America's Forest Research Policy

Final Report by the Blue Ribbon Panel on America's Forest Research Policy

April 2, 2004

Executive Summary

America's population is growing in size and income. Our citizens want more from our forests. Forests are critical to sustaining our quality of life, providing wood and fiber products, clean water, fish and wildlife, jobs, community stability, recreation, and important ecological values. However, expanding urbanization and increasing regulation of forest practices are rapidly shrinking the available forest land base that provides these benefits and values. Obtaining the full range of values desired from our forests usually requires management and manipulation of the forest ecosystem. The detailed scientific information required to prescribe and apply these management activities must come from public investments in forest research.

According to a 2002 National Research Council report, America's forest research capacity is declining. The Blue Ribbon Panel on America's Forest Research Policy believes the nation will pay for declining research capacity and a lack of new information with a decline in forest conditions. The quality of American life depends on sustainable forestland management supported by the nation's forest research capacity. The consequences of declining capacity will be felt over the long-term as rising and competing demands for our forest resources exceed our knowledge and ability to provide them. The result will be ineffective and inefficient use of the nation's forestlands leading to a loss in overall economic and ecological benefits.

Our forest research capacity, if improved and expanded, will provide information to obtain the values we want, improve the productivity and qualities of our forests, and compete better in the global economy. The current research policy, however, is not building this needed capacity. Stable to declining funding for forest research, an aging science workforce, restructuring of the forest products industry, and increasing infrastructure costs have depleted existing capacity. Renewed attention to our forest research capacity, its structure and administration, and its deployment is essential to meeting current and future resource management demands.

The Panel makes two important recommendations regarding forest research and extension funding from the US Department of Agriculture (USDA).

1. Improve the structure of USDA forest research and its administrative processes to increase efficiency and effectiveness of all elements. Included are:
   - Forest Service research and development and technology transfer,
   - Cooperative State Research, Education, and Extension Service's (CSREES) forest research and extension activities, and
   - Research and extension programs in all the schools and colleges receiving forestry funding from the USDA.

   Focusing on results and linking research and outreach to information users will make budgeting and accountability more explicit and easier to improve.

2. Increase the total funding appropriated to the USDA for forest research, extension, and technical transfer by at least 50% as the structural changes are made and results realized on-the-ground.

Review, clarification, and implementation of these recommendations may require congressional action, but certainly will require improved collaboration among the two USDA agencies and their leaders of research, extension, and technical transfer.

America's Forest Research Policy

Background

In May 2002, the USDA Forest Service hosted the Forest Science Summit in Washington, D.C., to review the results of the National Research Council's Report on *National Capacity in Forestry Research*. The report raised many useful points, but it did not answer the questions:

- *Research capacity for whom?*
- *For what?*
- *And where?*

The Forest Research Advisory Council to the Secretary of Agriculture (FRAC) appointed us as a panel in early 2003 to follow up the National Research Council's Report. Our review was conducted from May 2003 through March 2004. We drafted *Talking Points* and associated questions, and then we systematically met with key individuals and groups representing forest research stakeholders. These interactions, followed by our analysis and interpretation, led to drafts of this document, which have been widely circulated. The Final Report states the essential conclusions of our ten-month review. It is addressed to FRAC, the Secretary of Agriculture, the leaders of the Forest Service and the CSREES, collaborators in America's forest research system, and the Congress, which funds the system and periodically gives it guidance through authorization legislation.

The Blue Ribbon Panel and its Members

The idea of a Blue Ribbon Panel emerged during the Forest Science Summit in May 2002. FRAC considered the idea during two meetings later in 2002, and FRAC's chair appointed an eight-person panel in early 2003. In its Report to the Secretary of Agriculture, FRAC said,

> *Our vision is an analysis that compares alternatives with the current allocation of forestry research effort and recent results. The priorities would come from the 2002 NRC National Capacity in Forestry, NRC's 1990 Mandate for Change report, and various external suggestions (e.g., industry's Agenda 2020). The results will help FRAC make recommendations that are more useful and help the Forest Service and Cooperative State Research, Education, and Extension Service allocate funds and scientific effort.*

The group selected is knowledgeable about forestry research and represents regional and problem perspectives across the nation. The members are:

- William Bentley, Salmon Brook Associates, North Granby, CT
- George Brown, Alabama A&M University, Normal, AL
- Jane Difley, Society for the Protection of New Hampshire Forests, Concord, NH
- Alan Ek, University of Minnesota, St. Paul, MN
- Sharon Haines, International Paper, Savannah, GA
- Greg Johnson, Weyerhaeuser, Albany, OR
- Hal Salwasser, Oregon State University, Corvallis, OR
- Gerry Thiede, retired Michigan State Forester, Lansing, MI

Americans Want a Variety of Values from Their Forests

America has a remarkable wealth and diversity of forests. The demands for all forest values and resources are rising in dollar, environmental, and political terms. Consequently, leading industrial, community, and environmental interests often clash over forest policies on public lands. America's forest policy conflicts are not limited to National Forest issues, however, even though it sometimes appears that way. Values from forests are threatened by many forces, for example, urban sprawl, changing land uses, fragmentation, invasive plant and animal species, fire, and unmanaged recreation.

Values from Forests

Forests support our quality of life and are valued for:

- Clean water and clear air
- Wildlife and fisheries
- Recreation and spiritual renewal
- Cultural and natural heritage
- Wood and fiber products; housing, paper, chemicals
- Jobs and incomes for families; subsistence values for some
- Private property ownership by individuals, companies, and nonprofits
- Carbon storage and climate
- And many other goods and services

Who Owns America's Forest Lands?

An overview of America's forest ownership washes away many false impressions held by the public. The 749 million acres of forestland is one-third of the nation's land base. About one-third of the forest land—245 million acres—is noncommercial, mainly in federal ownership in the West, with much of the area in national parks, wilderness, or other permanent reserves.

Ownership of Commercial Forestland

Ownership category	*Million acres*	*% Commercial forest*
Small private woodland ownerships	290.7	58%
Forest industry and investment institutions	65.6	14%
National Forests[1]	96.6	19%
Bureau of Land Management (BLM) and other federal (including tribal trust lands)	13.1	3%
State and local public	37.6	7%
Total	503.6	100%

Source: Forest resources of the United States, 2002. Gen. Tech. Rep.NC-241 (In press)—provided courtesy of USDA Forest Service.

[1] This number may exaggerate the acreage actually available for commercial timber production. For example, one reviewer informs us that the National Forest System's actual timber production acreage is 47.3 million acres, which is considerably less than the 96.6 million listed in this table. The same point may hold for the Bureau of Land Management, and to some extent other public lands. However, we have no estimate of the specific reductions that are appropriate.

Our focus is on the 504 million acres of commercial forests—forestlands capable of producing commercial timber harvests on a sustainable basis and not in reserves—because of their biological productivity for many different values. However, this focus is not to the exclusion of noncommercial forestlands. For example, California's oak woodlands are a major source of biodiversity in the state—and mainly privately owned. In addition, it is difficult to consider the landscape ecology of large public forest holdings in the West without linking private and commercial forest with wilderness and other reserved lands.

Ownership diversity of the commercial forestlands is why public funding for research is needed. Individuals or small private organizations—more than 10 million owners—own most of the commercial forest lands. These are commonly called non-industrial private forest owners, but referred to here as small woodland owners because that designation portrays the many reasons for private ownership beyond timber values. Most private woodland acres are in the East and South. Only 22% of commercial forestland is in federal ownership, mainly in the West. Most private owners and local public owners cannot fund research or provide technical and managerial expertise on the ground. They rely on public funding for new information and transfer of technology. This audience is changing. There are many more owners of yet smaller parcels often close to newly developing urban and suburban areas.

Threats to Forest-based Values

In 2003, USDA Forest Service Chief Dale Bosworth outlined the four largest threats facing the National Forests System as:[2]

> ***Invasive species:*** *Legions of non-native and destructive weeds, insects and other pests—to which our forests have little or no natural defense—are eating the woodlands and grasslands alive.*
>
> ***Unmanaged recreation, especially off-road-vehicle use:*** *The high-tech, powerful toys can run roughshod over almost any terrain, far from any road. As the number of ORVs* [off road vehicles] *has skyrocketed, so have erosion, wildlife harassment and wetland damage.*
>
> ***Loss of open space:*** *In years past, national forests were surrounded by ranches and farms. Today, many are hemmed in by condos, trophy homes and strip malls. One result has been an alarming loss of wildlife habitat. The proximity of houses and commercial development also makes it politically difficult for the Forest Service to do all it can to combat invasive weeds and wildfires.*
>
> ***Wildfire:*** *Huge blazes like the 2002 Hayman fire* [and the 2003 southern California fire complexes] *captured attention but did little to help the public understand why such titanic fires erupt—and what can be done to reduce their size and power.*

The *Denver Post* notes … *the same threats also loom over national parks, wildlife refuges, Bureau of Land Management properties and state lands.* We observe that these threats are even more critical to the production of forest-based values on the 73% of the forestlands in private ownership. Despite better control and ease of management by private owners, these threats can

[2] Chief Bosworth's comments are quoted from Sunday, September 28, 2003 *Denver Post* editorial, *Forests face fresh threats*.

and do cross private boundaries. Research can develop solutions for dealing with these threats and other problems.

Important changes are occurring on the American rural landscape. For more than 50 years, the size of farms increased as farmers bought up other farms to create more economic units. At the same time, big timber companies bought up smaller companies. USDA research units and the Land Grant colleges adjusted to meet these changes. Today, two other factors are changing what is happening to America's rural land. Urban sprawl is chewing up vast quantities of farm, range, and forestland, converting it into ranchettes, farmettes, and tiny woodlots that are not economic units. Wall Street has finally convinced many industrial owners that it is foolish to hold on to large land inventories, and companies are selling huge forest land areas in recent years. These changes have profound implications for what should be happening in forestry research and where that research should be happening.

Research Helps Us Obtain the Many Values We Want from Forests

Historically, America's forest research system has met the challenges of the times. For example, it produced the information needed to implement:

- Sustained-yield forestry
- Water and soil protection
- Modern forest harvesting, processing operations, and new products
- Insect and disease management
- Technology and methods for fighting catastrophic fire
- Reforestation on harsh sites, like mineland reclamation
- Maintenance of fish and wildlife resources in managed forests
- Enhanced recreation values in diverse landscapes

Obtaining the future values desired from forests usually requires some form of management and manipulation of the forest ecosystem. Harvesting timber and biomass often is not the primary goal, but an important means for achieving wildlife habitat, scenic views, watershed protection, forest health, and many other values. In addition, providing certain desired future values from the forest requires a viable domestic forest products industry—markets for timber must exist for harvesting to be an option and to sustain incentives for private owners to keep forest lands in forest use for forest values.

Research results help keep American private forests competitive with rapidly emerging competition in developing countries. America is the world's largest market for wood products. If American forests do not remain competitive wood sources, our imports will rise and family forest owners will lack the markets and financial motives to retain their land in forests. Southern California illustrates the consequences of having no viable local industry to conduct salvage and thinning efforts on public and private forests.

Scientifically sound information delivered to forest practitioners and landowners allows them to reach their goals. This is why forest research must focus more on protection, restoration, production, and education in a context of increasingly diverse demands for a wide variety of forest uses, values, services, and goals.

America's Core Forest Research System is in the Department of Agriculture

The core of the forest research system is in the US Department of Agriculture (USDA). In dollar terms, annual appropriations of about $300 million support forest research, technology transfer and extension, and closely related activities in two USDA agencies.

Additional research funds flow through several other federal agencies, such as the National Science Foundation, National Aeronautics and Space Administration, the Department of Energy, the Department of the Interior, and the Environmental Protection Agency. States and the private sector are also major sources of research and outreach funding. The Panel, however, focused on the USDA funds because they are the most likely to influence on-the-ground practices on the nation's 749 million acres of commercial and noncommercial forestlands.

FY 2004 USDA Forest Research Funding	
Forest Service (FS) research	FS R&D was $266 million; $235 million to FS forest experiment stations and the Forest Products Laboratory; $30+ million passed to universities and others under cooperative agreement or earmarks; $52 million is for the Forest Inventory and Analysis. The President's proposed budget for FY 2005 is $280 million, with increases in part supporting Healthy Forest initiatives. Another $5.1 million in International Forestry–largely concerned with research and technology transfer in developing nations. About 10% of the FS State and Private Forestry (which totals $279 million) supports technical transfer—$27 to $30 million—and FIA ($5 million).
Cooperative State Research, Education, & Extension Service (CSREES) research and extension	Almost $22 million for the McIntire-Stennis Cooperative Forestry Research Program—formula funds distributed to public universities (mainly forestry programs in land grant institutions); must be matched by state funds. $4.0 million through Renewable Resources Extension Act (RREA) distributed to cooperative extension units at land grant universities for outreach and technology transfer. $8 to $15 million in the NRI competitive grants program—focused on *Big Science* questions concerned with forests, but % allocation to forestry is shrinking.

We also believe that USDA funding for core forest research capacity is more stable and more broadly directed than funds from other sources. This is especially important as we look toward the next decade. Public funding for research on forests and renewable resources, while critical to the nation, will be under constant pressure because of overall budget deficits. A clear

understanding by Congress of the benefits from public investments in research on forests and renewable resource questions is necessary to continue and expand this support.

Further, the role of industrial research is changing and declining overall. As the global forest products industry consolidates, many industrial lands are being sold to investment organizations, such as pension plans and syndicates with no tradition of supporting research. This reduces the complementary research role industrial organizations have played over the past 50 years, especially their focus on timber productivity questions.

Public Support of Forest Research Is Necessary and Desirable

The arguments for public funding of forest research in America parallel the rationale for public research investments in agriculture, energy, clean air and water, and similar resource arenas. Many problems are too large, pervasive, or complex for the private sector to address. In many cases, private capture of intellectual property rights is not possible, and sometimes not socially desirable.

Public funding requires public policy to guide the funding allocations. Additionally, it makes sense to periodically evaluate the results from such investments and refine our course. Complicating matters, the major stakeholders in America's forests do not share a common national vision regarding the values forests should provide. Consequently, no collective vision exists about what information research should provide so that each group can work toward the future forest values they desire. We believe these voices can come together on what we see as substantial common ground.

Our Forest Research Capacity Is Declining

We expect that future demands on forests will increase for virtually every use and value they can provide. We also expect that threats to the forest land base——loss of comparative value in forest uses, loss of open space, invasive species, and fire—will increase. This array of threats requires more value from less forestland, often involving a choice between more intensive management or putting fragile forest lands under yet more stress.

Research must show how to sustain all the forest values and uses Americans will demand. Yet, real spending on federal forest research is declining. An aging scientific workforce is retiring and not being replaced. Many disciplines and specialties are disappearing. For example, forest entomology, covering the many new invasive insects such as the Asian Long-horned beetle and the Ash Borer, is a vanishing research specialty. Wood products engineering, tree physiology, and forest policy analysis are other examples where capacity is declining.

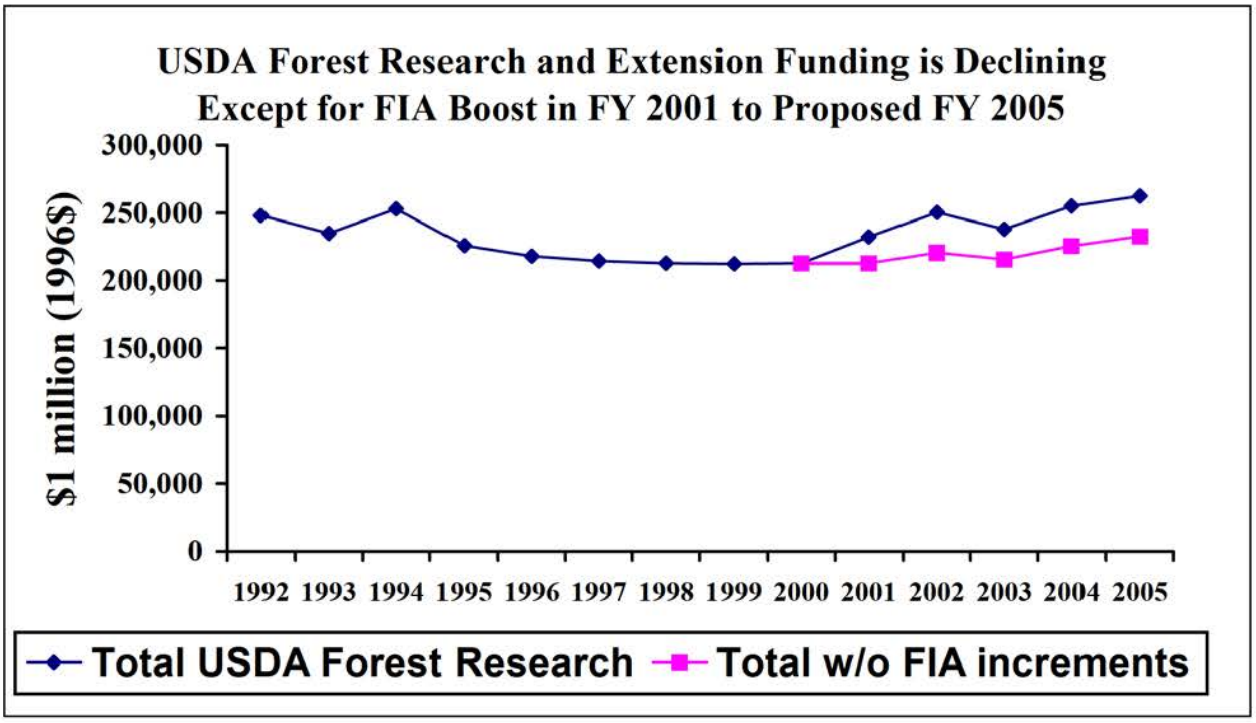
The graph on the next page sums USDA funding for Forest Service research, McIntire-Stennis Cooperative Research, and Renewable Resource Extension for Fiscal Years 1992-2004. Some increases occurred following the release of *Mandate for Change*, a forest research review published by the National Academy Press in 1990. A steady decline led to a 16% reduction in real dollars by FY2000 (base year is 1996).

The appropriation increases in FY2001 and FY2002 brought the total almost back to the FY1994 peak, but this picture hides more than it reveals. The rapid increase was due to more than a decade of prompting by a coalition of state foresters, industry, and others that the Forest Service and Congress bring the Forest Inventory and Analysis (FIA) budget and results up to standard. The FIA argument began well before the 1992 starting point of our graph. The FIA funds were new money added to the budget, not reallocations.

In FY2005, proposed McIntire-Stennis and RREA funding would decrease in real dollars. The Forest Service funding increase is for FIA. The National Research Initiative (NRI), in contrast, has a proposed increase of 7.59%, typical of proposed increases in federal research funding.

USDA Program	***% change***	***FY 2004 Actual (Millions of 1996 $)***	***FY 2005 Proposed (Millions of 1996 $)***
McIntire-Stennis	-1.38%	19,000	18,738
RREA	-0.67%	3,528	3,505
Forest Service research	+3.30%	232,664	240,346
NRI	+7.59%	143,255	154,123

We are among the strong supporters of increased funding for FIA, and applaud the Administration and Congress for responding to strongly expressed needs by the many stakeholders. However, overall we see almost a 20% real dollar decline in USDA forest research funding since FY1994, except for FIA. We are concerned that the Forest Service, CSREES, and the Congress do not recognize the need for a strong USDA forest research program.



America's forest research capacity also is declining because the global forest industry is consolidating. Several corporate forest research groups that historically complemented federal

and university research have already disappeared. The new timberlands investment organizations rarely fund research or collaboration among forest landowners and research organizations. The few remaining industrial research organizations cannot answer all the challenges to America's forest lands as their focus is on issues related to timber production. This change creates yet stronger arguments for federal funding of the core USDA forest research capacity.

Capacity is not simply the number of scientists or total funding for people, laboratories, and field stations. The private sector has discovered that effective problem solving requires people from all of America's diversity. The same is true in forest research. Research needs to address the interests of all segments of society. Current federal funds are inadequate to engage the 1890 and 1994 universities in research or the education of minorities. This lack of investment undermines the results and hinders stewardship of America's forest future.

The capacity problem will not cure itself. Funds for forestry research are inadequate to attract and retain the diverse research talent required to address current and emerging research questions. Forest research must compete with pharmaceuticals, electronics, and other technical fields for the *best and brightest* young people in very competitive and economically stressed university and governmental environments.

The nation's forest research system should include the scope and potential for complementary research in universities and institutions beyond the traditional forestry realm, especially with respect to non-timber attributes and values of forests. Many universities do credible research related to ecology, flora, fauna, water, and local ecosystems that provide useful information to integrate into broader forestry knowledge.

Improved Linkages between Forest *Science* and *Practice* Increase Capacity

The increasing distance between research and practice stood out as an issue during our review. The relationships in forestry among research, development, and practice clearly deserve more consideration. Forest practitioners find it difficult to reach and pose questions for scientists to solve; scientists have trouble listening to practitioners' problems and converting to solvable scientific questions. Dialog is often more technical than the public can understand. In part, this reflects cultural differences. The various groups face different realities, including the differences between solving practical field and factory problems and addressing scientific problems.

Why should Congress care if scientists, practitioners, and forest landowners are not communicating well? We think Congress should care for two reasons. First, one-third of the nation's landscape is forest, and forests can contribute more than they currently do to our economy and to the quality of our lives. Second, and more to the point, Congress can rewrite the rules guiding public funding so a more fruitful dialogue occurs.

Applied research requires combining science and outreach to solve problems. Effective extension begins with observing and listening. What are the clientele's problems? Can the question be answered by existing knowledge or easily repackaged information? Effective applied research begins with questions from clients, which is interpreted by outreach specialists where answers based on existing information do not exist. The process is not complete until specialists convert

the scientific answer into knowledge that practitioners and forest owners can use. Given this communications need, we believe the integration of funding and administration for applied forestry research with that for extension and other outreach will improve the overall capacity and flow of useful results.

Applied research should begin with a dialogue between the owners and managers of forests, industry, extension and research specialists, and the public as appropriate. This process helps insure that the right questions are asked and creates a demand for the answers, making technology transfer easier. Thus, the clients are both the beginning and end of the dialogue that leads to research and extension efforts, not merely the audiences to which technical transfer is directed. A motto for the research, extension, and client dialogue is *Better Questions Lead to Better Answers*.

So What Is Lacking in Forest Research?

Given clear gains in some areas, why are we not getting more from research? Our review suggests that in recent decades the Forest Service research capacity focused too much on the National Forest System—only 19% of the nation's commercial forest land base. Many people, including several federal researchers, share our perception. Statements before Congress explicitly note this focus in recent years. Given the many federal forest policy controversies of the past two decades, this focus by a line natural resources agency is not a surprising response. However, most federal forestlands already were under low-intensity management and many more were moved into this category by deliberate administrative decisions. The payoffs from scientific research focused on the national forests are not entirely obvious under these circumstances.

The focus on National Forest System problems is a relatively new trend and not what Congress directed over the past 75 years of forest research mandates. Both the Forest Service and CSREES have national mandates for research and outreach to all forest landowners.[3] Both USDA agencies have an increasingly diffuse role, with fewer staff and operational resources and reduced leadership for education, research, and extension. The Panel believes the USDA agencies are not attracting enough leaders to fully review projects and programs, create linkages with other agencies, and enforce accountability to program goals. This is most obvious in the currently understaffed CSREES program office.

Forestry schools, which are an integral part of the USDA forest research system, are less able to focus on the research problems of diverse private forest owners. Lacking funding for applied research, academic research capacity has increasingly responded to federal science grant programs and short-term industrial objectives. Solving complex problems faced by forest managers and owners requires an integrated research mandate and funding rarely present in these grants and contracts. Graduate student training also suffers as the focus shifts from skill development to short-term results. Stressed state funding also leads to greater use of federal funding for salaries and less for research operations and targeted problem solving. In the case of McIntire-Stennis funding, we suspect there has been a reduction in the portion going to support

[3] McNary-McSweeny Act of 1928 formalized the research mission of the Forest Service. The Forest and Rangeland Renewable Resources Research Act of 1978, which was amended through December 31, 1996, PL 104–333, modified this initial legislation.

graduate education and the training of future science capacity. Yet documentation and accountability for such trends is lacking.

Earmarks are also becoming a bigger percentage of the USDA forestry research budget. One appointed leader in the Department suggested that this is a symptom of drift and lack of attention to enabling legislation and its avowed purpose.

Adding to this concern, the Congress, despite annual reviews, has not held comprehensive hearings regarding forest research and extension since the late 1970s, and perhaps not since the McIntire-Stennis Cooperative Forestry Research Act was passed in 1962.

Balance, Reform, and Funding

Refocusing USDA investment in forest research requires new designs, investments, and delivery mechanisms to rebuild America's forest research system. A starting point is recognition that science problems are not the same as management problems; so applied research must combine science and outreach. At the same time, basic and long-term research is needed to build the knowledge base and the capacity to train future scientists and problem solvers.

Effective solutions to real problems will also lay the groundwork for developing a shared national vision and voice that respects differences among America's forests, landowners, and society. The solutions will reflect understanding science and research roles in the future of these forests, but also the current challenges and future opportunities. This requires the difficult process of setting broad priorities based on America's needs for the future and developing funding mechanisms that guide USDA dollars to these priorities and associated problem solving.

Meeting these criteria and steps may be possible using the current Forest Service and CSREES organizations. After almost 100 years of forest science and extension in America, however, the nation may require more dramatic changes. While we do not recommend specific organizational changes, we do recommend that Congress and the two agencies consider major changes in the existing agencies and programs.

In particular, we suggest considering a unified budgeting process, perhaps entirely within the agricultural appropriations process. We believe adjustments are possible that would focus on applied research integrated with extension or outreach activities. This would improve the tracking of results from implementing new research and extension information.

The Forest Service has an important continuing role in Forest Inventory and Analysis and the stability of a federal agency makes it ideal for long-term research on forests. We recommend focusing the agency's long-term research on both private and public managed forests. This will provide logical connections and counterpoints to the *Long Term Ecological Research Sites* funded by NSF that are not managed.

Universities and their formula funding (current McIntire-Stennis and RREA funds) are especially important because together they build and maintain a significant part of the national system and give all states a base capability and a stake in the system and in forests. They also represent the

main capacity for outreach and technology transfer, and the best connection to the diverse small private woodland owners.

The proper balance between applied and basic research shifts with time and the complexity of issues. The balance depends in part on the starting point in terms of baseline appropriations. Congress allocated $292 million in FY 2004 to the Forest Service and CSREES for research and extension activities. The Administration proposes a FY 2005 budget of almost $307 million. We believe that an improved allocation mechanism, coupled with more funding, will lead to the desired results from forest research and the nation's forests.

Along with reform of budgeting and accountability, we recommend increasing total funding by at least 50% as results improve. The following table illustrates an allocation of $450 million in appropriated funds, which is roughly the 50% increase, using two allocation strategies: toward applied research and toward basic research. The research funds awarded on a competitive basis would use a process modeled after the current USDA National Research Initiative, although longer award periods may be desirable.

Applied research with extension or outreach	***Toward More Applied***		***Toward More Basic***	
	$ Millions			
FS FIA & long-term research on private & public forests	40.00%	180	48.89%	220
Formula funding to public colleges (e.g., McIntire-Stennis, RREA)	8.89%	40	6.67%	30
Competitive grants for applied. research & outreach	37.78%	170	22.22%	100
Competitive grants for basic research on forests	13.33%	60	22.22%	100
Total	100 %	450	100%	450

We must balance the rapid payoff of solving important current problems against longer-term opportunities for break-through innovations in forest productivity and biodiversity enhancement. America needs both applied and basic research regarding forests. The appropriate balance point is a major policy question that deserves a thoughtful response from the agencies and the Congress. Current estimates of the payoffs to research on various forest problems, short and long term, would help the Congress and the USDA make more sound financial decisions about total funding and budget allocations.

The Panel's Recommendations

We make two specific recommendations: one regarding the forest research system and its structure; the other regarding increased funding.

1. **Improve the current USDA structure of forest research organizations and consider alternatives that would unify programming for forest research, extension and technology, budgeting, and accountability, and reporting.**

The core of the nation's forest research and outreach system is funded through the USDA. Included are:

- Forest Service research and development and technology transfer,
- Cooperative State Research, Education, and Extension Service's (CSREES) forest research and extension activities, and
- Research and extension programs in the 50 states and the territories receiving forestry funding from the USDA.

While the system is most concentrated in the Forest Service research branch, it is located throughout the nation in many institutions. Focusing on results and linking research and outreach to information users will make budgeting and accountability more explicit and easier to improve.

The system needs to have uniform processes for budgeting and accountability. The budget goes through two different congressional committees, the agencies report to separate undersecretaries of agriculture, and the agency traditions are different in culture and focus. Perhaps the single most important difference is that the Forest Service's most dominant role is management of 191 million acres of national forest, which means it is an action agency unlike most USDA operations. The Research, State and Private, and International elements of the Forest Service are much more like the Agricultural Research Service and its agricultural elements in CSREES. These points are noted, not to say unification of budgeting and accountability is impossible, but to suggest that increased coordination and oversight will be necessary to make it happen.

We strongly urge that all applied research be integrated with extension, outreach, or technical transfer efforts. This will make accountability much easier and much more explicit for applied work. Publications and other common measures of output are important, but not as critical as on-the-ground application. We observe that the great successes of industrial forestry research and Forest Service and university programs (e.g., FIR, an integrated research and outreach effort in the Douglas Fir region of Oregon) have occurred where the desired results were implementation and were easy for all to measure.

Longer-term and basic research results are harder to measure, but also fall more comfortably into the conventional criteria for success and scientific progress found in NSF, NIH, or NRI projects. Reviews by peers every 3-5 years and open sharing of data help make sure that these efforts are of high quality and useful to both the scientific and operational communities.

As a vision of the future, we would like to see the USDA and its component agencies and partners as the "go to" place for information and solutions for productive management, protection, and sustainability of the nations forests. This further implies a structure that has

- the resources and flexibility to address today's issues effectively, both broad and local, and to respond to tomorrow's needs
- effective translation and communications capability—rapidly transforming scientific discovery to usable knowledge

The Panel believes this is a solid vision for the core American forest research and extension system, which includes Forest Service R&D, CSREES, forestry schools and related extension units, and Forest Service efforts in technical transfer.

2. Increase the total USDA funding for research on forests and related renewable resources by at least 50%.

While improved system and structure will produce more and better forest research results, the plain truth is that America is underinvesting in applied knowledge about its forests. A few points demonstrate why the total forest research funding to the USDA needs to increase:

- Flat funding in real dollars means declining funding in effective dollars. Salaries for top scientists are rising in real terms; the same is true for most equipment. Consequently, the forest research system has fewer scientist full time equivalents (FTEs), and is less able to compete for top women, minority, and other needed talent to have an excellent workforce in forest science.
- Marginal returns to investments in forest research are high. For many topics, like tree improvement, growth and yield, watershed quality, and improvements in utilization, the risks are low and the results spread over many thousands or millions of acres and/or firms. In terms of global economic competitiveness, we cannot afford to shrink from these investments. In other topics, like control of invasives or biotechnology, the risks are higher, but the returns are enormous and risks can be lowered by broad strategies of inquiry.
- Traditional strengths, like forest entomology and silviculture, are dying out as experts retire and are not replaced. Some new areas, like water quality changes with movement of the urban fringe into forested areas, are not pursued with appropriate intensity given the public health and economic costs of not dealing soon with these issues. From economic and ecological perspectives, we know too little about the consequences of forest fragmentation and its impact on the effective area of forests.

In earlier drafts of our report, we recommended Congress hold hearings on America's forest research system. This remains an important idea. Beyond that step, however, we hope the content and spirit of this report will help the system improve and set in place key benchmarks for progress.

Support

The work of the Panel was supported by small grants from the US Department of Agriculture and the American Forest & Paper Association. The Panel's activities were housed with the Connecticut Forest and Park Association, one of America's oldest conservation organizations.

Further Reading

The following references are useful for people who want to learn more about America's forest research system and the policies that guide it.

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