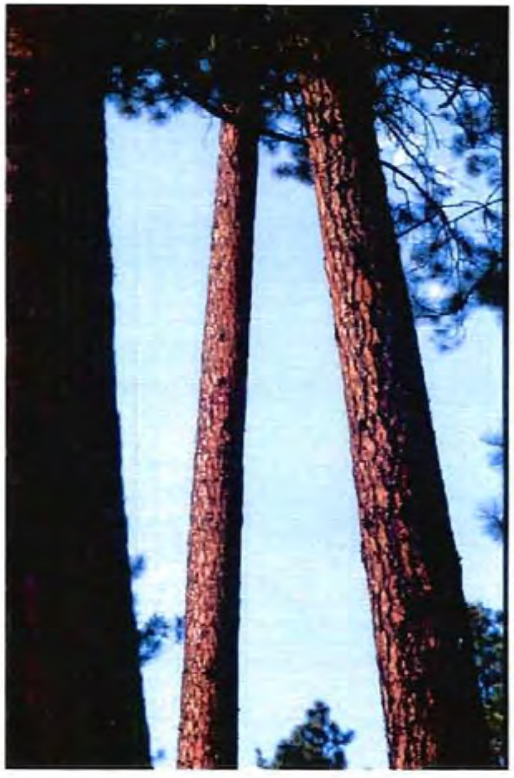
Pathways in Time--

Living with Change in a Ponderosa pine/ Douglas-fir forest



FireWorks

Forests change all the time. Sometimes they change dramatically, as during a crown fire in a forest. Sometimes they change a little bit at a time; this happens during a "low severity" fire, like many surface fires. Sometimes they change slowly and subtly, so the differences are hard to see from year to year.

Think of the forest travelling a path through time, changing as it goes. This booklet shows a few stops along the path that might be followed by a ponderosa pine/Douglas-fir forest.

Ponderosa pine can grow in many places in a forest. The kind of forest shown in this booklet grows on a dry hillside. Here is a photo of such a forest. This is Forest Stand B4, in the Bitterroot National Forest, western Montana. Most of the trees in the photo are Douglas-firs. The very large trees with golden-brown bark are ponderosa pines. Stand B4 is one of many old-growth ponderosa pine stands studied by Dr. Steve Arno, a scientist at the Fire Sciences Laboratory.

The "cartoon forests" on these pages show changes during the past century in Forest Stand B4. Use the small "tree portraits" below to figure out which tree species are shown in the drawings.

Ponderosa pine

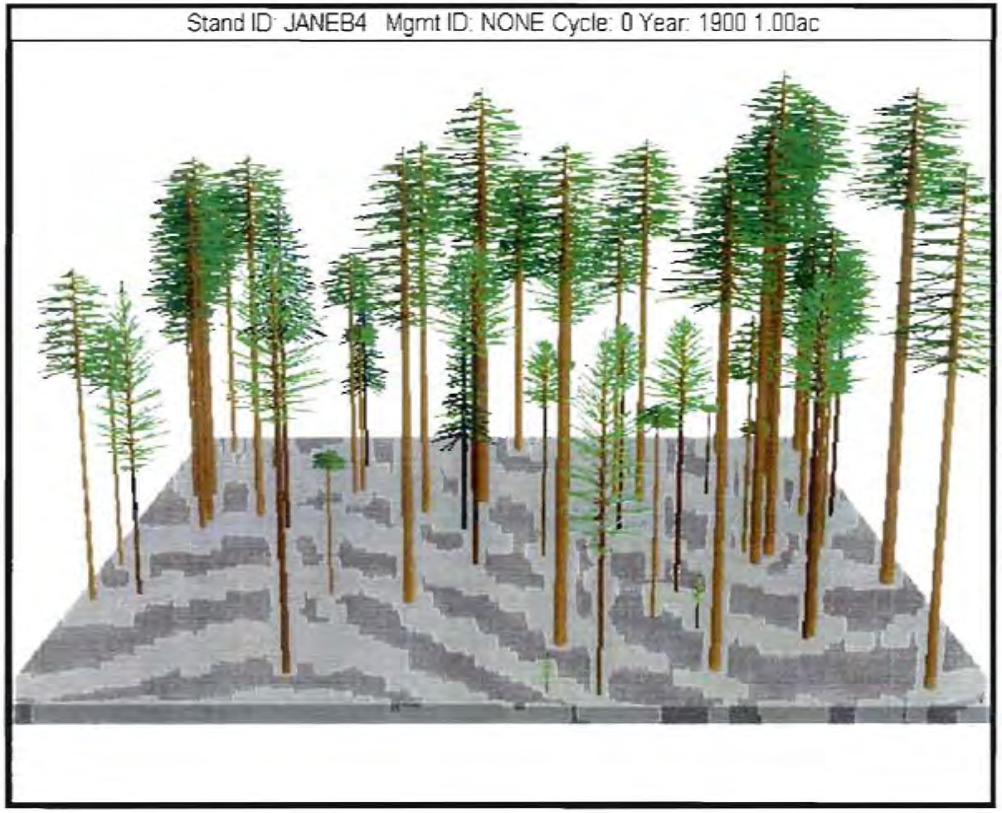
Douglas-fir

Grand fir

Subalpine fir

Most of the big old pines in Stand B4 have many fire scars. According to Dr. Arno's observations, a surface fire burned through Stand B4 about every 13 years in the time between 1600 and 1900. The flannelboard story for ponderosa pine/Douglas-fir forests calls these "creepy, crawly fires." We don't know if there were fires in Stand B4 before 1600 because there were no stumps or trees that old. Many of the oldest ponderosa pines in Montana and Idaho have fire scars from the 1500s, 1400s, and even 1300s.

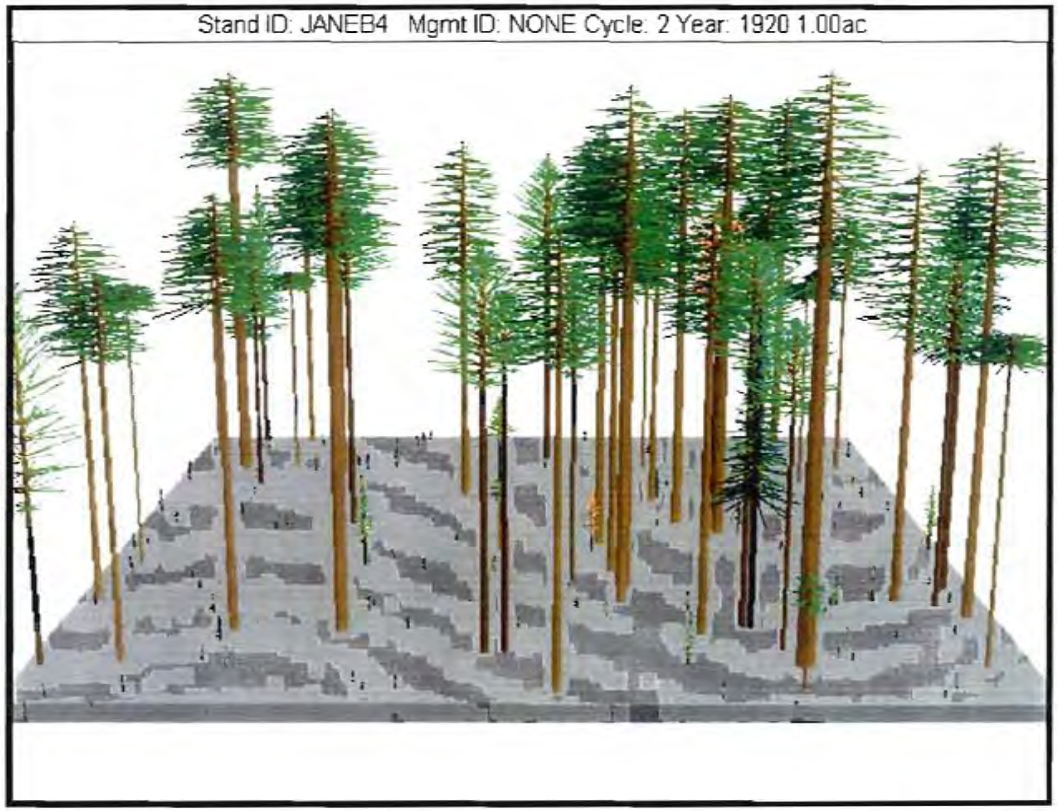
According to Dr. Arno's data, this is how Stand B4 looked in 1900, right after a surface fire. There were about 60 trees per acre. Most of them were ponderosa pines, and most of them were big. There was a lot of open, grassy space between the trees.



	How many trees?	
	<8 inches in diameter	**≥8 inches in diameter**
Ponderosa pine	7	31
Other species	9	13
Total	16	44

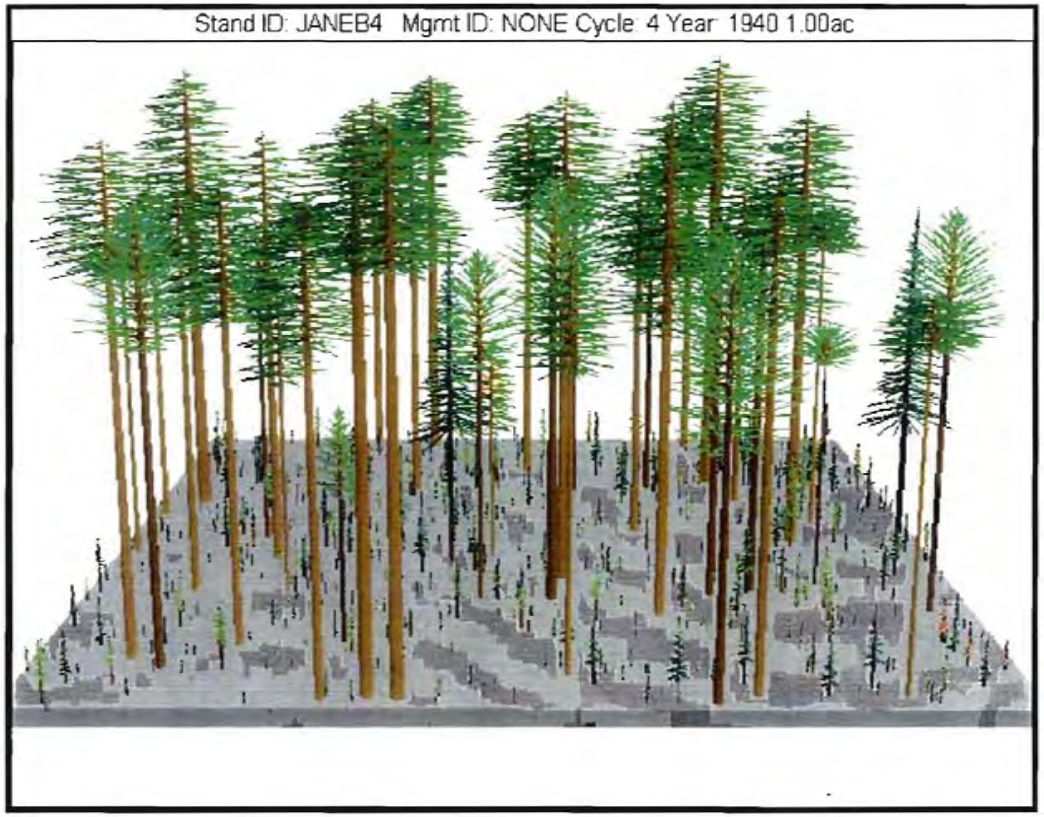
A computer program uses mathematics to predict tree growth, reproduction, and death in forest stands. **This "model" shows what Stand B4 may have looked like in 1920-- with no fires in more than 20 years. There are 181 trees per acre,** more than four times as many as the forest had in 1900. The new trees are still very small. Few of them are ponderosa pines. Most are Douglas-firs, grand firs, and subalpine firs. These trees grow well in openings and also in the shade of the pines.

	How many trees?	
	<8 inches in diameter	**≥8 inches in diameter**
Ponderosa pine	5	30
Other species	131	15
Total	136	45



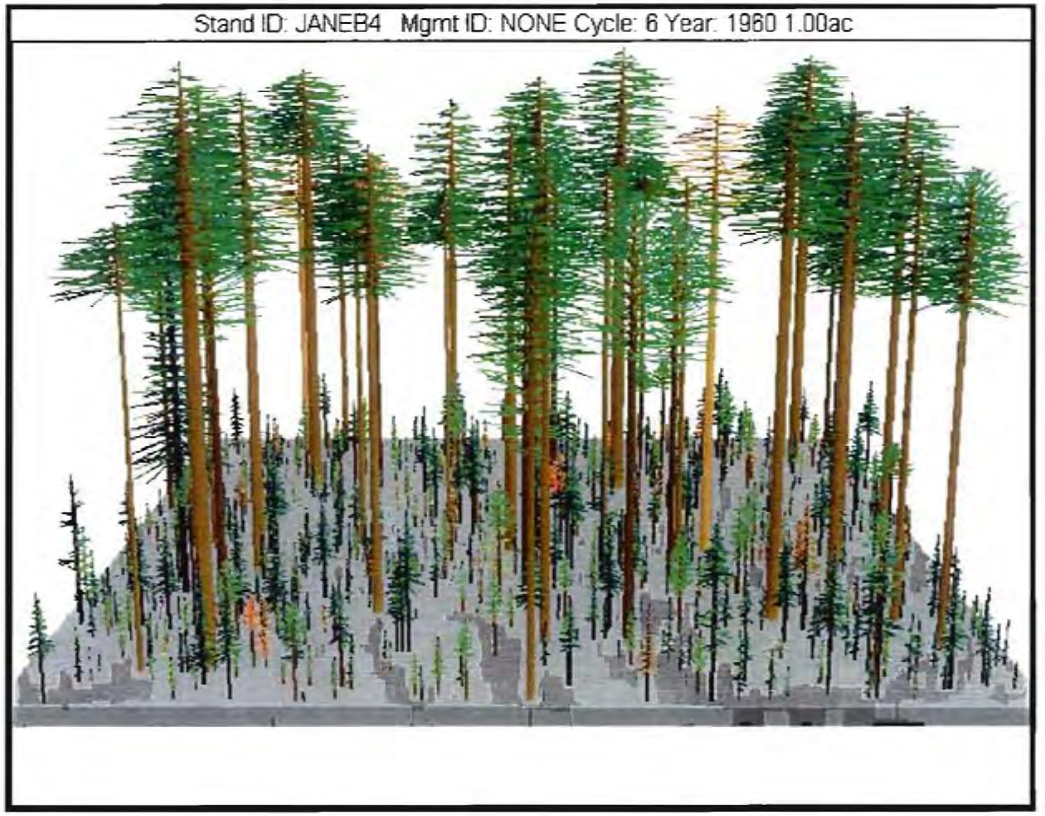
The mathematical model shows what Stand B4 may have looked like in 1940. The forest has not burned in more than 40 years. There are nearly 700 trees per acre. Young trees continued to grow in, but the biggest trees in the forest were still those old, fire-scarred ponderosa pines.

	How many trees?	
	<8 inches in diameter	**≥8 inches in diameter**
Ponderosa pine	2	28
Other species	640	13
Total	642	41



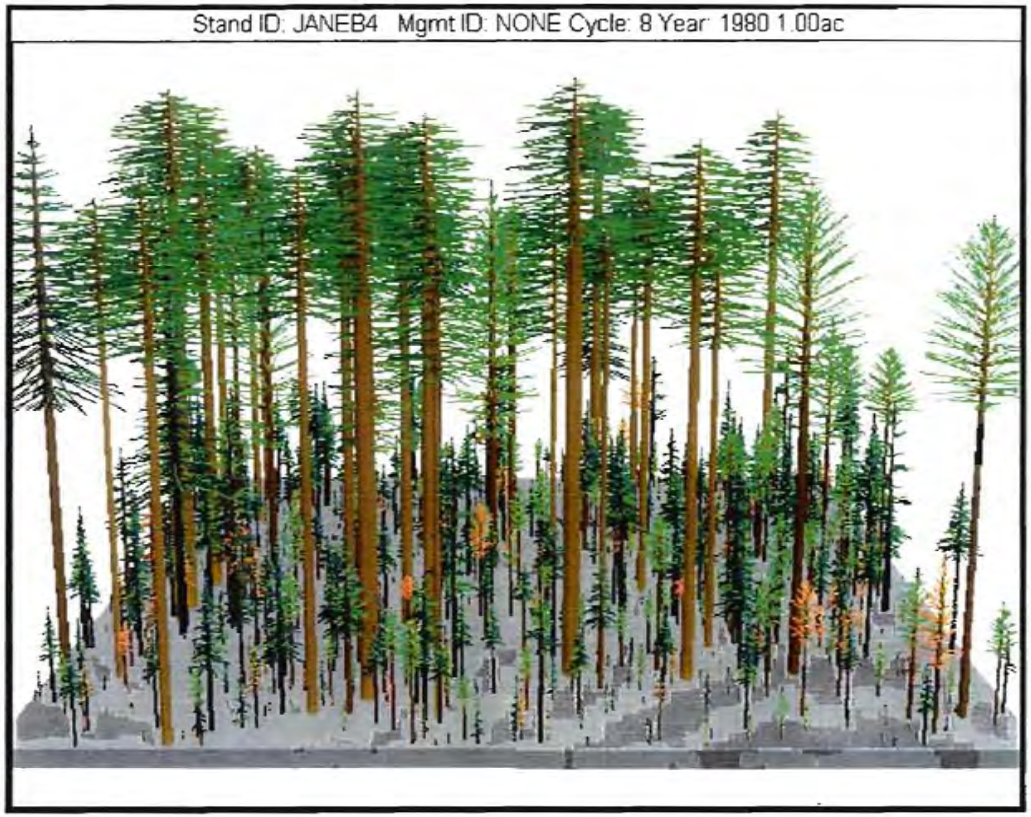
By 1960, the mathematical model shows more than 700 trees per acre in Stand B4. Some of the young fir trees were growing tall, and new trees continued to grow from seed.

	How many trees?	
	<8 inches in diameter	**≥8 inches in diameter**
Ponderosa pine	0	30
Other species	723	19
Total	723	49

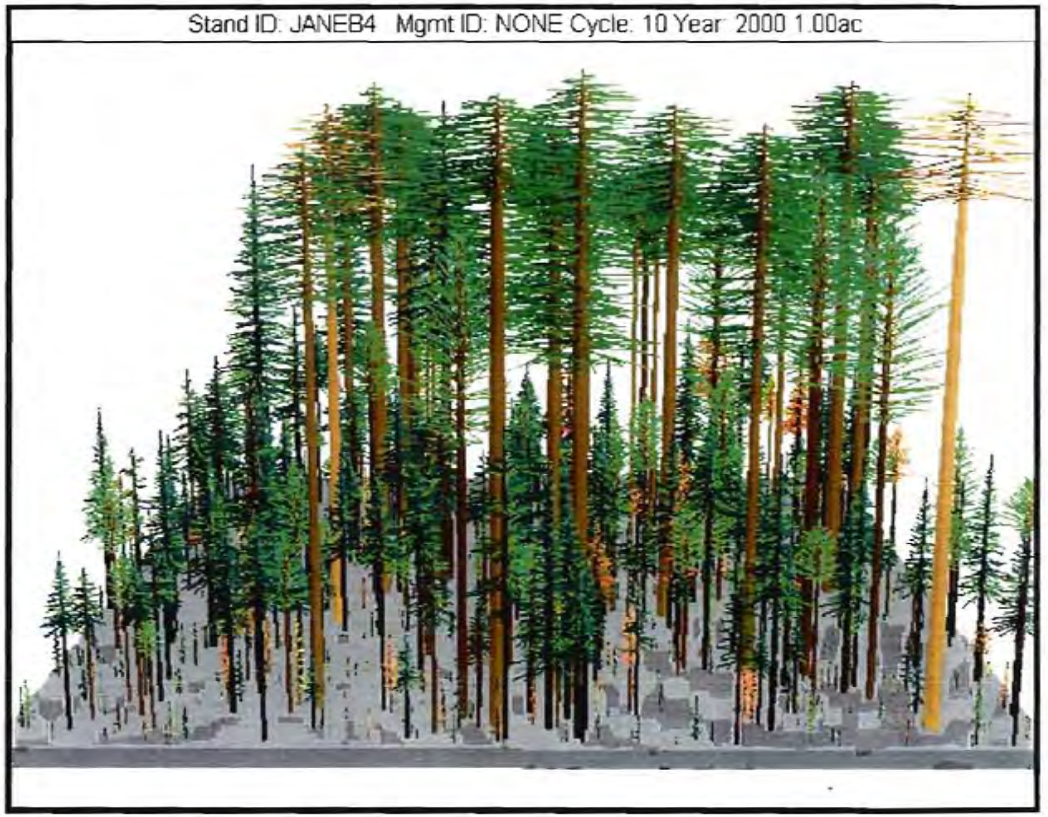


The mathematial model shows what Stand B4 may have looked like in 1980. There are hundreds of small trees per acre, but none are ponderosa pines. Young trees are beginning to form ladders of fuel from the ground into the crowns of the big old trees.

	How many trees?	
	<8 inches in diameter	**≥8 inches in diameter**
Ponderosa pine	0	25
Other species	829	52
Total	829	77



By the year 2000, Stand B4 will have grown for more than 100 years without any fires. The mathematical model predicts that there will be nearly 1000 trees per acre, and nearly all of them will be firs. Many of the trees will slowly die because they can't get enough moisture and nutrients in this crowded forest. Even the biggest pines, which have lived here for 400 or 500 years, can't survive with so many other trees surrounding them.



	How many trees?	
	<8 inches in diameter	**≥8 inches in diameter**
Ponderosa pine	0	27
Other species	876	93
Total	876	120

This 1993 photo from Stand B4 shows a large ponderosa pine that has died, probably because there are so many trees competing for the scarce water and nutrients during the dry summer months.

80 YEARS OF CHANGE IN A PONDEROSA PINE FOREST

Computer models aren't our only source of information about the histories of ponderosa pine/Douglas-fir forests. In 1909, in a little valley in western Montana, foresters began an experiment. They cut some of the trees, and they left many of the big trees still standing. Luckily for us, they carefully photographed their work and wrote down exactly where each "photo point" was located. Every ten or twenty years afterward, scientists visted this location to study it and take pictures. They tried to take pictures at exactly the same locations used in 1909. Here is one collection of their photos.

In the first photo, notice the dead branches from logged trees lying on the ground. How many stumps can you find? Do you think the forest looked like the Stand B4 did in 1900? Then look at the rest of the photos in this collection. Can you tell what kind of tree has grown fastest in the past 80 years? What kind of tree is likely to be most plentiful here in the next hundred years?


1909


1948


Large pine cut ~ 1952
1958


1968


1979


1989