Fire Scar Dates from the Pringle Falls Area of Central Oregon

Report Prepared For:

The Silviculture Laboratory
Bend, Oregon

Prepared by:

Terry Mazany
Marna Ares Thompson

Modern Studies Section
Laboratory of Tree-Ring Research
University of Arizona
Tucson

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FIRE SCAR DATES FROM THE PRINGLE FALLS AREA OF CENTRAL OREGON

In 1982 the Silviculture Laboratory located in Bend, Oregon provided the University of Arizona's Laboratory of Tree-Ring Research with nine fire-scarred ponderosa pine (Pinus ponderosa) cross sections from the Pringle Falls area in Central Oregon to assess the potential for fire history studies in that locale. The primary problem was to determine whether or not Pringle Falls tree-ring series could be dendrochronologically crossdated so that accurate calendar dates could be assigned to observed fire scars. The results of this study surpassed all initial expectations. The individual ring series did contain enough shared sensitivity for crossdating and the development of a Pringle Falls skeleton plot chronology. This chronology made possible the accurate dating of the tree-ring series and fire scars, resulting in an extraordinarily lengthy record of fire occurrence. This report describes the process of fire scar identification and presents the chronological record of dated fire scars preserved in the nine cross sections from Pringle Falls.

CHRONOLOGY CONSTRUCTION

The tentative dating of the Pringle Falls cross sections was attempted using the skeleton plotting technique described by Stokes and Smiley (1968). This method is used to graphically record and compare patterns in ring-width variation among different ring series. Trees in Central and Eastern Oregon typically exhibit great tree-to-tree variability in ring-width pattern compared to the consistency found among trees in the Southwest. The Pringle Falls trees proved to be no exception. Fortunately, the individual variation did not completely obscure ring-width pattern consistencies common to all sections throughout the length of the ring series (with the exception of the early portion of the chronology that is represented by only one sample, and thus not crossdated). There was sufficient regularity in ring-width patterns for crossdating. The common ring-width patterns from the individual-tree skeleton plots were combined to form the site skeleton-plot chronology which was crossdated against other Oregon chronologies to establish the validity of its dating. No discrepancies were found, indicating that the Pringle Falls skeleton plot chronology (Graph 1) is an accurate representation of calendar dates. A second dendrochronologist checked the accuracy of the chronology.

After the chronology was established each cross section was dated and pinpricked to mark the dates on the sections. Inside (pith) and outside (bark year) dates are listed in Table 1 and illustrated on Graph 2. The length of the chronology is remarkable. Trees from Central and Eastern Oregon usually only date back to the early 1600's except for a few samples from stands of virgin timber which date back into the 1400's. The oldest pith date among the Pringle Falls specimens is 1362, and taken as a whole, some of the oldest dated trees from Central and Eastern Oregon are contained in this sample of nine sections.

FIRE SCAR IDENTIFICATION AND DATING

Fire scar identification was limited to cases of cambial damage that could be positively determined to be caused by fire. A total of 160 fire scars were identified on the nine sections. A second dendrochronologist checked the dates assigned to the individual fire scars. The patterned temporal distribution of the fire scars is illustrated in Graph 2, and the dates for the fire scars are listed in Table 2. The final two columns of Table 2 contain the aggregate numbers of fire scars for each year summed both by total number of scars identified, and by total number of trees exhibiting a scar for a particular year.

The identification of the year of occurrence of a fire scar is made relative to the growth characteristics of the tree rings. This is illustrated in Figure 1 (adopted from Barrett, 1981). Fire scars that occur during the growing season can appear in either the earlywood or latewood portions of a ring. Those scars that occur during the dormant period appear on the latewood boundary between two rings. The time of year represented by each stage of ring-width growth will vary according to the tree growth patterns of any particular region. The year designation for the dormant-period scars follows the dendrochronologic standard of defining a new year after the complete cessation of growth in the latewood. Thus, a dormant-period scar is dated to the year of formation of adjacent earlywood cells (that is, dated to the year of the ring it precedes). While this assignment follows accepted dendrochronologic theory, it may not be an accurate indicator of year-of-fire occurrence for all regional settings.

The difficulty in assigning accurate year designations to dormant-period fire scars occurs because the dormant period in the Northern Hemisphere spans two calendar years. In the Southwest, dormant-period scars probably indicate spring fires occurring when forests are dry (Weaver, 1951; Swetnam, n.d.), whereas late summer in the Southwest is usually a time of heavy rains from the monsoons. Consequently, the dendrochronologic designation for dormant-period scar dates probably accurately indicates the calendar year of fire occurrence. The situation may be reversed in the Northwest where it is typically rainy in the spring and dry during late summer and into the fall. There may be a legitimate basis for assigning the calendar date of the year prior to a dormant-period scar rather than the date of the year succeeding the scar occurrence. This, however, is a matter that requires empirical study.

The distinction between earlywood scars and dormant-period scars, and between latewood scars and dormant-period scars is not always as clear as illustrated in Figure 1 because of extensive structural damage or impeded growth. This probably accounts for the deviation of a few scars that appear to be a "year off" compared to a consistent pattern exhibited by other fire scars. Fire scars dated within a year (either before or after) of a consistently defined fire occurrence can probably be considered to represent that same fire.

One final observational note pertains to the pattern of ring widths associated with the occurrence of fire scars. Trees in this sample consistently exhibited a marked reduction in ring width for five to ten years after a major fire. This pattern was so striking that it was possible to infer the existence of a fire scar where scars were lacking (probably the result of succeeding fires burning away the scars of earlier fires) based on the decrease in ring widths. These hypothesized fire scars correlate extremely well with major fire occurrences preserved as scars on the other cross sections. This pattern of a decrease in ring width following a fire has implications for tree growth and forest productivity studies.

CONCLUSIONS

The nine cross sections from Pringle Falls did crossdate and it was possible to construct a local chronology that crossdates with established chronologies from surrounding locations (Graph 1). The positively identified fire scars were than dated to the calendar year of occurrence. These dates are presented in Graph 2 and Table 2. The series of dated fire scars forms perhaps the longest record of fire history yet developed for any one region. Consequently, these data have value, not only for reconstructing the fire ecology of the Pringle Falls area, but also as baseline data for the emerging discipline of fire ecology based on fire history reconstructions.

Bibliography

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Table 1

Sample	Inside (Pith) Date	Outside (Bark) Date
482	1553	1981
483	1426	1981
488	1542	1981
489	1541	1981
490	1467	1981
491	1362	1981
495	1470	1981
496	1460	1981
498	1535	1981

Table 2

Fire Scar Date	Sample Number 482	483	488	489	490	491	495	496	498	Number of Fire Scars	Number of Trees Scarred
1387						A*B**				2	1
1434						B				1	1
1446						B				1	1
1487		B								1	1
1521±							A B			2	1
1525					B					1	1
1527					A					1	1
1542							B			1	1
1551					B					1	1
1552					A					1	1
1581						B				1	1
1589						B				1	1
1628					B					1	1
1629						B				1	1
1652				A B	A		A			4	3
1653					B					1	1
1658						B				1	1
1662					B					1	1
1672							A			1	1
1673	A				A					2	2
1678					B					1	1
1689			B							1	1
1692			B		A					2	2
1693					B	B	A B			4	3

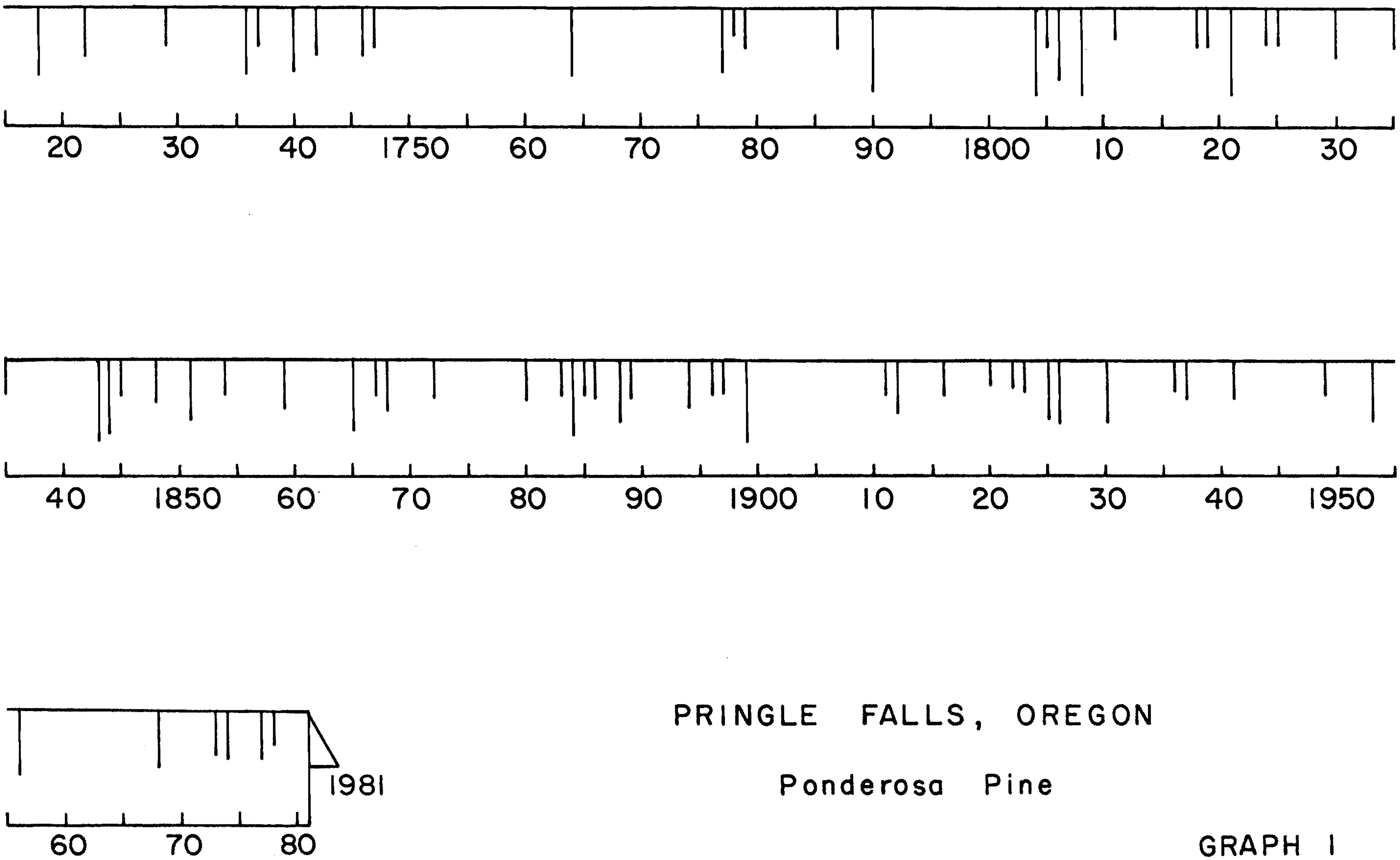
* A side of cross section
**B side (or reverse side for #490) of cross section

Table 2

Fire Scar Date	Sample Number 482	483	488	489	490	491	495	496	498	Number of Fire Scars	Number of Trees Scarred
1706					A			A		2	2
1707					B	B	A B		A B	6	4
1716				A B	A			B		4	3
1717					B					1	1
1724									B	1	1
1732	B					B	B	B		4	4
1732±							A			1	1
1733			A B						A	3	2
1734±				B					B	2	2
1738	B									1	1
1748								B		1	1
1748±									A	1	1
1749	A B	A B			A B				B	7	4
1762					A				A	2	2
1762±						B				1	1
1763			A B	A B	B		B		B	7	5
1788	A B	A B	A	A B	A B	B	A	A	A B	14	9
1799	B		A		A B	B	A B	B	A	9	7

Table 2

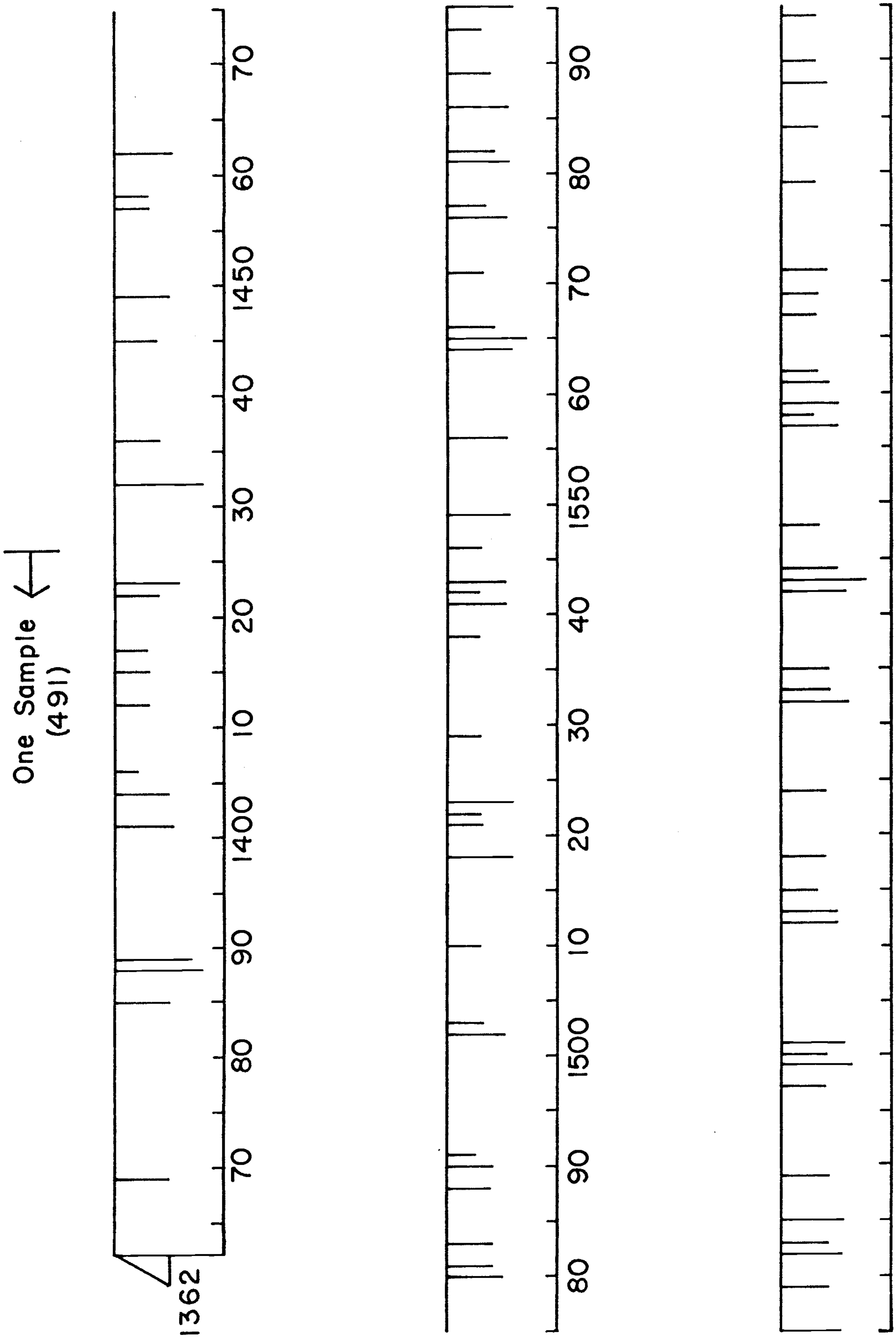
Fire Scar Date	Sample Number 482	483	488	489	490	491	495	496	498	Number of Fire Scars	Number of Trees Scarred
1800									B	1	1
1802			A							1	1
1806±			A							1	1
1807	A									1	1
1808±			A							1	1
1811	A									1	1
1824	A B	A B				B	B	A B		8	5
1824±							A			1	1
1842		A B	A B	A B	A B			A B	A B	12	6
1865	B		A B	A B	A B	B	A B		A B	12	7
1872						B		A B		3	2
1880±	A B									2	1
1886			A							1	1
1887			B		A B	B		A B	A B	8	5
1901	A									1	1
1902±	B									1	1
1908±							A			1	1
1919±	A									1	1
1928±	A									1	1
1930±	B									1	1
1931±			A							1	1
1936±			A							1	1
1940±	A B									2	1
1955	B									1	1
1956±	A									1	1
1971							A			1	1
1974±	A B									2	1

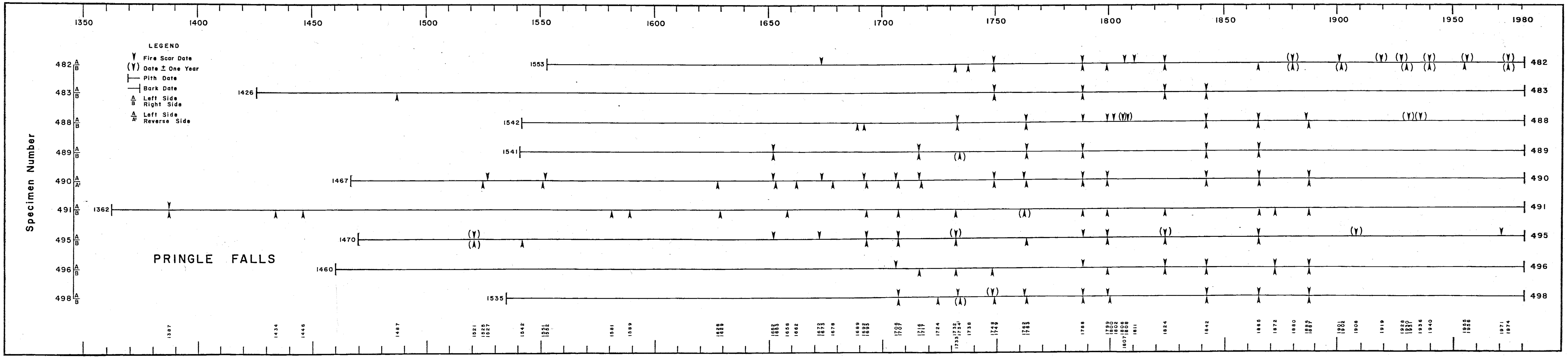


PRINGLE FALLS, OREGON

Ponderosa Pine

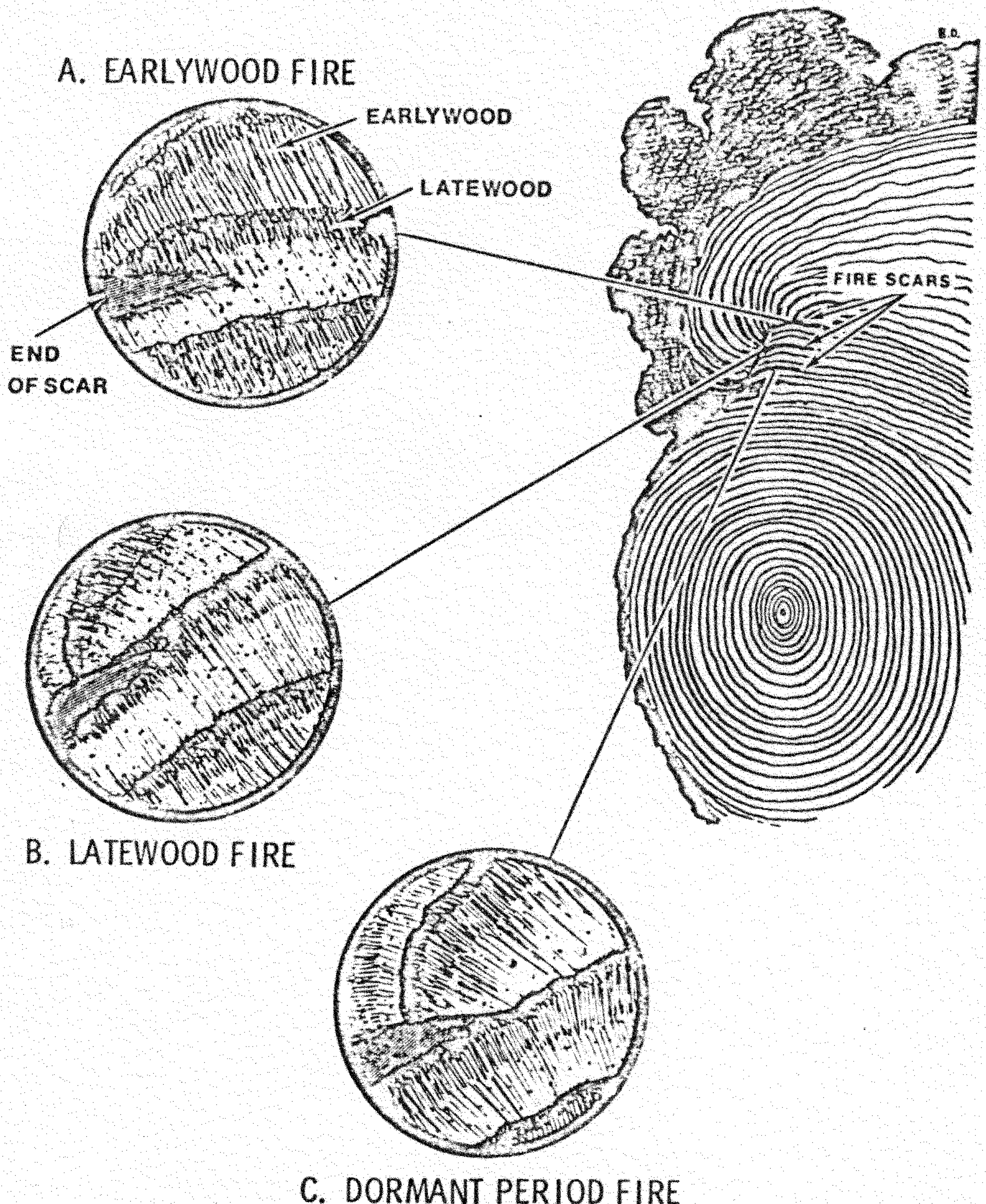
GRAPH I


One Sample
(491)
1362
70
80
90
1400
10
20
30
40
1450
60
70
80
90
1500
10
20
30
40
1550
60
70
80
90
1600
10
20
30
40
1650
60
70
80
90
1700
10



LEGEND
Fire Scar Date
Date ± One Year
Pith Date
Bark Date
Left Side
Right Side
Left Side
Reverse Side
Specimen Number
PRINGLE FALLS
1350
1400
1450
1500
1550
1600
1650
1700
1750
1800
1850
1900
1950
1980
482
483
488
489
490
491
495
496
498
1553
1426
1542
1541
1467
1362
1470
1460
1535

Figure 1



(from Barrett, 1981)