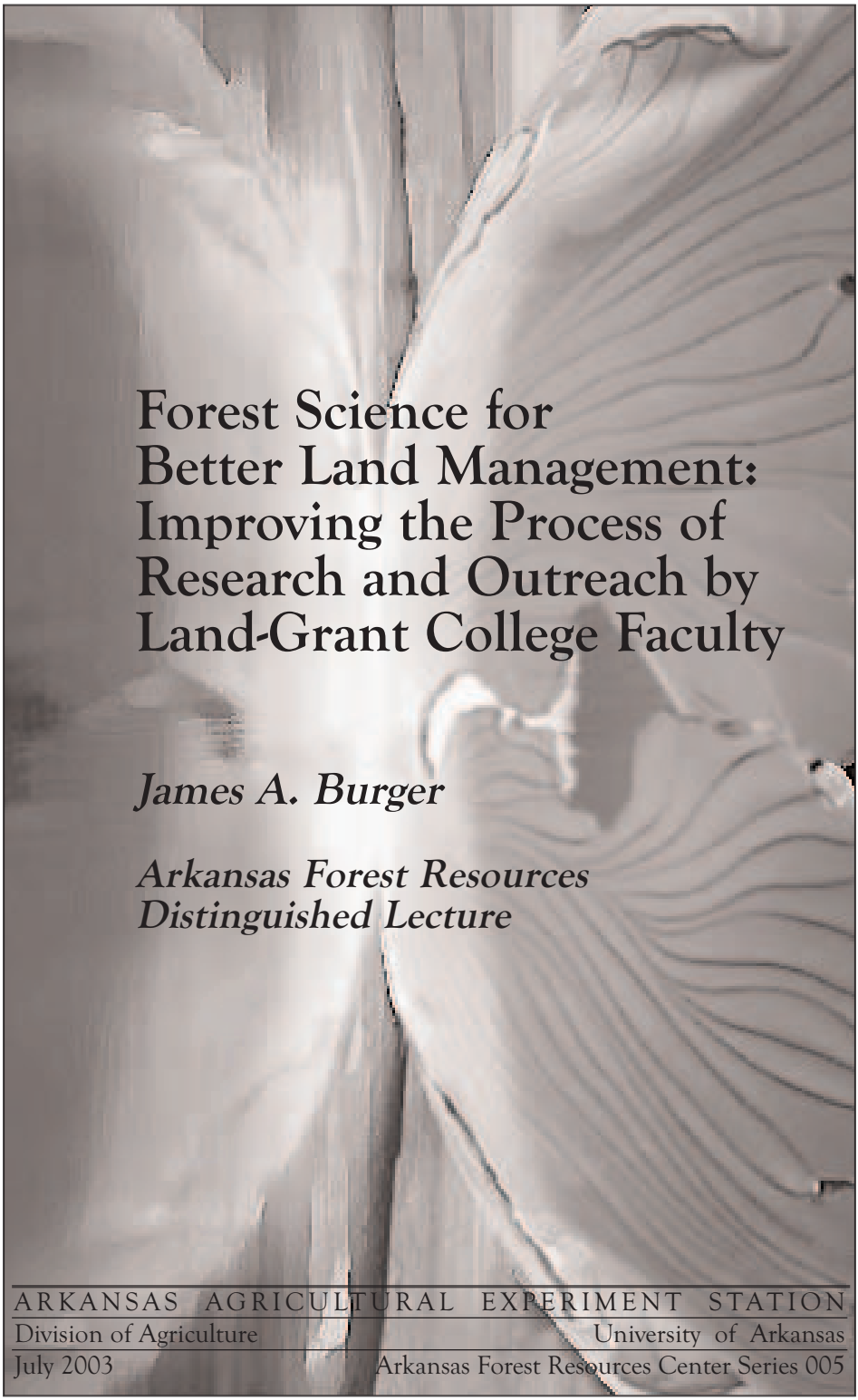

Forest Science for Better Land Management: Improving the Process of Research and Outreach by Land-Grant College Faculty

James A. Burger

Arkansas Forest Resources Distinguished Lecture

ARKANSAS AGRICULTURAL EXPERIMENT STATION
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Dr. Burger received his B.S. (Agronomy, 1968) and his M.S. (Forestry, 1975) from Purdue University, West Lafayette, IN. He recieved his Ph.D. in Soil Science from the University of Florida (1979).

Dr. Burger served in the United States Army (1968-1972) as a helicopter pilot in Viet Nam and as a flight instructor. He joined the faculty of the Department of Forestry at the Virginia Polytechnic Institute and State University, Blacksburg, VA, in 1979 and since has won numerous awards, including the prestigious W.T. Plass Award for career contributions to reclamation science given by the American Society for Mining and Reclamation, and the Gamma Sigma Delta Research Award of Merit.

He has received multiple "Best Paper" awards from the Soil Science Society of America and was elected a Fellow of the Soil Science Society of America in 1996. His high-quality research has brought him international recognition and he has been an invited keynote speaker at major conferences in Greece and Portugal. He has traveled abroad for the U.S. State Department advising on land restoration techniques.

Dr. Burger has authored six book chapters, over 70 technical papers and refereed monographs, and over 130 other papers on various original research subjects. He has over 20 extension publications and over 150 professional presentations to his credit. To date, he has guided 34 masters and doctoral students through rigorous research programs. Dr. Burger is active in ten professional societies and organizations and has held leadership positions in many of them.

Dr. Burger is a distinguished academician who brings together a mix of rigor in his academic expectations, demands of excellence in research and compassion for students while serving as a superb pedagogical model.

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The Challenge

The University of Arkansas at Monticello School of Forest Resources was founded on dedication and commitment to service. It began with Henry H. "Hank" Chamberlin's amazing contributions to the school over a 35-year period. In 1945 Hank Chamberlin began with no classroom, no equipment, and no budget. But he had three brave, willing students and the courage and determination to begin a forestry school in Arkansas that would serve students, forest landowners, and the public at large. The Arkansas Forest Resources Center was founded in 1989 with the same dedication and commitment to service and a mission to enlarge the body of knowledge in renewable forest resources and to disseminate new ideas and technology. This service is especially important in a state with 50% of its land area covered with forests, a state with rich and abundant wildlife and thousands of miles of fishable streams, a state with more than a million acres of forested wetlands, and a wood-based industry with timber as the number one cash crop. Based on the excellent teaching, research, and extension programs in place and planned for the School, the UAM forestry community will surely provide the leadership and service to ensure sustainable forest resources and an improved quality of life for the people of Arkansas and beyond.

The challenge of managing the state's forests to sustain these valuable resources will increase as its citizens demand greater and more diverse values. I will argue that to fully meet this challenge, your School faculty, administrators, and students alike must become fully engaged with your public clientele through a program of outreach that transcends the traditional teaching, research, and extension functions of the Land-Grant model. My objectives in this presentation are to re-emphasize the value of forests and forestry, examine the Land-Grant model and question its adequacy for meeting your mission, distinguish between research output and research outcome, examine the meaning of scholarship in the context of the tripartite mission, and suggest that a sense of service must permeate all School and Center activities in order to achieve overall excellence.

Forest Products and Services Sustain Life

Forests provide myriad timber and non-timber forest products, as well as ecosystem services including watershed control, water quality, carbon sequestration, wildlife habitat, biodiversity, and recreation opportunities. I discovered this firsthand growing up on a grain and livestock farm in southern Indiana. In addition to 200 acres of corn, wheat, soybeans, orchards, and permanent pasture, my family had 60 acres of mature, mixed mesophytic forest from which we extracted game animals, mushrooms, ginseng, paw paw fruits, hickory and walnuts, wild cherries and grapes, wild honey, and high-quality veneer logs. Growing up on the family farm in the 1950s and 60s, I didn't think much about carbon sequestration, but clear water in the creek running through the forest, the squirrels, rabbits, raccoons, and deer that I pursued during the regular hunting seasons, and the solace the forest provided for weekly Sunday afternoon hikes were forest services that were clear and valuable even to a boy.

Forest products and services are increasingly important to the public at large as well as to those of us who had the opportunity and need to subsist from the forest on a daily basis. To reduce it to a personal level, I tell my students that their yearly consumption of wood amounts to two 20-inch trees that are about 75 feet tall. Value to society of watershed control and water quality and other forest services is enormous and is becoming more appreciated as economists are able to fully evaluate these benefits. With a raised awareness of the value of forests on the part of landowners and the public, the changing condition of our nation's forests and the influence of forestry practices on forest health have become perennial issues of concern. As a result, the need to manage forests sustainably to produce products and services in perpetuity is widely shared.

Sustainable forestry is forest management that meets changing human needs by growing, nurturing, and harvesting trees for products and energy while conserving and protecting soil, water, wildlife habitat, and the integrity of forestland. A call for monitoring sustainable forestry was made by the United Nations Conference on Environment and Development (UNCED) during the Rio Earth Summit in 1992. Post-UNCED initiatives, including the Montreal Process (1995), on which the U.S. was a signatory, have developed criteria and indicators of sustainable forestry, not all of which are fully founded in science. Sustainable forestry is required by law within the U.S. National Forest System (Powers et al., 1998), and the USDA Forest Service is charged with ensuring that forest productivity is protected. On corporate forestlands, the American Forest and Paper Association requires member companies to participate in a sustainable forestry initiative (American Forest and Paper Association, 1995). Furthermore, increasing numbers of non-industrial forest landowners are attempting to practice sustainable forestry based on a personal stewardship ethic. Therefore, the forestry community at all levels needs science-based best management guidelines to ensure that forestry is sustainable.

The Land-Grant Missions

Historically, the scientific foundation of forestry has been largely provided by Land-Grant colleges, schools, and departments of forestry like your UAM School of Forest Resources and your Forest Resources Center through a process of research and outreach. The teaching mission of the Land-Grant colleges is stated in the Morrill Act of 1862:

> "...to teach such branches of learning as are related to agriculture and the mechanical arts...in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life."

The 1887 Hatch Act and the 1914 Smith-Lever Act further charged the Land-Grant colleges with a three-part mission of teaching, research, and extension. As the forestry community pursues a goal of sustainable forestry, the Land-Grant colleges must continue creating new knowledge to underpin the development of forestry best management practices and then deliver that knowledge directly to the landowner in order to achieve an outcome.

My first experience with the Land-Grant research and outreach missions was as a teenager on the family farm. In 1938, with only 8th-grade educations, my grandfather and father (Figure 1) started an innovative hybrid seed corn business and sold seed in a three-state region until my father's death in 1973. They

were very successful farmers, having carefully integrated the seed business with diverse, traditional farming enterprises including hogs, cattle, small grains, and woodlot forestry. Years later I appreciated the fact that my family's farming success was a function of interaction with Purdue University's Land-Grant agriculture faculty who made outreach visits to the farm.

Figure 1. August Burger and son Emil: beneficiaries of Land-Grant University research and outreach—1948.

Due to changing priorities and perspectives during the decades of the 1970s and '80s, the public service mission was de-emphasized for teaching and research faculty. Research expenditures and new-knowledge outputs were emphasized while the public service mission was relegated to extension faculty disconnected from the research process (Kellogg Commission, 2000).

This research/outreach disconnect is illustrated by the Land-Grant Research/Outreach Model recently depicted by the National Association of Public Forestry Schools and Colleges (NAPFSC, 1999) (Figure 2). The model shows that the landowner's or public's questions are answered by extension foresters using existing information. In the event information doesn't exist to answer the question, the extension forester directs the question to a Land-Grant university as a research need (Figure 2). Teaching and research faculty do basic and applied research with research assistants and students to create new knowledge to answer the need. This new knowledge is a research output that is pub-

lished in research journals. However, studies have shown that it can take 5 to 15 years before this new knowledge is interpreted by extension foresters and applied for the benefit of the landowner. The slow process of creating a research outcome (e.g., applied forest practice) from a research output (e.g., research journal article published in Forest Science) has been criticized (Kellogg Commission, 1999).

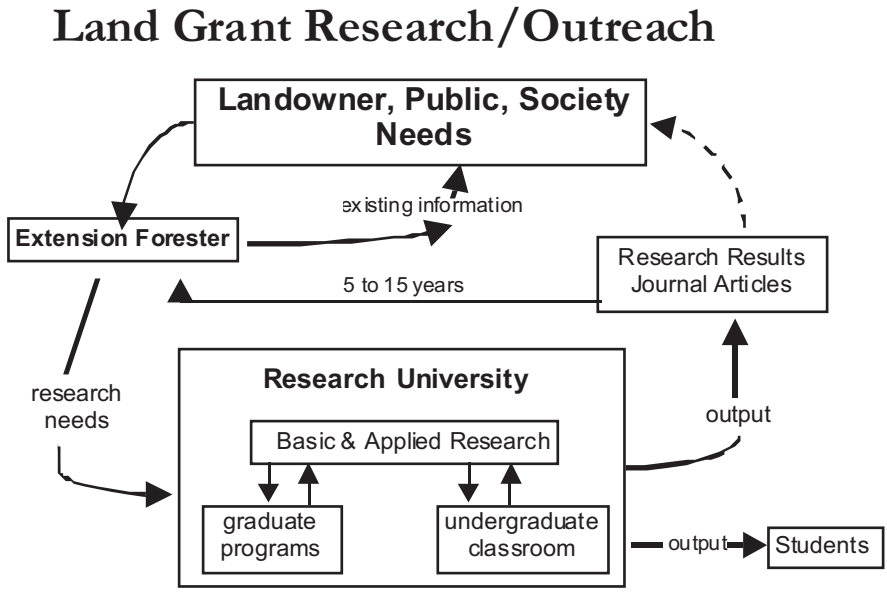

Figure 2. The Land-Grant university research and outreach model showing the flow of information to landowners and the public (NAPFSC, 1999). The gap (dashed arrow) between Research Results and Landowner Needs represents a disconnect between research output and research outcome.

During the 1990s, The National Association of State Universities and Land-Grant Colleges began to recognize a growing disconnect between the public and their institutions. In 1995 they sought support from the W. K. Kellogg Foundation to examine the future of their traditional mission. The Kellogg Foundation undertook a six-year study on the future of state and Land-Grant colleges that resulted in a final report, published in 2000, entitled *Renewing the Covenant*. In a climate of urgent requests for solutions to problems, the Commission found a growing public frustration with unresponsive college teaching and research faculty and administrators; a perception that we are out of

touch and out of date; and that we cannot bring resources and expertise to bear to solve problems. The Commission noted a new emphasis on accountability and productivity from trustees, legislators, and donors. The Commission recommended that we become more "engaged" with our clientele, commit to sharing and reciprocity, develop mutual respect among partners, do relevant research on critical problems, and put knowledge to work. In addition to an emphasis on relevant and timely questions, these recommendations suggest that a fundamental change to the Land-Grant Research/Outreach Model is needed to ensure a direct connection between teaching and research faculty outputs and outcomes. That is, with the help of the research faculty who created the new knowledge, research results need to be directly implemented to effect changes in practice or policy.

More or less co-incident with the Kellogg study, the National Research Council formed a Committee on the Future of the Colleges of Agriculture in the Land-Grant University System. The committee's charge was to assess the adaptation of the Land-Grant colleges of agriculture to the public's changing needs and priorities and to recommend public policy and institutional change that could enhance the colleges' roles in serving the national interest (National Research Council, 1996). In their 1996 report, the committee recommended that the Land-Grant colleges revitalize the linkages among teaching, research, and extension by combining federal formula funding for research and extension. The idea was to require a coordinated effort to link university research and extension to encourage their integration. Formula funds were combined, but the intended effect of integrating extension and research is less certain.

Recognizing that progress in resource management must be underpinned by an academic research base, a second important committee recommendation was that the entire university be accessible and responsive to our public clientele. To accomplish this, the committee recognized that administrative structures, incentives, and reward recognition must be generated within the university to promote the commitment and involvement of faculty, staff, and administrators across the university to actively participate in outreach, extension, and public service (National Research Council, 1996).

Teaching/Research Faculty Perspective

Keeping one's finger on the pulse of research needs within the forestry community is not too difficult. Stakeholder organizations constantly update research wish lists and are often willing to help leverage funding to pursue their priorities. Participants in the Seventh American Forest Congress held in

Washington, D.C., in 1996 developed a list of "Research Needs to Sustain the Forest." The recently completed Southern Forest Resource Assessment (Weir and Greis, 2002) concluded with a list of "knowledge gaps and scientific uncertainties;" and the Southern Industrial Forest Research Council's annual report contained a review and recommendations for cooperative research (SIFRC, 2000). Notable among overlapping recommended research topics were:

- Sustainable forest productivity
- Water quality and forested wetlands
- Fire ecology and management
- Ecosystem structure, function, and processes
- Forest utilization—timber, fiber, chips
- Management of wildland-urban and agro-forest interfaces
- Markets, management, and values
- Decision support tools and management models
- Social science, public needs and perceptions

The SIFRIC recommendations also included suggestions about how to structure and manage the research:

- Develop creative funding mechanisms
- Obtain outside grants
- Do multidisciplinary research
- Research multiple factor interactions
- Do process-level research

Identifying timely research questions, obtaining funding for conducting research, and then actually doing the research are important steps in the Land-Grant research/outreach model, but more difficult and equally time-consuming is the process of outreach to achieve research outcomes. Outreach requires a different set of skills; it requires travel that is often incompatible with teaching schedules, it is rewarded to a lesser degree than research and teaching, but it can be one of the most personally rewarding activities of all.

An initiative within my own research program over the last two decades has been restoring forests on drastically disturbed surface-mined land. The problem and benefits were obvious, the funding was forthcoming, and the research results were clear and publishable in journals. Research outputs consisted of graduate student degrees and journal articles. But application of the results was

challenging and difficult. Reforesting mined land is complicated by reclamation practice, economic disincentives, regulations biased against forestry, and miners who understand little about forests except that they are in the way of their mining operations. Over a period of 15 years, using extension mechanisms such as field tours, demonstrations, on-mine research, extension bulletins, and one-on-one consulting with miners, landowners, and regulators, I was eventually able to apply research results to the ground. This effort resulted in a research outcome consisting of new guidelines and regulations for reforesting mined lands accepted and promulgated by state reclamation and enforcement agencies in three states. Thousands of acres of disturbed land have since been reforested. With my outreach effort, I helped the extension foresters close the gap between producing a research output and achieving an outcome (dashed line in Figure 2).

Rewarding Outreach and Service

Applying research results to achieve outcomes, the upshot of the Kellogg Commission and National Research Council reports, is a time-consuming process that has not been adequately rewarded in the past. Therefore, it is unlikely that the recommendations found in these reports will be followed unless the reward system for teaching and research faculty changes. Historically, Land-Grant universities have disproportionately rewarded research, or the creation of new knowledge, over that of applying existing knowledge. In effect, this short-circuits the research/outreach process at the expense of our public clientele. In a study by the Carnegie Foundation for the Advancement of Teaching entitled *Scholarship Reconsidered: Priorities of the Professoriate*, Ernest L. Boyer, then President of the Foundation, suggested that for America's colleges and universities to remain vital, a new vision of scholarship was required (Boyer, 1990). He observed that scholarship is often thought of as a sub-category of research and that a comprehensive view of scholarship is needed that recognizes the full range of faculty talent and the great diversity of functions performed. He argues that knowledge is acquired through research, through synthesis, through practice, and through teaching, and so the scholarship of discovery, integration, application and teaching are tied inseparably to each other and should be valued equally. If Boyer's suggestion were applied during faculty promotion and tenure evaluations, that is, if equal weight were given to the scholarship of research and outreach, the goals of the National Research Council Committee and the Kellogg Commission might be met.

A follow-up Carnegie Foundation report, *Scholarship Assessed: Evaluation of the Professoriate* (Glassick, et al., 1997), provided standards that might be used in

assessing scholarship in all its forms. However, there is little evidence that these reports had a significant effect on university faculty evaluation procedures (Kovar and Overdorf, 1996). Most Land-Grant colleges are contained within research universities that obtain their national ranking based on research expenditures. To achieve and keep national stature and ranking, an emphasis on grant writing for "big-money" projects by all colleges within a university is needed. Therefore, the outreach goals of Land-Grant colleges and the research goals of universities that contain them can be mutually exclusive. Furthermore, there has been little formal effort to examine and remedy this dilemma.

A promising exception is an effort by The Pennsylvania State University, both a Land-Grant and top-ranked research university, to consider the role of outreach within a full range of scholarship as defined by Boyer (1990). In 1998 a committee of faculty and administrators undertook a study on how to best recognize and document outreach scholarship. In 2000 they published their report, *UniSCOPE 2000: A Multidimensional Model of Scholarship for the 21st Century*, where UniSCOPE stands for University Scholarship and Criteria for Outreach and Performance Evaluation (UniSCOPE, 2000). The model attempts to change an academic culture that shows preference for rewarding basic research and teaching over other forms of scholarship. The model equitably measures a full range of scholarly activity and rewards specific types of scholarship that apply to certain fields (Figure 3). Shown in the diagram is part of their measuring device depicting research scholarship as a function of Discovery, Integration, Application and Teaching by Research Type, Delivery and Audience. In this example, a faculty consultation on an applied practice made to a combination of private, public and professional organizations is documented and would be weighted equally with any other combination of research type, delivery, or audience. This Penn State University approach can provide a model for other colleges and universities to fully credit outreach scholarship and encourage faculty engagement with Land-Grant stakeholders.

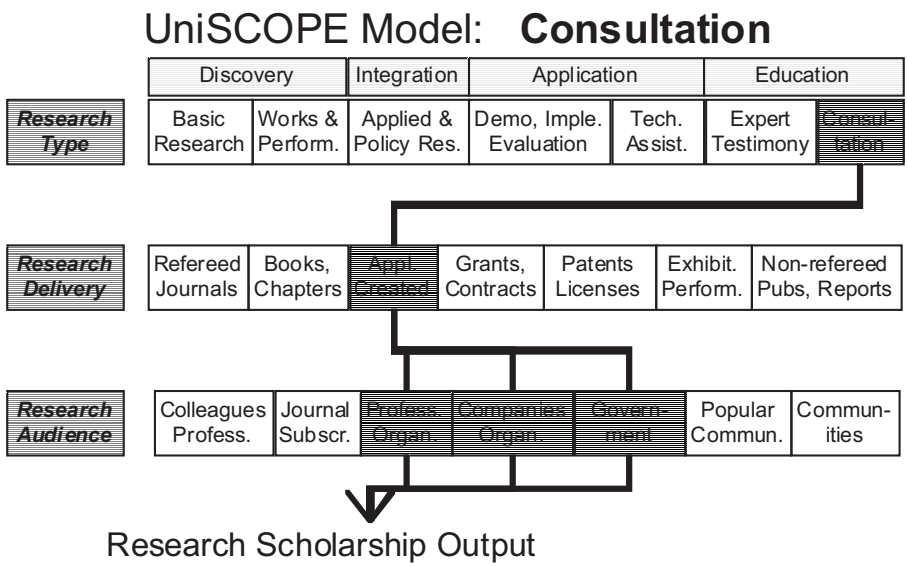

Figure 3. Part of The Pennsylvania State University UniSCOPE Model for assessing outreach scholarship (UniSCOPE, 2000).

Conclusions

Integrating research and outreach to better apply results of forest science for better forest land management is a Land-Grant College imperative. Governments, trustees, donors, and the public are encouraging administrators and researchers to become more engaged in meeting immediate public needs. However, doing it all—discovery, integration, application and transmission of knowledge—is very time-consuming. Nonetheless, if university rewards mechanisms are consistent with university outreach goals, teaching and research faculty will respond to new outreach challenges.

But what is a faculty to do while administrators revise goals, missions, strategic plans, and rewards systems to better serve the public? I believe the answer is to charge ahead with knowledge, courage, integrity, curiosity, and persistence—the basic characteristics of scholarship—knowing that your research and outreach program is timely, based on current questions, and serves the goal of achieving sustainable forests and forestry. However, to help ensure a focused effort of integrated research and outreach, be an expert at something and good at lots of things; be accessible and responsive to all clientele individually and as groups; encourage joint definition of problems and questions; develop partnerships with stakeholders rather then conveying an impression of higher authority; and

include graduate and undergraduate students in outreach as well as research activity. In the process of executing research, use powerful experimental designs over time and space; pursue both short- and long-term relevant questions; stay neutral and maintain your objectivity and integrity; be a Boyer scholar: simultaneously discovering, integrating, applying, and transferring knowledge. In the process of reaching out, make sure you are helping your sponsors with their agendas, not yours; always give credit to your partners and thank your donors.

As I helped my father and Purdue University research faculty install experiments to test different hybrid seed corn lines, I became convinced at an early age that faculty outreach was a critical public service. Even as a high school student, I could connect the results of the experiments with the success of the family business. For me, including outreach as part of my research program seems like a normal, logical extension of my work, perhaps because I was indoctrinated at an early age and because my family had been on the receiving end.

In his arguments for broadening the view of scholarship to include outreach, Stephen Boyer credits C. Wright Mills, a Columbia University professor, as saying that "scholarship is a choice of how to live as well as a choice of career." I believe the same can be said for outreach and service: if outreach and service are choices of how we live, it makes it easy to choose them and do them as a career. It is evident that Hank Chamberlin made these life choices.

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