REPORT: Analysis of Bitterbrush Stems from Mt. Hebron, California

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Stem sections of bitterbrush (Purshia tridentata) collected by the U.S.F.S. Range and Wildlife Habitat Laboratory from lightly and heavily grazed stands near Mt. Hebron, California, were submitted to the Laboratory of Tree-Ring Research for age determination. A preliminary analysis of a number of the older age plants revealed ring-width variation in common among sections, i.e., the sections crossdated with each other. The resulting tree-ring chronology developed from the crossdated bitterbrush samples was found, in turn, to crossdate conclusively with the well established ponderosa pine tree-ring chronology from Lakeview, Oregon. On this basis it was determined that all of the observed samples examined in the preliminary analysis had been cut following the 1970 growing season and prior to the 1971 growing season - a fact later verified by B. R. McConnell who stated that the entire collection of bitterbrush stem samples had been collected during the period September 22-27, 1970. This finding was significant for two reasons: it provided confirmatory evidence of the annual nature of the bitterbrush growth rings and it suggested a procedure for expediting the overall age determination study.

Since many of the older plants exhibited crowded exterior rings difficult to distinguish (particularly those from the heavily grazed stand), it was decided to employ standard dendrochronological dating techniques whenever possible as a quicker alternative to simple ring counting. Thus, the calendar year of the innermost ring was first determined by following the known tree-ring chronology through the more open ring series of the sample and then the age of the plant was calculated on the premise of a 1970 cutting date. When the entire ring series was legible, the rings were also counted as an additional check and in all cases the differing procedures yielded identical results. Ages of the younger plants, and those sections which did not contain sufficient ring-width variability for crossdating purposes, were derived by simple ring counts based on an assumed 1970 cutting date.

Many of the sections were lacking the pith ring and it was necessary to estimate the number of rings lost from the interior. Such estimates ranged from 3 to 30 rings and it should be recognized that the higher the estimate the lower the reliability. Pith ring estimates for two samples - Specimens 189 and 210 in Bag B - could not be made due to excessive interior erosion and the configuration of the sections. Only minimum ages could be determined for these two plants, and the true ages are undoubtedly considerably older than those assigned. All samples with

an observed pith ring are designated with the letter "p" following the year of the inside ring in the accompanying table of results.

A total of 265 sections were designated in the original consignment; however, because of duplication of numbered samples (several specimens from one individual plant all labeled with the same number) only 251 stem sections are listed. When duplication did occur, the maximum age from among the duplicates was recorded. It is believed that the final listing reflects the 251 separate plants included in the total collection. Two samples with the same number - Specimens 226 in Bag C - may possibly be from a stem and branch of a single plant, but we think it more likely they are from two different original plants and are thus treated separately in the table. A few sections - Specimen 193? in Bag C and Specimen 87X and 97A in Bag F - carried the additional markings as shown.

Lack of any comment in the table indicates the age estimate was obtained by means of the crossdating procedure described above. The comment "Ring count" identifies those sections in which the rings were merely counted to arrive at the age determination; "Ring count, poor" indicates a ring counting procedure was used but that the rings were crowded and difficult to distinguish (and therefore the age estimate is of less reliability); and "Partial ring count" signifies that crossdating was employed in determining the age but that it was also necessary to rely on

a ring count of the central portion of the sample because of the crowded nature of the inner rings. Other comments utilized are self-explanatory. It is worth noting that nearly every sample tended to have a very congested ring record immediately adjacent to the pith. Therefore, all estimates could be in error by one or two years.

A final observation of interest is that those sections from the heavily grazed plot appeared to undergo a reduction of growth commencing about 1950 or shortly thereafter.

BITTERBRUSH ANALYSIS
MT. HEBRON, CALIFORNIA

BAG A, Light Grazing (incomplete stem sections)

Spec. No.	Inside Ring on Section	Estimated No. Rings to Pith	Estimated Age of Section	Comments
176	1924	10	57	
216	1895	15	91	
232	1904	20	87	
242	1923	15	63	
259	1915	25	81	Ring count
287	1938	20	53	

BAG B, Light Grazing (plants with yield and nutrient data)

Spec. No.	Inside Ring on Section	Estimated No. Rings to Pith	Estimated Age of Section	Comments
156	1930p		41	
158	1901p		70	
166	1960p		11	Ring count
167	1931p		40	
172	1958p		13	Ring count
173	1907	30	94	
177	1909	20	82	
179	1908p		63	Inside rotten-could be off 1 or 2 rings
181	1948p		23	
182	1958p		13	Ring count
189	1919	?	52+	Much pith area erosion
191	1943p		28	
198	1904p		67	
200	1929p		42	
206	1949p		22	
209	1922p		49	
210	1925	?	46+	Much pith area erosion
215	1868p		103	Ring count prior to 1910
222	1954p		17	
227	1946p		25	
233	1944p		27	
239	1944p		27	
248	1942p		29	
250	1945p		26	
254	1944p		27	
265	1938p		33	

BAG B (continued)

Spec. No.	Inside Ring on Section	Estimated No. Rings to Pith	Estimated Age of Section	Comments
266	1913p		58	
267	1948p		23	
269	1952p		19	Ring count
275	1919p		52	
288	1939p		32	
289	1943p		28	Ring count
296	1925p		46	
298	1925p		46	

BAG C, Light Grazing

Spec. No.	Inside Ring on Section	Estimated No. Rings to Pith	Estimated Age of Section	Comments
151	1927p		44	
152	1895	10	86	Partial ring count
153	1942p		29	Ring count, poor
155	1953p		18	
157	1925p		46	
159	1960p		11	Ring count
160	1908p		63	
161	1953p		18	Ring count
162	1962p		9	Ring count
163	1934p		37	Ring count, poor
164	1930p		41	Ring count, poor
165	1950p		21	
168	1958p		13	Ring count
169	1924p		47	
170	1955p		16	
171	1960p		11	Ring count
174	1914	10	67	
175	1916p		55	
178	1936p		35	
180	1925p		46	
183	1935p		36	
184	1936p		35	
185	1945p		26	
186	1959p		12	Ring count
187	1945p		26	
190	1949p		22	

BAG C (continued)

Spec. No.	Inside Ring on Section	Estimated No. Rings to Pith	Estimated Age of Section	Comments
192	1956p		15	Ring count
193?	1958p		13	Ring count
194	1952p		19	
195	1922p		49	
196	1931p		40	
199	1959p		12	Ring count
201	1951p		20	
202	1965p		6	Ring count
205	1918p		53	
207	1965p		6	Ring count
208	1946p		25	
211	1936p		35	
212	1910p		61	
213	1949p		22	
217	1946p		25	
218	1906p		65	Ring count, poor
220	1908p		63	
223	1952p		19	Ring count
224	1940p		31	
225	1942p		29	
226*	1915p		56	
226*	1958p		13	Ring count
228	1958p		13	Ring count
229	1928p		43	
230	1925p		46	
231	1923p		48	
235	1960p		11	Ring count
236	1945p		26	
237	1959p		12	Ring count
238	1958p		13	Ring count
240	1908p		63	
241	1929p		42	
243	1958p		13	Ring count
244	1945p		26	Ring count
246	1937p		34	
247	1915p		56	
251	1959p		12	Ring count
252	1960p		11	Ring count
253	1959p		12	Ring count
255	1959p		12	Ring count
256	1909p		62	
257	1912	10	69	
258	1938p		33	

* different plants with same spec. number

BAG C (continued)

Spec. No.	Inside Ring on Section	Estimated No. Rings to Pith	Estimated Age of Section	Comments
260	1946p		25	
261	1952p		19	
262	1947p		24	
264	1961p		10	Ring count
268	1943p		28	
270	1944p		27	
271	1946p		25	
272	1929p		42	
273	1949p		22	
274	1946p		25	
276	1950p		21	
278	1958p		13	Ring count
279	1945p		26	Ring count
280	1925p		46	
281	1943p		28	
284	1960p		11	Ring count
285	1915p		56	
286	1887p		84	
290	1944	5	32	
291	1947p		24	Ring count
292	1939	10	42	
293	1918p		53	
294	1947p		24	
295	1951p		20	
300	1945p		26	

BAG D, Heavy Grazing (incomplete stem sections)

Spec. No.	Inside Ring on Section	Estimated No. Rings to Pith	Estimated Age of Section	Comments
8	1923	5	53	
16	1853	5	123	
56	1910	10	71	
68	1916	10	65	
69	1915	20	76	
74	1922	20	69	
84	1920p		51	
85	1904	3	70	
86	1916p		55	
103	1915	20	76	
106	1917	5	59	
130	1906	15	80	
134	1913	5	63	
145	1888	5	88	

BAG E, Heavy Grazing (plants with yield and nutrient data)

Spec. No.	Inside Ring on Section	Estimated No. Rings to Pith	Estimated Age of Section	Comments
1	1930p		41	Ring count, poor
2	1919p		52	
10	1906p		65	
14	1879p		92	Ring count, poor
20	1919p		52	
21	1913p		58	
25	1897p		74	
30	1904	10	77	
34	1916	5	60	
35	1952p		19	Ring count
41	1912p		59	
48	1914p		57	
49	1936p		35	
50	1900	10	81	
53	1952p		19	Ring count
64	1917p		54	
71	1913	20	78	
72	1915p		56	
73	1933p		38	Ring count
79	1928p		43	Ring count, poor
90	1907p		64	
92	1900p		71	
98	1933p		38	
105	1900p		71	
109	1925p		46	
112	1926p		45	
119	1913p		58	
121	1931p		40	
122	1914p		57	
123	1945p		26	
128	1899p		72	
129	1945p		26	
133	1965p		6	Ring count
142	1929p		42	
147	1944p		27	
148	1941p		30	
150	1925p		46	

BAG F, Heavy Grazing

Spec. No.	Inside Ring on Section	Estimated No. Rings to Pith	Estimated Age of Section	Comments
4	1938p		33	
5	1947p		24	
7	1927p		44	
9	1934p		37	Ring count
11	1939p		32	
12	1927p		44	
13	1939p		32	
17	1931p		40	Ring count
19	1916p		55	
22	1935p		36	
23	1952p		19	Ring count
27	1912p		59	
28	1936p		35	
29	1928p		43	
31	1911p		60	
32	1933p		38	
33	1943p		28	
37	1960p		11	Ring count
39	1948p		23	
40	1934p		37	
42	1953p		18	
44	1922p		49	
46	1941p		30	
51	1937p		34	
54	1944p		27	
55	1917p		54	
59	1911p		60	
60	1909p		62	
62	1944p		27	
63	1947p		24	
65	1908p		63	
66	1953p		18	
70	1925p		46	
75	1959p		12	Ring count
76	1932p		39	
77	1941p		30	
78	1955p		16	
83	1915	5	61	
85	1946p		25	Ring count
87X	1914p		57	
88	1965p		6	Ring count
89	1925p		46	
91	1914p		57	

BAG F (continued)

Spec. No.	Inside Ring on Section	Estimated No. Rings to Pith	Estimated Age of Section	Comments
93	1924p		47	
95	1906p		65	
96	1957p		14	Ring count
97	1948p		23	
97A	1950p		21	Ring count
100	1944p		27	
101	1946p		25	
107	1937p		34	
110	1930p		41	
113	1895p		86	Partial ring count
114	1947p		24	
116	1963p		8	Ring count
118	1941p		30	
124	1922p		49	
132	1930p		41	Ring count, poor
135	1945p		26	Ring count
136	1924p		47	
138	1935p		36	
140	1958p		13	Ring count
141	1913p		58	
144	1920	3	54	
146	1926p		45	
149	1945p		26	