

## **Essay: Forest Research & Development History**

### **Introduction**

There are numerous **environmental concerns** facing society today and most of them center on ways of maintaining an ecological balance in our world. It is clear that currently we need fuel to run cars; keep homes warm or cool; and keep the lights on in schools and other buildings. Coal, oil, natural gas, wood products and other natural resources are all used daily. How do we balance society's needs with those of the environment?

One tool is scientific research. Researchers examine new types of fuels for our cars, new ways to reuse items (recycling), new forms of energy, more efficient appliances, and the list could go on and on. There are also researchers seeking ways to improve our forests and make improved use of forest products. Throughout the last century and a half, making better use of forest products as a result of forest research has had a significant influence on addressing environmental concerns in society. Forest research is intended to accomplish numerous goals. Forest researchers work to collect, analyze and report on things that might harm our forestlands, such as insects and diseases. Forest products researchers work to improve technology for using timber and other forest resources more efficiently.

One organization that conducts forest research is the U.S. Forest Service. As part of the Forest Service, the Research & Development branch contributes to scientific discoveries and conservation of many natural resources in the U.S. There are also many universities and several private companies that conduct forest research in the U.S. and around the world.

Forest research contains several focus areas. Some researchers focus on product safety and human health. Urban forest researchers might analyze the effects of an urban forest on air quality and water quality in the city. Other research focuses on the economics of forestlands. These researchers might examine the economic impacts of changes in laws that govern use of the forests. Others focus their research on various ecological issues in forests such as fire, plant genetics, insects, and forest diseases. Research is also conducted on watersheds, landscape management, soils, and wilderness.

Then there are those researchers that focus on forest products. These researchers are attempting to find new technologies to improve wood products and reduce waste when harvesting and processing trees. For example, a forests product researcher may come up with new ways to create paper using recycled materials.



**Image 1:** August 1957: General view of Kawishiwi Ranger District Laboratory personnel checking spruce branches for spruce budworm masses. Image from U.S. Forest Service, Eastern Region Historical Photograph Collection



**Image 2:** August 1957: Research Entomologist collecting samples in spruce budworm biological study area. Jim Bean Kawishiwi Ranger District. Image from U.S. Forest Service, Eastern Region Historical Photograph Collection

In 1909 the Secretary of Agriculture, James Wilson, announced the University of Wisconsin in Madison as the future site of the **Forest Products Laboratory**. The Forest Products Laboratory opened on April 1, 1910 and its primary goal was to discover new technologies for producing wood products while creating less logging waste. Developing more efficient ways of producing wood products meant more products from fewer trees.

### **Examples of Research Accomplishments**

#### **Naval Stores:**

One example of the contributions of forest research in the Southeast comes from the Lake City Research Center in Lake City, Florida, where new techniques for **naval stores** production were developed. Naval stores refers to products extracted from raw pine gum from living pine trees. These products included: turpentine, rosin, and pine oils. These materials were used in building and maintaining wooden boats. They were used on sailing ships to caulk seams and to protect ropes. No ship left port without them. These pine products are still referred to as “naval stores,” but they now have many different uses. Now they are used to manufacture inks, adhesives, perfumes, and hundreds of other products.



**Image 3:** March 1928, Chipping a streak on a face. A streak was usually chipped once a week from March to November. Usually 1/4-inch to 5/8-inch of wood is removed up the tree and 1/2-inch to 3/4-inch deep. A series of these streaks chipped one above the other is called a face. The face shown is the result of nearly one season's chipping. This man is putting the first streak on the second year's face.



**Image 4:** March 1928, Choctawhatchee National Forest, Florida. A typical view in a turpentine woods, showing trees which are being worked for the fifth year.

In 1925, naval stores gum production was an inefficient process that destroyed millions of small trees each year before they reached logging size. In order to extract the gum or resin from a tree, a deep cut was made each week in the tree. This wound to the tree, called chipping, would cause gum (sap) to flow. The gum was collected in an iron gutter system. The gum naval stores industry needed to collect a greater amount of gum through an easier method. And, at the same time they wanted to keep the trees growing. If the trees could be grown to a larger size, then many more products could be made from the same trees.



Florida



Georgia

**Image 5:** Naval Stores, 1950s. Improved gum naval stores extraction methods required new tools and techniques. Special tools were required for removing bark and applying acid-treatment. These pictures depict new tools and the application of sulfuric acid to increase gum production and reduce tree damage.

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Due to research, naval stores practices drastically changed over several decades. The Lake City Research Center found that nearly half of the chipping labor could be saved with no loss in gum production by spraying sulfuric acid on a fresh cut to prolong the flow of gum. This one research development saved the naval stores industry about a million dollars in 1951 when applied to about one-fourth of the producing trees. The Lake City Research Center also developed a new type of chipping tool which removed only a strip of bark, and left the tree usable for other resources, such as pulp and other wood products. Austin Cary, a logging engineer, and Eloise Gerry, the first female scientist to work at the Forest Products Lab in 1910, are two people often cited for their research contributions to the new chipping techniques and better production methods for the gum naval stores industry. Using a lighter bark hack for chipping spiral gutters for collecting the resin and bringing it to the collection basin, and double-headed nails were some of the new methods and equipment developed for extracting gum and all helped in creating more effective naval stores production.

#### **Watershed Research:**

One of the main reasons for establishing forest reserves, later to be National Forests, in the U.S. was for the protection and improvement of water supplies. The importance of forests in flood protection was recognized by foresters very early on. Between 1905 -1907 President Theodore Roosevelt declared over 150 million acres of forest reserves, mainly in the West. Research on the waters in National Forests was a priority almost from the beginning of the USDA Forest Service in 1905.

One of the first watershed studies in the U.S. was the Wagon Wheel Gap Project in Colorado, which began in 1909 and ended in 1926. This was a cooperative project with the U.S. Weather Bureau and the Forest Service. This project studied of the effects of timber removal on water yield (or stream flow) and erosion under the conditions of the central Rocky Mountains. The lead scientist of Wagon Wheel Gap was Carlos Bates. The Wagon Wheel Gap research plan was to observe weather patterns and stream-flow for two neighboring watersheds in the Rocky Mountains for several years. After make initial observations on both watersheds, the forestland in one of the watersheds was harvested for timber. Then a comparison was made for the amount of stream-flow and amount of erosion in the stream before and after removal of the forestland. The other watershed was used as a **control**. [In a controlled experiment, two nearly identical tests are conducted. In one of them the factor being tested (in this case forest harvesting) is applied. In the other, the **control**, the factor being tested is not applied.] The Wagon Wheel Gap study found that forest harvesting, at first, increased annual water yield compared to the control watershed, however, the water yield increase became smaller as new trees and vegetation began to grow back. It was determined that it took about seven years for the forest to recover from harvesting. The Wagon Wheel Gap study set several standards for future research projects. In future research projects personnel would live on site, new instruments were used in the studies, and researchers studied soils, geology, and vegetation of the watersheds, as well stream-flow and erosion. Over the last century hundreds of forest watersheds have been monitored and used in watershed studies.



**Image 6:** The evaluation station at the Wagon Wheel Gap Project in Colorado. This was the model for later small forest watershed studies in the U.S. with a control watershed and an observation period prior to treatment. *Photo from the USDA Weather Bureau (1928).*

Forests offer significant opportunities for improvement in water quality through proper management. Much of the watershed research conducted in the national forests was intended to increase water yields from forest watersheds in times of severe drought, and as urban areas grew and needed more water. Research was also conducted to examine the quality of water provided by the nation's forested watersheds, as well as the effects of timber harvesting and roads on erosion and water quality.

A surge of environmental regulations in the 1960s and 70s re-energized an interest in watershed research and forests. Suddenly, water and the people who studied it were gaining federal funding to conduct research. Geologists, hydrologists and soil experts, among other scientists, were soon being hired to conduct watershed research to evaluate the effectiveness of forest management practices in protecting water quality. Researchers began to develop management practices to limit effects of timber harvesting and road construction. The value of watersheds in the U.S. became more apparent and research to preserve those watersheds increased. Since 1970, over 2000 articles have been published on watershed research. It is these watershed studies that continue to be used to evaluate forest management plans and alternatives, as well as regulate watershed uses. In the contiguous 48 States, about 18 percent of the nation's water supply originates on forests managed by the USDA Forest Service. As forest management practices change, there will continue to be questions about the effects on water quality and quantity.

## Recycled Paper:

In Europe and the U.S. through the mid-1800s all paper could have been considered recycled paper. Old rags and worn-out clothing were the primary source of fiber used in mills for paper production, because the process for making paper from wood had not yet been developed. As the demand for paper grew, it became harder and harder to find enough old rags for use as fiber to make enough paper to meet this demand. The first machine for grinding wood to pulp for paper production was patented in 1844. However, it wasn't until the late 1860s that Americans first began making paper from wood. In the late 1800s paper was mass-produced and created a more affordable product. Cheaper paper, schoolbooks, fiction, non-fiction, and newspapers became more readily available to all the members of society by 1900. As people began to use more and more paper and create additional waste the idea of recycling old paper began to slowly develop. Early recycled fiber was mostly used to produce products of lower quality, such as newspaper.

The U.S. Forest Products Laboratory made significant advances in recycling paper in the late 1960s and again in the 1990s. Recycling helps extend the functional life of wood fiber and helps reduce the buildup of waste in landfills. Initially, recycling paper was usually more expensive than producing new paper from wood, and therefore, at first, paper plants had little economic incentive to create recycled goods and consumers had little incentive to buy the more expensive products. In 1967 the Forest Products Lab built a Pulp and Paper Pilot Plant to conduct research on paper recycling techniques. In 1993, the Forest Products Lab built a new pulp laboratory and remodeled the existing paper testing laboratory to further paper production studies.

Paper recovery for recycling has increased significantly since the mid-1980s. Research has been conducted by numerous private companies across the U.S. Recycling research also resulted from a public demand for reducing landfill waste and timber harvesting beginning in the 1960s and really taking hold around the time of the first Earth Day in 1970. The recycling symbol used today was created in that same year, 1970, by Gary Anderson, a student at the University of Southern California. While the public outcry for recycling varied at different periods over the past 30 plus years, it has had an impact on the paper industries need and desire to find new solutions for recycling.



**Gary Anderson**

**Image 6:** In 1970, Gary Anderson (right) entered a contest for college students to create a recycling symbol and he won.



**Image 7:** Recycling Logo of today is very similar to Anderson's original image.

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In 1994 the Forest Products Lab combined efforts with the U.S. Postal Service, Springborn Testing & Research, paper recovery companies, paper recyclers, adhesive manufacturers, and chemical suppliers to conduct experiments on recycling paper, especially paper containing adhesives. Removal of pressure sensitive adhesives from recovered paper posed a major problem for the paper recycling industry. At the time the U.S. Postal Service purchased about 12% of these adhesive products and therefore initiated this recycling research project. Removing **contaminants** from recycled paper pulp is one of the biggest technical barriers to paper recycling. Contaminants are unwanted components that come from ink, plastic films, paper coatings, adhesives and various other sources. Companies across the U.S. offered samples of new adhesives and suggestions for new recycling methods. Research findings as a result of this combined effort have led to improved paper recycling techniques for all contaminated paper. Additional studies in the mid-1990s found that enzyme treatments given to used paper fibers resulted in improved bleach-ability (making paper white) and contaminant removal. Enzyme treatments are the addition of a complex protein to the initial recovered paper pulp, helping make contaminants easier to remove. This research developed a new process, which when followed by traditional bleaching processes, was one of the first steps to help improve the brightness of recycled paper.

In 2000, research at the University of Florida's Engineering Research Center for Particle Science and Technology created a new process for recycling paper that lowered the cost to the producer. This research was conducted by Hassan El-Shall and Brij Moudgil and developed a new technique used to remove inks from used paper. The technique replaced one type of chemical, which was expensive, with a blend of a cheaper mix of chemicals. By lowering the cost of the recycling process the hope was that it would be more economical and enhance the recycling incentive for paper companies. While people in the U.S. wanted to use recycled paper, paper companies could not make a profit selling recycled paper. Therefore many companies were hesitant to produce large amounts of recycled paper. This new recycling technique would allow the benefits of recycling to include corporate profits, as well as protecting the environment and reducing energy use. A ton of paper from recycled pulp saves at least 14 trees, 3 cubic feet of landfill space and 7,000 gallons of water, according to the Environmental Protection Agency and other government sources.

U.S. paper consumption is the highest in the world. In 2006, it was estimated that each person in the U.S. consumed roughly 730lbs of paper per year. That accounts for about one-third of the world's paper consumption, even though the U.S. has roughly 5% of the world's population. In 2006, about 53.4% (53.5 million tons) of paper used in the U.S. was recovered for recycling. Most paper is recycled into newsprint, tissue, boxboard, and chipboard. Recycled paper has several problems; low brightness, high contaminant levels, and low paper strength. Therefore only small amounts of it are used to create the paper products that are consumed most. Research is being conducted at the Forest Products Lab to develop new technologies needed for recycling materials into all types of paper, paperboard (cardboard), composites, and lumber. Hopefully in the future this research will yield a recyclable paper and other products of a higher quality that will be consumed most often, therefore reducing the wood resources necessary to make these products.

### **Conclusion**

Forest products research is critical to the social and economic well being of people on a global level, because the demand for wood and paper continues to increase while the resource continues to decrease. As world population grows, the need for sustainable use of our natural resources will only continue to grow. Forest research will remain a necessity to identify and solve major forest resource issues and problems, while offering economic gains. Changes in gum production came out of a need for greater amounts of resin with less damage to potential timber harvests. Many watershed projects occurred due to a need for greater amounts of water from the same limited source or out of a need for cleaner water sources. Many paper recycling techniques came out of a need to reduce costs to paper companies and businesses using paper products. So while sustainability of forests is an added bonus, many times it is economic, political, or ecological needs that drive the research in the first place. As the focus on global climate change and environmental awareness increases and people in the U.S. and the world begin to demand more ecologically-friendly products, we can expect to see new discoveries due to forest research.



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## Worksheet 1: Forest Research Poetry

Name: \_\_\_\_\_ Date: \_\_\_\_\_

An acrostic poem is one where you choose a word or name and use each letter in the name as the beginning of a word or line that tells something about that person or topic.

**Example:** An acrostic poem using the word "recycle."

**R**ecycling helps the  
**E**nvironment;  
**C**hanging  
**Y**our  
**C**ans, paper, plastic, glass, etc into useable materials again.  
**L**et's do our part to help the  
**E**nvironment and recycle.

Write an Acrostic Poem using the words below and the information you learned in the "Forest Research & Development History" essay.

	R
F	E
O	S
R	E
E	A
S	R
T	C
	H

## Worksheet 2: Keywords

Read the essay entitled "[Forest Research and Development History](#)." Copy a sentence that uses the word below. Then propose your own definition of the concept.

### Environmental concerns

1. Sentence:

2. Definition:

### Urban Forests

1. Sentence:

2. Definition:

### Forest Disturbance

1. Sentence:

2. Definition:

### Naval Stores

1. Sentence:

2. Definition:

### Watershed

1. Sentence:

2. Definition:

### Recycling

1. Sentence:

2. Definition:

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## Worksheet 3: Eloise Gerry Biography

Eloise Gerry was born January 12, 1885 in Boston, Massachusetts. In June of 1910, at the age of 25, she became the first female scientist hired by the USDA Forest Service. She was hired to work in the Forest Products Laboratory (FPL) to prepare microscope slides and **photomicrographs** for wood anatomical studies. Photomicrographs are photographs made of something seen through a microscope. Gerry had both a bachelors and masters degrees from Harvard University's Radcliffe College for women and was hired because of her experience in wood anatomy and her specific training in the preparation of wood specimens and photomicrographs. She later obtained her PhD from University of Wisconsin in 1921. In her personal notes, Gerry states, "I must admit the Forest Service did not want a woman, but as it happened there wasn't any man willing to come and do the work." Her statement reflects some of the politics at the time, for in 1910 women did not even have the right to vote. In fact Gerry was hired by the US Forest Service a decade before women would gain the right to vote. Gerry recognized her role as a pioneer for female scientist in the U.S.

When Gerry was hired in 1910 the Forest Products Lab did not have a wood collection nor did it have much equipment for wood anatomy research. In the summer of 1910, the University of Wisconsin provided a microscope and research room in the Science Hall for Gerry. Then, before Gerry could begin her research, she needed wood samples, so her first job was collecting woods of the United States. At first most of the samples she collected came from expositions and fairs. Then in 1916 Gerry moved to Columbia, Mississippi, to apply her knowledge to naval stores research. This became one of her most lasting contributions to her research field. Gerry's studies of southern pines and the production of turpentine at her field-based research site in Mississippi helped her develop the program of "More turpentine, less scar, better pine." Many later credited this program to saving the struggling naval stores industry.



**Image 1:** Eloise Gerry sometime in the early 1950s, near the end of her career, probably in her office at the Forest Products Lab. (Photo courtesy of the U.S. Forest Products Laboratory.)

Eloise Gerry was a research scientist at the U.S. Forest Products Laboratory in Madison from 1910 to 1954, during which time it was not socially acceptable for woman to work outside the home. She focused on the microscopic study of growing trees and became an expert in southern pines, turpentine techniques, and foreign woods and their properties. Dr. Eloise Gerry proved to be an exceptional scientist, a devoted Forest Service employee, and a person determined to contribute greatly to society. She applied her expertise in a variety of directions:

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improving methods to produce military supplies for World Wars I & II, writing stories for children, publishing more than 120 articles in various journals, and in creating a fellowship program, through her membership in “Graduate Woman in Science,” for female graduate students of chemistry or biology. Eloise Gerry died in 1970 at the age of 85. At that time a longtime friend and former lab colleague, Benson Paul, said “She has given of herself not only in scientific fields but in the world about her with the generous impulses of a warm heart. Evidently, she has made a life pattern from the living forest that gives and gives yet seeks nothing in return. In performance of task, it is not her habit merely to DO, but always to DO MORE than is normally required or expected.”

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## Carlos G. Bates Biography

Carlos G. Bates was born on October 14, 1885 in Topeka, Kansas to well educated parents. His mother was part of the first graduating class at Vassar College and his father held three degrees. Carlos Bates spent his childhood in various small communities across the Great Plains region. He attended the University of Nebraska and graduated in 1907 with a Bachelors of Science in Forestry. He then worked for the USDA Forest Service from 1907 until his death in 1949.

Bates worked in Washington DC until March of 1909, at first on **silvical** studies, then later on windbreak planting. Silvical is the study of the life history and general characteristics of forest trees and tree stands, in particular regional or area factors on trees or as a result of the trees. Bates was then assigned by the Forest Service was to establish a field station for silvical research within the central Rocky Mountain region. Bates established the Fremont Experimental Station in Sept of 1909 to meet this assignment and begin the Wagon Wheel Gap study that same year. Wagon Wheel Gap became the first controlled experiment on forest-streamflow in the U.S. Nearly nothing was known about the hydrology of mountain watersheds at this time making Wagon Wheel Gap a ground-breaking study. These two research sites were about 300 miles apart from each other yet with Bates' successfully ran both for over 15 years. Bates worked on the Fremont Experimental station 18 years and the Wagon Wheel Gap study for 16 years. Bates was an innovative man. From the Wagon Wheel Gap study, Bates developed ideas about how water moves through the soil of mountain watersheds to maintain streams in rainless or drought periods. He presented ideas in his writings on Wagon Wheel Gap that would later be published as "new" ideas nearly fifty years after. Bates worked in the Rocky Mountain region until 1927.



*Carlos Bates, Forester in Charge, hauls supplies to the Fremont Experiment Station in 1917.*

Image 1: Carlos Bates working near the Fremont Station.

Provided by the Rocky Mountain Research Station, USDA Forest Service, <http://www.fs.fed.us/rmrs/about/history/>

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In 1927 Bates was transferred to the Forest Products Lab in Madison, Wisconsin, as chief of the Biological Section. After three weeks there, he requested a transfer back to the Fremont Station to continue his soil research studies. Instead he was sent to the Lake States Station in St. Paul, Minnesota. Due to issues plaguing the Nation at the time, the dust bowls and massive erosion concerns, Bates focused his studies on erosion sources, causes, and cures. In 1929 he began a special study of erosion in southeastern Wisconsin and southwestern Minnesota. Then in 1934 Bates was put in charge of the Great Plains **Shelterbelt Project**, for erosion control. The shelterbelt project was the plan of planting trees to create windbreaks to reduce erosion in farm fields and prairie lands of the Central U.S. Then in the 1930s and 1940s Bates was in charge of flood control projects, developing ways to potentially reduce flooding through improved land management and other upstream practices. The last few years of his life were spent writing up his findings on his watershed and shelterbelt studies.

“C.G.” as Bates was called, was an independent spirit. He was a very logical man and appeared to many to be stern, aloof, and arrogant. To his close associates he was also warm, kind and gentlemanly. He paid close attention to detail, was reluctant to leave any point unexamined, and was a perfectionist. Because of these traits he conducted lengthy studies and wrote long scientific writing about his findings. He preferred to do much of his work himself, and he enjoyed being outdoors working on a definite set of problems and finding results to his experiments. Bates’ curiosity and imagination led him to conduct studies and investigations not normally conducted or pursued by other researchers of his time. His constant search for scientific truths dominated his life. Bates died at his St. Paul home of a heart attack in July 1949. He was still working for the Forest Service’s Lake State Station. Bates was known for his keen mind, outstanding capabilities, and his versatility. While other researcher of his time excelled in one field, Bates distinguished himself in three: silvics, shelterbelt forestry, and watershed management.

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## Bruce J. Zobel Biography

Bruce J. Zobel was born in Los Gatos, California on February 11, 1920. His parents owned a fruit and vegetable farm near Watsonville, California and he was the youngest of six children. Zobel graduated from high school in 1938 and then attended Salinas Junior College in preparation to attend the University of California, Berkeley.

In 1941 Zobel married his wife, Barbara, and began attending school in Berkeley. In 1943 Zobel graduated with his Bachelor's of Science in Forestry from Berkeley. He then began working at the Pacific Lumber Company as a logging engineer until he was drafted into the U.S. Marine Corps in 1944.

While in the Marines, Zobel worked at Camp Lejeune, North Carolina, and helped develop a forestry management program. In 1946 Zobel completed his time with the Marines and took advantage of the **GI Bill** to return to graduate school at the University of California, Berkeley. The GI Bill provided funding for college or vocational education for those individuals that served in the Armed Forces. While again at Berkeley, Zobel received both his Master's in Forestry in 1949, and his Ph.D. in Forestry in 1951. While working on these degree programs he also worked as a Senior Laboratory Assistant in the Forestry School.

In 1951 the Zobels moved to College Station Texas where Dr. Zobel was hired to head a new tree-improvement program. This program was funded by major forest products companies, Texas A&M University, and the Texas Forest Service. While there Zobel developed a successful breeding program for forest trees.

Interest in forest genetics and in Zobel's work grew and in 1956 Zobel moved his wife and four children to Raleigh, North Carolina. There Zobel helped start the North Carolina State University-Industry Tree Improvement Program. In addition to running this tree improvement program, Zobel taught courses and advised forestry students at North Carolina State University (NCSU). He became a well-respected authority on forest improvement and **forest genetics**, and was honored with numerous awards. Forest genetics is the study of heredity in forest trees. This involves developing new types of trees with "improvements." Forest genetics might create fruit trees that produce more or larger fruit, or create trees that grow faster to produce more timber for harvesting, etc.

In 1979, Zobel retired from NCSU, although he continued to teach part-time until 2004. Zobel consulted for international forestry firms over the several years, and in 1984, he founded the Zobel Forestry Associates. In 1995, Zobel sold his half of the company, but continued to work for the company as a consultant.

His accomplishments both in forest research and in the development of a tree improvement program, providing "better" trees for industrial forestry in the South have been widely recognized. Here are a few of the many awards received by Zobel

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throughout his career: 1965, Governor's Award for Conservation in North Carolina; 1973, Outstanding Extension Services Award, North Carolina State University; 1982 named Man of the Year in Forestry by the North Carolina Forestry Association; and in 2004 Alexander Quarles Holladay Medal for Excellence, North Carolina State University. Bruce J. Zobel is described in numerous lecture brochures as “a creative scientist and gifted teacher.”



**Image 1:** Bruce J. Zobel and John W. Duffield, pioneers in tree improvement and forest genetics, discuss the development of seed orchard technology in 1967 at one of many seed orchards that were being established in the southeastern U.S. **Photo by Bill Libby.**



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## Malcolm M. Furniss Biography

Malcolm “Mal” Furniss was born in Branchville, New Jersey on June 17, 1926. He grew up in Waverly, New York where he explored the nearby woodlots and streams and developed a life-long attraction to nature and the outdoors. In January 1945, Furniss entered the Army Air Corps at Beale Air Force Base, California. He was stationed throughout the U.S. and was discharged in November of 1945 after the end of World War II. In January 1946, Furniss enrolled in forestry with a minor in entomology at the University of California, Berkeley. He received his bachelor’s degree in 1950.

In June of 1950 Furniss was hired at the Berkeley Forest Insect Lab, Bureau of Entomology & Plant Quarantine, USDA, to survey bark beetle-killed trees in the Sierra Nevada Mountains. In 1953, the Bureau of Entomology & Plant Quarantine was closed and Furniss was transferred to the USDA Forest Service, California Forest and Range Experiment Station. Then in October 1954 he moved with his wife, Irene, and two

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children to Ogden, Utah, where he worked at the Intermountain Forest & Range Experiment Station as an **Entomologist**. An entomologist is a scientist who studies insects. In May 1955, he was transferred to Boise, Idaho. The Idaho forests were experiencing widespread damage from leaf-eating insects such as the spruce budworm. While at Boise, Malcolm studied the Douglas-fir beetle and insects infesting bitterbrush, an important browse plant for deer during winter.



**Image 1:**  
Douglas-fir  
beetles laying  
eggs in inner  
bark (phloem).  
Spores of a  
disease causing  
fungus are  
carried on their  
bodies helping  
to overcome the  
host tree. Photo  
by M. Furniss



**Image 2:** Western coniferous forest infested  
by the mountain pine beetle. The brown  
trees have been infested and destroyed.  
Photo by W.C. Guy, USDA Forest Service.

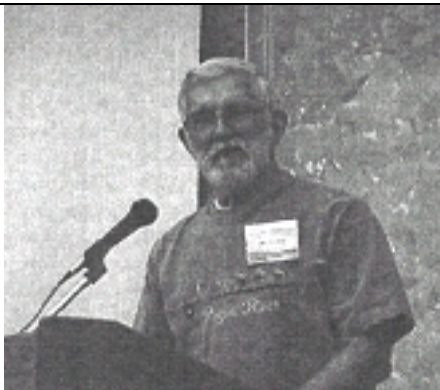
In 1963, Furniss transferred to the Forestry Sciences Lab in Moscow, Idaho and began attending graduate school part-time at the University of Idaho. He graduated in May 1966 with a master’s degree in Entomology. He continued to conduct numerous studies on the Douglas-fir beetle, as well as other **bark-beetles**. Bark beetles are a natural part of forests. Some “primary” species of bark beetles can be very destructive to coniferous (pine, spruce, fir) forests and kill trees; most, however, are “secondary,” meaning that

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they infest only dead or dying trees, thereby helping the forest ecosystem. The “primary” species have evolved a relationship with Blue Stain fungi that helps them infest coniferous trees. These bark-beetles carry fungus spores into the trees on various parts of their bodies. The fungi then infect the phloem (inner bark) and xylem (sapwood), obstructing the movement of fluids, and disrupting the tree’s defenses against the invading beetles. Eventually the tree may die due to lack of moisture; however, not all attacked trees will die.

In 1969 Malcolm Furniss became Project Leader of the research work unit, Insects of Forest Trees and Wild-land Shrubs of the Northern Rocky Mountains. From 1970-1982, he tested various bark beetle pheromones (chemicals secreted by an insect, that influence the behavior or development of others of the same species) and in 1971 discovered that the odor of Douglas-fir beetle pheromone MCH (methylcyclohexenone) was an anti-attractant to the beetle. This discovery led to a 10-year research and development project that resulted in new technology to help prevent Douglas-fir beetle infestations. This project developed a formula containing MCH that could be applied by helicopter to susceptible trees such as those damaged by storms. Application of this formulation to such weakened trees can prevent Douglas-fir beetles from increasing in number and subsequently infesting healthy live standing trees.

In April 1982, Furniss retired from the USDA Forest Service. He then became affiliated with the Department of Entomology at the University of Idaho. From 1982 to the present, he has continued to study forest insects in western North America and Europe. Furniss was the winner of the Western Forest Insect Work Conference Founders Award in 1998. The Founders Award is given to an individual who has made an outstanding contribution to western forest entomology. Furniss has authored or coauthored 115 publications, and has published a field guide to Idaho bark beetles. He is widely recognized for his expertise in bark-beetle identification.



**Image 3:** Malcolm M. Furniss giving his Founders Address after winning the Western Forest Insect Work Conference 1998 Founders Award. Breckinridge, CO, September 16, 1999



**Image 4:** Furniss in his home laboratory in Moscow, Idaho, 2004.

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## Jerry F. Franklin Biography

Jerry Forest Franklin was born in Waldport, Oregon on October 27, 1936. He loved the forest at a young age, and it is said that by age nine he knew he wanted to grow up to be a forester. Franklin did just that. He received both his Bachelor's and Master's degrees in Forest Management from Oregon State University. Then in 1966 he completed his PhD in Botany and Soils from Washington State University.

Dr. Franklin has been a researcher for the Forest Service and at academic institutions since 1959. He became a research forester for the USDA Forest Service in 1959. He worked as a forest researcher at the Corvallis, Oregon Research Station, and the Coniferous Forest Biome International Biological Program. While working as a forester he challenged the practice of clear-cutting and instead offered logging solutions that were more science based. His "new forestry" strategy taught management practices of leaving logs and other wood debris, standing dead trees and some larger live trees when logging an area. While his new ideas were met at first with uncertainty within the timber industry, eventually they were accepted by environmentalists and timber companies alike. He has conducted numerous long-term experiments designed to help forest science for years to come. He has studied old-growth forests, natural disturbances in forests (such as fire) and the recovery process of forest ecosystems (how forest recover after a disturbance such as logging or wildfires).



**Image 1:** Jerry F. Franklin in an Old Growth Forest in the Pacific Northwest.

Dr. Franklin has spent more than 40 years studying old-growth forests, primarily in the Pacific Northwest. He has been a researcher for the USDA Forest Service, at Oregon State University and the University of Washington. He was the program director of the Wind River Canopy Crane Research Facility. He has served on many local, national and global commissions dedicated to the analyses of forest issues. He was on the

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national boards of The Nature Conservancy and The Wilderness Society. Dr. Franklin has written over 300 scientific articles and books. He is considered one of the country's leading authorities on sustainable forest management, and is often called the "father of new forestry."

Dr. Franklin was a recipient of the 11<sup>th</sup> Annual Heinz Award for the Environment in May 2005. The Heinz Awards were created to recognize the extraordinary achievements of individuals and to highlight the power an individual can have on American society. In the award description of Dr. Franklin it was written that: "With unwavering courage and conviction, wisdom and passion, Dr. Jerry Franklin has dramatically expanded our knowledge of natural forest ecosystems and used this knowledge to help redefine forest management in the United States and many parts of the world. Because of his contributions, millions of acres of forests have a more sustainable future."

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## T. Kent Kirk Biography

T. Kent Kirk was born on October 13, 1940, in Minden, Louisiana and grew up in Natchitoches, Louisiana, a town surrounded by pine forests. He received his Bachelors Degree in Forestry from Louisiana Polytechnic Institute in 1962 and his Masters in Plant Pathology (the study of plant diseases) from North Carolina State University in 1964. Then in 1968 he completed his Ph.D. in Biochemistry and Plant Pathology from N.C. State. In 1970 Kent Kirk began working for the USDA Forest Products Laboratory in Madison, Wisconsin.



**Image 1:** T. Kent Kirk, USDA Forest Service Researcher, in his high school chemistry lab. Studying hard, long before he went to work for the Forest Product Lab in Wisconsin.

Dr. Kirk is currently considered one of the world leaders in understanding **microbiological degradation of lignin**. Lignin is a complex chemical compound that is one of the main components of wood and of the cell walls of all woody plants. Kirk's research involved the study of microscopic organisms and their effects while breaking down lignin into simpler compounds. His research studied various wood decay fungi that break down wood, including lignin. This breakdown is central to the earth's carbon cycle and to the environment. Kirk made numerous ground-breaking discoveries. These discoveries led to the development of procedures that utilize lignin-decaying fungi in the biological pulping (**biopulping**) of wood. Biopulping uses a fungus to convert wood pieces to paper pulp. These biopulping discoveries, made in part by Kirk, may become an essential step in paper production and a key new method used by the paper industry since it results in significant reduction in energy costs.

Dr. Kirk's research at the USDA Forest Products Lab was important not only to the timber industry but to the environment as well. Applying biotechnology in wood utilization can help in cleaning up chemical bleaching wastewaters, and polluted soils contaminated with organic pollutants.

Dr. Kirk has written over 200 papers and won numerous awards for his research efforts, including election to the National Academy of Sciences in 1988. In an oral history

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completed in 2005 Kirk said “I think a willingness to embrace and develop new techniques is a strength that scientists need.” From his accomplishments, it would appear that he possessed this strength.

Dr. T. Kent Kirk retired early from the USDA Forest Products Lab in 1996. He then worked for a few years at the University of Wisconsin, Madison, and the National Academy of Sciences' National Research Council.



**Image 1:** Kent Kirk "Receiving the Marcus Wallenberg Prize from the Carl XVI Gustaf, King of Sweden, in 1985 in Falun, Sweden." Photo provided by: T. Kent Kirk

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## Worksheet 3: What made them who they were/are?

Name: \_\_\_\_\_ Date: \_\_\_\_\_

Person Studied: \_\_\_\_\_

Often times people we learn about in history, science, and language arts tend to share certain personal characteristics. Use this worksheet to list examples of behaviors demonstrating each quality that pertains to the each individual you studied. Not every personality trait will apply to each person. You may discover more than one example for each trait.

### Personality Traits:

### Behavior that demonstrates this Personality Traits:

**Expertise** (knowledgeable or highly  
experienced in a particular field)

\_\_\_\_\_ -

\_\_\_\_\_ -

\_\_\_\_\_ -

\_\_\_\_\_ -

\_\_\_\_\_ -

\_\_\_\_\_ -

\_\_\_\_\_ -

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## Assessment 1: Application & Integration Exercise

### Current Events: What is the Forest Products Lab Up to Now?

Name: \_\_\_\_\_ Date: \_\_\_\_\_

In this activity you will visit the Press Room at the Forest Products Lab (FPL) Website (<http://www.fpl.fs.fed.us/pressroom/index.html>) to find out what they are up to now. Search through the articles listed in the Press Room and pick one that is of most interest to you. Then you are to give a synopsis of the latest research happenings. You may write an article summarizing your findings, create a poster showing the latest research findings/investigation, or produce a brief news story via video explaining the latest happenings at FPL. You will have 5 minutes to present your findings to the class.

Things to do:

- Go to the FPL Press Room site and choose three articles of most interest to you.
- Bring your top three choices into class. **Due Date:** \_\_\_\_\_
- You will be assigned one of the three articles so that no overlapping in presentations occurs. You may be assigned to do this project in a group.
- Read the article you are assigned and start working on your summary.
- Decide how you would like to present this information (article, poster, video).
- Complete and turn in Project. **Project Due Date:** \_\_\_\_\_
- **Presentation Date:** \_\_\_\_\_







## Assessment 3: Reflective Exercise

We just finished learning about forest research and forest research discoveries. Many of the things we learned about had a great impact on society at the time of the discoveries but does this still impact our lives today? Let's take a look at one example, naval stores.

Read over the following list of uses for Rosin and Turpentine. (You may look up additional uses if you would like more information to help you in completing this assessment.)

Turpentine is used as a solvent; used for thinning oil-based paints, for producing varnishes, and as a raw material for the chemical industry.

Turpentine is also added to many cleaning and sanitary products due to its antiseptic properties and its "clean scent."

Turpentine also has medical uses. Applied externally to affected areas, turpentine is a highly effective treatment for lice. Turpentine used to be mixed with animal fat as an ancient chest rub for nasal and throat ailments. Today, many modern chest rubs still contain some turpentine, i.e. Vicks.

Rosin is an ingredient in printing inks, varnishes, adhesives (glues), soap, and in soda (listed as glycerol ester E445). Rosin paper sizing is applied to almost all paper. Paper sizing is a substance applied to paper to help keep ink from absorbing too much into paper, keeping the ink on the surface. Rosin can be used to coat medicines and some chewing gum, giving them a shiny appearance or protective coating. (This would typically be written on a label as E915).

Rosin is also used in many ways to help create friction. For example, Rosin is often used on the bows of stringed-instruments (violins, violas, cellos and basses) to add more friction to produce sound from the strings. Ballet dancers sometimes use rosin on their shoes to help reducing slipping when dancing on stage. Baseball pitchers, bowlers, and some climbers often use Rosin powder on their hands to help create friction as well.

Your assignment is to conduct the following survey on at least 10 people (this may include family members, family friends, neighbors, teachers, other students, etc.). After conducting the survey you will compile your data using a histogram.

Name: \_\_\_\_\_ Date: \_\_\_\_\_

Please ask at least ten people if they use the following products. Record their answers with a tally/slash mark (one mark per person per box that applies to that person). For example if I use Vick VapoRub at least once a year but not once a month, you would make one mark in the second column and leave the third column blank. On a separate sheet of paper make a list of the names of the people surveyed and their occupation (i.e. student, teacher, homebuilder, dentist, etc.) to hand in with this assignment.

<b>Items Containing Turpentine or Rosin</b>	<b>Number of people that use this at least once a year</b>	<b>Number of people that use this at least once every month</b>
Paint Thinner (turpentine)		
Vicks VapoRub (turpentine)		
Furniture or Floor Polish (turpentine)		
Shoe Polish (turpentine)		
Printing Ink (rosin)		
Soap (rosin)		
Adhesives/glue (rosin)		
Paper (contains rosin in paper sizing used to make the paper)		
Soda (rosin written on the label as glycerol ester or E445)		
Coated Medicine (written as E915)		
Coated Chewing Gum (written as E915)		
Play bow stringed- instrument (rosin on bow)		
Use rosin powder on ballet shoes for dancing (rosin)		
Use rosin powder on hands for baseball, bowling, or climbing (rosin)		

Now that you have completed the survey on at least 10 people you will create two Histograms. A Histogram is a bar graph in which the length of the bar illustrates the number of observations or the frequency of each item. Write the top 7 most commonly used items in the blank spaces of the Histograms. One Histogram is labeled for uses per year and one for uses per month. Then shade in bars with different colored pencils to show the number of observations or frequency of each of the choices.

**Histogram 1**

**Number of People Using Turpentine or Rosin Items at Least Once a Year**

Top 7 Most Commonly  
Used Items

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

0      2      4      6      8      10      12      14

**Histogram 2**

**# of People Using Turpentine or Rosin Products at Least Once Every Month**

Top 7 Most Commonly  
Used Items

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

0      2      4      6      8      10      12      14