

RECOVERY OF RIPARIAN VEGETATION ON AN INTERMITTENT STREAM FOLLOWING REMOVAL OF CATTLE¹

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Abstract: In 1984 – 1987 the recovery of riparian willows (Salix spp.) and sycamores (Platanus racemosa) was studied on two short, intermittent stream sections in a newly acquired portion of Henry W. Coe State Park in central California. Prior to removal of cattle in 1983, the plots contained mature sycamores, one young sycamore, and five willows. By 1985 over 320 willows, 16 sycamores and 1 cottonwood (Populus fremontii) had appeared, and basal sprouts had developed on the mature sycamores. Young willows and sycamores grew slowly, and establishment and growth generally ceased as surface flows disappeared. Because of slow growth at the sites, a significant willow corridor is probably only possible in the absence of cattle browsing.

Grazing has been found to have severe effects upon riparian habitats (Meehan and Platts 1978). Altered species composition and vegetation density, along with streambank erosion and channel widening, have stimulated research on fencing (Platts and Wagstaff 1984) and seasonal regulation of grazing (Bryant 1985; Siekert and others 1985) as ways to reduce impacts. However, most studies of grazing impacts and treatment strategies have been conducted on public lands outside of California. A century or more of intensive private ranching has probably substantially changed parts of the California landscape, but left us with few undisturbed areas with which to judge the impacts of cattle.

In 1982 the California Department of Parks and Recreation acquired two former ranches as additions to Henry W. Coe State Park. Cattle grazing was halted in 1983, but a heated public debate over the general plan for the park included consideration of the desirability of renewed grazing. The absence of documented evidence for grazing damage in central California was used by some as proof that no damage occurs. The removal of cattle in 1983, however, provided an opportunity to assess the effects of longterm cattle grazing.

Study Area

North Fork Pacheco Creek is a fourth order stream in the eastern portion of Henry W. Coe State Park in the Mt. Hamilton Range of central California. Although a tributary to the coastal Pajaro River, the stream is east

of and in the rain shadow of both the coast range and the highest ridges of the inner coast range. Vegetation within the 200 to 800 m high watershed is primarily: chaparral, dominated by chamise (*Adenostoma fasciculatum*); oak woodland, dominated by blue oak (*Quercus Douglasii*), buckeye (*Aesculus californica*), California bay (*Umbellularia californica*), and digger pine (*Pinus sabiniana*); and grassland, dominated by introduced annual grasses (*Avena spp.* and *Bromus spp.*). The stream is intermittent and generally dries to a few isolated pools by early to mid summer. During the study surface flow ceased by late June of 1984, May of 1985, late May of 1986, and March of 1987. At the start of the study, woody riparian vegetation consisted almost exclusively of mule fat (*Baccharis viminea*) and mature sycamores (greater than 25 cm in diameter).

Methods

In March 1984 all young willows greater than 5 cm tall in a 35 m section of North Fork Pacheco Creek (study area A) were tagged with numbered Floy tags, and heights of longest stem recorded. The plot was resurveyed again in July and October 1984, May and October 1985, and October 1987, and heights of tagged and untagged willows recorded. New willows taller than 30 cm and a portion of shorter willows were tagged during resurveys, and evidence of browsing and general plant health (dead branches, desiccated leaves, etc.) were recorded during each survey. In May 1985 study area B, a 300 m long stream section 0.1 km upstream of study area A, was established, and all willows, cottonwoods, and young sycamores were tagged with numbered Floy tags, and heights and health recorded. Study area B was resurveyed in October of 1985 and 1987.

Five willows and one young sycamore were present in the streambed between the two study areas prior to removal of cattle in 1983. These 6 young trees plus 20 associated mature sycamores were cored with an increment borer to determine approximate ages of the trees. Ages determined from cores were considered approximate for the young trees, as subsequent studies suggested that several years of suppressed growth, with possibly no growth rings, could have occurred during early years due to cattle browsing. Ages of mature

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sycamores were approximated by extrapolating growth rates found in the outer portion of the core to the rotted interior found in all trees. Cores were coated with phloroglucinol to improve their readability.

Numbers of basal sprouts on mature sycamores were counted on 50 trees in October 1984 and October 1985 for comparison with 1983, when sprouts were absent. Sprouts were not counted in October 1987, but general observations were made on condition of sprouts within the two study areas.

Results

Photographs of study area A taken in April 1983 showed no plants larger than 30 cm, other than mulefat and mature sycamores, but by March 1984, 70 willows to 130 cm high were found (table 1). By July of 1984, 271 willows were present, with 3 exceeding 150 cm tall. No new willows appeared by October and two tagged willows had died. In 1985, no new willows appeared and 26 died. By October 1985, nine willows exceeded 150 cm in height and the tallest was 265 cm high. By October 1987, only 86 willows remained, with most small willows apparently buried or washed away by an intense February 1986 flood. Fifteen willows died in 1987 due to desiccation.

Photographs of study area B in April 1983, showed no plants larger than 30 to 50 cm tall. By May 1985, 45 willows, with two-thirds taller than 1 m, were present (table 2). Fifteen young sycamores and one cottonwood were also present. By October of 1985, seven additional willows and one additional sycamore were present. Two new sycamores appeared in 1987, but Seven willows and two sycamores were apparently lost to 1986 flooding. Study area B had a lower density of young trees than study area A, but the trees grew faster. By October 1987, the majority of willows and all but 1 sycamore exceeded 1 m in height, and 12 trees exceeded 3 m in height (table 2).

Table 1 – Heights (cm) and numbers of willows in study area A on North Fork Pacheco Creek.

Height	Date					
	1984		1985		1987	
	Mar	Jul	Oct	May	Oct	Oct
5 - 9	7	73	65	45	10	7
10 - 19	35	63	67	53	38	8
20 - 29	6	40	43	37	51	5
30 - 49	13	46	45	67	74	23
50 - 99	8	36	36	38	49	23
100-149	1	10	10	11	12	13
150-199		2	2	3	5	4
200-299		1	1	1	4	2
300-399						1
Totals:	70	271	269	255	243	86

Table 2 – Heights (cm) and numbers of willows and young sycamores in study area B on North Fork Pacheco Creek.

Height	Willows			Sycamores		
	1985		1987	1985		1987
	May	Oct	Oct	May	Oct	Oct
5 - 49	3	10	5	1	2	
50 - 99	12	12	13	2	2	1
100-149	5	3	6	2	2	2
150-199	8	11	4	4	4	2
200-299	13	9	8	5	3	8
300-399	4	6	8	1	2	1
400-499					1	2
500-599		1	1			
Totals:	45	52	45	15	16	16

Most willows tagged in March of 1984 showed substantial growth by July, despite limited browsing by rabbits and deer (fig. 1). Surface flow in study area A was gone by late June of 1984, and few willows showed growth between July and October (fig. 2). All willows showed some browsing by October, and some larger willows suffered limited damage from sparring male deer. In 1985 surface flow ceased by May in both study areas, and only larger willows and sycamores showed May to October growth (fig. 3).

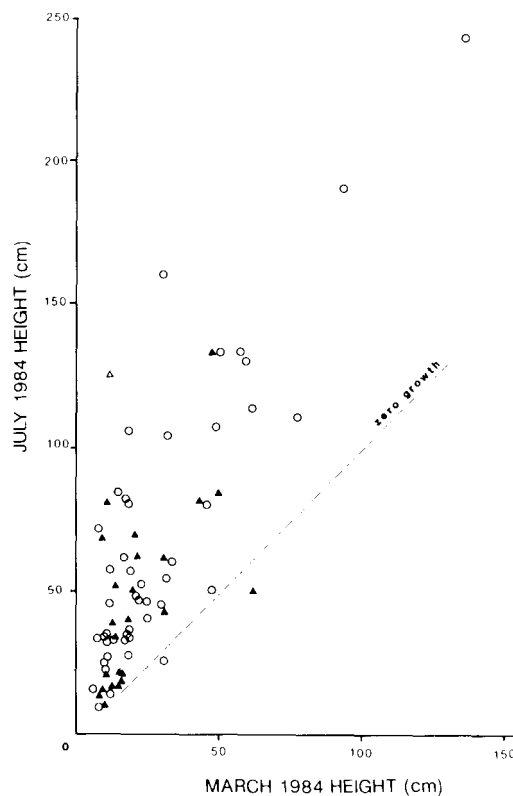


Figure 1 - Growth of browsed (triangles) and unbrowsed (circles) willows from March to July 1984 in study area A.

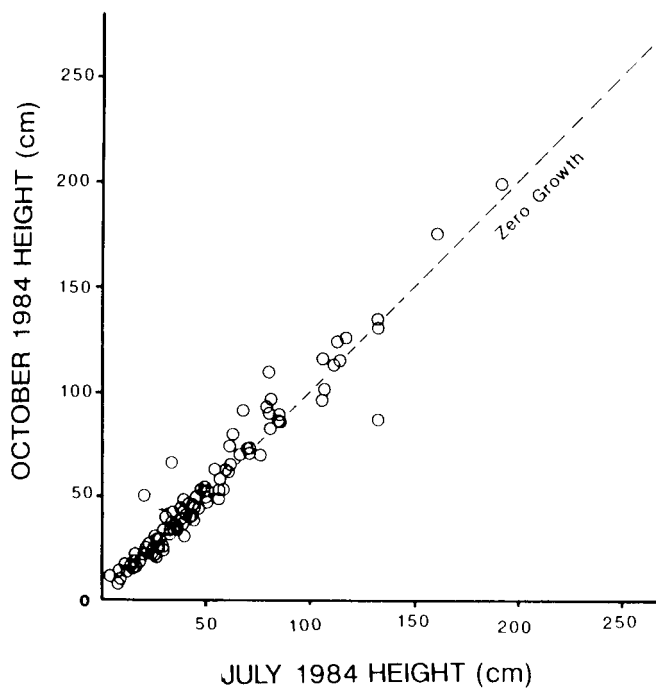


Figure 2- Growth of willows from July to October 1984 in study area A.

From October 1985 to October 1987 willow recovery was hindered by browsing by trespass cattle. Although few cattle were present, they spent much of their time along the stream. The problem was especially pronounced in 1987, when nine cattle were present on and near the study areas. Although 1986 was a relatively wet year, growth of willows from 1985 to 1987 was generally poor, especially on study area B, where the cattle spent more of their time (fig. 4). In study area B, only half (21 of 42) of tagged willows showed any growth from October 1985 to October 1987, while nine willows were reduced 20 to 70 percent in height by severe cattle browsing. Willows 1 to 2 m high in 1985 suffered most, with 8 of 12 being reduced in height and 4 being reduced more than 40 percent. In study area A, heavy 1985 - 1987 tag loss limited height comparisons, but all 4 willows which were 1 m to 2 m high in October 1985 and retained tags were reduced in height by October 1987 (5 to 45 percent). Although all willows taller than 3 m showed some growth from 1985 to 1987, most, including the five large willows present prior to cattle removal, showed pronounced browse lines in 1987.

On the 50 sycamores examined for basal sprouts only a total of 46 sprouts were found in October 1984, but by October 1985 the total had reached 197. Sprouts were present on all but 2 trees by 1985. Although trespass cattle heavily browsed willows, there was no evidence that they browsed sycamore basal sprouts or young sycamores in 1987. All but one young sycamore showed

growth from October 1985 to October 1987, with 5 of 14 showing height gains of 50 percent or more (fig. 4). The sycamore showing no height gain was broken off near the base, apparently during the February 1986 flood.

Three of the five willows present before cattle removal were dated by cores to 1977. The other two were dated to 1978. The single young sycamore present prior to cattle removal was dated to 1977. Estimated ages of mature sycamores ranged from 79 to 135 years.

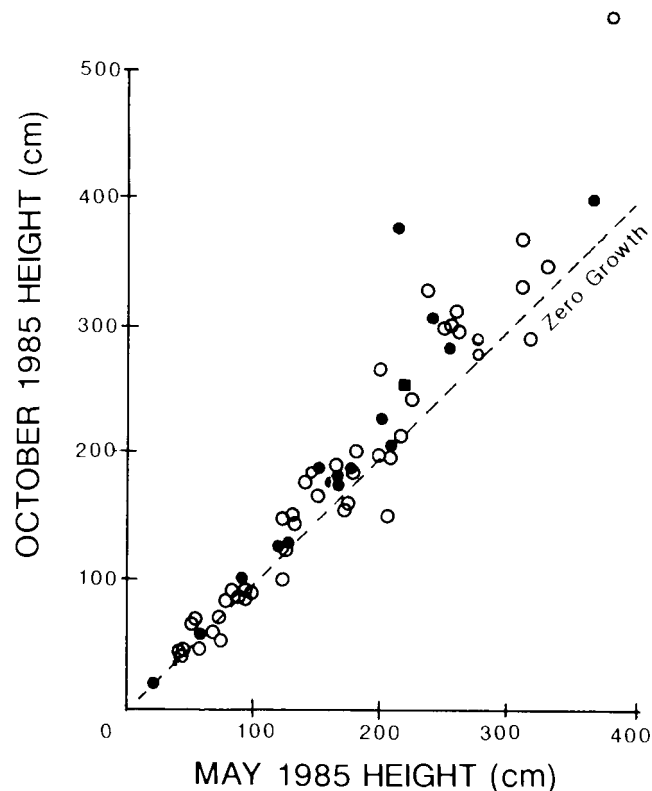


Figure 3- Growth of willows (open circles), sycamores (closed circles), and cottonwoods (square) from May to October 1985 in study area B.

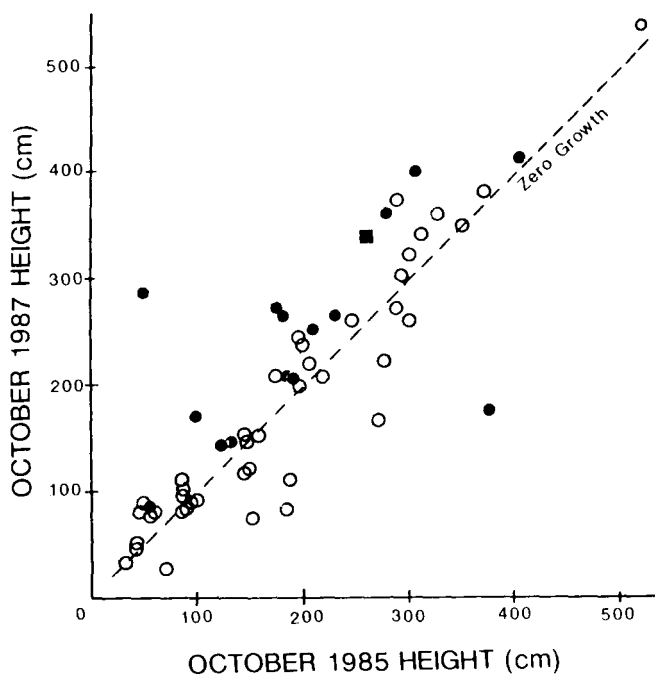


Figure 4— Growth of willows (open circles), sycamores (closed circles), and cottonwoods (square) from October 1985 to October 1987.

Discussion

Prior to removal of cattle, the study sections on North Fork Pacheco Creek contained primarily sycamores germinated prior to 1910 and unpalatable mule fat. The single young sycamore present and three of the five willows date to approximately 1977, and the other two willows date to 1978. It appears that successful survival of young willows and sycamores on this intermittent stream has been limited to a single period within the last 70 or more years of intensive cattle use. The isolated survival of a sycamore and possibly three or more willows in 1977, the second year of a severe drought, is a surprising pattern for riparian species. However, poor forage conditions and surface water availability during the drought resulted in removal of cattle from ranches in the area in 1977 (Peter Andresen, pers. comm.), and 1978 was a wet year, apparently allowing successful establishment.

Most of the new willows and sycamores appeared in 1984, and total numbers actually declined from 1984 to 1987 (table 1). The loss of established plants was due to the 1986 flood and to desiccation. The lack of significant recruitment in 1985 and 1987 was apparently the result of wide year to year variation in water availability. Successful willow and sycamore germination sites were mostly at the tails of pools and along riffles, sites where seeds are likely to lodge, and where subsurface water

remains as flows decline. In 1984 surface flows lasted into late June. In 1985 — 1987 surface flows ceased by May, providing less time for successful seedling establishment. Desiccation losses of established willows in study area A were also much greater in 1985 (26 deaths) and 1987 (15 deaths) than in 1984 (2 deaths).

The presence of 131 willows, 16 young sycamores, and 1 cottonwood three years after the removal of cattle indicates that, despite the intermittent character of the stream, portions of North Fork Pacheco Creek have the potential to develop significant riparian vegetation in the absence of cattle. Growth rates, however, were low, and germination and growth of small trees was generally limited to the relatively brief period of surface flow. Because of slow growth and infrequent germination success, willows were unable to establish or survive previous intensive cattle browsing. Even light or seasonal cattle presence might be sufficient to prevent establishment of a significant willow population; in 1985 — 1987 many established willows suffered severe hedging by only a limited number of trespass cattle.

Young sycamores and basal sprouts on mature sycamores are apparently not preferred food and were not browsed by the few trespass cattle present in 1985 — 1987. However, young sycamores were absent and basal sprouts very rare or absent during the period of intensive grazing prior to 1984. The sycamore population might be able to maintain itself under a regime of light cattle stocking or in a wetter area, where young sycamores grow faster. However, previous persistent heavy browsing by cattle apparently eliminated recruitment on this intermittent stream. Although sycamores are presently the "typical" riparian tree of many intermittent streams in central California, widespread and intensive cattle grazing may be jeopardizing recruitment. Longevity of sycamores has not yet been studied, but all 20 of the 79 to 135 year old sycamores cored on North Fork Pacheco Creek had partially rotted trunks. For many grazed intermittent streams in California, lack of recruitment and loss of older sycamores makes barren streamsides a real possibility in the future.

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