STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
NORTHERN DISTRICT

Land Use Change in the Sacramento River Riparian Zone, Redding to Colusa An Update–1972 to 1977

June 1979

FOREWORD

In the 5-year period from 1972 to 1977, an additional 830 hectares (2,050 acres) along the Sacramento River have been converted to orchards. Of these, 356 ha (880 acres) were climax high terrace forest -- the most imposing of nature's wild, natural progress along the river -- and nearly 20 percent of the climax forest that remains in private ownership in the long stretch between Redding and Colusa.

In the same period, only 200 ha (500 acres) of mixed riparian forest have been purchased for the survival of wildlife and the enjoyment of the public.

The Upper Sacramento River system has undergone dramatic changes during the last four decades. Shasta Dam began impounding water in the mid-forties. The McCloud and Pit Rivers, major tributaries to the Sacramento, were extensively developed for hydroelectric energy. Down river, near Red Bluff, the Tehama-Colusa Canal diverts large quantities of water from the Sacramento for irrigation. Major new developments are planned for the Sacramento or its tributaries, requiring the Department of Water Resources to continue comprehensive baseline studies that measure the impact of past alterations and gauge the effects of future ones.

Shortly after completion of the initial baseline report on riparian habitat loss, Land Use Changes in the Sacramento River Riparian Zone, Redding to Colusa, April 1975, the Secretary for Resources formed the Upper Sacramento River Task Force, comprised of representatives from federal, state and county agencies and environmental groups dedicated to solving the many problems related to management of the Sacramento River. Bank erosion, disappearing riparian habitat, declining fish runs, flooding, seepage, lack of public access and trespass on private lands are some of these problems.

This update report shows -- even more clearly than the first -- that the natural character of the river will not be spared unless the public agencies concerned secure riparian forest lands along the river for their constituencies.

Wayne S. Gentry
Acting District Engineer
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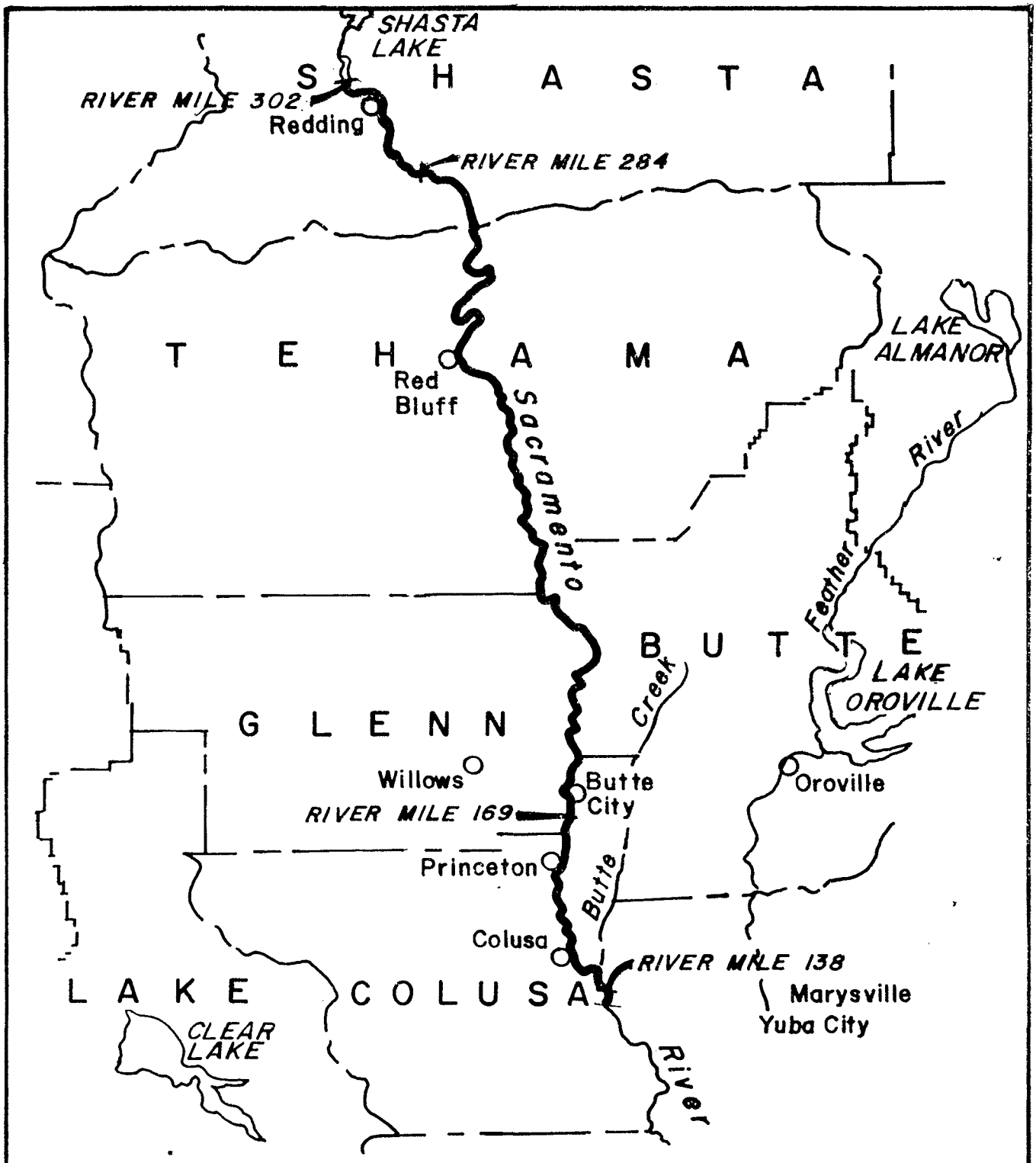
Figure 1



NORTHERN CALIFORNIA INVESTIGATION

SACRAMENTO RIVER RIPARIAN ZONE STUDY AREA

Keswick Dam to Colusa

CONVERSION FACTORS

Metric to Customary System of Measurement

Quantity	Metric Unit	Multiply by	To get customary equivalent
Length	millimetres (mm)	0.03937	inches (in)
	centimetres (cm) for snow depth	0.3937	inches (in)
	metres (m)	3.2808	feet (ft)
	kilometres (km)	0.62139	miles (m)
Area	square millimetres (mm^2)	0.00155	square inches (in^2)
	square metres (m^2)	10.764	square feet (ft^2)
	hectares (ha)	2.4710	acres (ac)
	square kilometres (km^2)	0.3861	square miles (mi^2)
Volume	litres (l)	0.26417	gallons (gal)
	megalitres	0.26417	million gallons (10^6 gal)
	cubic metres (m^3)	35.315	cubic feet (ft^3)
	cubic metres (m^3)	1.308	cubic yards (yd^3)
	cubic metres (m^3)	0.0008107	acre-feet (ac-ft)
	cubic dekametres (dam^3)	0.8107	acre-feet (ac-ft)
	cubic hectometres (hm^3)	0.8107	thousands of acre-feet
	cubic kilometres (km^3)	0.8107	millions of acre-feet
Flow	cubic metres per second (m^3/s)	35.315	cubic feet per second (ft^3/s)
	litres per minute (l/min)	0.26417	gallons per minute (gal/min)
	litres per day (l/day)	0.26417	gallons per day)(gal/day)
	megalitres per day (Ml/day)	0.26417	million gallons per day (mgd)
	cubic metres per day (m^3/day)	0.0008107	acre-feet per day
Mass	kilograms (kg)	2.2046	pounds (lb)
	tonne (t)	1.1023	tons (short, 2,000 lb)
Velocity	metres per second (m/s)	3.2808	feet per second (ft/s)
Power	kilowatts (kW)	1.3405	horsepower (hp)
Pressure	kilopascals (kPa)	0.145054	pounds per square inch (psi)
	kilopascals (kPa)	0.33456	feet head of water
Specific capacity	litres per minute per metre drawdown	0.08052	gallons per minute per foot drawdown
Concentration	milligrams per litre (mg/l)	1.0	parts per million
Electrical conductivity	microsiemens per centimetre (μS/cm)	1.0	micromho per centimetre
Temperature	degrees Celsius (°C)	(1.8 × °C) + 32	degree Fahrenheit (°F)

SUMMARY AND FINDINGS

This report is an update of the April 1975 report, Land Use Changes in the Sacramento River Riparian Zone, Redding to Colusa. Using statistical and photographic records, the earlier report recorded changes in vegetation use between 1952 and 1972, for a narrow 29 140 ha (72,000 acre) strip of land along the Sacramento River.

To document these changes, 35 mm color aerial photographs for 1972 and 1977 were compared and mappable changes were recorded on 97 large scale (1 cm = 52 m or 1 inch = 400') sepia maps of the study area. The riparian zone land uses were broken down into categories of present land use, such as orchard or urban, or in terms of the vegetative cover on the land, such as grass and forbs or other types of riparian vegetation.

This update used the same study boundary as the 1975 study. There were, however, some differences in mapping concepts, as reported on page 7.

During the past five years, the Sacramento River has been affected by four significant hydrologic events. A January 1974 flood and a larger one in April, were significant in terms of historic post-Shasta Dam flood events. After the floods came severe drought in 1975-76 and 1976-77. Undeterred by these events, landowners along the banks of the Sacramento River continued to convert riparian vegetation into deciduous orchard.

The rate of decline of environmental amenities shown in the 1952 to 1972 study continues unabated through the 1972-77 period. Bank erosion is threatening prime agricultural lands, riparian vegetation is disappearing, and river meander threatens both wild and developed lands. This 5-year update indicates that:

- Orchard lands have increased by 830 ha (2,050 acres).
- Row crop lands have diminished by nearly 400 ha (1,000 acres), most of which was converted to orchard.
- All classes of high terrace riparian vegetation diminished by 688 ha (1,700 acres), much of which went directly into orchard land.
- Climax high terrace riparian vegetation (V1/H) was reduced by 356 ha (880 acres), again, going mainly to orchard.

- Referring to the Sacramento River Environmental Atlas, published in 1978, about 566 ha (1,400 acres) of riparian vegetation is now in public ownership, such as Woodson Bridge State Park.
- Of the lands in public ownership, about 405 ha (1,000 acres) are classified as climax high terrace (V1/H).
- Bank erosion claimed 369 ha (912 acres) of prime high terrace land, of which 30 percent was riparian vegetation.
- Urban development at Lake California claimed 69 ha (170 acres) of agricultural land.
- River wash gravel bars diminished by nearly 364 ha (900 acres) revegetation changed gravel bars into forb and grass-covered low terrace riparian mainly through lack of flood scour.

Aerial reconnaissance during the summers of 1976 and 1977 showed that riparian forests along the river suffered severe drought damage. Much of the forb, grass or other low-growing understory vegetation either died or was severely blighted and near death by the fall of 1977. This was particularly true on high terrace lands, which indicates the importance of precipitation and occasional flooding to the survival of riparian vegetation.

Table 1 shows that only 3 828 ha (9,460 acres) of high terrace riparian vegetation was left by the fall of 1977. Of this, 566 ha (1,400 acres) are in public ownership, such as Colusa and Woodson Bridge State Parks and Foster Island (BLM). This means that the remaining developable high terrace land is only 3 260 ha (3 827 - 567) or 8,060 acres (9,460 - 1,400). Any future loss, then, becomes particularly significant when added to a loss of 17 percent over the 5-year study period.

High terrace climax vegetation (V1/H) suffered the largest proportionate loss. At least 405 ha (1,000 acres) in this class are currently protected in public ownership, but the remainder, in private hands, was reduced by 20 percent in five years.

The area in low terrace gravel bars appears to be increasing at the expense of high terrace lands. The erosion of high terrace lands is not being offset by the building processes that formed them. These lands are ending up as sand and gravel bars or as silt and clay sediments down river. Table 1 reports a gain in low terrace riparian vegetation of 305 ha (750 acres). Most of the low terrace category is in the V4/L forbs

and grasses classification, the transition between gravel bar and low terrace. Low scour water years are responsible for this anomaly. Normally, the V4/L category would be several thousand acres smaller during more average hydrologic periods where scour by high water would remove emerging vegetation.

Management Efforts

Certain developments during the past five years give hope to saving some of the outstanding natural environmental values of the upper Sacramento River. The most significant of these was formation in 1976 of the Upper Sacramento River Task Force, a group of officials from county, state and federal agencies, environmental groups, and private citizens. This task force represents a symposium within which a management plan for the Sacramento River can be forged, incorporating many conflicting views. No management plan has yet been developed, but the task force produced an important basic data document, the Sacramento River Environmental Atlas in the fall of 1978. The atlas shows more than a dozen data elements on aerial photomaps of the river between Colusa and Keswick Dam, near Redding. These elements include riparian vegetation, land use, prime agricultural lands, recreational development, public lands, navigational hazards, bank protection areas, commercial gravel operations, waste water discharges, stream gaging stations, water quality sampling sites, salmon spawning sites, and the 1970 floodline. The atlas provides a valuable planning and decision making document for all levels of government.

The Wildlife Conservation Board, Department of Fish and Game, has bought selected parcels of riparian vegetation along the river. To date three outstanding parcels, totaling 162 ha (400 acres) have been purchased. Negotiations are pending on other purchases.

The Secretary for Resources recently disclosed a plan to establish a preservation corridor or parkway along the entire length of the Sacramento River. This plan, although still in its conceptual stage, would preserve riparian forests, provide much needed recreation access and, eventually, reduce the cost of bank protection because the river would be allowed to meander within certain limits.

TABLE 1A

SUMMARY OF CHANGES IN THE SACRAMENTO
RIVER RIPARIAN ZONE
(in hectares)

Land Use Category	Map Symbol[1/]	1972	1977	Net Change
Agricultural				
High Terrace - Orchard	AD/H	6 564	7 394	830
High Terrace - Annual Cropland	AG/H	7 414	7 017	-397
Subtotal		(13 978)	(14 411)	(433)
Low Terrace - Orchard	AD/L	28	61	32
Low Terrace - Annual Cropland	AG/L	332	380	49
Subtotal		(360)	(441)	(81)
Native Vegetation				
High Terrace - Climax Vegetation	V1/H	2 242	1 886	-356
High Terrace - Sub-Climax Vegetation	V2/H	534	506	- 28
High Terrace - Young Trees	V3/H	255	190	- 65
High Terrace - Forbs and Grass	V4/H	1 485	1 246	-239
Subtotal		(4 516)	(3 828)	(-688)
Low Terrace - Climax Vegetation	V1/L	712	639	- 73
Low Terrace - Sub-Climax Vegetation	V2/L	429	530	101
Low Terrace - Young Trees	V3/L	732	757	24
Low Terrace - Forbs and Grass	V4/L	1 218	1 469	251
Subtotal		(3 092)	(3 395)	(304)
Other Land Uses				
Oxbow Lakes	OW	146	162	16
Exposed Gravel Bars	R	2 428	2 076	-352
Water Surface	W	3 886	3 942	57
Park Areas	P	142	166	24
Commercial Recreation	RC	16	20	4
Urban or Associated	U	789	842	53
Urban Vacant	UV	0	69	69
Subtotal		(7 406)	(7 277)	(-130)
Total Area		29 352	29 352	0

1/ Symbols are explained in Table 3.

TABLE 1B

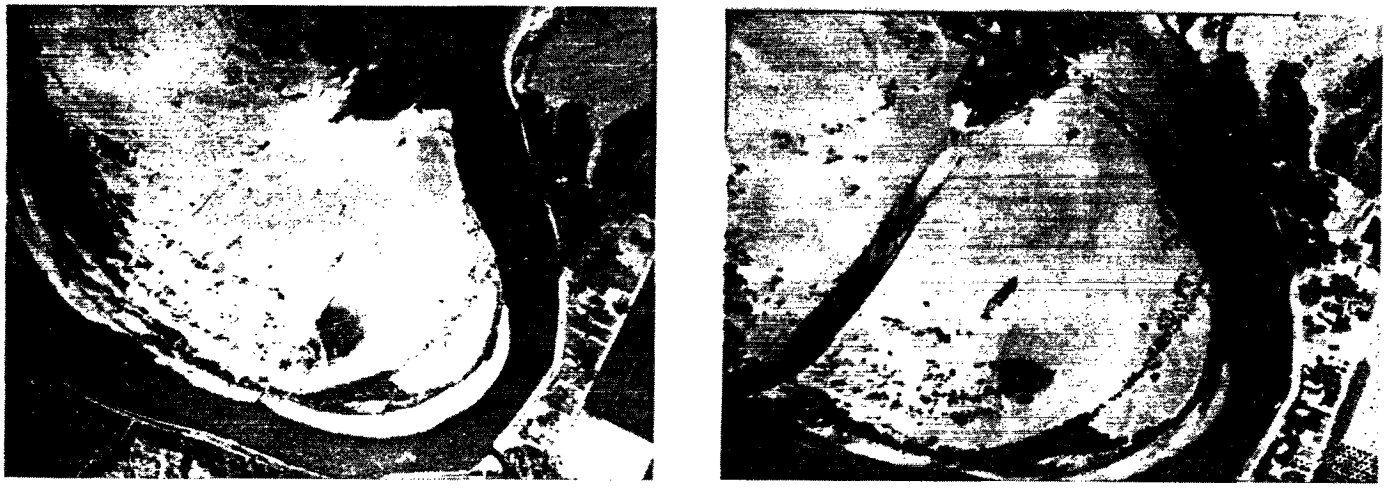
SUMMARY OF CHANGES IN THE SACRAMENTO RIVER RIPARIAN ZONE
(in acres)

Land Use Category	Map Symbol[1/]	1972	1977	Net Change
Agricultural				
High Terrace - Orchard	AD/H	16,220	18,270	2,050
High Terrace - Annual Cropland	AG/H	18,320	17,340	-980
Subtotal		(34,540)	(35,610)	(1,070)
Low Terrace - Orchard	AD/L	70	150	80
Low Terrace - Annual Cropland	AG/L	820	940	120
Subtotal		(890)	(1,090)	(200)
Native Vegetation				
High Terrace - Climax Vegetation	V1/H	5,540	4,660	-880
High Terrace - Sub-Climax Vegetation	V2/H	1,320	1,250	- 70
High Terrace - Young Trees	V3/H	630	470	-160
High Terrace - Forbs and Grass	V4/H	3,670	3,080	-590
Subtotal		(11,160)	(9,460)	(-1,700)
Low Terrace - Climax Vegetation	V1/L	1,760	1,580	-180
Low Terrace - Sub-Climax Vegetation	V2/L	1,060	1,310	250
Low Terrace - Young Trees	V3/L	1,810	1,870	60
Low Terrace - Forbs and Grass	V4/L	3,010	3,630	620
Subtotal		(7,640)	(8,390)	(750)
Other Land Uses				
Oxbow Lakes	OW	360	400	40
Exposed Gravel Bars	R	6,000	5,130	-870
Water Surface	W	9,600	9,740	140
Park Areas	P	350	410	60
Commercial Recreation	RC	40	50	10
Urban or Associated	U	1,950	2,080	130
Urban Vacant	UV	0	170	170
Subtotal		(18,300)	(17,980)	(-320)
Total Area		72,530	72,530	-0-

1/ Symbols are explained in Table 3.

1972 1977

The conversion of high terrace riparian habitat on prime soil to agriculture continues -- river mile 222, left, above Woodson Bridge.



1972 1977

This shoot formed across a point bar occurred during the 1974 flood season. If allowed to widen it will eventually shorten the river by 1.1 kilometers (0.7 miles), which will probably be claimed downstream by more meander. River mile 234, Ohm Bar.

Changes in Mapping Concepts

During the field work period of this study it became apparent that there was considerable discrepancy between the mapping criteria for the 1972 Land Use Changes report and these used for the 1978 Sacramento River Environmental Atlas in the delineation of high and low terrace lands. The Fish and Game Biologists who did most of the field work for the environmental atlas mapped a much higher percentage of both agricultural and native lands in the high terrace category than was mapped in 1972 (see Table 2). Agricultural high terrace lands, because of this differing criteria, increased by about 1 619 ha (4,000 acres), while high terrace native lands increased by 1 356 ha (3,350 acres). Consequently the high terrace-low terrace symbols and tabulations on the original 1972 data sheets were adjusted to conform to those shown in the 1978 River Atlas. Table 2 also shows that there is a difference of minus 134 ha (330 acres) between the 1972 data used in this report and the earlier 1972 Riparian Zone study. This was caused by a tabulation error in Reach 6 of the earlier study.

These defects in the earlier study were not crucial; they merely move vegetation categories between low and high terraces.

TABLE 2A

A COMPARISON OF DATA CATEGORIES
BETWEEN THE 1972 RIPARIAN ZONE STUDY
AND THE SACRAMENTO RIVER ENVIRONMENTAL ATLAS, 1978
(Hectares)

	1972 Riparian Zone Study	1972 Adjusted to River Atlas 1/	Difference
Agriculture/High	12 359	13 978	+1 619
Agriculture/Low	1 974	360	-1 614
Subtotal	14 333	14 338	+ 5
Native/High	3 160	4 516	+1 356
Native/Low	4 378	3 092	-1 286
Subtotal	7 538	7 608	+ 70
Oxbow Lakes	121	146	+ 25
Gravel Bars	2 452	2 428	- 24
Water Surface	4 075	3 885	- 190
Parks	158	142	- 16
Recreation Commercial	24	16	- 8
Urban	781	789	+ 8
Urban Vacant	0	0	0
Total	29 482	29 352	- 130

1/ After adjusting the 1972 data sheets to agree with the mapping symbols shown in the 1978 Sacramento River Environmental Atlas.

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TABLE 2B

A COMPARISON OF DATA CATEGORIES
BETWEEN THE 1972 RIPARIAN ZONE STUDY
AND THE SACRAMENTO RIVER ENVIRONMENTAL ATLAS, 1978
(Acres)

	1972 Riparian Zone Study	1972 Adjusted to 1/ River Atlas	Difference
Agriculture/High	30,540	34,540	+4,000
Agriculture/Low	4,880	890	-3,990
Subtotal	35,420	35,430	+ 10
Native/High	7,810	11,160	+3,350
Native/Low	10,820	7,640	-3,180
Subtotal	18,630	18,800	+ 170
Oxbow Lakes	300	360	+ 60
Gravel Bars	6,060	6,000	- 60
Water Surface	10,070	9,600	- 470
Parks	390	350	- 40
Recreation Commercial	60	40	- 20
Urban	1,930	1,950	+ 20
Urban Vacant	0	0	0
Total	72,860	72,530	- 330

1/ After adjusting the 1972 data sheets to agree with the mapping symbols shown in the 1978 Sacramento River Environmental Atlas.

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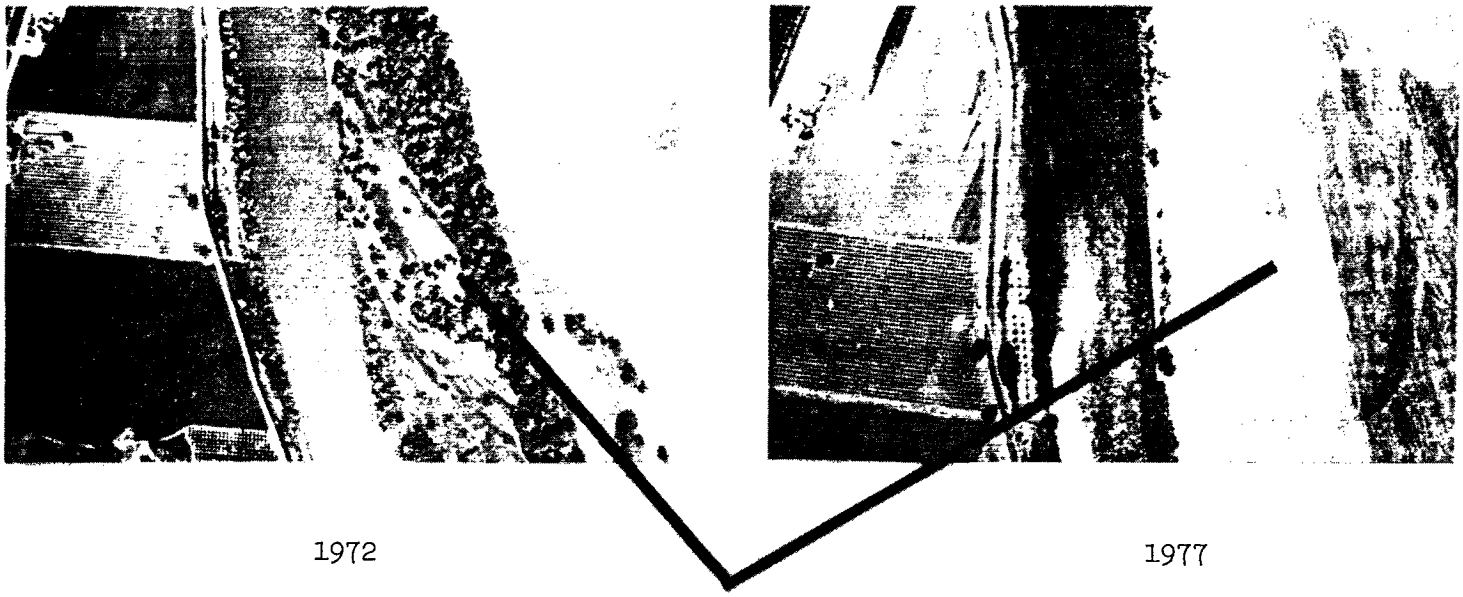
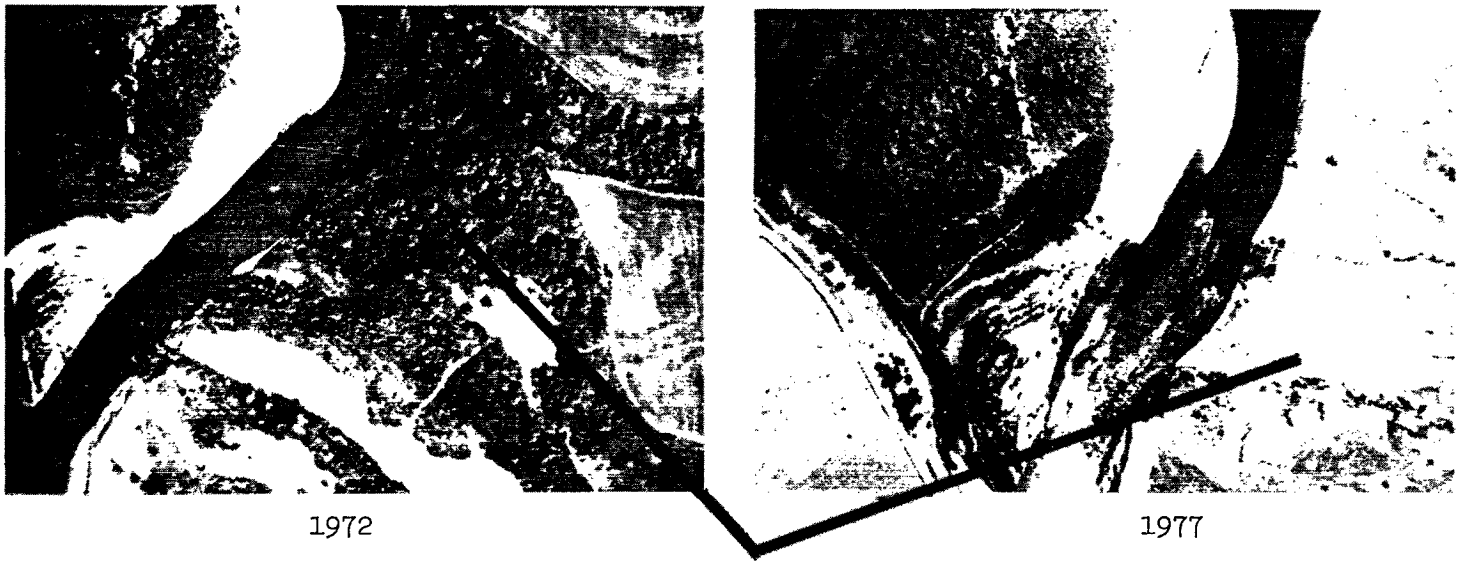


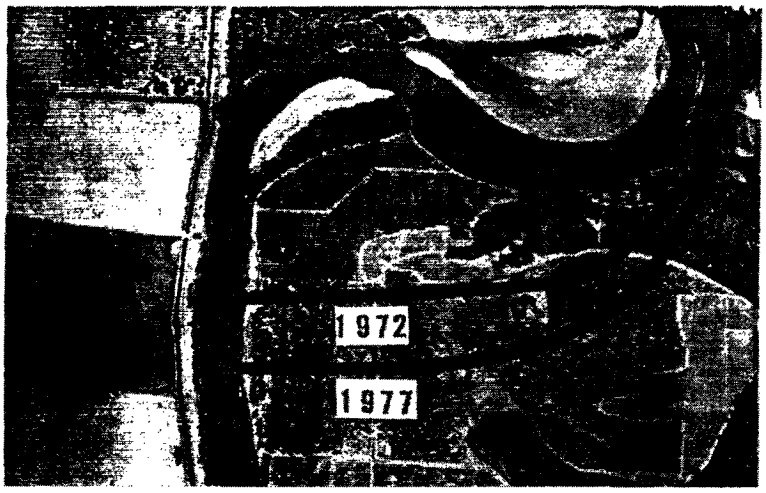
1972 1977

This landowner has further reduced a thin vegetative buffer, appropriately left from previous land clearing, Mile 177L.

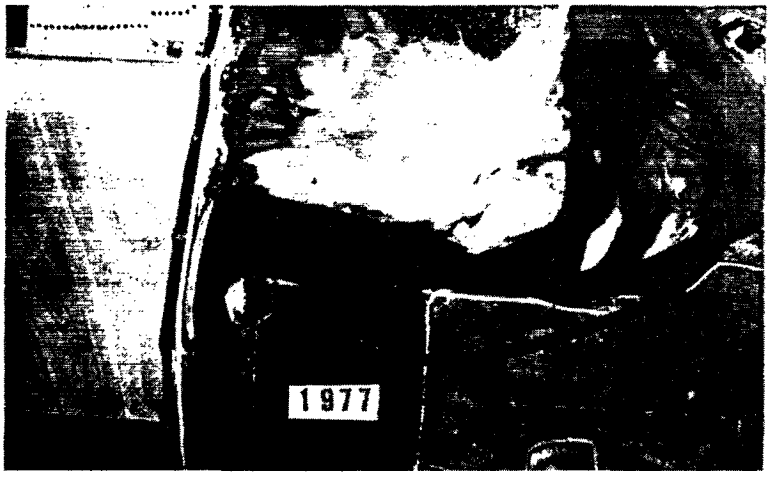


1972 1977

Another conversion of prime riparian vegetation, Llano Seco Ranch near river mile 180. The large block of riparian vegetation just north of Hawaiian Gardens Fishing Resort (the docks are visible as a pale, wiggle line in the slough in the 1977 photo) was purchased by the Wildlife Conservation Board for conservancy in 1978.



1952



1972

1977

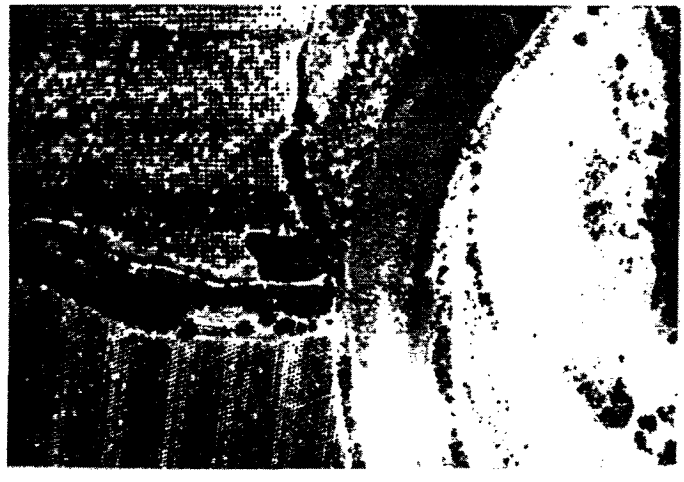
Bank erosion continues to gnaw at orchard lands near river mile 165, about one-mile north of Princeton. The dotted lines on the top photo (1952) show how erosion has progressively reduced prime orchard land over a 25-year time span. Snags in the river make this section hazardous to boaters (lower photo). The lower photo also shows how high terrace prime agricultural soils are being replaced by low terrace gravel bars.

April 1972

July 1977

Foster Island, owned by BLM, is subject to bank erosion no less than private lands. Notice how several large oak trees are missing in 1977. Spring grasses gave the April photograph a rich dark appearance, missing by mid-summer 1977. River mile 210R

1972



1977

Over 809 ha (2,000 acres) were converted to orchard from row crop land or riparian vegetation during the 5-year study period. This is near river mile 170.2R.

Climax riparian vegetation, typified by a dense crown cover and thick understory. Climax vegetation is that which will ultimately dominate a given location if natural development is permitted.

Sunlight filters through a stand of river-edge climax vegetation on high terrace land (V1/H).

Subclimax vegetation at the river's edge (V2/L).

Gravel bar (right) grading into low terrace (left) beginning the slow process of alluvial soil formation and revegetation.

Low terrace soil with low-growing grass and forb cover (V4/L).

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MAPPING PROCEDURES

The mapping base used for the earlier Land Use Changes in the Sacramento River Riparian Zone, Redding to Colusa study was a set of Corps of Engineers photomaps at a scale of one cm = 52 meters (one inch equals 400 feet). Updating that earlier work for this report was accomplished by on-site field investigation and interpretation of 35 mm colored photoslides taken in August, 1977. This involved the mapping and tabulation of 97 individual sheets. Actual changes in land use or vegetative classes during the 5-year period were recorded in red pencil over the top of the 1972 mapping effort. A more graphic picture of 1977 conditions was obtained by tracing the updated 1972 map data onto clearprint paper. The clearprint copies showing 1977 conditions were then planimetered to obtain the updated values shown in this study.

Mapping Criteria

Mapping criteria, except for the delineation of high and low terrace mentioned earlier, remained the same as reported in the 1952-72 study and again in the Sacramento River Environmental Atlas (quoted below).

"Riparian vegetation is comprised of plant species that obtain their nutrient and water supply at the capillary fringe (just above the water table) or have the ability to survive with their roots entirely submerged. The following legend was used to map the vegetative types within the study area boundary".

"For this study, riparian vegetation was grouped into climax (mapped as V1), subclimax (V2), young trees (V3), and, finally, grass and forbs (V4) classes. Climax vegetation is a grouping of plant types that will ultimately dominate a given location. As mapped for this study, it could be dominated by sycamore, black walnut, cottonwood, oak (mainly valley oak), or combinations of the above. Valley oak and California sycamore tend to dominate the highest of the high terrace sites, giving way to cottonwoods and alders as the physiography approaches low terrace. Unmixed stands of valley oaks along the margins of the river are rare now, although a few large blocks still survive away from the river, interspersed with agricultural land".

"Oxbow lakes, some located 1 or 2 kilometres (3,000-6,000 feet) away from the main river channel, provide the water necessary to sustain large bands of riparian vegetation. Some of these should be protected from degradation, because they represent the finest example of a complete riverine ecosystem."

It is difficult to distinguish between idle agricultural land and land characterized by native forbs and grasses. When agricultural land is left idle, possibly for as little as two years, the native plant succession begins. Signs of tillage and other cultural impacts begin to disappear, and nature reclaims the land. The reason for distinguishing between native plants and those that typically grow on idle agricultural land is that native plants have a greater capacity for sustaining wildlife populations.

TABLE 3

MAPPING LEGEND

Symbols

AD	Deciduous orchard.
AG	General crops including grain, alfalfa, pasture and row crops.
V1	Large climax vegetation restricted mainly to black walnuts, cottonwoods, sycamores, oaks, and alders with an understory comprised of box elder, grape, blackberry, poison oak, and some perennial grasses.
V2	Vegetation similar to V1 but with less crown density and tree height. Mix of trees tends more toward alders, cottonwoods, and willows -- subclimax vegetation.
V3	Vegetatively less mature than V2, lower tree height, open crown density. Comprised mainly of young alders, cottonwoods, and willows.
V4	Comprised mainly of forbs, grasses, and low-growing willows and alders.
OW	Oxbow lakes, disconnected from river.
R	Gravel bars, rocks, sand.
W	Water surface.
P	Formal parks, e.g. Woodson Bridge State Park.
RC	Commercial recreation
U	Urban or urban related.
UV	Urban vacant, a subdivision with streets but no homes.

Denominator Symbols

H	High terrace lands, generally free from inundation except during exceptionally high river flows.
L	Low terrace lands, generally inundated at only moderately high river flows.

TABLE 4

SAMPLE DATA SHEET SHOWING CHANGES IN LAND USE
(In hectares and acres)
Photomap 48 of 97

	1972		1977		Change	
	Hectares	Acres	Hectares	Acres	Hectares	Acres
AD/H	68	169	78	192	+ 9	+23
AG/H	46	114	32	80	-14	-34
Subtotal	114	283	110	272	- 4	-11
AD/L	16	39	17	41	+ 1	+ 2
AG/L	82	204	72	179	-10	-25
Subtotal	98	243	89	220	- 9	-23
V1/H	35	87	39	97	+ 4	+10
V2/H	0	0	0	0	0	0
V3/H	0	0	0	0	0	0
V4/H	0	0	0	0	0	0
Subtotal	35	87	39	97	+ 4	+10
V1/L	41	102	40	99	- 1	- 3
V2/L	1	3	1	3	0	0
V3/L	0	0	8	19	+ 8	+19
V4/L	32	79	46	114	+14	+35
Subtotal	74	184	95	235	+21	+51
OW	4	9	4	9	0	0
R	30	75	27	66	- 4	- 9
W	46	114	39	96	- 7	-18
P	0	0	0	0	0	0
U	0	0	0	0	0	0
RC	0	0	0	0	0	0
Total	401	995	403	995	0	0

LAND USE CHANGES BY REACH

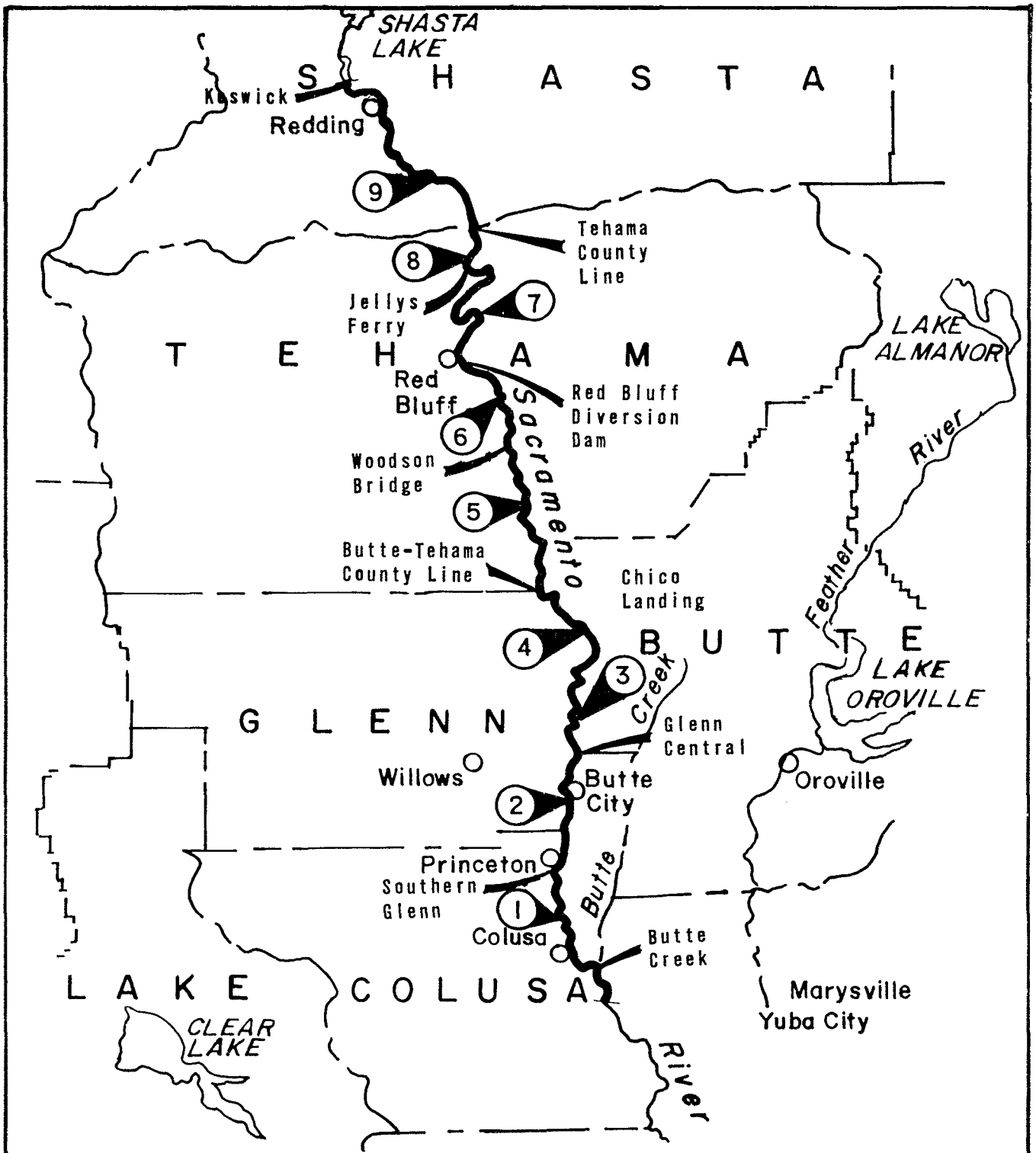
Table 5 shows the distribution of major changes within the nine reaches shown in Figure 2. Tables 6-1 through 6-10 report the detail of changes by reach over the 5-year period.

Reach 3 clearly displays the most change. This reach extends from Central Glenn County, near Golden State Island, north to Chico Landing. Within Reach 3 the most bank erosion, 121 ha (300 acres), the largest total loss of all classes of high terrace climax vegetation, 174 ha (431 acres) and the largest total loss of all classes of high terrace riparian vegetation, 412 ha (1,019 acres), were recorded. This stretch of the river is choked with tree snags that pose a serious threat to river navigation. Reaches 1, 2, 4, 5, and 6 demonstrate the same general type of losses found in Reach 3, however, less spectacularly. The one exception was the large gain of 351 ha (868 acres) of orchard in Reach 6.

Reaches 7, 8, and 9 which extend from the Red Bluff diversion dam north to Keswick Dam shows the least change. No mappable bank erosion was recorded and only minor changes in other use categories were noted. This section of the Sacramento River is the least subject to meander, because much of the river is bounded by high, rocky bluffs. This is in contrast to the physiography of the river below Red Bluff, where the river meanders across a broad alluvial flood plain comprised mainly of loose, easily eroded material.

The data in Table 5 also suggests that the Sacramento River is not building any new high terrace soils; however, land conversion from high terrace riparian habitat to high terrace agriculture continues.

Figure 2



NORTHERN CALIFORNIA INVESTIGATION

SACRAMENTO RIVER RIPARIAN ZONE STUDY AREA-NINE REACHES

Keswick Dam to Colusa

TABLE 5

SUMMARY OF SIGNIFICANT LAND USE
CHANGES IN THE SACRAMENTO RIVER RIPARIAN ZONE

Reach	Bank Erosion Loss[1/] Agriculture Hectares	Agriculture Acres	Native Hectares	Native Acres	High Terrace V1-Only Hectares	V1-Only Acres	V1, V2, V3, V4 Hectares	V1, V2, V3, V4 Acres	Orchard Hectares	Orchard Acres	All Low Terrace Hectares	All Low Terrace Acres
1	19	47	16	40	- 60	-148	- 77	-191	- 6	- 16	17	+ 43
2	52	129	15	38	- 29	- 72	- 65	-160	23	+ 58	102	+251
3	79	195	42	105	-174	-431	-238	-588	189	+466	-28	- 68
4	52	128	1	3	- 2	- 6	-116	-288	200	+493	37	+ 91
5	53	131	19	48	- 26	- 64	- 65	-160	87	+214	95	+235
6	9	22	11	26	- 61	-151	- 68	-167	351	+868	-42	-104
7	0	0	0	0	0	0	0	0	- 15	- 36	9	+ 23
8	0	0	0	0	- 2	- 4	- 34	- 83	- 6	- 15	-32	- 80
9	0	0	0	0	- 2	- 4	- 31	- 76	5	+ 12	143	+353
Total	264	652	104	260	-356	-880	-694	-1,713	828	+2,044	301	+744

1/ From Table 7

TABLE 6-1

CHANGES IN THE SACRAMENTO RIVER RIPARIAN ZONE

REACH NO. 1

Central Colusa

Land Use Type	Hectares			Acres		
	1972	1977	Change	1972	1977	Change
AD/H	822	815	- 7	2,030	2,014	- 16
AG/H	134	200	+ 66	332	494	+162
Subtotal	(956)	(1 015)	(+ 59)	(2,362)	(2,508)	(+146)
AD/L	-	-	-	-	-	-
AG/L	-	-	-	-	-	-
Subtotal	(-)	(-)	(-)	(-)	(-)	(-)
V1/H	422	362	- 60	1,043	895	-148
V2/H	85	78	- 7	210	193	- 17
V3/H	37	23	- 14	91	56	- 35
V4/H	232	236	+ 4	573	582	+ 9
Subtotal	(776)	(699)	(- 77)	(1,917)	(1,726)	(-191)
V1/L	41	35	- 6	102	87	- 15
V2/L	15	14	- 1	37	35	- 2
V3/L	28	18	- 10	69	45	- 24
V4/L	124	158	+ 34	306	390	+ 84
Subtotal	(208)	(225)	(+ 17)	(514)	(557)	(+ 43)
OW	26	26	0	65	65	-
R	106	120	+ 14	262	298	+ 36
W	456	445	- 11	1,128	1,099	- 29
P	33	31	- 2	81	76	- 5
RC	2	2	-	6	6	-
U	-	-	-	-	-	-
UV	-	-	-	-	-	-
TOTAL	2 563	2 563	-0-	6,335	6,335	-0-

TABLE 6-2

CHANGES IN THE SACRAMENTO RIVER RIPARIAN ZONE

REACH NO. 2

Southern Glenn

Land Use Type	Hectares			Acres		
	1972	1977	Change	1972	1977	Change
AD/H	940	963	+ 23	2,323	2,381	+ 58
AG/H	371	322	- 49	918	796	-122
Subtotal	(1 311)	(1 285)	(- 26)	(3,241)	(3,177)	(- 64)
AD/L	-	-	-	-	-	-
AG/L	42	43	-	103	107	+ 4
Subtotal	(42)	(43)	(+ 1)	(103)	(107)	(+ 4)
V1/H	333	304	- 29	822	750	- 72
V2/H	21	21	0	53	52	- 1
V3/H	0	0	0	1	-	- 1
V4/H	246	211	- 35	608	522	- 86
Subtotal	(600)	(536)	(- 64)	(1,484)	(1,324)	(-160)
V1/L	81	64	- 17	201	159	- 42
V2/L	24	33	+ 9	59	81	+ 22
V3/L	79	88	+ 9	196	217	+ 21
V4/L	32	133	+101	79	329	+250
Subtotal	(216)	(318)	(+102)	(535)	(786)	(+251)
OW	68	68	0	168	168	+ 0
R	152	146	- 6	375	361	- 14
W	267	260	- 7	660	643	- 17
P	-	-	-	-	-	-
RC	-	-	-	-	-	-
U	-	-	-	-	-	-
UV	-	-	-	-	-	-
TOTAL	2 656	2 656	-0-	6,566	6,566	-0-

TABLE 6-3

CHANGES IN THE SACRAMENTO RIVER RIPARIAN ZONE

REACH NO. 3

Central Glenn to Chico Landing

Land Use Type	Hectares			Acres		
	1972	1977	Change	1972	1977	Change
AD/H	714	903	+189	1,765	2,231	+466
AG/H	2 529	2 489	- 40	6,250	6,150	-100
Subtotal	(3 243)	(3 392)	(+149)	(8,015)	(8,381)	(+366)
AD/L	-	-	-	-	-	-
AG/L	-	-	-	-	142	+142
Subtotal	(-)	(57)	(+ 57)	(-)	(142)	(+142)
V1/H	597	423	-174	1,476	1,045	-431
V2/H	122	55	- 67	301	137	-164
V3/H	57	76	+ 19	141	188	+ 47
V4/H	266	250	- 16	658	618	- 40
Subtotal	(1 042)	(804)	(-238)	(2,576)	(1,988)	(-588)
V1/L	140	111	- 29	346	274	- 72
V2/L	134	128	- 6	330	316	- 14
V3/L	98	122	+ 24	243	302	+ 59
V4/L	195	178	- 17	481	440	- 41
Subtotal	(567)	(539)	(- 28)	(1,400)	(1,332)	(- 68)
OW	33	33	0	81	82	+ 1
R	365	393	+ 28	903	971	+ 68
W	561	593	+ 32	1,387	1,466	+ 79
P	-	-	-	-	-	-
RC	-	-	-	-	-	-
U	-	-	-	-	-	-
UV	-	-	-	-	-	-
TOTAL	5 811	5 811	-0-	14,362	14,362	-0-

TABLE 6-4

CHANGES IN THE SACRAMENTO RIVER RIPARIAN ZONE

REACH NO. 4

Chico Landing to Southern Tehama Line

Land Use Type	Hectares			Acres		
	1972	1977	Change	1972	1977	Change
AD/H	643	842	+199	1,588	2,081	+493
AG/H	685	620	- 65	1,693	1,531	-162
Subtotal	(1 328)	(1 462)	(+134)	(3,281)	(3,612)	(+331)
AD/L	16	49	+ 33	39	122	+ 83
AG/L	142	87	- 55	350	215	-135
Subtotal	(158)	(136)	(- 22)	(389)	(337)	(- 52)
V1/H	94	92	- 2	233	227	- 6
V2/H	7	6	- 1	17	14	- 3
V3/H	-	-	-	-	-	-
V4/H	146	33	-113	360	81	-279
Subtotal	(247)	(131)	(-116)	(610)	(322)	(-288)
V1/L	82	73	- 9	202	181	- 21
V2/L	21	36	+ 15	53	90	+ 37
V3/L	49	92	+ 43	122	227	+105
V4/L	165	153	- 12	407	377	- 30
Subtotal	(317)	(354)	(+ 37)	(784)	(875)	(+ 91)
OW	8	20	+ 12	19	49	+ 30
R	127	84	- 43	313	207	-106
W	242	240	- 2	599	593	- 6
P	-	-	-	-	-	-
RC	3	3	0	7	7	-
U	41	41	0	102	102	-
UV	-	-	-	-	-	-
TOTAL	2 471	2 471	-0-	6,104	6,104	-0-

TABLE 6-5

CHANGES IN THE SACRAMENTO RIVER RIPARIAN ZONE

REACH NO. 5

Southern Tehama to Woodson Bridge

Land Use Type	Hectares			Acres		
	1972	1977	Change	1972	1977	Change
AD/H	1 414	1 501	+ 87	3,496	3,710	+214
AG/H	652	599	- 53	1,610	1,479	-131
Subtotal	(2 066)	(2 100)	(+ 34)	(5,106)	(5,189)	(+ 83)
AD/L	0	0	0	-	-	-
AG/L	6	10	+ 4	16	25	+ 9
Subtotal	(6)	(10)	(+ 4)	(16)	(25)	(+ 9)
V1/H	273	247	- 26	675	611	- 64
V2/H	-	27	+ 27	-	67	+ 67
V3/H	17	11	- 6	42	27	- 15
V4/H	154	94	- 60	380	232	-148
Subtotal	(444)	(379)	(- 65)	(1,097)	(937)	(-160)
V1/L	144	130	- 14	355	322	- 33
V2/L	32	32	0	80	80	-
V3/L	99	106	+ 7	245	261	+ 16
V4/L	107	209	+102	265	517	+252
Subtotal	(382)	(477)	(+ 95)	(945)	(1,180)	(+235)
OW	4	4	0	9	11	+ 2
R	242	194	- 48	598	479	-119
W	424	406	- 18	1,047	1,002	- 45
P	49	47	- 2	121	116	- 5
RC	6	6	0	15	15	-
U	-	-	-	-	-	-
UV	-	-	-	-	-	-
TOTAL	3 623	3 623	-0-	8,954	8,954	-0-

TABLE 6-6

CHANGES IN THE SACRAMENTO RIVER RIPARIAN ZONE

REACH NO. 6

Woodson Bridge to Red Bluff Diversion Dam

Land Use Type	Hectares			Acres		
	1972	1977	Change	1972	1977	Change
AD/H	1 401	1 752	+351	3,461	4,329	+868
AG/H	1 451	1 191	-260	3,586	2,942	-644
Subtotal	(2 852)	(2 943)	(+ 91)	(7,047)	(7,271)	(+224)
AD/L	-	-	-	-	-	-
AG/L	6	49	+ 43	14	120	+106
Subtotal	(6)	(49)	(+ 43)	(14)	(120)	(+106)
V1/H	444	383	- 61	1,097	946	-151
V2/H	157	154	- 3	389	381	- 8
V3/H	44	25	- 19	109	61	- 48
V4/H	128	144	+ 16	315	355	+ 40
Subtotal	(773)	(706)	(- 67)	(1,910)	(1,743)	(-167)
V1/L	126	135	+ 9	312	334	+ 22
V2/L	85	159	+ 74	211	394	+183
V3/L	239	148	- 91	589	367	-222
V4/L	310	275	- 35	767	680	- 87
Subtotal	(760)	(717)	(- 43)	(1,879)	(1,775)	(-104)
OW	5	10	+ 5	13	26	+ 13
R	495	455	- 40	1,224	1,125	- 99
W	592	591	- 1	1,462	1,460	- 2
P	23	31	+ 8	56	76	+ 20
RC	2	5	+ 3	6	12	+ 6
U	30	31	+ 1	75	78	+ 3
UV	-	-	-	-	-	-
TOTAL	5 538	5 538	-0-	13,686	13,686	-0-

TABLE 6-7

CHANGES IN THE SACRAMENTO RIVER RIPARIAN ZONE

REACH NO. 7

Red Bluff Diversion Dam to Jelly's Ferry

Land Use Type	Hectares			Acres		
	1972	1977	Change	1972	1977	Change
AD/H	27	12	- 15	67	31	- 36
AG/H	179	194	+ 15	443	479	+ 36
Subtotal	(206)	(206)	(-)	(510)	(510)	(-)
AD/L	-	-	-	-	-	-
AG/L	-	-	-	-	-	-
Subtotal	(-)	(-)	(-)	(-)	(-)	(-)
V1/H	19	19	-	46	46	-
V2/H	-	-	-	-	-	-
V3/H	-	-	-	-	-	-
V4/H	41	41	-	102	102	-
Subtotal	(60)	(60)	( )	(148)	(148)	( )
V1/L	27	27	-	67	67	-
V2/L	17	17	-	42	42	-
V3/L	27	27	-	67	67	-
V4/L	66	75	+ 9	163	186	+ 23
Subtotal	(137)	(146)	(+ 9)	(339)	(362)	(+ 23)
OW	-	-	-	-	-	-
R	251	244	- 7	620	603	- 17
W	522	520	- 2	1,291	1,285	- 6
P	19	19	-	46	46	-
RC	4	4	-	11	11	-
U	310	310	-	765	765	-
UV	-	-	-	-	-	-
TOTAL	1 509	1 509	-0-	3,730	3,730	-0-

TABLE 6-8

CHANGES IN THE SACRAMENTO RIVER RIPARIAN ZONE

REACH NO. 8

Jelly's Ferry to Shasta County Line

Land Use Type	Hectares			Acres		
	1972	1977	Change	1972	1977	Change
AD/H	204	199	- 5	506	491	- 15
AG/H	178	213	+ 35	439	525	+ 86
Subtotal	(382)	(412)	(+ 30)	(945)	(1,016)	(+ 71)
AD/L	-	-	-	-	-	-
AG/L	60	64	+ 4	149	158	+ 9
Subtotal	(60)	(64)	(+ 4)	(149)	(158)	(+ 9)
V1/H	23	21	- 2	57	53	- 4
V2/H	-	-	-	-	-	-
V3/H	14	8	- 6	34	19	- 15
V4/H	92	66	- 26	228	164	- 64
Subtotal	(129)	(95)	(- 34)	(319)	(236)	(- 83)
V1/L	73	62	- 11	180	153	- 27
V2/L	40	40	-	98	99	+ 1
V3/L	28	20	- 8	68	50	- 18
V4/L	105	90	- 15	259	223	- 36
Subtotal	(246)	(212)	(- 34)	(605)	(525)	(- 80)
OW	-	-	-	-	-	-
R	227	135	- 92	563	333	-230
W	135	174	+ 39	333	431	+ 98
P	-	16	+ 16	-	40	+ 40
RC	-	-	-	-	-	-
U	-	-	-	-	-	-
UV	-	71	+ 71	-	175	+175
TOTAL	1 179	1 179	-0-	2,914	2,914	-0-

TABLE 6-9

CHANGES IN THE SACRAMENTO RIVER RIPARIAN ZONE

REACH NO. 9

Shasta County Line to Keswick Dam

Land Use Type	Hectares			Acres		
	1972	1977	Change	1972	1977	Change
AD/H	400	405	+ 5	988	1,000	+ 12
AG/H	1 233	1 193	- 40	3,046	2,947	- 99
Subtotal	(1 633)	(1 598)	(- 35)	(4,034)	(3,947)	(- 87)
AD/L	11	11	-	26	26	-
AG/L	78	72	- 6	193	178	- 15
Subtotal	(89)	(83)	(- 6)	(219)	(204)	(- 15)
V1/H	37	35	- 2	91	87	- 4
V2/H	140	163	+ 23	347	403	+ 56
V3/H	87	47	- 40	216	117	- 99
V4/H	181	170	- 11	449	420	- 29
Subtotal	(445)	(415)	(- 30)	(1,103)	(1,027)	(- 76)
V1/L	-	-	-	-	-	-
V2/L	61	68	+ 7	150	169	+ 19
V3/L	85	135	+ 50	209	333	+124
V4/L	114	199	+ 85	281	491	+210
Subtotal	(260)	(402)	(+142)	(640)	(993)	(+353)
OW	-	-	-	-	-	-
R	460	305	-155	1,137	754	-383
W	685	714	+ 29	1,693	1,765	+ 72
P	20	24	+ 4	50	59	+ 9
RC	-	-	-	-	-	-
U	407	458	+ 51	1,005	1,132	+127
UV	-	-	-	-	-	-
TOTAL	3 999	3 999	-0-	9,881	9,881	-0-

TABLE 6-10

CHANGES IN THE SACRAMENTO RIVER RIPARIAN ZONE

SUMMARY - ALL REACHES

Butte Creek to Keswick Dam

Land Use Type	Hectares			Acres		
	1972	1977	Change	1972	1977	Change
AD/H	6 566	7 393	+827	16,224	18,268	+2,044
AG/H	7 413	7 019	-394	18,317	17,343	- 974
Subtotal	(13 979)	(14 412)	(+433)	(34,541)	(35,611)	(+1,070)
AD/L	26	60	+ 34	65	148	+ 83
AG/L	334	382	+ 48	825	945	+ 120
Subtotal	(360)	(442)	(+ 82)	(890)	(1,093)	(+ 203)
V1/H	2 242	1 886	-356	5,540	4,660	- 880
V2/H	533	505	- 28	1 317	1 247	- 70
V3/H	257	189	- 68	634	468	- 166
V4/H	1 486	1 245	-241	3 673	3 076	- 597
Subtotal	(4 518)	(3 825)	(-693)	(11,164)	(9,451)	(-1,713)
V1/L	714	638	- 76	1,765	1,577	- 188
V2/L	429	529	+100	1,060	1,306	+ 246
V3/L	732	756	+ 24	1,808	1,869	+ 61
V4/L	1 217	1 470	+253	3,008	3,633	+ 625
Subtotal	(3 092)	(3 393)	(+301)	(7,641)	(8,385)	(+ 744)
OW	144	162	+ 18	355	401	+ 46
R	2 426	2 076	-350	5,995	5,131	- 864
W	3 885	3 943	+ 58	9,600	9,744	+ 144
P	143	167	+ 24	354	413	+ 59
RC	18	21	+ 3	45	51	+ 6
U	788	841	+ 53	1,947	2,077	+ 130
UV	-	71	+ 71	-	175	+ 175
TOTAL	29 353	29 353	-0-	72,532	72,532	-0-

TABLE 6-8

CHANGES IN THE SACRAMENTO RIVER RIPARIAN ZONE

REACH NO. 8

Jelly's Ferry to Shasta County Line

Land Use Type	Hectares			Acres		
	1972	1977	Change	1972	1977	Change
AD/H	204	199	- 5	506	491	- 15
AG/H	178	213	+ 35	439	525	+ 86
Subtotal	(382)	(412)	(+ 30)	(945)	(1,016)	(+ 71)
AD/L	-	-	-	-	-	-
AG/L	60	64	+ 4	149	158	+ 9
Subtotal	(60)	(64)	(+ 4)	(149)	(158)	(+ 9)
V1/H	23	21	- 2	57	53	- 4
V2/H	-	-	-	-	-	-
V3/H	14	8	- 6	34	19	- 15
V4/H	92	66	- 26	228	164	- 64
Subtotal	(129)	(95)	(- 34)	(319)	(236)	(- 83)
V1/L	73	62	- 11	180	153	- 27
V2/L	40	40	-	98	99	+ 1
V3/L	28	20	- 8	68	50	- 18
V4/L	105	90	- 15	259	223	- 36
Subtotal	(246)	(212)	(- 34)	(605)	(525)	(- 80)
OW	-	-	-	-	-	-
R	227	135	- 92	563	333	-230
W	135	174	+ 39	333	431	+ 98
P	-	16	+ 16	-	40	+ 40
RC	-	-	-	-	-	-
U	-	-	-	-	-	-
UV	-	71	+ 71	-	175	+175
TOTAL	1 179	1 179	-0-	2,914	2,914	-0-

present day flood flows measured at Colusa Weir are a foot lower for identical volumes of water recorded in past years.

TABLE 7

EROSIONAL LOSSES ON PRIME SOILS
1972-1977 COLUSA TO KESWICK

	Hectares Lost			Acres Lost		
Reach	Ag Lands	Riparian Veg.	Total	Ag Lands	Riparian Veg.	Total
1	19	16	35	47	40	87
2	52	15	67	129	38	167
3	79	42	121	195	105	300
4	52	1	53	128	3	131
5	53	19	72	131	48	179
6	9	11	20	22	26	48
7,8,9	0	0	0	0	0	0
	264	104	368	652	260	912
	(70%)	(30%)	(100%)	(70%)	(30%)	(100%)

The erosion-deposition processes in effect today could ultimately reduce most high terrace lands to low terrace riverwash or gravel bars. This is particularly true within the flood control project south of Ord Ferry where the river can only migrate back and forth between rock-lined levees. Erosion on prime soils at river mile 165 is a case in point (see photos page 11). As prime soils are washed into the river on the left bank, the right bank adds more low terrace gravel bar. New gravel bars tend to rapidly revegetate, particularly during periods when there are few scouring floods. Revegetation starts with forbs and grasses that eventually give way to trees. What is happening, in effect, is that as the river loses prime high terrace lands it appears to be gaining low terrace riparian wildlife habitat.