



Nanotechnology Growth Platform

Forest Service

Research and Development Mission Area

January 2009

VISION

Nanotechnology holds the potential to stimulate the next industrial revolution. Wood-derived nanomaterials can generate new high-value products, such as stronger, lighter paper and durable composites, which create new revenue streams for forest-based product manufacturers. Use of nanotechnologies promises new value-added features, improved performance attributes, reduced energy intensity, and more efficient use of materials. Commercial application of innovative nanotechnologies in forest products can increase use of sustainable materials from renewable resources and decrease reliance on oil-based products.

New revenue will create economic growth, new jobs, and new opportunities for skilled workers with materials we can grow, transport, and convert into value-added products in the United States and do so more efficiently than nearly anywhere else in the world. Both the European Union and the Asian countries are investing more than \$1.5 billion each in nanotechnology research every year. The United States is in a race with these countries to capture the economic benefits of increasing knowledge in nanotechnology.

The Forest Service's 75-year history of research on the basic properties of wood and wood fiber makes nanotechnology a logical next horizon for innovation.

CAPABILITIES

Although the nanotechnology research effort is fairly young, the Forest Service's experience in understanding the basic nature of wood and wood fiber is deep. We have already:

- Initiated basic research to characterize cellulose nanofibers
- Started basic research to develop nanofiber-enhanced papers and films
- Completed a roadmap for nanotechnology in the forest products industry
- Fostered innovation in nanotechnology in the forest products industry through sponsorship of three international conferences.

In addition, we are working closing with an industry association (American Forest & Paper Association) that has adopted a program to support nanotechnology.

DELIVERABLES

The following are some of the advances in technology that we will accomplish with an emphasis in nanotechnology in the Research and Development mission area:

- Much stronger and lighter paper and paperboard than currently exist.
- New fiber-based products that display the special properties of nanomaterials such as super strength, decay-proof lumber, and extra-durable siding for homes and businesses
- Stronger and more durable composites than exist today for use in buildings
- New catalysts for producing liquid fuels from wood

BENEFITS

In addition to the actions identified above, an emphasized science program in nanotechnology, Forest Service Research and Development will provide benefits including:

- Better infrastructure through lower cost, stronger, more durable building products
- Reduced impacts on the environment through increased use of recycled materials
- Improved human health via food packaging with bacteria-resistant layers and spoilage-retarding properties and shipping containers that warn of contaminants
- Lower postage and shipping costs for businesses and consumers from lighter-weight yet stronger papers
- Less fire risk for forests through increased use of woody biomass for liquid transportation fuels



Growth Platform Investments

Nanotechnology

INVESTMENTS

The investment for the Nanotechnology Growth Platform calls for increases totaling \$85,000,000. The table below illustrates our proposed growth strategy above the 2008 enacted level (Dollars in Thousands).

Item	Purpose	Year 1	Year 2	Year 3	Year 4
A	Generate, manage, and apply information.	Characterize woody nanofiber properties.	Continue characterization work. Develop handling procedures	Develop matrix-enhancing procedures.	Begin nanomanufacturing process investigations.
B	Develop staff capacity and infrastructure.	Increase material science staffing at several Stations. Develop staff and facilities.	Increase material science staffing. Enhance staff and facilities.	Increase material science staffing and technical support.	Expand material science staffing and technical support.
C	Accelerate nano program at FPL.	Continue baseline research in nano material characterization.	Continue baseline research. Begin nanomanufacturing research.	Expand nanomanufacturing research.	Explore adoption of nanosensors into forest products.
D	Develop and diversify partnerships.	Create partnership development officer position at FPL ¹ .	Attract industry partners to station scientists at FPL.	Continue partner development.	Expand partner development.
E	Develop and continue a competitive grants program for universities.	Establish production methods for nanofibers.	Develop dispersion methods for nanofibers.	Develop composites.	Expand composites.
Funding Increment:		\$20,000	\$20,000	\$20,000	\$25,000
Total Funding:		\$20,000	\$40,000	\$60,000	\$85,000

¹ Forest Products Laboratory