation is . . .

SMITH: There aren't any annual rings, and memories are short in many of the countries. I suspect that some of the difficulties have been that people have kept short-term track of increment in old forests. It may very well be a situation that if you're in a thirty-year old forest in the tropics and look at what it's producing in a given year, it's sort of like looking at the net annual production of a three-hundred-year old stand in the Pacific Northwest. At that age they're already old, they may have stopped their height growth.

STEEN: You've been involved in the International Society of Tropical Foresters?

SMITH: I'm a member and once in a while I go to the meetings to support my friend Warren Dolittle. I've never been very directly involved, but I get students from the tropics. It used to be exasperating, that foreigners would come here but there wasn't the financing for any of us to go there. It's only in recent years that we have been able to travel much. It's something I know from reading about it and talking with people. We started doing some research work in Puerto Rico, which is the U.S. window on tropical America. All I can say is I've been interested in it a long time and derived some ideas about it, but I wouldn't say I was a tropical forester. I pay dues to the ISTF because I want to support them and I want to learn more. Their newsletter publications that Frank Wordsworth puts out are excellent.

STEEN: If somebody wanted to study tropical silviculture of the western hemisphere, where would they go to school to do that? Here?

SMITH: As far as I'm concerned, at the moment Yale is as good a place as any. Silviculture is based on principles.

STEEN: Principles apply regardless of where the forests are?

SMITH: I sometimes tell people that with trees, the tops grow up and the roots grow either down or sideways, and all the rest is a bunch of details. To the extent tropical forestry study works well here is because we've got a good library, we have a longstanding connection in one way or another with the tropics, and we get students from there, and the students learn as much from each other as they do from anything that was on the premises when they came. I used to run a session where there were several students from Asia and some from tropical America, and maybe one from Africa, and I sat around while they discussed things with each other. Once in a while I'd raise a question that I wanted an answer to.

For a very long time people have suggested that we should have courses on tropical silviculture. I'd tell them no, we don't have courses in Pacific Northwest silviculture either, or Connecticut silviculture. If they try to make my course one in Connecticut silviculture they're apt to get a reduced grade. I tell them this Connecticut stuff's very interesting but the place is very small. "All of you will go some other place, so you'd better learn about other places in general."

STEEN: It's my guess that the biggest single difference between tropical and temperate forests are the number of species per acre.

SMITH: That's part of it, although on good sites around here we have stands that have twenty species on an acre. In fact, learning about forests, say, in the complex eastern forest--maybe West Virginia's as good a place as any--ought to be a good way of sneaking up on the even more complex ones in the tropics. At present we've got a student working in the Yucatan which is sort of on the edge of the rainforest. She's studying some aspects of the development of mahogany in the stands. She may be downstairs today trying to figure out whether the trees have annual rings or don't. It's a seasonal climate, and there are things which clearly seem to be like annual rings. They could help keep track of how old the stand is and what's been happening in the interaction of all the different species that are growing there, and in fine detail. Does the mahogany get big because it grows faster than everything, or is it big because it's strong enough to hold up against the frequent hurricanes when other stuff blows down? We don't know which, but maybe when she's done we'll know.

STEEN: I suppose another fundamental problem is the lack of convenient transportation, the lack of soil type maps and the sort of things that we would take for granted in this area. The ability to sit in an office and make an analysis. You have to do field work there.

SMITH: You know there's something interesting about that. In the early days of forestry in this country, starting in the era of that Bureau of Forestry, there were lots of short term studies of what amounted to silviculture and potential silviculture that were done by people going out and examining. In fact there was a position called Forest Examiner, which was one of the entry-level positions in the Forest Service. Many of these young men went around the country producing accounts of how you might proceed. Our library is full of these things. I can remember seeing an unpublished 1911 book by Thornton Munger about forestry in the Northwest. It was a mimeographed thing.

STEEN: When I was an undergraduate I went to the university bookstore and bought Mason, Bruce, and Girard volume tables for my mensuration class. You could just go to the store and buy one. We have photographs in our library of earlier days with forestry students making log tables as a part of their classroom preparation. It's sort of like a computer does away with the ability to do arithmetic, a typewriter ruins handwriting. And each generation loses one skill but gains another.

In the tropics there are no volume tables. I assume you can't go to the local bookstore in Rio de Janeiro and buy a volume table for all the species.

SMITH: There is a technique which has been developed and should be worth more, where you don't do it species by species, you do it by diameter, height, and some function of taper in the equation.

STEEN: That's Mason, Bruce, and Girard.

SMITH: I've often wondered why people got started on this species by species volume table business anyway.

STEEN: In that case we could use the Mason, Bruce, and Girard tables in Brazil.

SMITH: Yes.

STEEN: Well 65 is the lowest form class, and maybe we'd have to go lower than that for some of the tropical species.

SMITH: If you can measure it you can know what to do. That's an example of what can be a problem in forestry where there's been so much attention given to measuring trees that people aren't comfortable unless they're out doing it. I do see it a lot with some of the people from Mexico, all they know is measuring trees. If I tell them to do research or try something else, it's like casting them out to sea in a leaky boat with no chart. They're very uncomfortable about it.

The textbook is holy writ, and if they learn what it says in the textbook, that's it. I get very nervous about what may be going on with the Spanish edition of that Hawley-Smith textbook which came out in 1954. It was written almost forty years ago and it was never intended for external consumption anyway. It took long enough to translate that the newer edition was out before the translation appeared. It almost makes you feel guilty about writing textbooks, although they certainly do have a role. Whoever's teaching the course can have the students read the book. The spoken word is a very inefficient way of conveying information, the written word is much better, and it gives a point of departure even if all they do is lecture about what's stupid about the textbook.

Ecology and Ecologists

STEEN: This may be just another outfit you send dues to--Ecological Society of America--but that strikes me as something pretty close to what it is you do.

SMITH: I like to get the journal. I did my doctoral work not in silviculture but in forest ecology.

STEEN: Does it bother you when people say "Save the Ecology," just the misuse of the word?

SMITH: It shows that most of them don't know what they're talking about. Actually there are ecological phenomenon that go on ash heaps, which I think will get studied. I guess many other forest scientists find the Ecological Society of America somewhat frustrating.

One thing that does irk me about those people is the many ecologists who indulge in the luxury of totally ignoring all of the ecological studies that have gone on in forestry. They're self-defeating. It's just a kind of intellectual arrogance.

STEEN: I haven't looked seriously at ecological literature for twenty years, so my impression of it may be out of date, but it was my impression then that it's largely descriptive, there was no theory. You didn't predict succession, you went out and you described succession.

SMITH: You're precisely correct.

STEEN: Is it still the same?

SMITH: Not as much as it was. For example, in the pure circles recognition of the role of the initiating disturbance has come along mostly in the last fifteen years. They call it patch dynamics and tend to ignore that a lot of the regeneration studies that Leo Isaac and others did were studies of patch dynamics. What they're doing is catching up with what silvicultural researchers were doing a long time ago. They are still not ready to engage in experimental ecology.

STEEN: How is ecology a legitimate university discipline? The concept of practice as opposed to theory. Ecology seems to hang in there, even though it doesn't have the theoretical approach that seems so necessary these days.

SMITH: Well actually the question would have been a theoretical approach and there is a brand that is becoming prominent (I wonder where it's heading) a mathematical kind of population ecology. There's always been a lot of it in animal ecology. If you examine that, most of it you'll find are desperate efforts to find how many animals there are. They invented some quite sophisticated mathematical concepts to do it. I can recall when ecologists used to ask, "well why don't you have this in forestry?" I said, "we do, look at all these yield tables, that's a kind of population ecology." It registered on me that part of the reason for the difference was that in animal ecology you've got these organisms that are jumping around all the time. With our trees, we're lucky that they stay in one place and we go out and count them, one, two, three, four. You go out a few years later and there'd be some of them gone, but at least some of the ones that were there before are still there.

Ecologists used to ask me, "do you have life tables for trees?" I said, "we don't think of it in those terms, but often these yield tables are life tables." Maybe I should have told them that in addition to telling you how many organisms there are, they tend to tell you how much mass there is of them.

There is something which also has happened in forestry or silviculture or forest mensuration. It used to be that all of our efforts to keep track of the yields of the forest were done in units of merchantable volume. I can remember thinking, particularly when I was wrestling with what to put in that textbook about things like thinning, that there are all kinds of things that would work better if we simply worked with the total amount of matter that was being converted from sugar into tissues. It seemed it would straighten out all of the morass of these different merchantable units which are very confusing, to say the least. Along in the early 1960s or so, it began to happen.

There were some ecologists who started total biomass studies, but some of the very first were in the forestry sector. For example, one of the doctoral students from New Brunswick, now the dean up there,

Gordon Baskerville, did a very good study for doctoral dissertation here. One of the first biomass studies was one that Ovington started in Britain. Some of the best work was by Japanese foresters such as Satoo. Now there's quite a bit of this, and we are beginning to get a better handle on this kind of quantitative ecology and quantitative silviculture or whatever it is you call it. One sad feature I know of is that they still don't have the units of measurement straightened out, and sometimes I look at the literature and there are these undefined things like annual rates of production, or accumulation of tissue, that are as much of a tower of Babel as the board foot unit ever was. But at least this has been one of the developments in research in both forest ecology and silviculture and forest mensuration which has begun to contribute importantly to knowledge. It begins to be a good source of maybe what we need to know about if the world gets even more worried about managing forests to accumulate carbon.

STEEN: I doubt that I'm creative enough to have made this up, so I must have read it or been told about this when I was an undergraduate. Using the Clements model of ecological succession--pioneer, intermediate, and climax--because we foresters understand forest succession, we use silviculture to disrupt normal ecologic succession at the opportune moment to achieve the stand we want. Douglas-fir was the example we used as a, quote, intermediate species. We keep interrupting the natural succession. That's what silviculture is, disrupting ecological succession in some predictable way. Is that still a valid . . . ?

SMITH: Yes. One embellishment I think we ought to put on it now is that it works especially well in situations in which the natural system has these powerful adaptations to follow the comparatively severe kinds of forest fires. Ones where vacancies are made in the vegetation by killing little trees, which fire often does very well. Sometimes it causes us unexpected problems, it just makes the existing vegetation sprout which can be grass or shrubs, but that's part of the different ways in which fire behaves.

For certain kinds of forestry the Clementsian succession idea fits very, very well. Both ecologists and foresters have increasingly recognized that that isn't the only thing that governs the development of these forest stands, that there are other pathways. Maybe it is oversimplification to suggest such things to people that in very humid climates where there are lots of species growing and there hasn't been much history of fire. There's this alternative business where the new forest starts under the old and is released in nature by windstorms or insect outbreaks or that sort of thing, the enemies of the big trees. Some plant ecologists now distinguish between these two things by referring to the old Clementsian stuff as "relay forestics," and the kind I was just referring to it goes with the forest being killed from top down is "initial forestics." The "initial" being the stuff that's sitting there waiting for something horrible to happen to what is above it.

STEEN: These definitions I carried in my head without challenging them, forestry in effect was applied botany, silviculture was applied ecology.

SMITH: Ecology with succession.

STEEN: Ecology with succession. That's what started bothering me. Where's the science to all of this?

SMITH: There was certainly a theory to it, and that was basically the idea that somehow one set of plants prepared the way for the next. There's often been a conflict between the idea that these natural systems are ones where if you simply leave nature to itself everything will work alright--the natural system is perfect. The extreme opposite opinion is the idea of agronomic crops where you clear everything off and plant corn or wheat. If you try to fit it all together, all clean-cultivation agriculture is plant management by extreme disturbance.

The natural precedent we find for agronomy is the combination of something that kills all the trees, and then a fire that comes along and burns up all that dry fuel. This is like the Yellowstone fires where a lot of fuel was left by beetle outbreaks and other things. Years ago Harold Lutz pointed out to me that the sequence of blow-down and fire produced the most extreme kinds of natural disturbance, ones likely to wipe the slate clean. The only natural disturbance that was more extreme is the phenomenon of the landslide of the volcanic eruption, or maybe the exposure of sea bottom.

When I first started studying forest ecology here with Harold Lutz, it was still in the stage where, as you indicated earlier, most plant ecology in this country was studies of the Clementsian natural succession. There were desperate efforts to try to take every kind of vegetation and fit it into that mold. Harold Lutz did some very good studies in these parts where he made an attempt to do that. I used to sense that he was somewhat uneasy because he wasn't sure it fitted very well. Now in the magnificence of hindsight I think we can see that although there was some validity to the approach, it had to do with the situation where if you examined what was going on in the Clementsian sense, it was hard to see why you wouldn't wind up with the whole countryside covered with eastern hemlock.

STEEN: Yes.

SMITH: It's akin to the Northwest. If you follow this idea, the end product would be hemlock. In the extreme west coast you can certainly find pure stands of hemlock. It's interesting that those are places where fire hasn't been operating, and there's still Sitka spruce and now and then some red alder getting into the act. Here, the only times we ever find any pure hemlock stands is when they are artifacts where everything else has been cut. Ultimate succession to hemlock clearly wasn't happening.

It finally occurred to me if you went out to look where one hemlock had somehow been killed, one big one, the little world just north of the stump could not be recolonized by hemlock because the seedlings couldn't live in the blazing sunshine. It occurred to me that at the north end of that opening, the natural succession can start right over again at the beginning with pioneers like birches. It's only at the south end that hemlock will follow hemlock. This meant that it is impossible in this case for succession to lead to a pure stand of one shade-tolerant species. Mixtures are more likely. Then along about that time was when this initial forestics idea began to develop in ecology, and we began to get somewhat more sophisticated notions in forestry also.

STEEN: There's a botanist at Duke who I talk to a lot. He's an ecologist. He makes fun of the Clementsian view, and I thought gee, wonder what else I know that's out of date?

SMITH: I think those people have thrown the baby out with the bath water, that if you went back and read what Clements said that he had something like a political platform. He had all sorts of different kinds of climaxes. There was an edaphic climax where if the soil was poor, it might be something like the Steilacoom Plains where you weren't going to get past the Douglas-fir stage. Or pyric climax where there was so much fire that you just cycled lodgepole pine after lodgepole pine. It was his disciples who oversimplified it all. He had a framework that would include a lot of this disturbance ecology.

STEEN: Disciples do a lot of damage in this world. Historians have the same problem, Frederick Jackson Turner had a thesis about the impact of the frontier. It wasn't all that dramatic, but his graduate students went out and taught a rather exaggerated version and that's what became discredited, what his graduate students claimed.

SMITH: They made a lot more of it than he ever did.

STEEN: That's right.

SMITH: That's one of the chronic problems, every good idea lives to be run into the ground.

STEEN: Marx is supposed to have said on his deathbed, "I am not a Marxist."

SMITH: Sometimes winning is almost as bad as losing. Sometimes if one examines the consequences of a good innovation we see that the better it may have seemed the more likely it is to get corrupted or overdone. In the Northwest the revulsion against the clearcutting of vast areas associated with railroad logging helped develop selective logging as the universal panacea. The problems with that caused a wholesale swing to staggered-setting clearcutting. Now there are reverberations from that.

As far as silvicultural practice is concerned, the antidote is recognition of the fact that there are no universal best methods suitable for all times and places. It was for this reason that I long since concluded that the teaching of silviculture and the writing of the textbook should be merely the presentation of collections of ideas. That is, ideas about how forest vegetation behaves and might be manipulated for human benefit. This wasn't just my idea but one inherited from my predecessor, Ralph Hawley. All that I have tried to do is to expand upon it and to try to show how to make the design of silvicultural systems or programs more scientific.

There are many different ways of doing things. It is unwise to think in terms of ready made, preconceived solutions. One must examine the natural and social circumstances and design a solution. After the solution has been designed one can usually see that it is a variant that fits into one of "standard" categories of silvicultural methods or systems. Logically the act of inventing them comes first and the act of naming them comes afterwards, but there's been a tendency to reverse the process. I've often wondered if all of these names of these silvicultural systems and methods of cutting were invented in Germany. Many of them are almost direct translations of German words.

STEEN: Shelterwood has a nice sound to it, who could be opposed to shelterwood?

SMITH: In German it's *Schirmslag*, the protection cut. There are some words that are not easy to translate, but most of them are and have been. I suspect that what happened was that in the last century there were local foresters who devised these various techniques, and some professorial person came along, with a well-known scientific zeal for classification, and began to classify these things. The classification becomes confused with the substance.

We got to the point where people would argue over whether this system or that was the best, and if it was the best it had to be best the whole world over. Even in Germany they change enough that I remember once I was there traveling around and one of the foresters said, "I want to show you some pictures that show the result of an old method of handling the forest, we don't use it anymore but we found that our aerial photos would pick it up." It was even important enough we had to go to the forest headquarters that night to see it. He got out the air photos and began to describe it. I told him, "gee, I know what that system was. I remember studying about it when I was a student." I even told him what the German name for it was. It was enlightening to me that it was something that embodied some good ideas but it tended to neglect some other things. It was a way of protecting forests from blowdown.

STEEN: I see.

SMITH: Actually the basic concept is pretty good, and they use a lot of it but not in exactly those terms. They modified it.

STEEN: That was always a big issue in clearcut silviculture, Douglas-fir blowing down along the cutting line.

SMITH: I've had interesting discussions with Roy Silen who tried to develop a technique where you had the roads at the upslope end of the clearcut. When it almost inevitably blew down at the corners, you could get there to salvage it.

STEEN: Yes.

SMITH: Now that's a sample of what a silvicultural system is all about. You analyze the circumstances, you anticipate the problems, and try to figure out a solution for them. Then you keep watch of what happens, and you don't anticipate all the problems, you find another one, or another opportunity that was overlooked. Then you go back to the drawing board and modify the scheme. It ought to be a dynamic process and not something that gets locked up in some handbook. I claim sometimes this zeal for the handbook is a result of the fact that either people are too lazy to think, or they're too preoccupied with other problems. For example in managing forests, dealing with the personnel, fixing the buildings, fighting with the neighbors, and so on can just blow you away.

STEEN: It's true. But handbooks are a way for an institution to standardize the operation. Everyone uses the same nomenclature when they describe the process that makes the reports more uniform and easier to file. All of the pragmatic reasons of a handbook.

SMITH: With regard to this business, some of the problems of naming of these things is unnecessarily restrictive. I think that too often people want to do something and somebody says "now you've got to tell us whether that's clearcutting or selection cutting." You're not allowed to say that this selection cutting aimed at a particular situation, or that it's the west Olympic Peninsula Sitka spruce/hemlock selection cutting.

STEEN: Nomenclature is important. I remember a major fire I was on, we had fire fighters coming in from the East. Listening to the radio chatter, they would ask for piece of equipment, and our warehouse people didn't know what it was because the vocabulary that the southerners and easterners used to describe a nozzle or a kind of hose was different than what we used. That's a case where the handbook is justified, we all call a thing the same thing, like a scientific name of a tree I guess.

SMITH: You can see why people have them. I'm trying to think what technique it was that Duncan Dunning, a Forest Service researcher, invented in the California Sierra. It was unit area control, and it was very hard to figure out what it was, but it came down to saying you divide areas up into units that are somewhat smaller than the administrative stand and decide what to do with them on the basis of their observed characteristics.

STEEN: So a working circle would be divided up into unit area controls.

SMITH: It was never quite clear which was the unit area and which was the stand and which was the working circle, but it was an attempt to grapple with some things that they were having difficulties with.

STEEN: You had some other suggestions on your outline. The 1938 hurricane must have had quite an impact on subsequent silvicultural problems throughout New England.

SMITH: It was mostly here in southern New England. New England is a very diverse place; it extends from New York suburbia to northern Maine and the biggest tract of privately owned forest land in the world. Here we have suburban forestry, and up there is a big scale spruce-fir management.

I've been looking after the Yale Forests and using this environment here to teach. This tropical cyclone that destroyed much of the timber on our two forests, also the Harvard Forest, had a very powerful influence on our policies. Mostly it led to severe discouragement. For example, it put the finishing touches on the old-field white pine box board culture. The box industry was shifting to corrugated containers anyhow, but this finished it. It also had the effect of causing us to pay even more attention to the role of natural disturbances. I've been looking after Yale's Forests for all these 40 years, and the devastation of that hurricane greatly reduced the growing stock on these lands. They had been heavily cut over by previous owners; the growing stock was low and the hurricane made it lower yet. One of the things that makes me appreciate sustained yield is the problem of trying to manage forests for income where you don't have any growing stock from which you can cut. That is a typical case in which the people who appreciate things most are the ones who don't have them.

STEEN: Sure.

SMITH: When you're dealing with the results of not having followed a sustained yield policy, it makes sustained yield look very alluring. I think that's something that people in the Pacific Northwest have missed, that with all this old-growth timber around, somehow that's a problem, but you don't have this problem of holding vast areas of forest land where you can't find anything to cut.

Origins of Yale Forests

STEEN: What's the origin of Yale Forests? Did the university acquire cutover land, or it made the land cutover to generate revenue, or what?

SMITH: These were cutover lands mostly already that were acquired during the era when there was lots of abandoned agricultural land which had grown up to white pine. A lot of it was old sheep pastures of the 1850--1870 era. Incidentally I'm not sure what George Perkins Marsh had to do with introducing Merino sheep, but that didn't necessarily improve the ecological circumstances in these parts. What had happened was these old farms and their old-field pine were bought up by lumbermen to cut for the box industry. The cutover land was left lying around and it was quite cheap. Mr. Toumey bought some of the Yale Forest; he was a Scotchman and didn't believe in spending money.

The person who put them together mostly was a wealthy person who was a member of our first graduating class, a man named George Myers. One of the few times I ever encountered him was with regard to this big forest we have in northeastern Connecticut. He told me he never paid more than 15 dollars an acre for any acre of it, even stuff with houses on it. What he did was he put together something which would be impossible now. Most of these old farms averaged about 70 acres. They'd been abandoned and grown up to pine which often had been harvested. Part of the reason our faculty actually opposed the acceptance of that particular gift was that unlike Henry Graves they knew quite well that it would be a financial problem because you had young trees all over the place but nothing much that you could cut.

When I had to take over looking after them I had this problem in spades. Always hearing the complaints from the dean about pouring money down that rat hole up in Union, Connecticut. We had a picturesque Russian émigré forester, who's now our oldest living graduate who's been retired for years. He and I would walk around that forest looking desperately for something we could harvest; we could find some trees that had escaped the '38 hurricane, but not very much. Mostly we got a lot of exercise. I remember we used to figure "well if we hang on long enough the trees will grow and the situation will take care of itself." We decided we weren't going to high grade it by cutting red oaks for railroad ties. Ironically about the time he retired was about the time things grew up enough that we could start doing something. That was thirty years ago, and I have the satisfaction of seeing some of the oaks that we refused to cut for low prices now sell for prices that are almost gold-plated as veneer logs on overseas markets.

One of the outfits we used to sell to was a company called Rossi Company, which was in the pallet business. One of the nice things about Rossi Company was they could use a lot of junky trees for making wooden pallets. There were a lot of manufacturing and shipment of goods around here, there's always been a pretty good market for pallets. That generation of the Rossi Company was characterized by the fact that the head Rossi kept the records in the medicine cabinet. He died, and a younger Rossi had to take over the business and had to figure out what was going on from the papers in the medicine cabinet. Now, they claim to be one of the biggest exporters of hardwood timber in the United States.

STEEN: I've heard this from others that our best market for hardwood is Europe. Why not in the States?

SMITH: Log export probably has to do with the problem that our labor cost is so high.

STEEN: It's higher than in Germany?

SMITH: It has been. More of the export is to Taiwan and South Korea. Still some of it's to Italy or Belgium, but it's for furniture. In this case a lot of it's oak, oak furniture is very fashionable. I'm told that the red oak in this locality is yellowish pink and not bright red and it looks somewhat like the European oak. In fact, I've got a piece of oak here from Germany. This is the piece of the special oak that forest economists are always poking fun at that. It was left to grow in a small district of Germany, on what had been the hunting forests of the Archbishops of Mainz. It was for boar hunting, and they grew oaks to favor the boar hunting. When the Bavarian government took over the monasteries in Napoleonic times they had this old growth, the trees are 300 years old. Economists have poked fun at keeping such long rotations, actually their rotations have been cut to 250. And the Bavarian government cries about its problems all the way to the bank. They'll sell this

stuff for stupendously high prices to furniture manufacturers who'll say we bought this special oak so our furniture is really hot stuff.

The cheaper oak that they get elsewhere in Germany, but they piece it out even more from what they regard as very cheap oak from a certain underdeveloped country across the Atlantic Ocean. In fact I've had complaints from some, saying, "you're killing us with those low prices that you charge for this stuff," which look very high to us. A forester with one of the big German companies told me once, "Why don't you let us sell it for you." I tried to arrange that but I didn't get very far.

STEEN: We live in a wooded area on the edge of Durham and next door they've been logging. They came in and took the pine, then they came in and took the oak. Two completely separate operations. I thought we were too far toward the ocean for a good furniture-quality hardwood. Some of the oak is 20 inches in diameter.

SMITH: It might be interesting to see what it looks like going through the sawmill. I've always been puzzled, I go to the Piedmont and see a lot of hardwood that looks pretty good, and I'm told that you take it to the sawmill and open it up and it isn't.

STEEN: I was impressed it was two separate operations, two different operators, one came in and took pine, one comes and takes the hardwood.

What's the relationship between say Harvard Forest, Yale Forest, Duke Forest, Pack Forest? We discussed this earlier about the demonstration concept for the general public and they were put in the areas of major thoroughfares. But academically what's come out of these forests? Are they really a teaching tool?

SMITH: Probably the most important thing that's come out of ours has been the modest amount of research, a very substantial amount of on-the-job learning on the part of the faculty who managed them, and a kind of sense of involvement in real problems. Our students, in the case of the Yale Forests--there aren't very many of them--who have worked on the management of them are spread all over the country. Those who worked always spent a summer marking timber or doing other things at some Yale Forest. I'm about to retire, and I think this will change. In the case of the Yale Forests I got so exasperated over all the complaints about what the ownership of these things was costing. I was told, in effect, "Yes, we know there are endowment funds that pay for this but we'd rather spend the endowment income for something else." I just fixed it so, yes, it could be spent for something else. When I fixed it so we didn't have to spend endowment income on the forest in northeastern Connecticut, the first use it was put to was financing the Forest History Society when they were here.

STEEN: Is that right?

SMITH: That was what actually happened when they managed to get the big money loser, this forest in northeastern Connecticut, put on a break-even basis. It happened to be in the early '60s, and I figured that I want to show it can be done, that you can manage a forest so that you can win.

I'm reminded of something my father told me once, he was an agricultural scientist and he did many things in chemistry. One of them was that he did a tremendous amount of work with turf research for things like people's lawns and golf greens and what not, and once I went to see him and his lawn was in wretched condition. I guess the problem was he hired somebody to mow it, and they set the lawnmower too close and just fixed it so weeds would come in. Finally I remonstrated him a little bit about it. He said well, "I spent part of my career learning how to grow a good lawn and I don't have to go over and over proving that I can do it."

In that connection I'm reminded of something that the person who learned the most about white pine management at Syracuse's Pack Forest, Clifford Foster. He retired fairly early and went back where he came from out in the end of Long Island and transferred his attention from growing high quality white pine to growing high quality oysters. He told me, "well, when I started this I wanted to learn about solving two problems: one of them was the mysterious rot that comes into old field white pine when it's forty years old and the other was how to deal with the crooks, the deformities caused by the white pine weevil, and also

how to grow white pine." He said, "I've been at it here for thirty years. I've learned what I set out to do. It's now known how to do this, so I'm going to quit." In my case at the Yale Forests it's mostly figuring out how to put them on an income producing basis, also I wouldn't argue that's necessarily the logical thing to do with them, although we are planning to continue some of that. If somebody will give us more forest land without any strings attached to it and suitable circumstances, we'll accept it.

There hasn't been as much research as there might be. One of the problems was there wasn't much long term research on the big forest. There was this plan to dispose of it, and that if there's anything that will kill any long term research, that's it. One of the problems we had, if it's a problem, was the use of the large Eli Whitney Forest of the New Haven Water Company around. I used to be told we don't need a forest, we have the use of one. It never even occurred to me to suggest that the land tenure on that might not be forever. It was a privately owned public utility regulated by the state, and about fifteen years ago some people began to buy up the stock with the idea that they could sell the land.

The threat of this takeover was so great that there was a lot of concern on the part of all the governmental units around it, not just the water-using ones but the ones who had been taxing the watershed land. One community used to practically support itself by such taxes and they became agitated about this. The net result was that the privately owned stockholder-owned company was bought out by a newly created public authority. The same foresters continued to manage it and the zeal to dispose of land has been very greatly curtailed. In that case we found that much of our long-term work that would get buggered up somehow even with the best of intentions. We needed some land that we controlled ourselves. Then there've been problems of the sort you're acutely aware of with the Duke Forest where you've got some land close to the city that's very valuable. People will conjure up some big values which are probably partly illusion. There are some differences. Duke Forest was there when the Forestry School was established.

STEEN: That's right.

SMITH: With ours it's the reverse. We deliberately acquired these. One time a university official told me there wasn't any doubt about who they belonged to as I was the only one who knows where they are--see they aren't right on the campus, which may be partly a blessing. I've been involved in situations where agricultural research farms have been gobbled up at state universities. My family owned a very good farm immediately north of the University of Massachusetts campus, and I can remember when we desperately tried to get them to buy it for their experimental farm. They'd been chased out of the one they had right next to the campus, and they weren't about to buy one that you could see from the campus.

The Harvard Forest, there's a very interesting problem there. It was one which was brought home to me when I read something Herman Chapman wrote. It was a memo to the rest of the faculty here when their good friend Dick Fisher started the forestry school at Harvard. He started it off in the woods at Petersham, Massachusetts, under the aegis of Harvard. The Chapman memo was in 1913 when Mr. Toumey started the forest we've got in New Hampshire. Actually it was by accepting the scattered pieces that George Myers had acquired and had dropped because he figured that New Hampshireites were charging him too much money for the land. That's why he transferred his attention to the rural part of Connecticut and operated so people didn't know what he was doing. Anyway, in this memorandum Herman Chapman, in spite of the fact that at the same time he was head over heels into organizing and running our field work in the South, said "it's a very good idea for Toumey to start a forest and do research and demonstration work, but whatever else we do, let's not make the same mistake that Dick Fisher is doing at Harvard in moving the school off in the woods." Forestry schools should be on university campuses. If you look at this situation in detail, Herman Chapman as usual was absolutely right. The state of Pennsylvania had an independent forestry school in Mount Alto.

STEEN: That's right.

SMITH: It was finally dragged kicking and screaming into Penn State, and after that they had an awful time figuring out what to do with the campus. I think it's a regional general campus. Wilbur Ward was running it for Penn State. About 1960 he came here to be one of my doctoral students and he got quite exasperated. Just as soon as he came here, Penn State closed the thing down on him. Later he was head of the

department at Penn State, but I remember that earlier moving from Mont Alto was sort of the final blow. I remember once being called upon to advise the president of Harvard just what to do with the Harvard Forest, and I told them that you've got too many buildings out there already. Transfer as much of the activity as you can to the Cambridge campus. Then I saw what happened afterwards, they moved even more out there. And now they've gotten to another identity crisis. I think that was part of the problem with the Biltmore School.

STEEN: Sure, it was nowhere.

SMITH: There've been too many poorly financed forestry schools started because some administrator saw three trees growing outside the office window. Both here and Canada there have been unsuccessful efforts to persuade the various states or provinces that running forestry schools isn't cheap. There was a time when there was a forestry program in a small college not far from the Yale Forests, up in Massachusetts, Nichols College, which is primarily a business administration school. It was off in the woods, and they started a forestry program. They finally bailed out because it was costing more than the business administration instruction. George Garratt, after he was dean here, did the big study of forestry education in Canada.

STEEN: That's right.

SMITH: He recommended that they not start any more forestry schools, and once he sadly told me, "the day my study was published happened to be the day that the forestry school at Lakehead University started."

Connecticut Forest Park Association and Other Activities

STEEN: Tell me about your involvement in the Connecticut Forest Park Association.

SMITH: That's mostly to support what they do. That's a very old and very successful counterpart of the American Forestry Association. Most of the time it's managed to keep together everybody concerned about wildland or forest and park matters here in Connecticut, everybody from sawmill operators to garden club people. It usually doesn't have the extreme groups. For example once we considered including people interested in horsebacking. We learned they wouldn't join unless we promised to devote all our attention to horseback riding trails.

There were many things involving forestry that were started here in Connecticut around the turn of the century. I don't know how much of it had to do with the fact that Gifford Pinchot was born in a place called Simsbury in northwestern Connecticut where his mother's family had a summer place. The Forest and Park Association was founded in 1895 in Simsbury by a preacher. When this school was started in 1900, simultaneously the Connecticut Agricultural Experiment Station, three blocks up the street, appointed Walter Mulford as the first state forester. The small Connecticut state forests were initially demonstration and research areas run by the Connecticut Agricultural Experiment Station, which incidentally is independent of the University of Connecticut. Almost immediately and for quite a few years this Forest and Park Association actually operated out of this building or Sage Hall. Then they gradually moved away, and then there was a period when the school wasn't as involved.

In the early '60s one of our graduates, a fine character named Austin Hawes who had been state forester and was a director of the association, died. The people in the association wanted more involvement with Yale. I've always been interested in promoting forestry and other things here in southern New England, because I come from here, but many of our Yale people don't. My family comes from Massachusetts and Vermont, I grew up in Rhode Island. I spent my whole career here and partly from looking after the Yale Forests became very much concerned about making intelligent forestry work.

The Forest and Park Association has been very effective at that over the years, particularly in recent times. There's a fine forester and executive director named John Hibbard. He's a University of Connecticut graduate who comes from northeastern Connecticut who has been a very effective in dealing with the state legislature and the state administrative agencies. Although there's little forest industry ownership here, there

are some mills and so on. I was president of it for quite a while, and I figured that my chief role was protecting John Hibbard while he did these things that were logical to do. I'm still a director of it. I got too busy to give it as much attention as I should, but I found a tree farmer, a retired clergyman, who was willing to take it over. He's been involved in raising all kinds of money. The time I was president John Hibbard had an office on the second floor in a somewhat seedy Hartford suburb, which was close to where the legislature meets. We used to joke about his office being one flight up next to the painless dentist. Now they've got a fancy office building next to a privately owned and managed forest in the central part of the state on an important highway right near Middletown.

STEEN: Your work in Maine is much different.

SMITH: Some of that started with just being involved in New England forestry, and very much interested in the spruce-fir business, partly because I had some classmates here who were heavily involved in it. This Baskahegan Company, which belongs to the Milliken family, had acquired a large tract of forest land back in the teens. Possibly because it was being chewed up by a budworm outbreak, it had been heavily cutover just after they acquired it. It just sat for years, partly because it was cut so hard that they couldn't do anything on it. They finally were persuaded by other people that they should start an active management program.

It was in the middle 1960s, and there was another forest ownership, a much more active one, the Dead River Company, that was going to manage it for them. Another member of our faculty, I guess I mentioned this before, Zebulon White, who had been and since has gone back to being a very influential consulting forester in the South. He took on oversight of the project but he wanted me to help him because he figured he didn't know enough about what was going on in Maine. I figured this was a very good chance to find out at first hand what was going on because many of the owners of the time, particularly in Maine, tended to be very suspicious of outsiders, whether it was the federal government or whoever. This was a sort of pathway into that situation.

Fortunately it's an ownership which very definitely has a long view of things--seemed to be more concerned about the next century than the present one. What they told us was "we want the best job of forest management in Maine." Once in a while I found it necessary to tell them, okay, there are various ways of defining this, please get a little more specific about what you want. But in general they've done logical things. There's a pretty good history of that which Roger Milliken, Jr. wrote. He is now the president of the company. His father, the head of the Milliken textile business, still has his hand in, but he's turned it over to his son to look after. The writing of the history was a deliberate effort by the father to fix it so that the son would be induced to look into it, to figure out analytically what was going on. It's very hard for people to write history about what's going on right now.

STEEN: It's like saying, you were in Vietnam carrying a gun, tell me what the war was about. You've got to wait until afterward, you have to look back at it.

SMITH: I remember being involved with the heavy bombing of central Europe during the second world war, and a lot of times we didn't know for sure what the objectives were. I've been in a position where once in a while I had a pretty good way of interpreting.

With the history of silviculture there's some things which make more sense to me now than they did earlier, partly from trying to analyze it. It's a very good idea to do it. We need history and I've often pointed out to people that the view out the rear view mirror is an awful lot better than that through the windshield on things like stand development. And in general you don't know where you're going unless you know where you've been. Understanding the development of forest stands is a historical analysis problem. In fact I wish there were more systematic collections of photographs. This would tell us an awful lot. One thing's difficult about it is you can go out and take a picture of a young stand and look across it. If you go out and try to take that picture twenty years later, there are trees blocking the view right in front of your face and camera.

STEEN: Photo point's a real problem.

SMITH: It works much better in the ponderosa pine country than any other place.

STEEN: I met a guy who makes a specialty in comparing old photographs, creating artificial photo points. By manipulating it with a computer, he can move the camera angle over to actually match up the original camera angle.

Looking Ahead

STEEN: You introduced this concept, so look through the windshield. What's going to happen to silviculture? What are the issues ten years from now, twenty years from now?

SMITH: People will surely still be concerned about managing forest vegetation, and that's what silviculture is. For whatever the purpose is. I think what the Yellowstone business tells us is that maintenance of wilderness is another kind of management. It's going to become quite obvious that there isn't anything that's completely natural, that's a mirage. With wilderness areas, we have to sort out the purposes and maybe not intervene very much. We've got natural areas here in the East that are being destroyed by our excessive deer populations. There's one in northwestern Pennsylvania which got to be an ecological disaster area simply because of excessive deer populations which are artificially induced.

STEEN: It's so awesome that I can't even comprehend it, the extreme predictions on global warming as opposed to the moderate predictions. You mentioned that maybe the most logical land use is to develop forests as a carbon sink.

SMITH: That could be one of the subsidiary purposes. It might become a reason to prolong rotations. For example there's a hypothesis that I want to test, it may be that the rotation of maximum sequestration of carbon isn't a heck of a lot different from a saw log rotation. I'm not sure, it probably differs from one kind of forest to another. We've got some data I think we can do it with, but some of the yield tables we have will help tell us this. But we've got to reinterpret them.

STEEN: A new kind of federal regulation where you can't grow pulpwood anymore because Holland's going to go under water. We've signed an international treaty that we're going to make every effort to . . .

SMITH: Save Holland from going under. Oh, it's possible.

STEEN: Is this far-fetched?

SMITH: Not necessarily. On one hand we need to figure out what to do if we get rapid climactic warming, on the other hand we need to keep continuing our studies to find out whether it's for real.

STEEN: Can we do that?

SMITH: Well, Bill Reifsnyder recently produced something which casts considerable doubt. It doesn't say there isn't any global warming but he says that some of the evidence that's being used to suggest there is just isn't that good.

STEEN: I'm an interested observer. I see the American Forestry Association has Global Relief, plant a tree, deal with global warming. Roger Sedjo of Resources for the Future publishes an article in the *Journal of Forestry*, says there's not enough land in the world to plant enough trees to have an impact. There's something going on that I don't understand.

SMITH: One of the chilling things about this is that the use of fossil fuel is so great that what we're doing and every year we're blowing in I don't know how many thousands of years of fossil fuel accumulation. There's a sustained-yield problem there, and it's not helped by economists who look at the price, which is the price of the oil that's in the pipeline. I claim the economic system will not pay any attention to the amount of oil that's left in the ground until absolutely the last drop is gone.

STEEN: Then it becomes scarce.

SMITH: Because scarcity is what's in the pipeline. My son-in-law's a carbon dioxide expert. He told me about a lecture he gave at Duke about what trees do with carbon dioxide. I guess his attitude was, I don't know whether there's going to be global warming or not but I do know that we're using fossil fuel too fast. In the meantime, it helps him get the means to do very precise research with what the trees do, how much carbon dioxide they use and what controls it. He's up to sapling size trees now and refuses to become involved yet in what the whole forests do with it.

I think we could figure out what we can do to maximize this if the world wants it. Then they've got to decide how much they want and how much they want the short rotation pulpwood. Of course to some people they propose that the quick growing stuff will do it, and I think they're mixed up over the rate at which carbon is removed and the rate at which it goes into long-term storage.

STEEN: Do we have enough science to actually deal with this?

SMITH: One of the things about applied science, Pete, is we never have enough information. The critics will always say you don't know what you're doing so don't do anything. Applied science always has to proceed in the absence of complete knowledge. We have to proceed where we're monitoring what goes on all the time, and if things are coming out wrong we've got to change it. In fact we have to do things and we have to keep examining objectively what we do. It's hard to do, especially if somebody's criticizing you for what you do. The world doesn't give you the luxury of saying you can just stand there doing nothing. With the forestry profession, we've been told we've got to manage the forests. And we haven't been told "you can go and do research on it and come back in a thousand years after you know everything, then you can start management."

I am always optimistic that people will do better rather than poorer by forests in the long run. Much depends, however, on human population trends. If populations continue to soar in underdeveloped countries, there will just be more and more unwise clearing of land for short-lived shifting cultivation and grazing. Solving food problems comes first and we can't solve forest problems unless and until those are solved.

Much of silviculture always has been rehabilitation of land damaged and deforested by unwise land uses of the sort just mentioned. This will continue to be the case. The desirability of reforestation for sequestering carbon or to substitute fuelwood for fossil fuel will be an increasingly important objective. Oil seems almost sure to be less and less available, although coal will be both a blessing and problem for centuries to come. All this adds up to the desirability or even the necessity to reforest extensive areas. This is one of the places for plantation silviculture.

It appears to me that there is now increasing attention to "natural forest management." This reverses a trend toward intensive plantation silviculture. It appears to me that society is having second thoughts about the high initial investment involved in plantation silviculture. We will probably see more the notion of managed forests that are 10 percent plantation and 90 percent naturally regenerated. In any event, it will be both kinds and not just one.

Much also depends on how much land is needed for agriculture. What will happen in this country when the fossil water of parts of the West is gone? Will forests be cleared for rain-fed agriculture elsewhere?

We also will see more agroforestry, perhaps mainly in the Third World, as a way of making subsistence agriculture work without soil erosion. In this country, existing silvo-pastoral systems (pines and grass) will probably continue to be our chief agroforestry manifestation.

STEEN: We've covered a wide range of material. This is a very good interview on the history of silviculture, and your role in it, and your perceptions.

Appendix A

1989

Curriculum vitae: DAVID MARTYN SMITH

b. Bryan, Texas, March 10, 1921

B.S. (Botany), University of Rhode Island, 1941

Non-degree military meteorology program, New York University, 1942

Master of Forestry (1946) and Ph.D. (1950) in forest ecology, Yale University

Sc.D. (hon.), Bates College, 1986

Military service 1942-45, to rank of captain, as weather forecaster at Hq. Fifteenth Air Force (North Africa and Italy) and Hq. US Army Air Forces (Washington).

Member of faculty of Yale University School of Forestry and Environmental Studies, 1946-47 and 1948 to present. Instructor, 1946-47, 1948-51; Assistant Professor, 1951-57; Associate Professor, 1957-63; Professor since 1963 and Morris K. Jesup Professor of Silviculture since 1967. Assistant Dean, 1953-58. Responsible for instruction in silviculture since 1948. In charge of management of Yale Forests (4,000 ha.) since 1949 and now Director of School Forests. Director of Alumni Relations since 1983. Instituted instruction in forest meteorology, 1950-55. At various times has also taught courses in forest fire management, forest taxonomy, forest ecology, conservation of wildland resources, harvesting and utilization of forest products. Has presided over the studies of 27 doctoral students who have finished their studies and 7 whose work is still in progress; the localities of these studies include forests in New England, Pennsylvania, New Jersey, Tennessee, West Virginia, Louisiana, Puerto Rico, New Brunswick, Newfoundland, British Columbia, Sarawak, Sri Lanka, Mexico, Panama, and New South Wales.

Research Assistant, Connecticut Agricultural Experiment Station (New Haven), 1947-48.

Visiting Professor of Silviculture, University of Munich, 1981.

Author of the 1954 (with Ralph C. Hawley), 1962, and 1986 editions of textbook, *The Practice of Silviculture* (which, in English and Spanish editions, is used throughout the world). Other publications are mainly commentaries of silvicultural practice with some accounts of research in silviculture and forest ecology.

Society of American Foresters: At various times has served as Associate Editor of *Forest Science* and *Journal of Forestry*. Also as Chairman of Divisions of Education and Silviculture and of the New England section. Continual service on some regional or national committee, 1955-1983. Distinguished Service Award of New England Section, 1969. Elected a Fellow of the Society in 1971.

Connecticut Forest and Park Association, Director (1962-75, 1982-), President (1975-82).

Member, Ecological Society of America, International Association of Tropical Foresters, Sigma Xi Scientific Society, and of two undergraduate honor societies, Phi Kappa Phi and Phi Sigma Biological Society.

Silvicultural consultant to Pacific Northwest Forest & Range Experiment Station (1967) and to President's Advisory Panel on Timber and the Environment (1972-73).

Member, U.S. Delegation to North American Forestry Commission, Mexico City, 1974.

Corresponding Member (hon.), Academia Nacional de Ciencias Forestales, Mexico, 1982 to present.

Member, Steering Committee for study of utilization of secondary tropical woods, a joint research and development project of U.S. Forest Products Laboratory and Agency for International Development (1974-78).

Connwood, Inc., landowners' cooperative forestry service firm, Director (1958-), President (1961-).

Management consultant to Baskahegan Company, owner of 40,000 ha. forest in eastern Maine, 1967-)

Wife: Catherine V. A. Smith

Children: Ellen D. Smith and Nancy V. A. Smith

Appendix B

Publications by David M. Smith

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