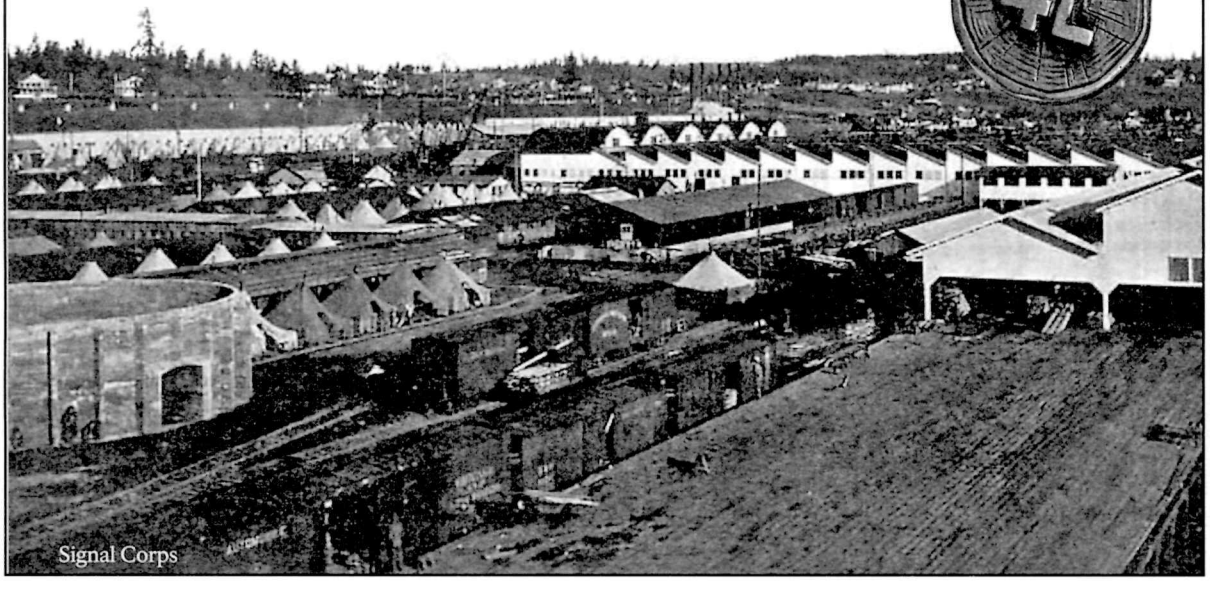
Spruce Trail Guide

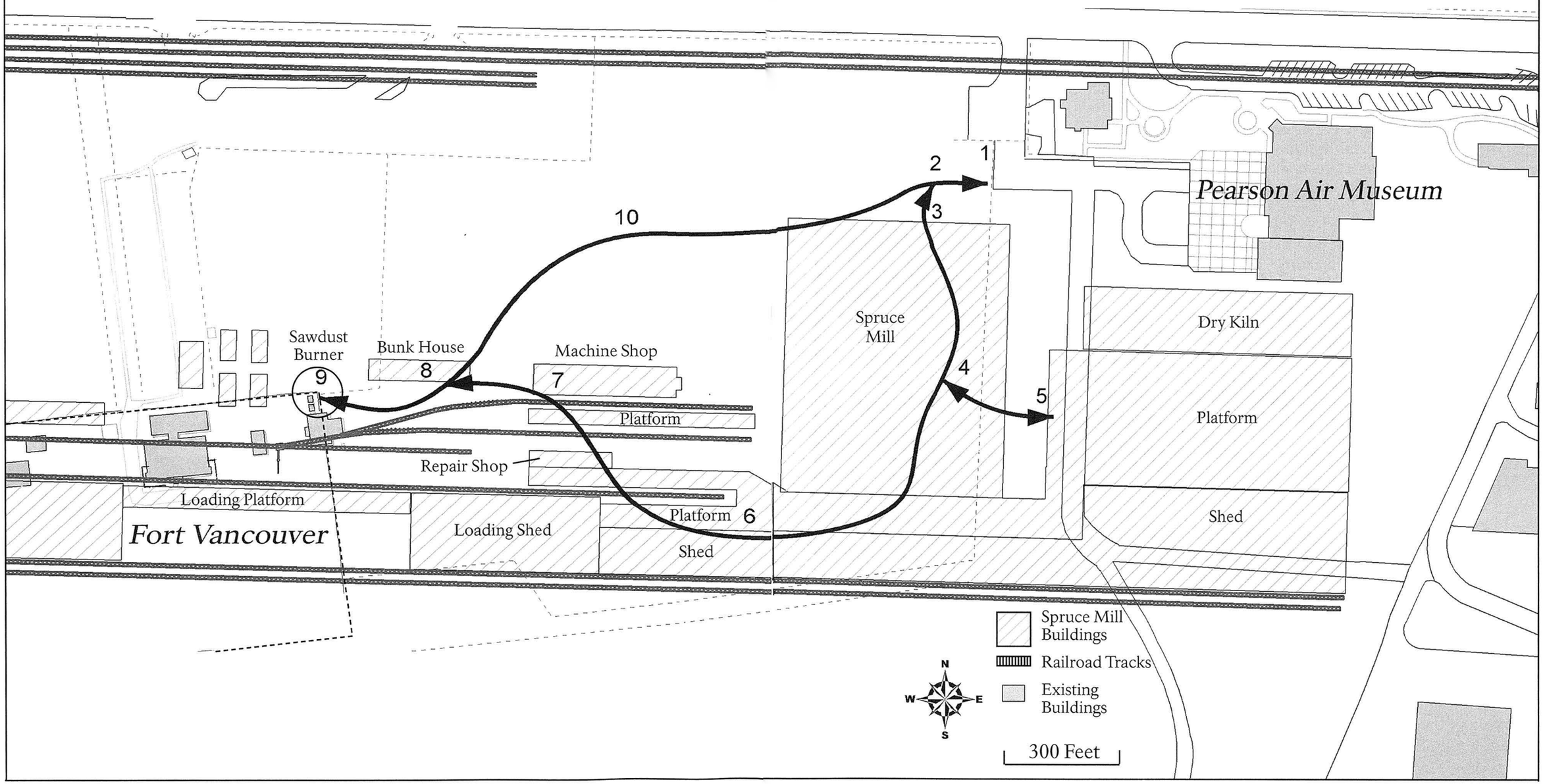
Fort Vancouver National Historic Site
National Park Service
Vancouver National Historic Reserve

The U.S. Army Spruce Production Division Mill

One Million Board Feet Each Day for the Allied Powers of World War I



The Spruce Trail

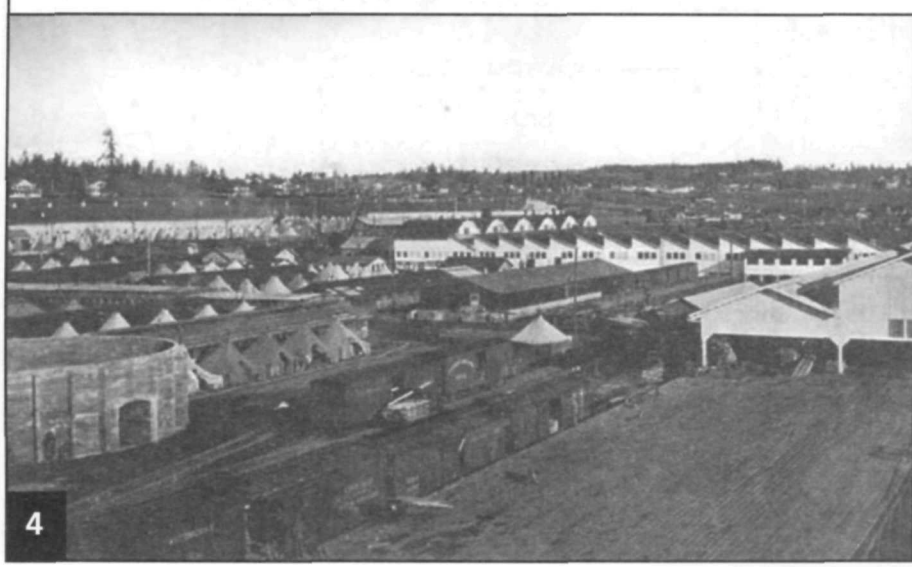


STOP 1

The United States Demonstrates the Strength of the Allied Powers

During World War I, the Army Signal Corps built and operated a very large saw mill on this site. The mill produced sitka spruce lumber to manufacture military aircraft. Although the military had cooperated with private industry before the Spruce Production Division (SPD) was formed, the SPD was an ambitious effort to use U.S. industrial technology to manufacture a strategic material. To meet the wartime production goal of 100 million board feet of sitka spruce lumber, the Army planned to build two saw mills in Washington and one in Oregon. It built thirteen separate railroads, commandeered hundreds of acres of spruce timber land, and assigned over 30,000 regular Army troops to duty in the logging camps and lumber mills of the Pacific Northwest. On the social front, the SPD organized the Loyal Legion of Loggers and Lumbermen, which reformed the living and working conditions of loggers and mill workers, and actively recruited women for war production work.

The huge Vancouver Spruce Mill was the centerpiece of spruce lumber manufacturing in the Northwest. Work on the Vancouver mill began on December 14, 1917, and the mill was operating by February 7, 1918. The last full month of production was October, 1918. By then, the Vancouver mill was cutting and shipping 1 million board feet of spruce each working day.



Finding the Spruce Mill

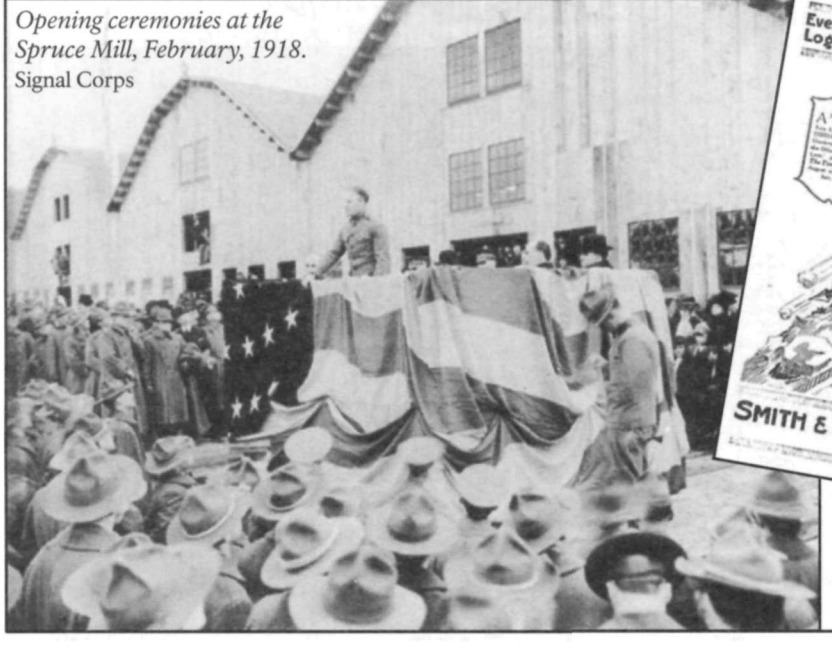
The photo shows the mill in the summer of 1918. The large concrete structure in the front left is the sawdust burner base. This was located where the northeast corner of the Fort Vancouver stockade now stands. The current Pearson Air Field headquarters and the aircraft shop are recycled buildings from the Spruce Mill.
Signal Corps

Lumber for the War

Creating the Spruce Production Division was a major military and political event. In 1916 and 1917 radical labor groups, including the Industrial Workers of the World, had organized loggers and mill workers. Strikes stopped Northwest lumber production in the summer of 1917. The Army wanted spruce lumber, but also wanted to suppress the unions. The government had previously used the Army to combat strikers and union organizers in other industries. The SPD was more subtle than previous government interventions in labor disputes.

Media coverage in newspapers and magazines at the time urged loggers and mill workers to show their patriotism by producing spruce lumber for the war.

The Pacific Northwest was the national center of the lumber industry in 1917. In addition to the mills and timber lands, the firms that produced lumber mill and logging equipment were located in Oregon and Washington. Mill owners and manufacturing companies welcomed the extra business that the SPD brought them.



Opening ceremonies at the Spruce Mill, February, 1918.
Signal Corps

The Timberman Magazine, *1918*

Where Did the Spruce Come From?

STOP 2

To supply the Vancouver mill with as much as one million board feet of spruce every working day, the Spruce Production Division tapped a network of spruce-producing forests and mills on the coasts of Oregon and Washington. Prior to the need for aircraft, spruce had not been a valued species of wood. The Army helped the industry meet the new demand for spruce by building thirteen logging railroads to get the logs out of the woods and to the mills. After the mill at Vancouver was up and running, the SPD built additional mills for spruce board production at Toledo, Oregon, and Port Angeles, Washington.

Signal Corps

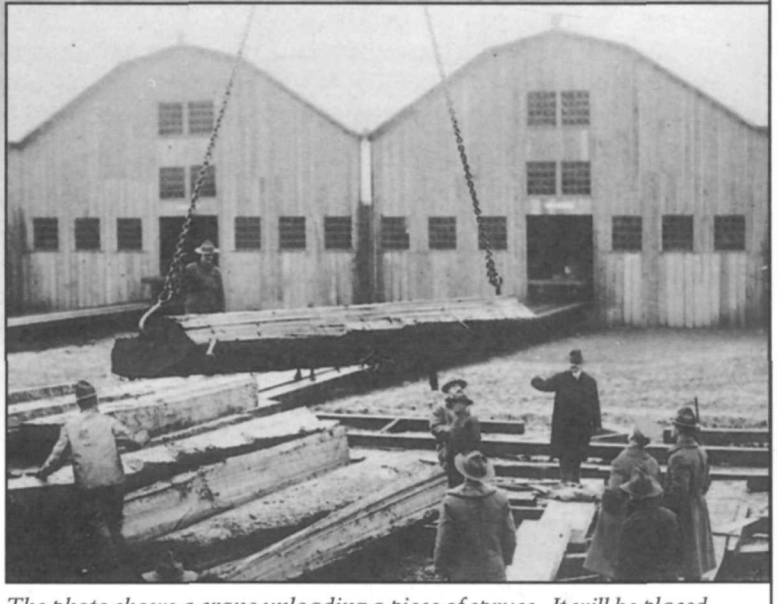
Railroad Logging

As the photo shows, spruce logs are very large. The only practical way to transport the logs from the forest to the mills was by rail. Railroad logging was well-established before WWI, but the war brought technical advances in several areas. At the end of the war, all of the SPD logging equipment was sold at auction, providing the private industry the state-of-the-art machinery at bargain prices.

Prentiss Photo,
University of Oregon,
Disque Collection

Bringing in the Spruce

The trains loaded with spruce from the coastal forests rolled into the mill on Spur A, parallel to 5th Street, immediately north of here. A self-propelled steam crane running on a separate track lifted the spruce "cants" (see below) off the rail cars onto flat carts. Then the mill crew wheeled the cants into the mills to be cut up for aircraft timbers. The mill was capable of processing an enormous amount of spruce. If each rail car held 10 thousand board feet of spruce, 100 rail cars would have to be unloaded each day to meet the production goal of one million board feet.



The photo shows a crane unloading a piece of spruce. It will be placed on a stack or "deck," and then moved into one of the six mill entries. At each entry, there were two huge saws that cut the spruce into smaller planks that were in turn cut into aircraft-size boards. Signal Corps

Although the ties and rails have been removed, some evidence of the railroad remains. Archaeological investigations of the spruce mill site have revealed tie fragments, railroad spikes, and other railroad hardware embedded in the earth.

Logs or Cants?

At the start of the Spruce Production program, the Army decided that they would not bring logs to the Vancouver mill. To streamline the manufacturing process, the spruce logs were cut into large timbers called "cants" at civilian mills on the coast. The Vancouver mill received only pre-cut timbers or huge chunks of spruce split from logs. These were easier and more efficient to work with than the whole logs would have been.

The Cut-Up Plant Runs 'Round the Clock

STOP 3

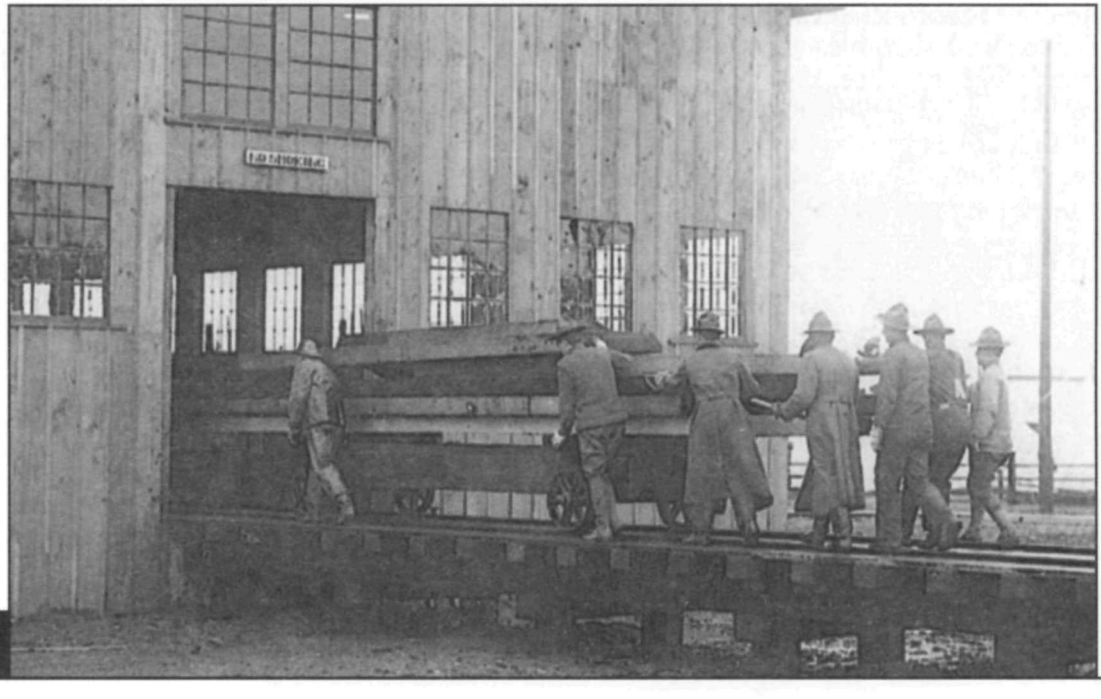
This is the approximate location of one of the entrances to the main mill buildings, called the "cut-up plant." Archaeological investigations conducted by the National Park Service have found remnants of the concrete foundation as well as artifacts from this central part of the Spruce Mill. There were six connected buildings totaling over 100,000 square feet.

At full operation, the cut-up plant ran 24 hours each day, in three 8-hour shifts. 3,000 Spruce Production Division soldiers worked at the Spruce Mill.

What's a "Board Foot?"

A board foot is a traditional measure of lumber that is equal to the volume of a piece one foot long, one foot wide, and one inch thick. A 10' 2"x6", for example, would equal 10 board feet of lumber. A pile of lumber 10' long, 4' wide and 2' high equals one thousand board feet.

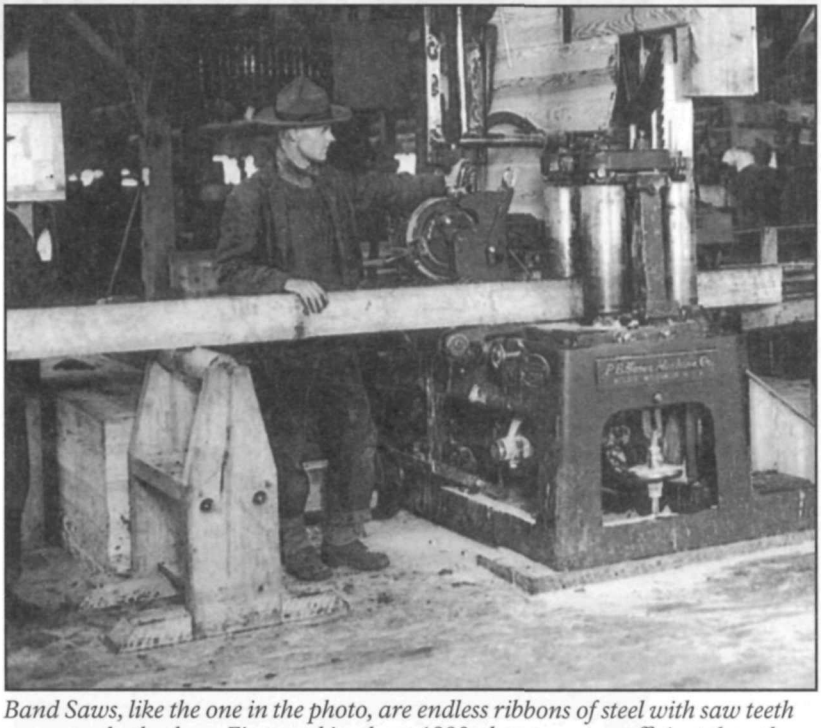
Soldiers bringing spruce cants into the cut-up plant. Signal Corps



Transforming Cants Into Flawless, High-Strength Boards

The man in this photo was one of the 3,000 soldiers working in the Spruce Mill. He is feeding a spruce plank into a band re-saw. The saw will cut the plank into thinner boards, perhaps for the wing-beams that were crucial for aircraft production.

Precision and quality were two critical requirements of the lumber produced at the Spruce Mill. A crack or a knot in an aircraft's wing-beam effected the wing's strength and stability. Inspectors checked each board to see that it was free of defects, and that it was the correct size. The inspectors also checked each board to see that it was cut parallel to the grain, which provided maximum strength.



Band Saws, like the one in the photo, are endless ribbons of steel with saw teeth on one or both edges. First used in about 1880, they are more efficient than the older circular saws, which are steel disks with teeth on the outer edge.
Signal Corps

Who Were the Spruce Soldiers?

Records from the 17th Spruce Production Squadron, one of several squadrons in Vancouver, Washington, show that the 559 soldiers in the squadron came from 43 of the 48 states and from Canada as well.

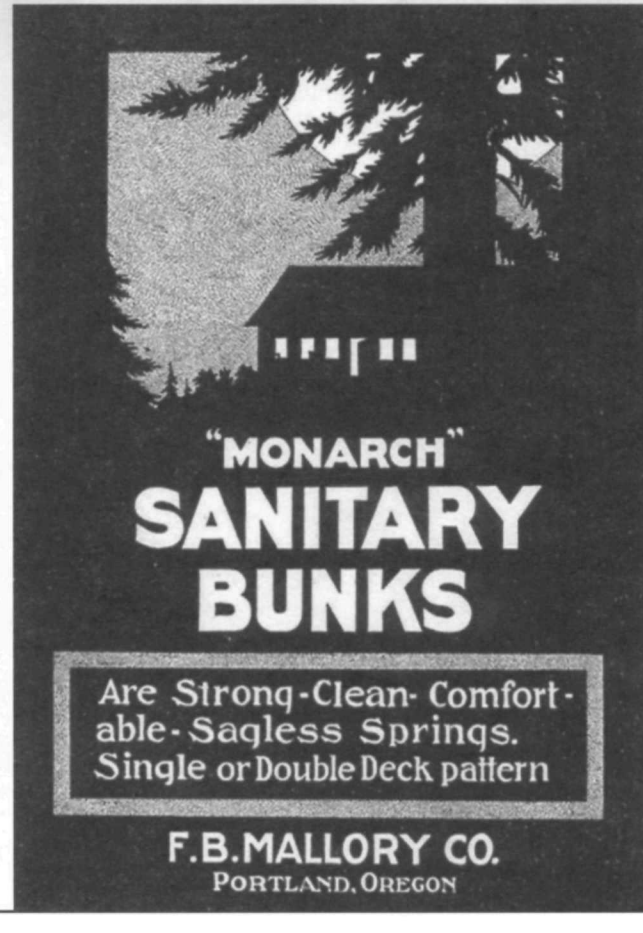
The Loyal Legion of Loggers and Lumbermen Sparked Progress

STOP 4

The Loyal Legion of Loggers and Lumbermen, known as the LLLL or 4L, was a labor organization started by the Army's Spruce Production Division. The 4Ls offered workers an alternative to groups such as the Industrial Workers of the World. The 4L's most important accomplishment was to require employers to meet health and safety standards for workers and soldiers stationed in the logging camps. Before the war, some logging camps were barely habitable. The Army and the 4L insisted that loggers have hot showers, clean bedding, and good food. Living conditions in the logging camps had to meet military standards, which were enforced by Army inspections. If Army standards were not met, the 4Ls and the SPD soldiers were not allowed to work.

What the 4L accomplished for the Lumber Industry

The Spruce Production Division and the 4L program helped bring the lumber industry to higher standards of safety and sanitation. The Army required that SPD soldiers work only 8 hours per day, and have clean camps and kitchens. The mill owners had to meet Army standards if they were to have soldiers working for them. Since civilian loggers lived in the same camps as SPD soldiers, all lumber industry workers benefitted from the Army requirements. When the war ended, the 8-hour day, hot showers, and improved conditions became the standard.



The Timberman Magazine, *1918*

Women and the War Effort

Women did not work in the Vancouver Spruce Mill, however, they did work in private mills producing spruce lumber in Oregon and Washington in a variety of production jobs. Labor became scarce in the lumber industry as men enlisted in the Army and Navy. So the Army encouraged women to take jobs in the private mills and box factories. After the war, most women quit working, but when the second World War began, the precedent had been established, and women returned to the mills and factories.

Although women had long been employed as cooks and service people in the lumber industry, it was front-page news when they went to work in positions traditionally held by men. Although the U.S. was in the first World War for less than two years, the conflict had important long-lasting social and political impacts.

Oregon Historical Society

Women 4L workers in a saw mill at Coos Bay, Oregon, pose for the photograph below.

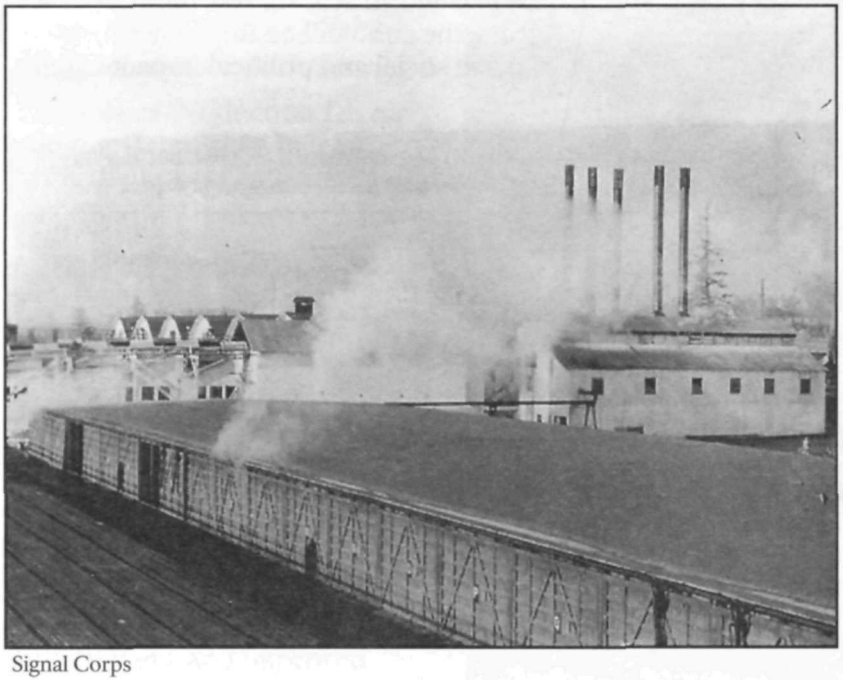
The Timberman Magazine, *1918*

The Dry Kilns

STOP 5

To the east of the Main Mill building, near where you are now, was the Spruce Mill's dry kiln system. Here the best of the spruce lumber was dried before shipment to the aircraft factories.

After the spruce was milled to specific dimensions in the cut-up plant, boards selected for wing-beams and other critical aircraft parts were brought to the dry kiln and blasted with steam at temperatures as high as 160 degrees fahrenheit. The kiln held 39,000 board feet of wing-beam stock in each of its 24 chambers, for a total of 936,000 board feet. Each "charge" of spruce took 18 days to cure, however, so the kiln could not keep up with the Mill's production rate. The excess lumber was dried in the open air, or shipped green, meaning undried.



Signal Corps

How can wet steam make dry lumber?

Green lumber is dried when steam is injected into the kiln chamber. The steam raises the temperature of the lumber and the wood cells release their moisture. When the lumber comes out of the kiln, it is wet on the outside but dry on the inside. The surface moisture dissipates, and the lumber is completely "cured."

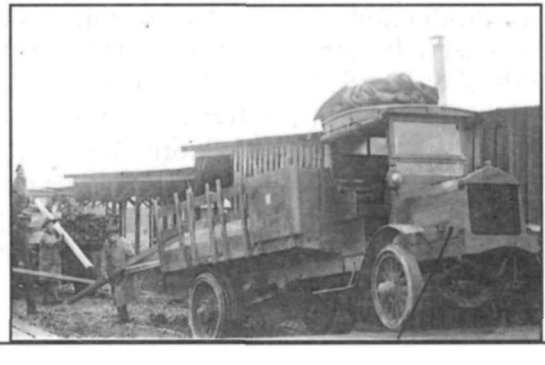
The Loading Sheds

STOP 6

In this area, which is south and west of the Main Mill building, was an extensive set of loading sheds.

Finished lumber was loaded into boxcars here for shipment to aircraft factories in the U.S., or to the Allied forces' aircraft factories in Europe. About 70% of the spruce went to aircraft plants in Britain, France, and Italy. Most of the spruce lumber began its journey with a trip east on the Spokane, Portland, and Seattle Railway, then into the transcontinental rail network to destinations in the Midwest, or to Atlantic ports. The Spruce Mill depended on the efficiency of the U.S. rail system. Logs came out of the woods by rail, and were delivered to the Vancouver mill by rail. Then the finished lumber traveled by rail to its destination a continent away.

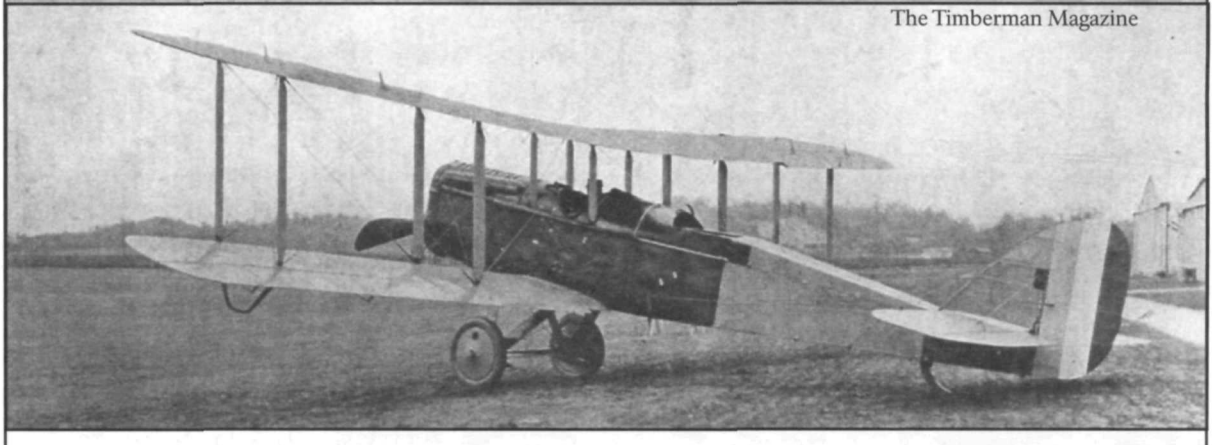
Signal Corps



The Spruce Production Division provided the impetus for the use of trucks in logging. Spruce trees grow in areas that are inaccessible by railroad. After World War I logging with trucks became standard.

Signal Corps

Making Aircraft for the War



The Timberman Magazine

World War I began in Europe in 1914, but the U.S. did not enter the war until 1917. By that time the opposing Allied and Axis troops had bogged down in the trenches of France. Aircraft were seen as the weapon that would turn the tide of war in the Allies' favor. Sitka spruce proved to be the best aircraft material available.

Approximately 4,000 aircraft were made in the U.S. for the war. More were made in Europe, but the amount of sitka spruce cut by the Spruce Production Division far exceeded the need. If each airplane required 2,500 board feet of spruce, the 143 million board feet that the SPD produced would have made 57,000 Allied aircraft. Allied propaganda emphasized the importance of sitka spruce and the limitless quantity in the forests of the Northwest. This was a strategic material that was inaccessible to the Axis powers.

Why Sitka Spruce?

Spruce is a common species of tree, found in America, Europe, and Asia. Engineers determined that sitka spruce, growing on the coast of Oregon, Washington, British Columbia, and Alaska, had the highest tensile strength of any spruce species. Also, sitka spruce grew larger than other species, so the amount of defect-free lumber was greater. Wartime folklore also maintained that sitka spruce could be hit by a bullet and not shatter. This may not have been very scientific, but it was probably a comfort to combat pilots.

STOP 7

The Machine Shop Kept the Mill On-Schedule

Signal Corps

The machine shop was a very important part of the Spruce Mill. All saw mills had machine shops where millwrights, the master mechanics of the timber industry, kept the equipment running efficiently. The senior millwrights at the Spruce Mill were veterans of the industry, highly experienced men who knew the quirks of saw mill machines and were exceptionally skilled at repairing them.

The machine shop was equipped with lathes for turning steel parts, vertical and horizontal milling machines for precision shaping, and drill presses for drilling holes in the parts. The equipment was powered by electric motors turning overhead shafts which drove belts to each tool. Although electric arc-welding technology was available in 1918, it is almost certain that the millwrights had a forge for welding large iron parts.

Future archaeological investigations of the machine shop should tell us more about the activities that went on there. Artifacts providing evidence of forges include coke (burned coal) and slag (impurities remaining after coal is burned), as well as bits of steel. Evidence of lathes and milling machines comes in the form of "sprue," the chips of steel left over from the cutting process. Some saw mills had small foundries for casting iron parts. Archaeological investigations of foundries find artifacts indicating the heating of iron, pattern making, and sand casting.

Daily Life at the Spruce Mill

STOP 8

At the peak of operations in September and October, 1918, 3,042 soldiers worked at the mill. A few fortunate men lived in wooden huts or "cantonments" like the one in the photo below, but most lived in pyramid-shaped tents pitched in rows to the north of the Spruce Mill.

Signal Corps

Tents or Cantonments?

Spruce soldiers lived in the two types of temporary housing pictured here. The cantonments were wooden sheds hastily built without foundations. The tents were large canvas squad tents with wooden walls and floors. Tents leaked more than cantonments, but both were drafty and soggy in the Northwest winter weather. Which would you prefer?

Soldiers in the Army Signal Corps Spruce Production Division came from most of the 48 states. Like soldiers everywhere, they worked, drilled, ate in the mess hall, complained about the food, and wrote home to their parents and sweethearts.

At Vancouver Barracks, soldiers could visit the base Canteen for entertainment. After the Armistice, in December of 1918, the Victory Theater opened on the post. The theater offered films twice daily, plus live music, amateur nights, and boxing matches. Admission was five cents for enlisted men and 10 cents for officers.

Entertaining the Troops

Although they were not subjected to the danger of the European battle front, Spruce Mill soldiers had their own hardships. The mill ran three shifts each day, so some soldiers worked days, some swing shift, and some night shift. The weather was wet, and the living conditions were primitive. Work in the mill was hard and dangerous. Medical records show many soldiers hospitalized with hernias and with heart strain.

When they were off duty, soldiers flocked to the bars in the town of Vancouver, on the west side of Vancouver Barracks. There they found beer, music, and social opportunities. Posters and leaflets from the Vancouver Barracks Chief Surgeon warned soldiers of the need for moderation and of the perils of venereal disease.

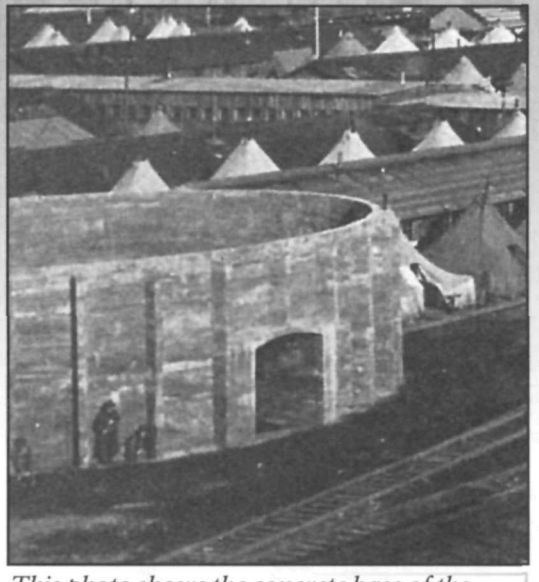
Soldiers take a break from a hard day of work in the mill. Signal Corps

Saturday Night in Vancouver

This photo shows soldiers enjoying their off-duty time in the Log Cabin Tavern, one of many bars in downtown Vancouver.
#HH9815.0 Fort Vancouver National Historic Site

Milling Lumber Produces Mountains of Wood Waste

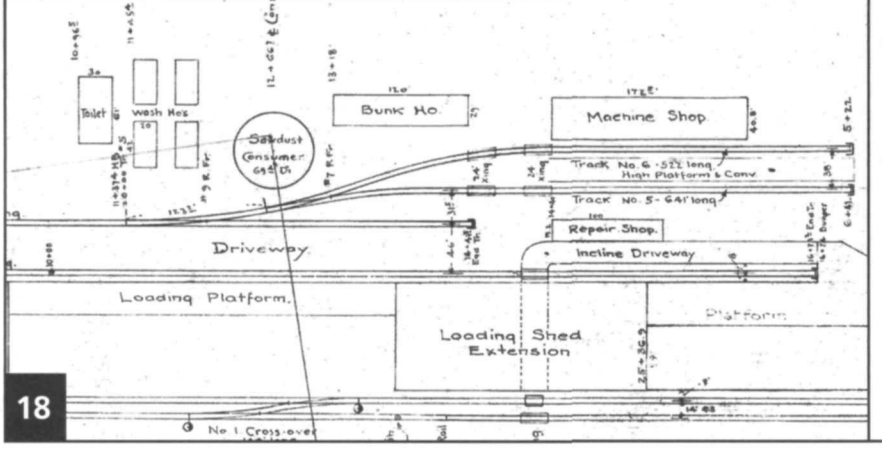
STOP 9



This photo shows the concrete base of the burner. The tents in the background, to the north of the burner, were quarters for SPD soldiers. Signal Corps

This is the location of the Spruce Production Mill's waste burner. We do not know what the completed Spruce Mill burner looked like, because no photos or plans of the burner have survived. In fact, the burner may never have been completed. We know that it was still under construction in the summer of 1918.

All saw mills produce large quantities of waste material in the form of bark, sawdust, and trimmings from the lumber. If the mill operated at 90% efficiency, it would have produced about 300 cubic yards of waste each day. Some of this could have been burned at the mill for boiler fuel, and some could have been shipped by rail to municipal power plants in Portland or elsewhere, but some would have needed to be disposed of at the mill.



This drawing is a portion of the plan of the Spruce Mill drawn by the S.P.& S. Railway. The mill produced so much rail traffic that the railway needed complete and accurate plans. The circular waste burner is in the left center of the drawing.

Spruce Mill Archaeology

Archaeological remains of the sawdust burner base provide an important reference as it was located in the northeast corner of the original Hudson's Bay Company stockade. Army Engineers built the Spruce Mill on the old Hudson's Bay stockade site. Some Hudson's Bay and early military artifacts have been covered and protected by fill from the construction of the Spruce Mill. In 1966, the Hudson's Bay Company stockade was restored. Some foundations of Spruce Mill structures, including the planing mill and loading platforms, are buried beneath the restored stockade.

Excavations during the 1970s, showing the Spruce Mill sawdust burner base.
National Park Service

The National Park Service collects archaeological data at Vancouver National Historic Site through research excavations and monitoring other kinds of excavation, such as utility trenches and road building. Artifacts and data recovered from these studies and activities are housed in the curation center inside the Fort stockade, and displayed in exhibits throughout the Historic Site.

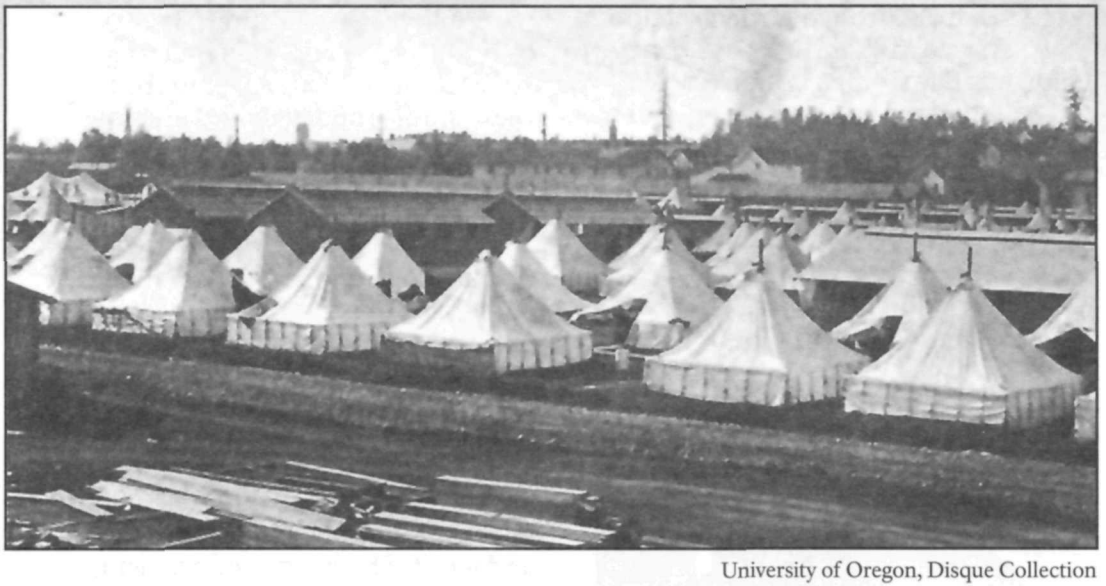
Archaeological work at Fort Vancouver dates back to excavations by Louis Caywood in the late 1940s. To date, archaeologists have excavated less than 10% of Fort Vancouver National Historic Site. Like most rich archaeological sites, the Vancouver area has appealed to different cultures over time as a suitable place to live and work. The overlay of prehistoric, historic, and industrial deposits in the same place is unusual, but by no means unique. Future research will tell us much more about the men who worked and lived at the Spruce Mill.

Tent City

STOP 10

This area was covered with white canvas squad tents during World War I. For most of America's involvement in the war, SPD soldiers lived in these tents. They were pitched on vacant ground north of the Spruce Mill, forming a sea of white on the slope north to the Vancouver Barracks Parade Ground.

Each tent was equipped with a heating stove, and some had wooden floors and side walls. Winter is mild in Vancouver, but also very wet, so living in tents must have been difficult.



University of Oregon, Disque Collection

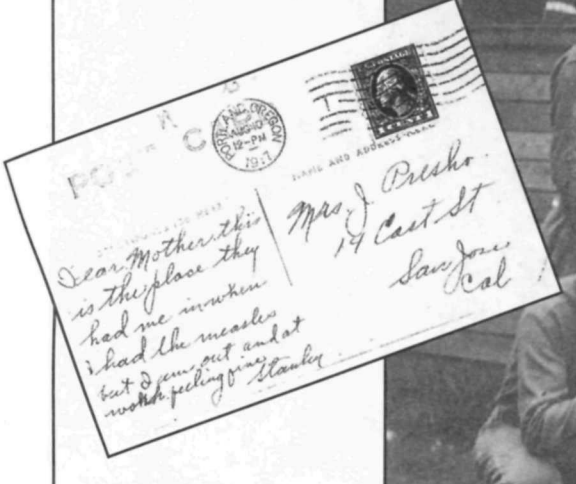
Influenza in 1918

An epidemic of influenza swept around the world in the fall of 1918, killing an estimated 18 million people in Asia, Europe, and the Americas. Spruce Mill soldiers were vulnerable to the 1918 'flu because of their crowded living conditions and susceptibility to respiratory infections. Medical records show that soldiers contracted the 'flu, but that the expanded medical facilities on the post were able to care for the sick.

Health Care for the Spruce Soldiers

During World War I, the medical staff at Vancouver Barracks had to care for 5,000 more personnel than they had before the war. The post hospital, built in 1905, had only 120 beds. Temporary buildings were erected near the hospital, and the staff was expanded to cope with the increase. Medical records show that the Vancouver Barracks Chief Surgeon was responsible for the Spruce Mill soldiers, plus those stationed at logging camps throughout Oregon and Washington. Admissions to the post hospital during the war totaled 21,617; mortality from all causes was 228 men.

The soldiers who were logging were especially vulnerable to accidents. For example, on one day in August 1918, 43 SPD soldiers from the logging camps were sent to the post hospital at Vancouver Barracks. Medical officers from Vancouver inspected the logging camps to ensure that they met military standards of sanitation and nutrition, conducted induction physical exams, and treated civilian workers from the spruce logging camps.



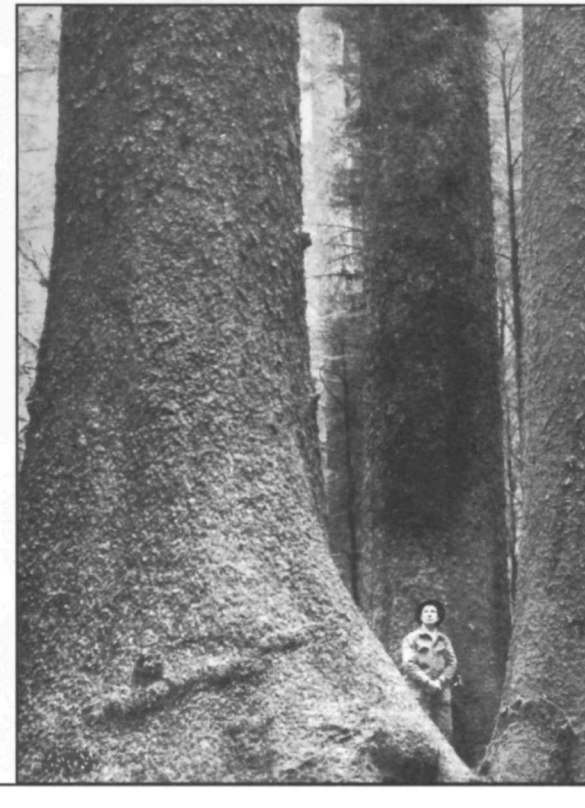
Signal Corps

The Spruce Production Division's Environmental Legacy

Prior to World War I, spruce was not a marketable wood. It's strength qualities were not widely known, and it grew in relatively small patches in the wet, densely-grown coastal areas of the Pacific Northwest. To meet the military's need for spruce during World War I, hundreds of miles of roads were developed into these remote areas. After the huge logs had been trucked out, they were transferred to new railroad lines to be taken to the mills.

However, the war was over before the SPD was fully into production. Certainly many trees were cut, but the majority of the negative effects on the environment developed from the increased access into the finely balanced ecosystem of the old growth forest. After World War I, and even today, these roads continue to be used by logging companies to gain access to not only spruce, but other marketable trees.

Although current reforestation practice is considered to be adequate to sustain our need for lumber, the continuing effects of logging on the environment and wildlife are hotly debated. The "forests" generated by man do not yet result in the balanced, self-sustaining ecosystems vital to the survival of many species of plants and animals.



A stand of spruce in Lincoln County, Oregon in 1923. Lincoln County Historical Society

The War Ends and the Mill Closes

SO LONG, OLD MILL! WE'VE DONE OUR STRETCH.

This illustration appeared in the December 21, 1918 issue of *Straight Grain*, the Vancouver Barracks newspaper. The caption communicates the mood on the post after the armistice was signed in November of 1918. The Spruce Squadron soldiers were quickly discharged and sent home to their families.

This artifact is a pin from the Loyal Legion of Loggers and Lumbermen. See Page 10 for more information.

Text by
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Cultural Resources Division
Fort Vancouver National Historic Site

9/2010

Vancouver National Historic Reserve

The Vancouver National Historic Reserve brings together a national park, a premier archaeological site, the region's first military post, an international fur trade emporium, one of the oldest operating airfields, the first national historic site west of the Mississippi River, and a waterfront trail and environmental center on the banks of the Columbia River. The partners of the Reserve teach visitors about the fur trade, early military life, natural history, and pioneers in aviation, all within the context of Vancouver's role in regional and national development. The Reserve's vast array of public programs – including living history events, festivals, cultural demonstrations, exhibits, active archaeology, and other special activities – create a dynamic, fun, and unique tourist destination for people of all ages.