A PRELIMINARY BIOPHYSICAL INVENTORY

AND

MANAGEMENT PLAN

FOR THE

SILVER CREEK BIOLOGICAL PRESERVE

The Nature Conservancy
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Submitted by Ken Wiley

INTRODUCTION

Silver Creek is undeniably a valuable resource. How one defines this value is directly related to how one views the creek. It may have economic value, recreational value, biological or ecological value. It may be seen in terms of fish or ducks or irrigation. But there is common agreement that the reason for its unique appeal is the special quality of its water.

Water from Silver Creek and its aquifer is responsible for the agricultural lushness of the surrounding valley floor. The especially productive water of Silver Creek is responsible for the fishery that has given the stream its widespread reputation. And the water is also responsible for the often-overlooked fact that Silver Creek is much more than a fishery.

Loren Eiseley, the noted author and anthropologist, has said, "If there is magic in this world, it is contained in water." The implications of this statement are exhibited with a special clarity at Silver Creek. In its arid environment, the effects of its water are indeed magical.

The visitor who spends a day here will find himself in an unusually beautiful and diversified environment. An abundance of nesting birds including raptors, songbirds and waterfowl dominate the creek through spring and early summer. Muskrat, otter, mink and beaver ply its quiet waters while deer and coyote lurk in nearby thickets. Hatching insects swarm from the surface of the stream while the silent swoop of countless swallows seines them from the air.

The spectacle of life inevitably linked to the creek is an affirmation of the adage that water and life are one thread woven intrinsically together. Herein lies the magic Eiseley spoke of and herein lies the greatest challenge to future management of this unique resource.

There is an old technique, long utilized by different groups of aboriginal Americans, for producing a long straight line from a full animal hide. Beginnning at the very center of the hide an even spiral outward is cut with a sharp knife until reaching the edge of the skin. The end result is one long line, efficiently utilizing the entire hide.

From the air, Silver Creek appears as a tiny line cutting through a relatively enormous valley. The space it occupies on the valley floor seems almost insignificant, yet in a curious analogy to the old aboriginal trick, the tiny line of Silver Creek and the valley that it drains are involved in a widening, reciprocating sprial that mark each other as effectively and irrevocably as knife on hide.

GENERAL GOALS AND OBJECTIVES
SILVER CREEK MANAGEMENT PROGRAM

The protection and enhancement of Silver Creek's exceptional natural features to benefit both its native plants and animals and its human users, is the primary objective of The Nature Conservancy's management program for the Silver Creek Preserve. More specifically, the goals of the program are essentially twofold as follows:

1. To restore, on the preserve proper, the natural diversity that pre-existed intensive agriculture. This includes preserving intact plant and animal species and communities and replacing, within the limits of reality and feasibility, non-native species and communities which have invaded or have purposely been introduced.

2. To restore and promote the functional health and vitality of the surrounding watershed and its resources, fish and otherwise. It is recognized that neither the preserve nor its aquatic resource exist as static entities but function as parts of the surrounding ecosystem, much influenced by upstream chemical and physical inputs. A broad-based, cooperative conservation program with surrounding landowners should begin on the preserve itself, through the demonstration of profitable land-use alternatives that are compatible with stream and general habitat preservation.

Compatible, non-consumptive public use and enjoyment of the preserve is another legitimate and desired objective.

While the eventual goal is "preservation" of an exceptional ecosystem, the most desirable and direct approach toward this end is an active and comprehensive management program designed to protect, enhance and restore naturally occurring aspects of the watershed.

Location and Description

The Silver Creek Biological Preserve is located in Blaine County, Idaho approximately thirty miles southeast of the resort town of Sun Valley (Figure 1). It lies in a broad, agricultural valley against the sagebrush-covered Picabo Hills. The preserve totals 479 acres and includes approximately three-and-a-half miles of the headwaters of Silver Creek (Figure 2). The official description of the area reads as follows:

TOWNSHIP 1 SOUTH, RANGE 19 EAST, BOISE MERIDIAN, BLAINE COUNTY, IDAHO.

SECTION 23: SE ¼ SE ¼
SECTION 24: S ½ S ½
SECTION 25: N ½ NW ¼, NW ¼ NE ¼ and Tax Lot No. 1245 in the NE ¼ NE ¼, being all the NE ¼ NE ¼, EXCEPT the following tract:

Beginning at a point 490 feet South of the Northeast corner of said Section 25; thence
North 200 feet; thence
West 200 feet; thence
South 200 feet; thence
East 200 feet to the POINT OF BEGINNING.

SECTION 26: NE ¼ NE ¼ and W ½ NE ¼; EXCEPTING THEREFROM THE RIGHT OF WAY FOR SILVER CREEK; and

SUBJECT TO THE TERMS AND CONDITIONS OF AN AGREEMENT BETWEEN SUN VALLEY CO., INC. AND LOUIS HUBSHMAN, JR. TO CONSTRUCT FENCING AND USE ACCESS ROAD LYING WITHIN PROPERTY DESCRIBED HEREIN, RECORDED OCTOBER 13, 1969, AS INSTRUMENT NO. 133843, RECORDS OF BLAINE COUNTY, IDAHO.

Access to the area is by an unnamed county road that crosses State Highway 68 two miles south of the town of Gannett. This gravel road enters the preserve approximately one-quarter mile after crossing Stocker Creek, follows the preserve boundary along the base of the Picabo Hills, crosses Silver Creek on Kilpatrick Bridge, and connects back with State Highway 68 approximately one-half mile east of the entrance to the Idaho Department of Fish and Game's Hayspur Fish Hatchery.

The terrain is generally flat with the exception of the southwest corner of the preserve. Here preserve boundaries encompass a small portion of the rising foothills that dominate its southern flank. Elevation of the preserve is approximately 4800 feet on the valley floor.

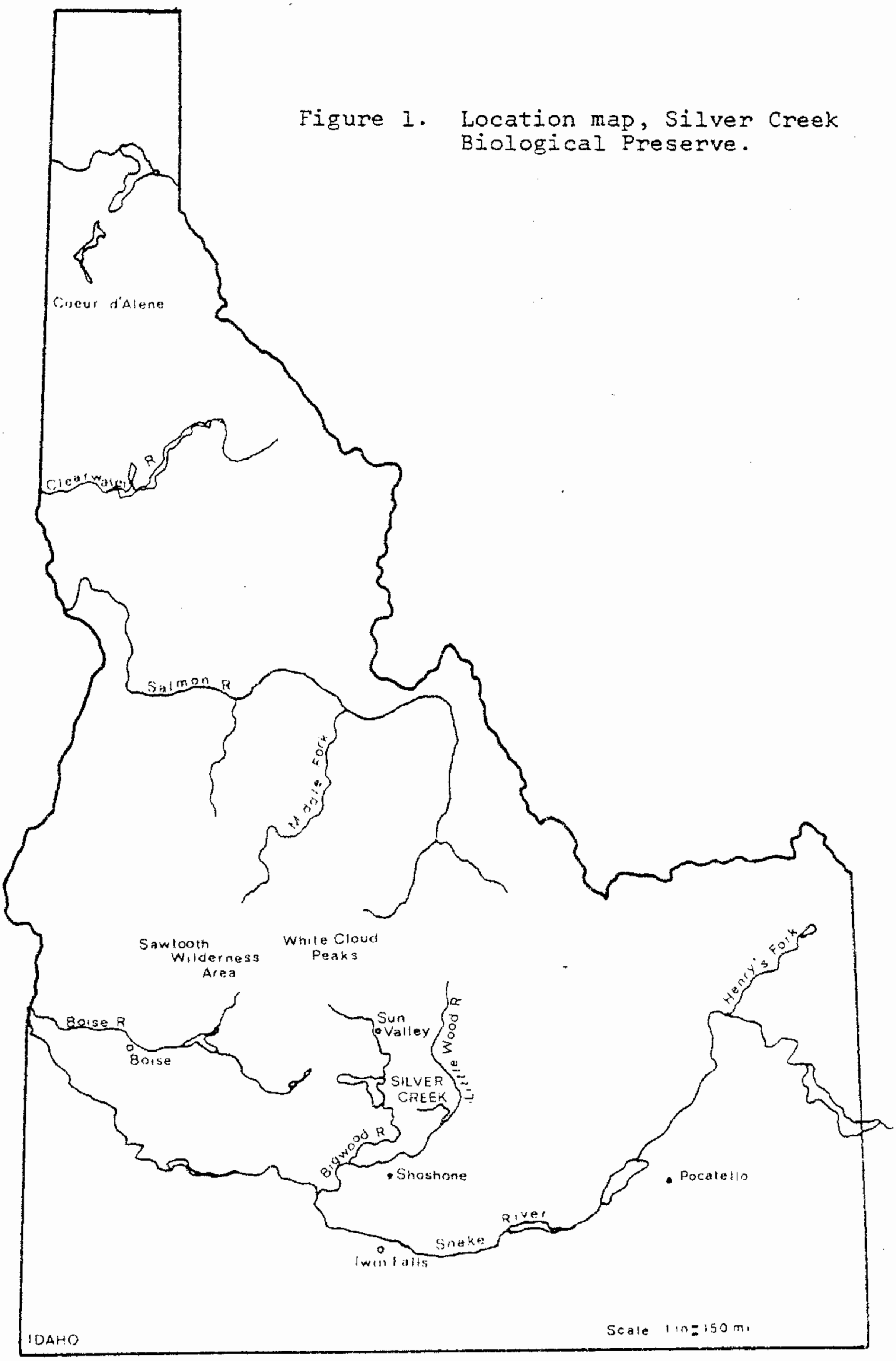

Figure 1. Location map, Silver Creek Biological Preserve.

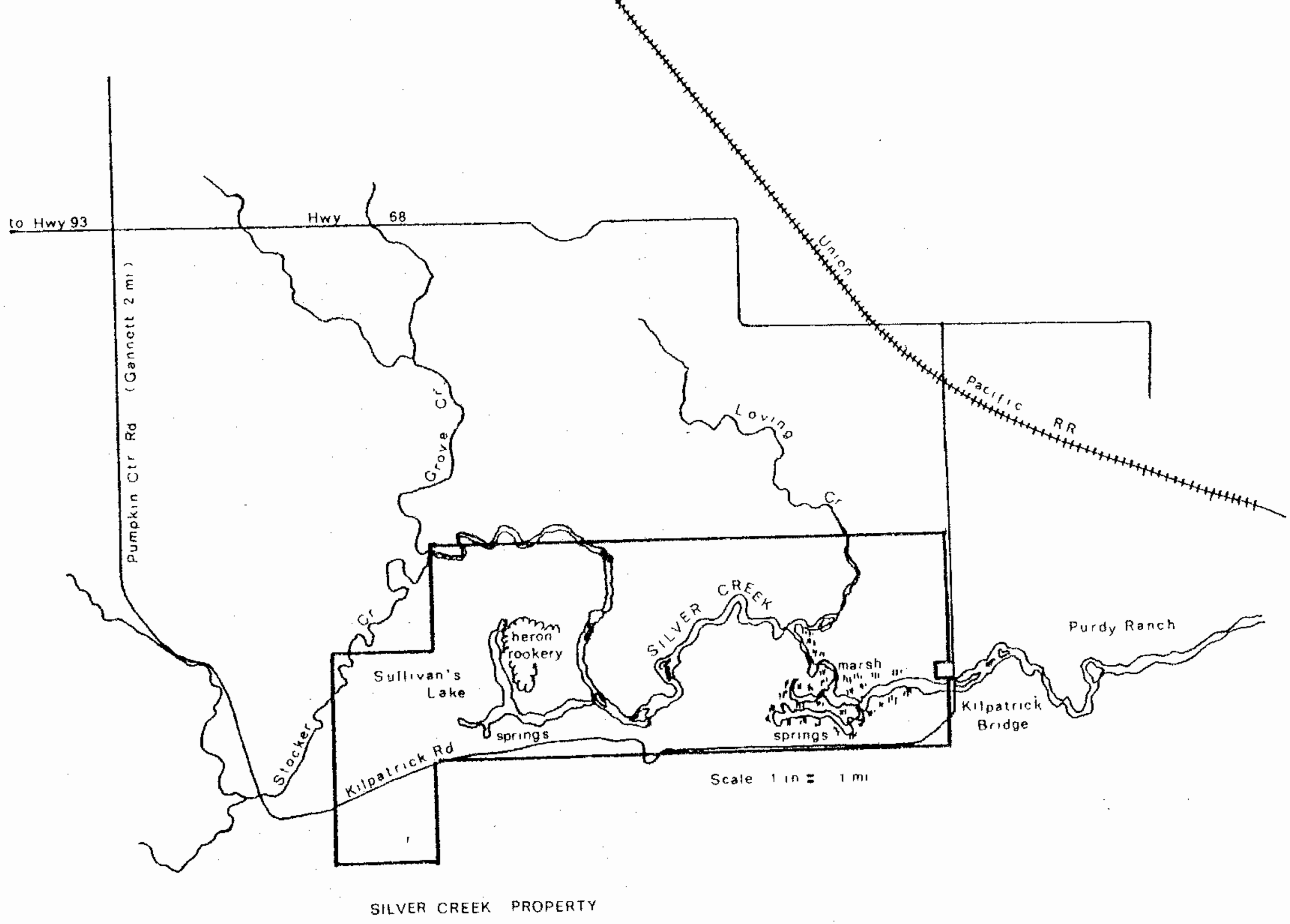

Figure 2. Map of Silver Creek Biological Preserve.

Pat Rogers' tenure as manager of the resort was apparently marked by a legendary hospitality, congeniality and generosity. Accounts of his reign at Sun Valley center around his exploits as an unparalleled host and mention, in passing, his somewhat casual approach to the profit-and-loss aspect of the business. That attitude is reflected in the way the Silver Creek property was utilized prior to his departure. Up until the early 1950's the major usage of the property was recreation. Horses owned by the resort were pastured there in the fall but intensive agricultural use didn't begin util after Rogers left in 1952. Aerial photographs taken in 1957 show that by that time nearly all the tillable land on the property was under cultivation.

When Sun Valley was purchased in 1964 by Bill Janss the Silver Creek property, known at the time as the Sun Valley Ranch, was also part of the deal. On the advice of Don Anderson, a long-time Sun Valley guide and outfitter and now Sports Director for the resort, Janss removed all cattle from the property to halt what Anderson felt was drastic overgrazing. Since that time the cultivation of barley has been the major agricultural use of the preserve.

In 1976 the Sun Valley Ranch became the Silver Creek Biological Preserve with its purchase by The Nature Conservancy from Janss' Sun Valley Company.

BIOPHYSICAL INVENTORY

Climate

Climate in the area of the Silver Creek Preserve is characterized by moderately cold winters and warm summers. The surrounding mountains protect the valley floor from high winds and manage to intercept much of the moisture carried by the winds, especially weather commonly arriving from the north and the northwest.

The nearest weather station with comprehensive data is at Hailey, approximately fifteen miles north of the Silver Creek headwaters, with an elevation difference of +500 feet. The average monthly minimum temperature of 18.7^{O} Fahrenheit (F) occurs in January. The average monthly maximum of 67^{O} F occurs in July (Figure 3). These figures could probably be accurately adjusted upward a few degrees to accomodate the geographical differences between the Hailey and the preserve areas. Hailey has an average frost-free growing season of 131 days, somewhat shorter than the more open and lower areas surrounding the Silver Creek region. Average annual precipitation for the ten-year period 1961-1971 at Hailey is 18.31 inches. Average annual precipitation at Picabo, approximately five miles east of the preserve area, for the same period is 13.74 inches (Figure 4).

Geologic Framework

The complex hydrology of the Silver Creek area is a direct expression of the geologic history of the region. The unique character of Silver Creek, its magical rise from a high sagebrush desert and its surprising volume are fully understandable only in terms of several aspects of its distant embryonic past. The most important of these is an interesting juxtaposition of volcanic fire and glacial ice (Castelin and Chapman, 1972.)

During the early Paleozoic Era, the region was covered by a succession of seas. Thousands of feet of lime, silt and sand sediments were compressed by the weight of overlying material forming limestone, siltstone and sandstone. These sediments now make up most of the basement rock forming the walls of the valley and underlie the valley fill. Following the deposition and consolidation of these sediments faulting occurred, resulting in a sunken, depressed area. This depression, now known as the Big Wood River Valley, has been slowly filling with sediments since its formation.

The next major event to modify the area was massive volcanic activity during the Tertiary Period. These flows, known as the Challis Volcanics, extruded, over a period of time, large volumes of siliceous lava sufficient to exceed several thousand feet in thickness. Flows from this early volcanic activity have been extensively eroded and are now exposed primarily in the Timmerman Hills and in the Pioneer Mountains near Picabo.

It was in the Quaternary Period, immediately following the Tertiary and beginning approximately three million years ago, that the most important geologic influences on the hydrology of Silver Creek occurred. At that time the Big Wood River flowed in what is now the Silver Creek drainage. Basaltic lava began flowing from a vent located approximately in Section 24, Township 1

South, Range 19 East, Boise Meridian; interestingly, almost the exact site of the Silver Creek Preserve. This flow blocked the southeastern portion of the valley and impounded the waters of the Big Wood River, forming a lake which eventually spilled through an outlet to the southwest. This outlet was later blocked by another lava flow issuing from a vent on the opposite side of the valley. The lake increased in size and sediments accumulated in a substantial sequence of alternating sands, silts and clays.

The River eventually breached the lava dam and attained a temporary base level until the eruption of what is known as the Priest lava flow. Located on the east side of the Timmerman Hills, the Priest flow created a dam approximately 110 feet high, again completely blocking the lake outlet.

Later in the Quaternary Period, extensive alpine glaciers in the headwaters of the Big Wood River began to recede. Their meltwater sustantially increased the flow of the river and much of the rock material they had scoured from the mountains was carried down and deposited in the lake formed behind the lava dam. These sediments were deposited according to the load-carrying capacity of the river, i.e. clay, sand and silt during low flows and fine to coarse gravel during periods of greater flow. This variation in flow led to a succession of alternating layers of clay, silt, sand and gravels. Further deposition of sediments during the next glacial stage added materially to the accumulation of this deposit. Sometime during this period the Big Wood River re-established its course once again on the west side of the valley, roughly in the river channel it presently occupies. The lake receded, extensive erosion modified the lava dam and the valley slowly assumed its present geography.

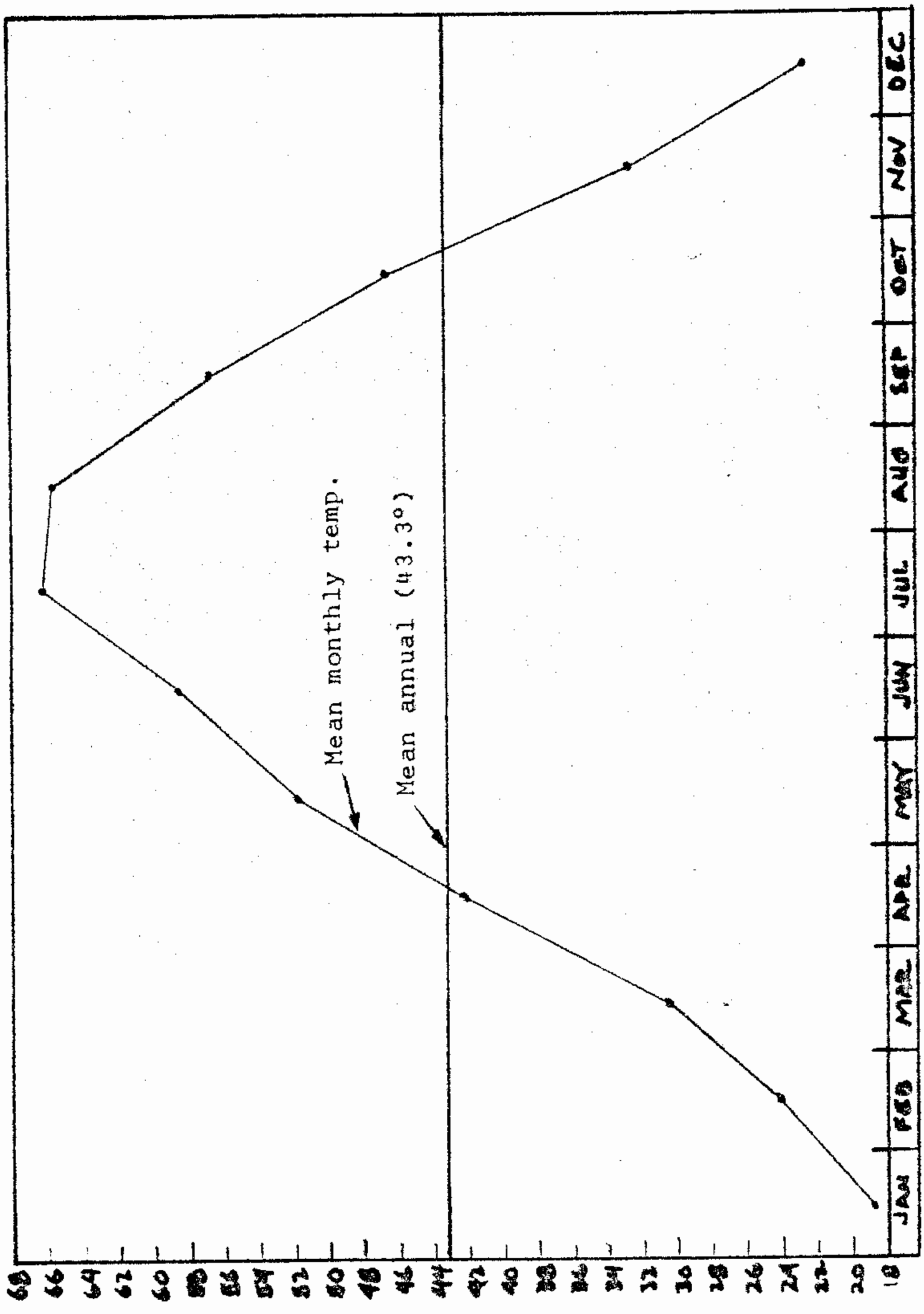

Figure 3. Mean monthly and annual temperature; Hailey, Idaho.
50 Years of Record

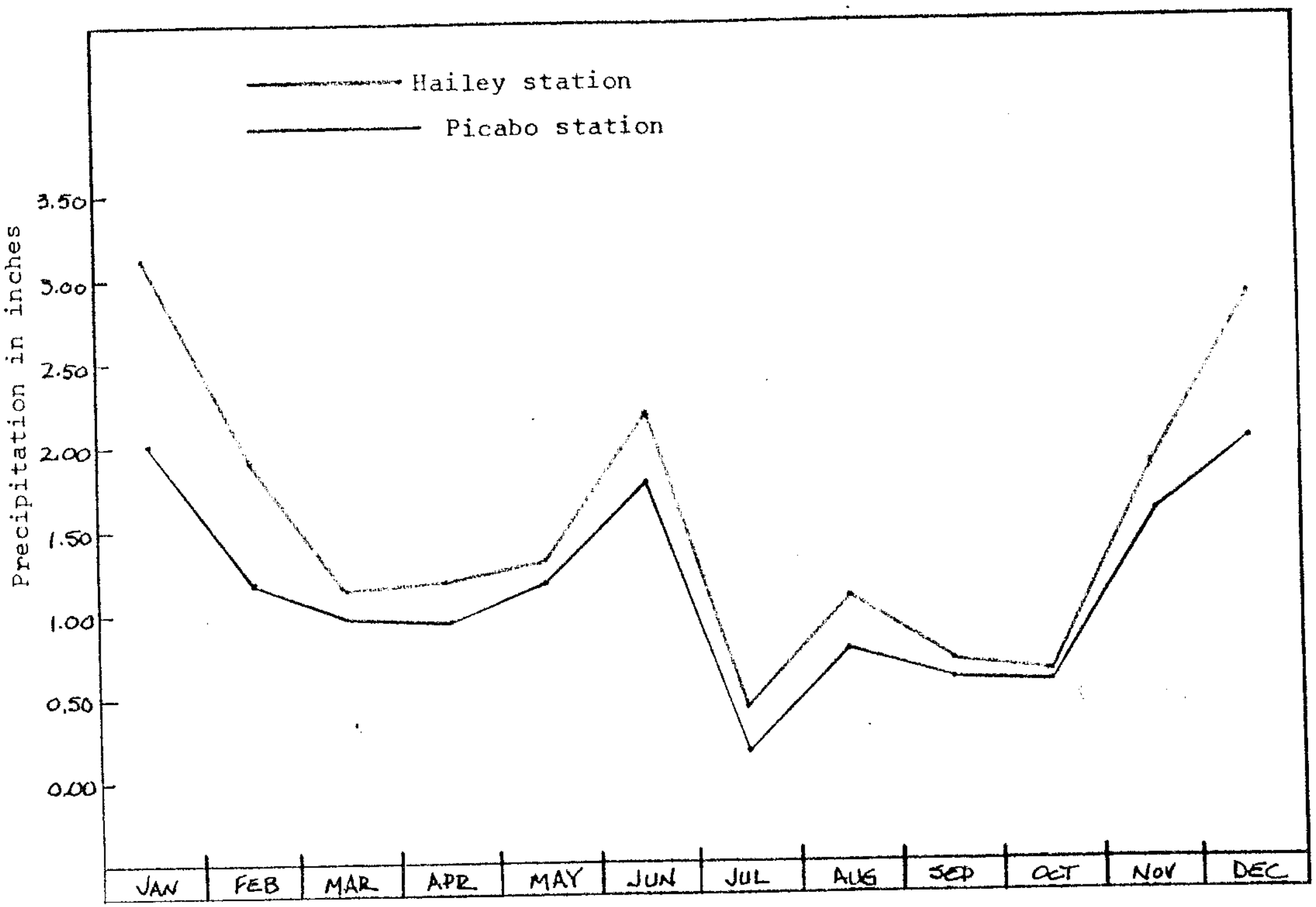

Figure 4. Average monthly precipitation at Picabo and Hailey stations (10 years of record - 1960-1969)

Hydrology

The thick sequence of sediments deposited in the valley lake by the melting of ancient alpine glaciers, and held there by enormous lava dams, make up the all-important underlying aquifer and ground-water system responsible for the existence of Silver Creek. The creek rises from a series of springs and seeps in the area below Baseline Road, from east of Highway 93 to roughly the town of Gannett (Figure 5).(Castelin and Chapman, 1972.)

Water entering the area from the north moves downward through the sand and gravel alluvial fill deposited by glacial runoff. These fluvioglacial sediments underlie the valley floor mainly in the area below Bellevue and the broad plain east of Gannett to Picabo. Water entering from the north travels southward through the coarse-grained sediments until it reaches an area just north of Baseline Road, where the fine-grained content of the sediment increases. Here significant deposits of silt and clay occur in the sand and gravel sequence. Much of the ground water moving through the area is trapped, under pressure, beneath these relatively impermeable layers, giving rise to the existence of the many artesian wells found in this area. That portion of the water not trapped beneath the confining layers of silt and clay continues through the upper coarse material. The overlying sediments become progressively finer in a southerly direction, becoming extremely fine just south of Baseline Road. Since these sediments do not transmit water as readily as the sand and gravel to the north, they inhibit the flow of ground water, resulting in upward leakage and a rise in ground water levels to a point where numerous springs and seeps begin to bubble out of the valley floor, run as surface water to the south and eventually consolidate as Silver Creek.

The sources of ground water responsible for the eventual formation of Silver Creek are both numerous and complex. Basically, the aquifer system is recharged by precipitation, underflow from the upper Big Wood River watershed, percolation from the river channel and irrigation canals, and infiltration of irrigation water applied in excess of crop needs.

Discharge from the aquifer is accomplished by evapotranspiration from plants (both crops and native vegetation), spring discharge, i.e. surface runoff, ground water pumpage and underflow out of the area. Nearly all water entering the system, however, either leaves as surface outflow or is evapotranspired by plants.

Fluctuations in the flow of Silver Creek are shown by the hydrograph of the discharge at the gauging station near Picabo for the years 1958-1962 (Figure 6). Low flows occur from about late May through July. Flows increase during the latter part of August or September and peak during the period from November into early winter. As shown, another peak occurs during March and early April.

The abrupt peaks occurring in the spring are a result of surface runoff caused by snowmelt. The low flows from late May through the summer are believed to result from the lack of recharge from the groundwater system. There is a time lag involved for irrigation water in excess of consumptive use requirements to travel through the aquifer system to the springs that supply the creek. The increase in flow from August into winter is the result of the recharge effect reaching the springs after approximately three to four months trave time through the aquifer system.

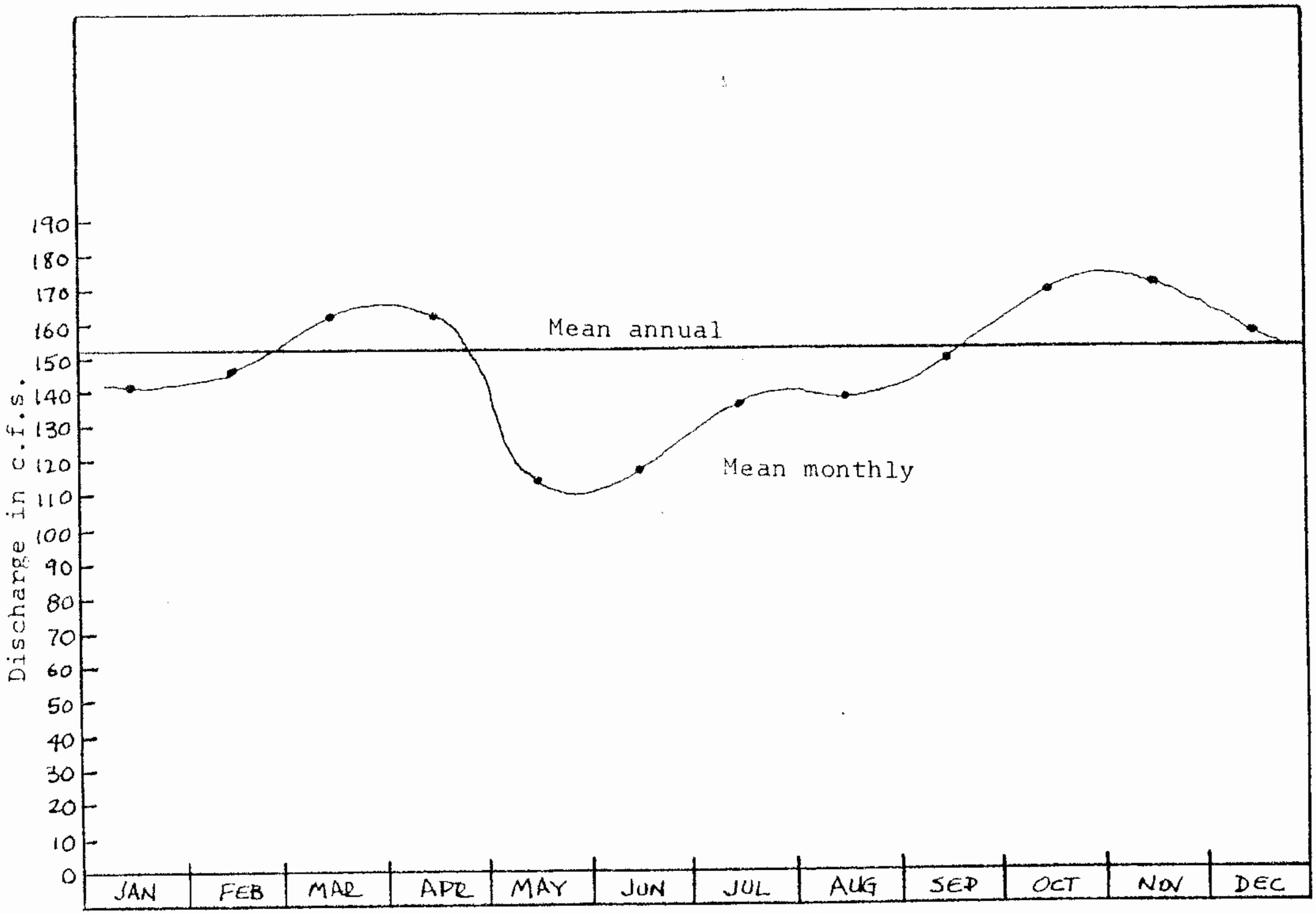

Figure 6. Mean monthly and annual discharge of Silver Creek near Picabo, Idaho.

Massive land use changes throughout the Silver Creek watershed, with increased consumptive use requirements for irrigation water and the recent widespread adoption of sprinklers to replace the long-standing practice of flood irrigating will have important effects on aquifer recharge and stream flow fluctuations. The practice of flood irrigation, so long a part of the area's agriculture, requires much more water than do sprinklers. Much of this water is lost for crop requirements through percolation into the aquifer (up to 80% according to some SCS estimates) and, also, flood irrigation has its attendant erosion problems. With sprinklers, on the other hand, because there is less water loss through percolation and more efficient consumptive use (up to 70% estimated to be evapotranspired by plants), a substantial aspect of aquifer recharge and eventually, of course, Silver Creek recharge, is removed from the hydrological equation. This example is symbolic of the complex interconnection between the surface-and-groundwater systems. The sensitive equilibrium between the two is such that any stress on one will result in an effect on the other.

Further data relevant to this important aspect of Silver Creek will be available later this year upon publication of the Silver Creek Aquifer Recharge Study being done in a cooperative effort by several agencies.

Soils

There are five basic soil types found on the Silver Creek Preserve:

1. Picabo Series (PiA) - This series is the major soil type on the preserve. All of the agricultural fields with the exception of Field F (Figure 7) are underlain by this soil type. This soil occurs on level to gently sloping alluvial bottom lands and has developed from medium to moderately fine textured older alluvium, which overlies gravel or moderately coarse textured alluvium. Gravel generally underlies the soil at 36-60". It is a poorly drained soil, runoff is very slow and permeability is moderately slow or slow. Picabo soils are usually saturated within 40" for at least two months or more during most years; natural vegetation overlying Picabo soils consisted of wet meadow plants, sedges and rushes. Texture is predominately a clay loam, but may include strata of silt loam, loam or silty clay loam. These soils are mildy to strongly alkaline, with the high pH values near the soil surface.

2. Molyneux Series (Mn) - Soils of the Molyneux series are found along the preserve's southern boundary and in the field currently utilized for alfalfa on the extreme western end. It is found, on the preserve, on slopes from 2 to 12% and has developed in mixed alluvium mainly from quartzite, sandstone, rhyolite and limestone. It is a well drained soil with medium runoff and moderate permeability. Native plants of this soil type include Sandberg bluegrass, needlegrass, bluebunch wheatgrass, great basin wild rye, big sagebrush, rabbitbrush, arrowleaf balsamroot and lupine. Typically, Molyneux soils have a grayish brown silt loam A horizon and a fairly loose silt loam to clay loam subsoil. These soils naturally have a relatively neutral pH on the surface

and range downward to mildly alkaline in the lower subsoils. The relatively high pH values of 7.9 to 8.5 found this year on Field F (Figure 7) are probably a result of high evaporation and plant transpiration rates concentrating salts in the upper soil horizons.

3. Hayspur Series (HSC) - Hayspur series soils are found throughout the preserve in wet marshy areas and along the corridor of the creek. Typically, Hayspur soils are wet and have gray, slightly calcareous silty clay loam A horisons, light gray and white non-calcareous clay loam subsoils and are underlain by sand and gravel below 40". The soils are poorly drained. Permeability of the upper horizon is moderate, with the lower horizons being much more permeable, especially below 40". The water table is high for several months and overflowing is common in the spring. Natural vegetation includes rushes, sedges, red top, saltgrass, shrubby sinquefoil, wild rose and willows. This soil is strongly alkaline at the surface (pH 8.6) and exhibits pH factors down to 7.8 through its subsoil.

4. Justesen Series (JCEG) - The Justesen soild type is found on the preserve's southern boundary on the steep slope just south of Sullivan's Lake, between the lake and the couty road. It is a non-calcareous, heavy, clay loam soil with up to 50% stones below the first 4 to 6". It is typically found on 30-60%, south-facing slopes and is, naturally, very well drained. Native vegetation includes bluebunch wheatgrass, big sagebrush, lupine and other assorted sagebrush community plants.

5. Kilpatrick Series (KaA) - This soil series, like the Justesen series, is of little influence on the preserve. It is found on the preserve as a strip cutting across the northeast corner. The soil is derived from alluvium, principally quartzite, rhyolite and andesite sources, and characterized by very dark

brown to very dark grayish-brown loam to loamy sand, slightly calcareous surface soils; and gray to olive-gray, massive, strongly calcareous, moderately coarse-textured subsoils. The subsoils are underlain by gravel, which is sometimes weakly cemented. Runoff is slow; erosion hazard is slight; permeability is 5 to 10" per hour. The natural vegetation consisted of semi-wet meadow type perennial grasses and shrubs.

Initial soil testing of several preserve fields was undertaken this year by Advanced Ag Associates-West of Boise, Idaho.

Vegetation

The Silver Creek Biological Preserve lies in what Daubenmire (1952) referes to as the "sagebrush-grass vegetation zone". The vegetation type is characteristic of the broad Snake River Plain and the floors of the larger valleys that open onto it. This semi-desert type of vegetation was originally dominated by shrubs and perennial herbs, including tall grasses and forbs. Among the more representative members of the original community were:

Artemisia tridentata (big sagebrush)
Artemisia tripartita (treetip sagebrush)
Purshia tridentata (bitterbrush)
Tetradymia canescens (horsebrush)
Eriogonum spp. (desert buckwheat)
Agropyron spicatum (bluebunch wheatgrass)
Poa secunda (Sandberg's bluegrass)
Koeleria cristata (junegrass)
Stipa spp. (needlegrass)
Agropyron dasystachyum (thickspike wheatgrass)
Orysopsis hymenoides (indian ricegrass)
Balsamorhiza sagittata (arrowleaf balsamroot)
Lupinus spp. (lupine)
Crepis spp. (hawksbeard)
Agoseris spp. (false dandelion)

Prior to the era of unrestricted grazing the sagebrush species grew as scattered individuals in a dense herbaceous cover made up of *Agropyron* and other perennials. Unable to withstand the competition, the sagebrush plants were then generally smaller in size and, by and large, were held in check by the grasses and other forage that attracted the early cattlemen. As the sagebrush zone fell victim to the ravages of over-grazing, the palatable grasses were nearly eliminated. The less palatable sagebrush species increased in size and abundance as their competition was depleted and today extensive areas of this vegetational zone are covered by dense stands, beneath which representatives of the original grasses exist in relative scarcity.

While sagebrush species (notably Artemesia tridentata and A. tripartita) dominate several areas of higher ground on the preserve's southern boundary, the majority of the terrain within the preserve perimeter is much lower and is directly influenced by the presence of water - both the marshy areas adjacent to the stream and the underlying ground water, so influential because of its close proximity to the valley floor. The progressive transect from higher and drier ground to the widespread marshy areas near the creek provides differing environmental influences sufficient to harbor an exceptional diversity of plant species.

An agricultural history dating back several decades has drastically altered the native vegetation originally existing within the preserve area. Aerial photos taken in 1950 indicate that those fields currently under cultivation were at that time unbroken. It appears that prior use of the area was primarily grazing.

By 1957 nearly the entire preserve was under intense cultivation. While slight changes in field contours have taken place, agricultural utilization of the preserve established by the late 1950's, with one exception, still exists. When the Silver Creek Preserve (known at the time as the Sun Valley Ranch) was purchased by Bill Janss and the Sun Valley Company from the Union Pacific Railroad in 1964 the cattle using the area were removed in response to concern about overgrazing and potential damage to the aquatic ecosystem. While still under cultivation, the area has not been utilized by cattle since the mid-1960's.

Those native species eliminated by this intensive utilization are, at this point, understandably difficult to determine. Easier to identify are those introduced, exotic and escaped species which have either been purposely established (such as the grass Agropyron intermedium) or which have invaded on their own as niches became available, e.g. many of the noxious weed species.

Comments on many of the species as to their wildlife value, origin and other potentially relevant aspects in relation to restoration goals follow the species list.

46. E. triticoides	beardless wild rye
47. Equisetum spp.	horsetail
48. Erigeron speciosus	showy daisy
49. Erigeron spp.	daisy
50. Eriogonum spp.	desert buckwheat
51. Erodium cicutarium	storksbill
52. Festuca arundinacea	tall fescue
53. F. idahoensis	Idaho fescue
54. Fontinalis spp.	spring moss
55. Galium boreale	bedstraw
56. Gentiana affinis	gentian
57. Geranium viscosissium	sticky geranium
58. Geum macrophyllum	avens
59. Gilia agregatta	scarlet gilia
60. Grindelia squarrosa	gumweed
61. Habenaria hyperborea	green bog-orchid
62. Helianthus annuas	sunflower
63. H. nuttallii	sunflower
64. Hippuris montana	marestail
65. H. volgaris	marestail
66. Hordeum jubatum	foxtail barley
67. H. vulgare	cultivated barley
68. Hyoscyamus niger	henbane
69. Hypericum spp.	St. Johnswort
70. Iliamna rivularis	mountain hollyhock
71. Iris missouriensis	wild iris
72. Iva axillaris	poverty weed
73. I. xanthifolia	marsh elder
74. Juncus balticus	Baltic rush
75. J. ensifolius	rush
76. Koelaria cristata	Junegrass
77. Lactuca scariola	wild lettuce
78. Lappula spp.	sticktight
79. Lemna minor	duckweed
80. L. trisulca	duckweed
81. Lepidium spp.	peppergrass
82. Linaria vulgaris	butter and eggs
83. Linum perenne	wild flax
84. Lithospermum ruderale	Western gromwell
85. Lupinus spp.	lupine
86. Melilotus officinalis	yellow sweetclover
87. Mentha arvensis	mint
88. M. spicata	mint
89. Mertensia ciliata	mountain bluebell
90. Mimulus guttatus	yellow monkeyflower
91. Muhlenbergia asperifolia	scratchgrass
92. Myriophyllum spicatum	water milfoil
93. Orysopsis hymenoides	Indian ricegrass
94. Panicum spp.	panicgrass
95. Paspalum distichum	knotgrass

	Latin Name	Common Name
96.	Penstemon speciosus	penstemon
97.	Phleum pratense	Timothy
98.	Phlox hoodii	Hodd's phlox
99.	Poa juncifolia	alkali bluegrass
100.	P. palustris	fowl bluegrass
101.	P. pratensis	Kentucky bluegrass
102.	P. secunda	Sandberg's bluegrass
103.	Polemonium pulcherriumum	Jacob's ladder
104.	Polygonum spp.	smartweed
105.	Populus angustifolia	narrow-leafed cottonwood
106.	P. tremuloides	quaking aspen
107.	Potamogeton pectinatus	pondweed
108.	Potentilla anserina	silverweed
109.	P. fruiticosa	shrubby cinquefoil
110.	P. gracilis	cinquefoil
111.	Prunus virginiana	chokecherry
112.	Purshia tridentata	bitterbrush
113.	Ranunculus aquatilis	water buttercup
114.	Ranunculus spp.	buttercup
115.	Ribes aureum	colden currant
116.	Robinia spp.	black locust
117.	Rorippa nasturtium-aquaticum	watercress
118.	Rosa woodsii	wild rose
119.	Rumex crispus	curly-leaved dock
120.	Salix exigua	gray sandbar willow
121.	Salix spp.	willow
122.	Salsola kali	Russian thistle
123.	Sarcobatus vermiculatus	greasewood
124.	Scirpus acutus	bulrush
125.	Seliginella sp	clubmoss
126.	Senecio spp.	groundsel
127.	Sisymbrium altissimum	tumbling mustard
128.	Sisyrinchium sarmentosum	blue-eyed grass
129.	Sitanion hystrix	squirreltail
130.	Sium suave	water parsnip
131.	Smilacina stellata	wild lily of the valley
132.	Solanum dulcamara	bittersweet
133.	S. triflorum	cut-leaved nightshade
134.	Solidago spp.	goldenrod
135.	Spartina gracilis	alkali cordgrass
136.	Sphaeralcea munroana	orange globe mallow
137.	Spirodela polyrhiza	duckweed
138.	Sporobolus airoides	alkali sacaton
139.	Stipa comata	needle and thread
140.	S. occidentalis	western needlegrass
141.	Symphoricarpos rivularis	snowberry
142.	Taraxacum officinale	dandelion
143.	Tetradynia glabrata	horsebrush
144.	Tragopogon dubius	salsify
145.	Triglochin maritima	arrowgrass

Latin Name	
146. *Typha latifolia*	common cattail
147. *Urtica holosericea*	stinging nettle
148. *Verbascum thapus*	mullein
149. *Veronica spp.*	speedwell
150. *Viola adunca*	early blue violet
151. *Wyethia amplexicaulis*	mule-ears
152. *Zigadenus paniculatus*	death camas

The following comments relevant to various species of plants found on the Silver Creek Preserve are offered as an initial attempt at compiling the information necessary to launch a restoration program aimed at re-establishing a native flora and providing maximum benefit to the area's wildlife. The common names used here are keyed to the preceding species list.

Grasses

GREAT BASIN WILD RYE: Seeds are utilized by rodents, songbirds and deer; it provides poor forage in winter but is eaten by a wide variety of wildlife when other vegetation is covered by snow. It is useful for revegetation because of its good seed production, its tolerance for a wide variety of soils, and its ease of establishment. Grows well in moist saline soil.

FOXTAIL BARLEY: Problems caused by its barbed awns render it a rather unpalatable species for browsers. Its seeds are eaten by rodents but it is generally considered to be of little value to wildlife.

IDAHO FESCUE: Utilized moderately by songbirds, rabbits, rodents and deer. Originally one of Idaho's most abundant grasses.

SMOOTH BROOM: This species, introduced from Eurasia, is consid-dered an excellent sod builder and boil binder. It is used as a food species by Canada geese, upland gamebirds, songbirds, rodents and deer.

QUACKGRASS: One of the many introduced species of Agropyron. It is eaten by deer and rodents.

CRESTED WHEATGRASS: This species has been introduced from Russian Turkestan as a hay and pasture grass.

KENTUCKY BLUEGRASS: An introduced species from Eurasia. Used by songbirds, upland gamebirds, rabbits, rodents and deer.

BLUEBUNCH WHEATGRASS: Good wildlife forage plant. Absence of this species in sagebrush in an indicator of over-grazing. It is common in sagebrush areas that have not been overgrazed. Not especially common on the preserve.

SANDBERG'S BLUEGRASS: Used by deer, rodents and songbirds.

ALKALI CORDGRASS: Eaten by muskrats and waterfowl. Seeds utilized by songbirds.

DOWNY CHEATGRASS: Introduced from Europe. Has replaced many valuable native species in overgrazed areas.

WILD OAT: Introduced from Europe. Seeds are valuable item in diet of many waterfowl, sandhill cranes, upland gamebirds, and rodents. Heavily utilized by red-winged and yellow-headed blackbirds and the sparrows.

ALKALI SACATON: Used mainly by ground feeding songbirds and rodents. Found in moist alkaline soils.

NEEDLE AND THREAD; WESTERN NEEDLEGRASS: These species are good forage for hoofed browsers when young. The seeds are an important food for rodents and songbirds.

INTERMEDIATE WHEATGRASS: This species, introduced from Russia, is widespread throughout the preserve. It is considered a good browse plant.

SQUIRRELTAIL: Seeds used to a small degree by rodents.

TIMOTHY: Introduced from Europe, this plant has escaped from cultivation and is found in a wide variety of habitats. Its seeds are utilized by a wide variety of songbirds.

NORTHERN REEDGRASS: A common species along the wet stream banks of the creek. It is eaten to a degree by muskrats but is probably of little value to other wildlife.

ORCHARD GRASS: Another European introduction, its seeds are sparingly utilized by songbirds.

PANICGRASS: An important species for ground-feeding songbirds, also utilized by waterfowl and upland gamebirds.

BEARDLESS WILD RYE: Excellent soil binder and an excellent forage grass. Seeds utilized by rodents and songbirds.

DESERT SALTGRASS: Grows in saline soil; provides nesting cover for various waterfowl, especially cinnamon teal and shoveler. Valuable food species for cinnamon teal, shoveler, Canada geese. Seeds utilized to a small degree by small mammals.

Trees and Shrubs

CHOKECHERRY: Fruits heavily utilized by many larger songbirds and upland gamebirds. A favorite food of cedar waxwings.

WILLOW: A preferred species for beaver. Used to a degree by muckrats,rabbits and rodents.

SHRUBBY CINQUEFOIL: Provides winter browse for deer.

BIG SAGEBRUSH;THREETIP SAGEBRUSH: This is a very important wildlife food plant, especially in winter. Important winter browse for deer. Heavily utilized by sage grouse, also eaten by rabbits and rodents.

WILD ROSE: Fruits eaten by rodents and upland gamebirds; especially important in winter. An important cover species for a wide variety of wildlife.

BLACK LOCUST: Introduced from the eastern and midwestern United States. Planted near the old cabins on Sullivan's Lake. Flowers visited by hummingbirds.

HORSEBRUSH: Of secondary wildlife importance; browsed in winter by deer when other food is scarce or snow-covered.

WATER BIRCH: Used by beaver; seeds eaten by songbirds. May have value for increasing streamside cover in those areas where the vegetation has been removed and as a buffer against wind erosion.

RED-OSIER DOGWOOD: Fruits are valuable winter wildlife food for upland gamebirds and a wide assortment of songbirds. Browsed by deer and rabbits.

RUSSIAN OLIVE: Introduced, Eurasia. Fruit important to cedar waxwings and robins in winter. Rare species on preserve.

RABBITBRUSH: A reserve food for jackrabbits and deer. Often an indicator of poor soil or overgrazing.

GREASEWOOD: Utilized sparingly by black-tailed jackrabbit and rodents. Grows in alkaline/saline soil.

SERVICEBERRY: Good wildlife plant, utilized by wide assortment of songbirds and upland gamebirds, rabbits and rodents. This is a preferred and valuable species for mule deer and is one of the first plants to disappear on overgrazed land.

QUAKING ASPEN: Good beaver species; used also by rabbits.

BITTERBRUSH: Important wildlife plant, favored by deer and small rodents. Usually will not come back after a fire.

SNOWBERRY: Important widlife plant; fruits utilized by upland gamebirds, songbirds; preferred browse of mule deer, provides good cover for many birds, rabbits and other small animals.

BITTERSWEET: Introduced from Europe. This is a favorite winter food of ring-necked pheasants.

GOLDEN CURRANT: Fruits utilized by many songbirds, small mammals; occasionally browsed by deer but not an important browse species.

Herbaceous Plants

MULE EARS: Minor forage value to deer in early spring; also eaten by rodents.

DANDELION: Native of Eurasia but an excellent all-around wildlife plant heavily used by a wide variety of species.

MULLEIN: Introduced from Europe; seeds are valuable in winter to songbirds and rodents.

CURLY-LEAVED DOCK: Introduced from Eurasia; seeds eaten by songbirds, upland gamebirds and rodents.

WILD IRIS: Little wildlife value; an indicator of water close to the ground surface.

MOUNTAIN BLUEBELL: Used by deer; marmots and other rodents.

STICKY GERANIUM: Eaten by upland gamebirds, songbirds, rodents, and deer. A good all-around wildlife plant.

SCARLET GILIA: Eaten by sage grouse, rodents; good hummingbird plant.

YARROW: Introduced from Eurasia; little wildlife value.

PUSSYTOES: Of minor important to sage grouse and rodents.

PENSTEMON: Low wildlife value, primarily used by rodents and hummingbirds.

LOCOWEED: Used by marmots and other rodents, upland gamebirds.

LARKSPUR: Extremely toxic to cattle; little wildlife value; visited by hummingbirds.

LUPINE: Eaten by deer, seeds gathered by rodents. Important fixer of nitrogen in the soil. Larval host plant for blue butterflies (plebejini).

BUTTERCUP: Minor importance as a wildlife food plant.

SALSIFY: Introduced, Eurasia.

WILD LILY OF THE VALLEY: Of minor importance as a wildlife food plant.

ORANGE GLOBE MALLOW: Some usage by rodents and deer.

DESERT BUCKWHEAT: Used to a degree by rodents and songbirds.

HENBANE: Introduced from Europe; very poisonous plant.

BEDSTRAW: Used to a small degree by waterfowl and rodents.

YELLOW MONKEYFLOWER: A preferred food plant of muskrats but very little forage value otherwise.

PAINTBRUSH: Little wildlife value; grazed by deer, visited by hummingbirds. Larval host plant for checkerspot butterflies.

MORNING GLORY: Introduced from Europe, this is one of Idaho's most serious field weeds. Not a major problem within the preserve at the present time. Little wildlife value.

SILVERWEED: Survives well in overgrazed areas.

ST. JOHNSWORT: Introduced from Europe. Causes itching and sores in light-skinned animals. Has been largely controlled by importation of a European beetle, Chrysolina gemellata.

ROCKY MOUNTAIN BEEPLANT: Some minor utilization by upland gamebirds and rodents; visited by hummingbirds.

GOLDENROD: Limited wildlife value. Excellent butterfly nectar source.

SUNFLOWER: Outstanding wildlife value; heavily utilized by mourning doves, grouse, pheasants, songbirds and rodents; some use by deer.

CANADA THISTLE: Introduced from Eurasia; one of the more serious noxious weed species, resistant to herbicides, plowing; used by hummingbirds and some songbirds.

BURDOCK: Introduced, Eurasia; used to a small extent by pheasants.

YELLOW SWEET CLOVER: Introduced, Europe; used by deer and upland gamebirds.

PINK MILKWEED: Poisonous to cattle and horses; little wildlife value; visited by hummingbirds. Monarch butterfly host.

POVERTY WEED, MARSH ELDER: Grows in dry saline soil.

DAISY: Generally members of the genus Erigeron are of minor value as a wildife food plant, except as butterfly nectar sources

RUSSIAN THISTLE: Introduced from Eurasia; seeds remain available over winter and are heavily utilized by rodents, songbirds and upland gamebirds.

TUMBLING MUSTARD: Introduced from Europe.

REDROOT, PROSTRATE PIGWEED: Heavily utilized by mourning doves, songbirds and rodents. Important by virtue of its very high seed production.

STORKSBILL: Introduced from Europe; eaten by mourning doves, songbirds, rabbits, rodents and deer.

LAMB'S QUARTER: Seeds heavily utilized by songbirds; also important to upland gamebirds and rodents.

ARROWLEAF BALSAMROOT: Can withstand heavy grazing; eaten by deer.

WILD LETTUCE: Introduced from Europe; minor wildlife value, utilized by some songbirds and upland gamebirds.

PEPPERGRASS: Seeds are of minor importance to birds and rodents.

CINQUEFOIL: Little forage value; cinquefoils can withstand heavy grazing and trampling and are frequently used as an indicator of range conditions.

ROCKCRESS: Seeds are of minor importance to songbirds and rodents.

SALTBUSH: Found in alkaline situations; seeds used to a small degree by songbirds and rodents; also utilized by waterfowl and jackrabbits.

Aquatic/Marsh Plants

WATERCRESS: Introduced from Europe; important cover for fish and habitat for aquatic insects, shrimp and snails.

COMMON CATTAIL: Very important wildlife plant; heavily utilized by muskrats and waterfowl. Major nesting cover for marsh wrens, red-winged and yellow-headed blackbirds, waterfowl and many songbirds. Important roosting cover for pheasants.

WATER BUTTERCUP: Utilized by waterfowl; habitat for aquatic insects and crustaceans.

SPIKERUSH: Some utilization by whistling swans.

ARROWGRASS: Waterfowl, found in saline soils.

BULRUSH: Very important plant for muskrats; utilized by waterfowl and virginia rail for nesting cover; also important nesting cover for red-winged and yellow-headed blackbirds, marsh wrens and bitterns.

HORSETAIL: Used to a small degree by whistling swans and muskrats.

SEDGES: Utilized by waterfowl, marsh and shore birds, upland gamebirds, songbirds, rabbits muskrats and other rodents.

PONDWEED: Important food plant for waterfowl.

WATERWEED: Some utilization by waterfowl.

DUCKWEED: Important food plant for waterfowl; eaten occasionally by Virginia rails.

SMARTWEED: Important food plant for waterfowl and songbirds.

Animal Life

Silver Creek is an environmental junction, a meeting place of habitat types. The southern boundary of the preserve touches dry sagebrush-covered hills. The sagebrush and its companion species give way to large meadows of grasses and rushes as the elevation drops approaching the creek. Thickets of wild rose dot the drier ground on the valley floor. Willows and birches line the banks of the stream and bulrush and cattail marshes border the backwater areas and spring-fed sloughs. An old established aspen grove grows on the shore of Sullivan's Lake and a large portion of the preserve is in cultivated barley and alfalfa.

The diversity of wildlife habitats, brought about by the relative presence of water and the corresponding diversity in vegetational types, is responsible for concentrating a variety of species along the stream corridor.

Silver Creek is especially noteworthy in the spring and summer for the birdlife that it attracts. The rich aquatics of the stream and the adjacent marshes provide a prolific and continual supply of insects while seeds, fruits and excellent cover are found in the adjoining vegetation. Canada geese and marsh hawks, yellow-headed blackbirds and yellow-breasted chats, great blue herons, Virginia rails, great horned owls, orioles, kingfishers and many other birds nest within the preserve boundaries. Many waterfowl, including a large number of whistling swans, make use of the open waters of the creek during the winter months.

No work has been undertaken as yet to determine species occurrence and relative abundance of the important small rodent population but it is assumed to be sufficient to support the wide variety of potential predator species found in the area.

Members of the family Mustelidae are well-represented and several are commonly observed on the preserve. Both river otter and mink are present in the area but rarely seen, while weasels are more common.

The semi-aquatic muskrat, since trapping removed beaver from the area, is the most conspicuous mammal seen on the stream channel. In an effort to re-establish them in the area, a beaver was obtained through the Idaho Fish and Game Department and released in Sullivan's Lake in August 1977. Further effort should be expended toward obtaining and releasing a pair.

In general, the original fauna of the area has fared better than the flora and is relatively well-represented. Mountain lion have not been seen in the immediate preserve area since 1972 but a few may still roam the dry hills to the south.

Donald S. Sias, in a 1976 field investigation, identified five amphibian and eleven reptilian species on the Silver Creek Preserve, including two species of horned lizard, the rubber boa and the western rattlesnake (Table 4).

Ironically, the most well known species on the preserve, the rainbow trout, is an introduced species not part of the original ecosystem. These rainbows, whose origin lies in the McCloud River in Northern California, were planted in Silver Creek late in the nineteenth centry and through hybridization and/or competition have eliminated the native stocks of cutthroat troup. Rainbow from several stocks have subsequently been planted in Silver Creek, contributing complexity to the genetic makeup of the resident population.

Table 2. Species of Mammals Observed on the Silver Creek Biological Preserve, 1977.

Species	Common Name
Peromyscus sp.	deer mouse
Sylvilagus nuttallii	Nuttall's cottontail
S. idahoensis	pygmy rabbit
Lepus californicus	black-tailed jackrabbit
Citellus columbianus	Columbian ground squirrel
Marmota flaviventris	yellow-bellied marmot
Ondatra zibethica	muskrat
Castor canadensis	beaver
Erethizon dorsatum	porcupine
Taxidea taxus	badger
Lutra canadensis	river otter
Mustela vison	mink
M. freneta	long-tailed weasel
Mephitis mephitis	striped skunk
Canis latrans	coyote
Odocoileus hemionus	mule deer

Table 3. Species of Birds Observed on the Silver Creek Biological Preserve, 1977.

Species	Common Name
Podilymbus podiceps	pied-billed grebe
Olor columbianus	whistling swan
Branta canadensis	Canada goose
Anas platyrhynchos	mallard
A. acuta	pintail
A. strepera	gadwall
Mareca americana	American widgeon
Spatula clypeata	shoveler
Anas carolinensis	green-winged teal
Anas cyanoptera	cinnamon teal
Aythya americana	redhead
Aythya collaris	ring-necked duck
Aythya affinis	lesser scaup
Bucephala clangula	common goldeneye
Bucephala albeola	bufflehead
Mergus merganser	common merganser
Cathartes aura	turkey vulture
Accipter gentilis	goshawk
Accipter striatus	sharp-shinned hawk
Circus syaneus	marsh hawk
Buteo lagopus	rough-legged hawk
Buteo jamaicensis	red-tailed hawk
Buteo swainsoni	Swainson's hawk
Buteo harlani	Harlan's hawk
Aquila chrysaetos	golden eagle
Haliaeetus leucocephalus	bald eagle
Pandion haliaetus	osprey
Falco mexicanus	prairie falcon
Falco sparverius	sparrow hawk
Centrocercus urophasianus	sage grouse
Phasianus colchicus	ring-necked pheasant
Perdix perdix	gray partridge
Ardea herodias	great blue heron
Nycticorax nycticorax	black-crowned night heron
Botaurus lentiginosus	American bittern
Grus canadensis	sandhill crane
Rallus limicola	Virginia rail
Fulica americana	American coot
Charadrius vociferus	killdeer
Numenius americanus	long-billed curlew
Actitus macularia	spotted sandpiper
Totanus flavipes	lesser yellowlegs
Steganopus tricolor	Wilson's phalarope
Capella gallinago	common snipe

Species	Common Name
Larus californicus	California gull
Larus delawarensis	ring-billed gull
Hydroprogne caspia	Caspian term
Columba livia	rock dove
Zenaidura macroura	mourning dove
Bubo virginianus	great horned owl
Asio flammeus	short-eared owl
Tyto alba	barn owl
Chordeiles minor	common nighthawk
Selasphorus rufus	rufous hummingbird
Selasphorus platycercus	broad-tailed hummingbird
Megaceryle alcyon	belted kingfisher
Colaptes cafer	common flicker
Asyndesmus lewis	Lewis' woodpecker
Tyrannus tyrannus	eastern kingbird
Tyrannus verticalis	western kingbird
Empidonax sp.	empidonax flycatchers
Hirundo rustica	barn swallow
Petrochelidon pyrrhonota	cliff swallow
Tachycineta thalassina	violet-green swallow
Iridoprocne biocolor	tree swallow
Stelgidopteryx ruficollis	rough-winged swallow
Pica pica	black-billed magpie
Corvus corax	common raven
Corvus brachyrhynchos	common crow
Telmatodytes palustris	long-billed marsh wren
Turdus migratorius	robin
Sialia mexicana	western bluebird
Bombycilla cedrorum	cedar waxwing
Sturnus vulgaris	starling
Dendroica petechia	yellow warbler
Dendroica auduboni	yellow-rumped warbler
Geothlypis trichas	yellowthroat
Icteria virens	yellow-breasted chat
Oporornis tolmiei	MacGillvray's warbler
Wilsonia pusilla	Wilson's warbler
Passer domesticus	house sparrow
Sturnella neglecta	western meadowlark
Xanthocephalus xanthocephalus	yellow-headed blackbird
Agelaius phoeniceus	red-winger blackbird
Euphagus cyanocephalus	Brewer's blackbird
Molothrus ater	brown-headed cowbird
Icterus bollockii	northern oriole
Piranga ludoviciana	western tanager
Passerina amoena	lazuli bunting
Carpodacus cassinii	Cassin's finch
Spinus pinus	pine siskin
Spinus tristis	American goldfinch

Species	Common Name
Ammodramus bairdii	Baird's sparrow
Pooecetes gramineus	vesper sparrow
Chondestes grammacus	lark sparrow
Junco hyemalis	dark-eved junco
Spizella arborea	tree sparrow
Spizella passerina	chipping sparrow
Spizella breweri	Brewer's sparrow
Spizella pusilla	field sparrow
Zonotrichia leucophrys	white-crowned sparrow
Passerella iliaca	fox sparrow
Melospiza melodia	song sparrow

Table 4. Species of Reptiles and Amphibians Observed on Silver Creek Biological Preserve (Donald B. Sias survey 1976)

Species	Common Name
Scaphiopus intermontanus	great basin spadefoot toad
Bufo boreas	western toad
Pseudacris triseriata	chorus frog
Rana pretiosa	spotted frog
Hyla regilla	Pacific treefrog
Sceloprous occidentalis	western fence lizard
Sceloprous graciosus	sagebrush lizard
Phrynosoma douglassi	short-horned lizard
Phrynosoma platyrhinos	desert horned lizard
Eumeces skiltonianus	western skink
Charina bottae	rubber boa
Coluber constrictor	western racer
Masticophis taeniatus	striped whipsnake
Pituophis melanoleucus	gopher snake
Thamnophis elegans	terrestrial garter snake
Crotalus viridus	western rattlesnake

Table 5. Species of Fish Found in Silver Creek Within The Nature Conservancy Boundaries.

Species	Common Name
Salmo gairdneri	rainbow trout
Salvelinus fontinalis	brook trout
Prosopium williamsoni	Rocky Mountain whitefish
Cottus spp.	sculpin
Rhinichthys spp.	dace
Catostomus spp.	sucker

Table 6. Aquatic Macroinvertebrates Identified to Date on the Silver Creek Headwaters (Hicks, pers. comm. 1977)

Insects

Ephemeroptera (mayflies)
- *Ephemerella infrequens*
- *Ephemerella inermis*
- *Tricorythodes minutus*
- *Cinygmula spp.*
- *Centroptilum spp.*
- *Baetis parvus*
- *Baetus tricaudatus*
- *Baetus alexanderi*
- *Pseudocloeon edmundsi*
- *Paraleptophlebia debilis*
- *Callibaetis coloradensis*
- *Siphlonurus columbianus*

Tricoptera (caddisflies)
- *Leptocella spp.*
- *Brachycentris spp.*
- *Potamyia spp.*
- *Rhyacophila spp.*
- *Limnephilus spp.*
- Heliopsychidae
- Hydroptilidae

Diptera (true flies)
- Simuliidae
- Chironomidae
- Tipulidae

Plecoptera
- *Isogenus spp.*
- *Classinia spp.*

Anisoptera (dragonflies)
- 3 undetermined species

Zygoptera (damselflies)
- 3 undetermined species

Coleoptera (beetles)
- *Corixa spp.*
- *Gerris spp.*

Miscellaneous Aquatic Macroinvertebrates

Gammarus lacustris (shrimp)
Hyallela azteca (shrimp)

Dina parra (leech)
Helabdella stagnalis (leech)

Physa spp. (snail)
Lymnaea spp. (snail)

MANAGEMENT PROBLEMS AND CONSIDERATIONS

A Management Challenge - The Land Use Change

While long revered for its unique character, the special aura it brings to its arid surroundings and its historically superb fishery, Silver Creek nonetheless has experienced a significant decline in its aquatic ecosystem in the relatively recent past. The following history, covering approximately the past twenty-five years, is offered as both a background and a reference point from which to view current management problems and future research needs.

Through the 1930's and 40's, when Silver Creek's reputation was being forged, the surrounding valley was a random mixture of small farms and enormous areas of pasture, open range and unbroken native ground. Much of the upstream surface drainage flowed through extensive marshes on what is now the Hillside and Stalker Creek Ranches. Long-time residents speak of watercress beds a hundred yars across and unparalleled waterfowl production. Fish between three and six pounds were regularly taken by the angler. The wide body of water backed up behind the irrigation dam just below Kilpatrick bridge was an especially productive fishery, often mentioned in past accounts.

By the very early 1950's agricultural reclamation had begun on the huge upstream marshes. With their draining and leveling, the first large areas of ground on the creek's upper watershed were broken for cultivation. Although, by the late 1950's, the majority of the watershed was still in pasture and unbroken ground (especially north of Highway 68) there began to appear subtle references to a slight decline in the condition of the creek. Three-pound fish were not unusual and still, occasionally, five-to-six-pound fish were taken.

By the early 1960's the slow decline in the heretofore unparalleled fishery on Silver Creek became more noticeable. While still a mecca for fly fishermen, it was the major tributary creeks - Stalker, Grove and Loving - that provided the best fishing. Stalker Creek is generally considered to have had deeper pools and a relatively small silt load compared to its present condition. Grove Creek, now heavily silted, had large areas of clean, gravelly bottom, while Loving Creek, from its mouth and immediately downstream, was generally much deeper than it is today. Although fish numbers and angler success were still high, the size of the average fish taken was down to approximately 18",or about two pounds. By the mid-1960's the draining of the marshes on and around the Hillside Ranch was nearly completed.

From the middle to the late 1960's many people long familiar with the creek began to notice changes in the condition of the fish and the established successional cycles of the aquatic vegetation.

A decline in the amount of watercress in the creek was reported. The large beds of aquatic vegetation which had, until this time, gone through a cycle of growth and eventual flushing that took several years, were beginning to flush out erratically, seemingly at random. Fish began to show signs of poor condition upon reaching 300-350 mm.; they were commonly thin and elongated with little body depth.

The town of Gannett, which had been relatively deserted since the early 1960's, began slowly to revive late in the decade, representing a new economic vitality and growth in the Big Wood River Valley. This meant increased fishing pressures, the sinking of more wells into the aquifer, and larger farms with higher livestock numbers and more acreage under cultivation.

By the early 1970's, a large amount of new ground was being broken along both upper Grove and Loving Creeks, and the aquatic vegetation was flushing from Silver Creek on an annual basis. The Idaho Fish and Game Department's Hayspur Fish Hatchery, supplied with water from Loving Creek, first began to experience problems with silt carried in solution from the water source to the hatchery raceways.

Current conditions on the creek are simply a further extension of this pattern of decline. According to figures obtained in a recent Fish and Game Department creel census study the average fish taken on upper Silver Creek is now approximately 11" in length. Many fish continue to exhibit the decline in body condition after attaining approximately 300 mm. that first began to show up in the late 1960's.

The problems of coping with ever-increasing sedimentation at the Hayspur Hatchery, now totaling approximately 365 tons per month at its peak, have prompted the Fish and Game Department to install a costly system of baffles and settling ponds between the inlet from Loving Creek and the hatchery raceways. The present condition of both Stalker and Grove Creeks indicates that the problem exists on all three of the major tributaries.

Problems confronting future management have arisen from this scenario. Some of the specific questions touching on these problems are dealt with in the remainder of this report. Many more remain to be identified.

Aspects of Aquatic Quality

Chemical analysis indicates that the water quality throughout the Silver Creek hydrological system is generally excellent(Clapp, 1977). A comparison of water samples taken from the Big Wood River and from Silver Creek are basically similar, however the water in Silver Creek is slightly higher in nitrates and significantly higher in total dissolved solids (Castelin, 1972). Since much of the flow in Silver Creek is a result of irrigation water recharging the ground-water system, it is apparent that irrigation water percolating through the soil will dissolve many chemicals present in the soil. Since most fertilizers contain a high percentage of nitrate, it is a reasonable assumption that at least part of the nitrates in Silver Creek are due to the application of fertilizers to the soil. Future researchers are directed to the Idaho Department of Water Administration's Water Bulletin #28 and the upcoming Silver Creek Aquifer Recharge Study, scheduled for publication in the winter of 1977-78.

An independent study by Hicks (1977) of the aquatic insects in upper Silver Creek was designed to be used as a monitor of water quality. This continuing study measures changes in the incidence, density, biomass, distribution and relative abundance of aquatic invertebrates at sixteen sampling stations on upper Silver Creek. It is planned to relate changes in these parameters to changes in water quality, to develop a system whereby the relative occurrence of certain species can be used as indicators of changes in the quality of the aquatic habitat.

To date two observations have evolved that are pertinent to this discussion:

1. At this time the diversity and abundance of different insect species is indicative of insignificant levels of herbicide-pesticide input.

2. The distribution of insect species is reflective of changes in benthic habitat. Where there is good plant growth and/or clean gravel there is good production in insect biomass and a high species diversity. In areas where appreciable siltation has occurred there is a significant decline in both species incidence and total biomass.

It is the question of siltation that is currently in need of the most intensive investigation when considering problems in aquatic quality. We can hypothesize, based on statements made by those familiar with the creek over the past twenty-five years, that a) some agricultural abuse, in the form of over-grazing, existed prior to single-crop grain farming; b) the general decline in the creek's productivity began roughy twenty-five years ago, closely paralleling the massive land-use change in the valley during that period; c) the direct effects of this land-use change, from pasture and open range to cultivated grain, includes the draining of extensive marshlands and the destruction of other habitat types, a new, widespread and totally different utilization of the water table, the widespread application of herbicides and chemical fertilizers, and the annual exposure of large amounts of bare ground from mid-fall until late spring.

The effects of any one of these factors related to the land-use change have the potential to account for various stream ailments. The feeling expressed by many interested observers, however, including independent researchers, Fish and Game personnel and fisheries biologists, and several long-time fishing guides sensitive to the changes in Silver Creek, is that the intensive cultivation along the upper watershed of Silver Creek and its major tributaries is responsible for contributing to the system a massive amount of silt in a relatively short amount of time, far above whatever silt load the creek may have carried historically.

The indications that this is the case are strong, both in their logic and their importance, and suggest an investigation into the sources and causes of siltation and a definition of the problem as the most pressing current research and management priority. It is important to obtain answers to specific questions before a management program can be formulated to deal with the problem:

1. What is the extent of the problem? Is it, in reality, the problem we think it is? The complexity of the myriad factors affecting Silver Creek and its hydrology make it especially important to isolate and define the sedimentation problem in order to avoid confusion with the effects of other protentially negative inputs.

2. What are the contributions of the three major tributaries, Grove, Stalker and Loving Creeks, in bringing silt in solution into the main Silver? What is the source of the silt borne by the tributaries?

3. What is the difference between the silt load of the main Silver and the total contribution of its major tributaries? What is the source responsible for this difference?

4. What percentage of the silt is due to run-off, both from snowmelt and from irrigation? Where are the identifiable problem areas? When are they a problem?

5. What percentage of the silt is carried into the creek by wind erosion? When does this mainly occur and what is its relative rate of occurrence over time? Is there a reasonable correlation between soil conditions as evidenced by soil analysis and any obvious sources of wind-borne erosion? Which tributaries carry how much wind-borne erosion?

Answers to these questions, we feel, are imperative if the Conservancy is to use study results as a basis for management objectives. Aside from these major issues there are related questions which need to be answered in order to illuminate the problem. These include:

1. What is the extent of the contribution to the siltation problem made by the numerous cattle found on the tributary creeks?

2. What exactly is the relationship between sediment in the creek and the irrigation dam just below Kilpatrick bridge? Does its creation of the lake-like situation extending nearly to the mouth of Loving Creek cause an appreciable settling-out of silt in solution throughout this area? Does established and existing upstream sediment, dislodged by cattle and/or fishermen, drift downstream to be trapped by the dam?

3. What type of relationship is there between the physical and chemical nature of the sediment input and the "hardpan" bottom found along parts of the creek?

4. Do analyses of sediment samples reflect soil imbalances found on adjacent agricultural fields? Do these imbalances shed any light on apparent changes in vegetational cycles and/or aquatic productivity? This would include all elements from high concentrations of herbicides to potentially toxic levels of micronutrients.

The ramifications of an excessive silt load in a creek of this type, with its many calm marshy areas, low gradient, and relatively slow velocity require no discussion. What is required, however, are accurate answers to specific questions that will enable the Conservancy to demonstrate conclusively 1) whether a problem does indeed exist, 2) if so, where the source of the problem lies, and 3) what the causes of the problem are.

Because of the complexity and the importance of sedimentation, it is strongly recommended that competent researchers be solicited and sufficient monies be made available to fund the needed research.

AGRICULTURE AND RESTORATION

(Compiled with the aid of Gordon Beebe)

What is the proper place of agriculture in a plan to restore and preserve Silver Creek? There are two divergent views, neither conclusive. One is to allow Nature to heal the wounds in her own way and her own time. The other is to intercede, and try to actively speed the process of recovery.

One must realize that the preserve itself has not escaped the effects of 100 years of agriculture. There is a long history of grazing and overgrazing, first by sheep, then cattle and as recently as 10 years ago by horses of the Sun Valley Company. Compaction and selective grazing have influced the plants and wildlife.

This watershed has been described, historically, as a "wet meadow". After World War II conversion began from grazing to cropping. This meant draining wet areas, turning over native sod, clearing, leveling, tilling and seeding to introduced species, mainly hay and grain. In the 1950's and 60's a practice of mono-cropping barley developed to take advantage of the market for malting barley. More land was brought under the plow, fields were moved closer to the streams and marshy areas diminished, until in some areas only narrow ribbons of open water remained. To maximize and maintain yields new techniques and materials were employed: irrigation, chemical nitrogen and other fertilizers, herbicides (mainly 2,4-D), ever larger tractors to pull ever larger equipment, spray planes to speed the process, in short, "modern agriculture" arrived.

The preserve did not escape. About half is now cultivated (see map, p.57a). All farm fields have been planted to barley except 35 acres in hay (field G) and alfalfa and orchard grass on higher, sloping ground. Cultivation has been intermittent over about 25 years, but the farming methods used have been the same: in fall, moldboard plow to 10 inches; in early spring, disk and harrow, level, seed, fertilize, spray herbicides; in summer, flood irrigate; in late fall, combine, bale the straw, moldboard plow.

How has this affected the native soils and the flora and fauna? Dramatically, no doubt, but no one knows exactly how. Experts disagree on the effects of these practices on soil life, on soil structure, on fertility, on life both below and above the ground. One of our primary goals of observation, experiment and research should be to find out, or try to. Until we have more facts, more answers, we can only guess what changes in the natural condition have occurred. These appear to be the most reasonably, educated guesses.

1. The water table is lowered.
2. The soil is compacted and layered.
3. Soil mineral balances, whatever they were, are altered.
4. Organic material and humus levels have been lowered.
5. Soil life (bacteria, fungi, insects, etc.) has been altered, perhaps, rendered less profuse and diverse.
6. The capacity of soil life to decompose organic material has been diminished. In short, fertility in its broadest sense has been reduced.

The side effects, we think, are found in increased stream siltation, less abundant and diverse aquatic life, reduced yield of farm crops and, possibly, in the vitality - the health - of both plants and animals. If health can be said to be "the capacity of plants and animals for self-renewal", then it would appear this watershed has lost health.

Where to begin? If, as it surely does, the quality of life and life itself depends upon the health of soils, then here is where to begin. In his essay, "The Land Ethic", Aldo Leopold saw "...a new vision of 'biotic farming'". He said, "The possible, ultimate ramifications of this idea are so immense that I must leave their exposition to abler pens." Few if any abler pens have existed, then or now. But he and others have pointed to the vision that we must begin to pursue. We must seek a humbler, gentler, yet practical approach to agriculture and, simultaneously, undertake to restore what we presume to be the natural condition which pre-existed agriculture on the preserve.

These objectives may appear mutually antagonistic. But they are not. In fact, if pursued jointly,they may provide the key to meaningful restoration. It is unlikely that the preserve can be restored completely or maintained as an island in an ever more intensively farmed and developed watershed. In great measure its restoration will depend on the kind of farming which surrounds it, especially upstream and upwind.

While we seek natural restoration, the preserve must serve as both nucleus and catalyst: nucleus of natural restoration and catalyst of a gentler kind of farming, with less violent impact, with restorative effects upon the natural flora and fauna and the subtle biological systems which sustain them and give them health.

No one has blazed a clear trail to follow. Even thoughtful, dedicated practitioners of ecofarming, conservation farming, bio-dynamic farming and organic farming do not agree in all details. But there are blazes on the trail and many prescriptions, not to follow blindly but to observe. It required 25 or 50 years to noticeably upset the natural ecosystems and it will take just as many, or many more, to restore them. Here are some of the ways in which we might intelligently proceed.

SOIL PROBLEMS

We must use extensive and precise soil tests to determine the problems and potentials in our soils. Within the limits of what is possible and practical, we shall decide what techniques and materials can be used to build soil balances which will invite native revegetation and enhance the possibilities of profitable agriculture. Soil testing must be employed both as a diagnostic tool and as a monitor of progess and be extended to other soils upstream and upwind.

This has been started. Our initial tests point to some serious problems, characterized briefly as:

1. high salinity and floculation
2. "Free lime" in a layer below plow depth
3. Low ratio of calcium to excess magnesium and potassium
4. Excess boron
5. Extreme deficiency of phosphorous
6. Deficiency of zinc, iron, copper and manganese
7. Low conversion rate of organic material

We do not know the extent to which some of these soil conditions may be endemic, explained in terms of geologic and hydrologic history, or may have been aggrevated by farming practices. But we have some ideas on how to restore "balance" and how to work with imbalance. Many avenues are open.

RESTORATION OF NATURAL HABITAT

We can undertake to restore the natural condition which, as we perceive it, pre-existed agriculture. Some presently farmed fields are at or near the point of impracticality to return them to profitable farm production (fields A and B). Other fields have encroached upon the streams or sloughs. Release from cultivation should be considered first in these.

1. Revegetation can begin experimentally on a field scale. Field A or B might be selected for controlled reversion to native vegetation, using species which may tolerate the severe soil conditions and will provide cover and feed for wildlife, competition for undesirable weeds and permanent ground cover to minimize erosion. Basin wild rye, wheat grasses and native forbs and shrubs seem most promising.

2. Field borders can be redefined to protect and enhance aquatic life. We can use certain of these strips and patches to observe and study natural successional changes in vegetation. Others can be used for experiments in controlled planting for improved habitat and protection of the streams and sloughs.

3. Marsh restoration can be considered. Once a major feature of the watershed and of the preserve, the majority of this wetland and marsh has been drained and leveled and used for farming; perhaps this is a key factor in the decline of natural productivity. Marsh areas can be enlarged, possibly recreated through various physical means, if it be deemed desirable to do so.

4. Increasing the vigor of existing natural vegetation deserves study and experiment. For example, foliar application of micro-nutrients to achieve soil balance is a farming technique that may be suitable in natural areas, without causing disturbance.

FARM FIELDS

These fields, when redefined, can be used both as a means of soil restoration on the preserve and to seek and demonstrate a more profitable and rewarding kind of farming in the watershed.

1. Grass Seed. We could select a field, possible C or D, and try to establish a grass seed crop with a native grass whose seed is marketable and profitable. This should accomplish any or all of several goals:

a. provide relatively permanent ground cover to minimize wind and other erosion and moderate extremes of soil temperature and moisture;

b. minimize tillage and thus compaction, especially in the spring when soils are most susceptible;

c. provide weed control;

d. offer cover for birds and other animals, especially after seed harvest;

e. minimize irrigation, since the likely native species will tolerate less moisture than small grains or hay;

f. build soil fertility, since grasses are recognized as healers of the soil, and

g. make a profit, both to ease the budget for restoration and to offer to our farming neighbors as inducement for change. (Consider these facts: in 1976-77 gross income per acre on barley in the area probably averaged no more than $150. On the preserve it averaged $70, hay $220. Some grasses and legume seed under good management can gross $1200-1500, with no more expense.)

Technical assistance in seed selection, cultivation, management and marketing will be available from Plant Material Centers of the Soil Conservation Service, possibly making the difference between this being a risky venture and a reasonable one.

2. New Methods of grain production need to be explored. We can select a field, probably C or D, in which to experiment with alternative varieties and methods of growing grain. This would be based on the assumption that it will take time to find and prove profitable alternatives to annual cropping of spring barley as now practiced, and that meanwhile any adverse effects can be reduced. A number of alternatives exist or can be tried:

a. Winter grain, planted in the fall and harvested a month earlier, permits tilling, leveling and seeding in late summer, when the risk of compaction and wind erosion is lower than in spring. Grain sprouts in early fall, leaves green feed available to ducks and geese and other wildlife in fall and spring and open winters. This pasturing improves rather than reduces yields. Soil is protected from erosion for 10 or 11 months, instead of 5 or 6. Help will be needed from the Soil Conservation Service, Agricultural Research Service, U.S Department of Agriculture and others to find promising varieties of barley, rye, wheat, triticale and others. Special marketing may be required.

b. Tilling methods should be reconsidered. The moldboard plow is poorly regarded by conservation farmers. On may soils, including these, its buries organic residues beyond the reach of wildlife and sufficient oxygen, to be preserved rather than to be decayed, thus preventing renewal of the soil. There are many proven or promising alternatives, among them the sub-soil plow, the chisel plow, the power harrow, which are not only gentler but also far more effective and economical. The moldboard plow, by comparison, inverts the soil, dredges up the soil deficiences from 8 to 12 inches, places them on top and buries top soil beyond the reach of sprouting plants.

c. Trash farming or mulch farming says "Stay on top". Instead of baling straw, "spin" it back on the soil as a source of humus. In tilling, keeping the organic material in the top 3 or 4 inches, available to air, moisture and soil bacteria. Or leave the stubble ("no till" farming) and drill through the trash to seed the field. Conserve moisture, avoid erosion, build fertile soil, feed the wildlife. Some equipment needs to be modified, but this is "nature's way". It works. We should try it.

d. Weed control, without"everything control", will require study and experiment. Undisturbed native vegetation has a built-in weed control system. But this ground has been disturbed. We may firmly believe that weeds are an ingenious device of nature to heal sick soils and should be left alone to do their work. And we may be right, but we will not persuade our farming neighbors to this view. They cannot afford weed competition. And they will not. They need not, for the law providing County Weed Control says, "Kill them any way you can." The quickest, cheapest and most widely used herbicide is now 2,4-D. There is considerable evidence of the damage done by this and other herbicides to natural vegetation and wildlife. But there is also evidence that some herbicides and some application methods are less damaging, or not apparently damaging. We must consider the least damaging and most effective alternatives to prevailing practices, supported by hard evidence from careful research. This may mean employing biological, rather than chemical, control. If we fail in this we will lose the battle of conservation by default. The Environmental Research Laboratory of the Environmental Protection Agency in Corvallis, Oregon can help with this and other technical research.

e. Irrigation methods can be improved, not only on the preserve but also in the watershed. The current Silver Creek Aquifer Study suggests this source of life and livelihood may be endangered. Agriculture is the major user and misuser and agriculture should lead the conservation effort. The preserve now uses only flood irrigation, which may result in the overuse and misuse of water. The replacement of this system by sprinklers should seriously be considered. Substantial expense is involved but substantial advantages will accrue, not only in dollars but in the time and effectiveness of restoration. This is now under consideration. A specific proposal will be submitted.

f. Crop fertilization methods and materials need study and experiement to guide the building of soil health. Some of these can safely be employed on the preserve, including composted manure, foliar sprays of non-toxic micro-nutrients and others. Here again, we need facts in place of fancy in a field where experts disagree.

3. Hay offers many advantages over grain cropping. It is a long term ground cover, can restore the soil, and it is - or can be - profitable. The common varieties of alfalfa do not prosper on lower, wetter soils, so legume-grass mix hay is either not considered or is soon abandoned on these soils. Experiments are needed in clovers, trefoils, grasses and alfalfa varieties bred to withstand high water tables and salinity. Field E or the lower part of G could be used for this. Again, our aim would be to turn up crops which are both restorative and profitable. We will need both help and imagination.

Our thinking and our efforts in farmland restoration should be guided by something Aldo Leopold told us 30 years ago: "The practices we now call conservation are, to a large extent, local alleviation of biotic pain. They are necessary, but they must not be confused with cures. The art of land doctoring is being practiced with vigor, but the science of land health is yet to to be born." This is still true, and no better opportunity exists to help give it birth than on the Silver Creek Preserve.

When we have been able to sow the seeds of a new agriculture in the watershed soils, by example, by persuasion, by conservation easement or in whatever way, then farming of the preserve should be phased out. If the land has been farmed with care and imagination, it will invite more abundant, more diverse and healthier natural vegetation, sooner.

CONCLUSIONS

While seeking natural diversity and health of plants and animals on the preserve itself, we should recognize that meaningful restoration can be accomplished only on a watershed scale. If we are to function as catalyst of bio-farming, then our ideas and demonstrations of ecologically campatible alternatives must be realistic (profitable) or they will not be adopted.

The task of restoring a balanced fertility in the preserve soils, and thereby enhancing diversity and health in the ecosystem, will be slow and difficult. By providing a model agriculture while restoring a naturally more productive plant and wildlife community we will demonstrate the truth that the quality of all life depends upon the soil.

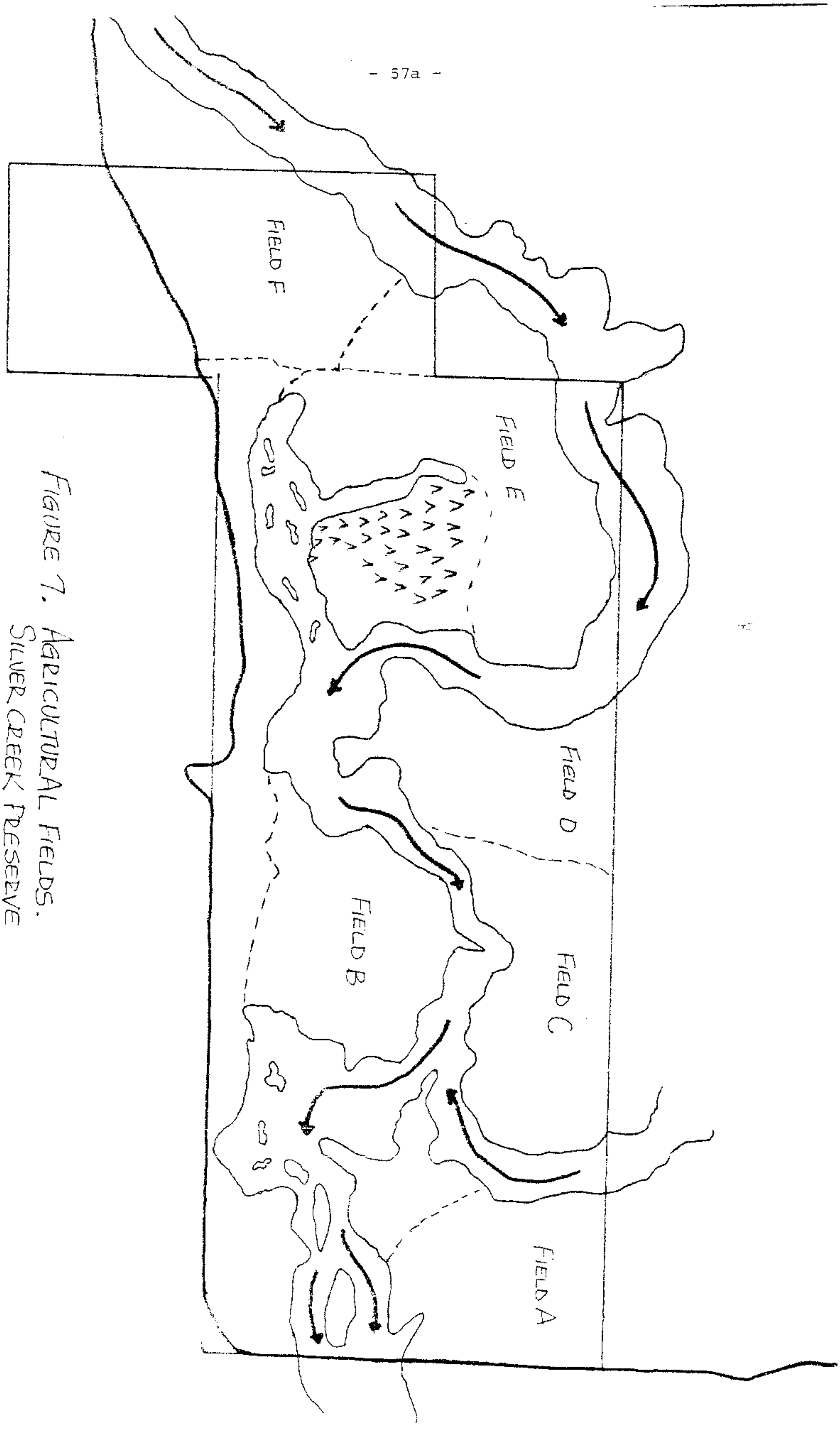

FIGURE 7. AGRICULTURAL FIELDS.
SILVER CREEK PRESERVE

Current Studies

At the present time there are five studies in progress concerned with various aspects of the Silver Creek headwaters and The Nature Conservancy property. All of them, with the exception of Ron Hicks' ongoing investigations of aquatic insects as a monitor of water quality, are slated for completion at some time in 1978. Following is a brief discussion of these studies. It is recommended that upon publication their respective findings and recommendations be carefully reviewed for inclusion in a revised version of this report.

Fisheries

1. A Study of the Aquatic Resources of Silver Creek at The Nature Conservancy Site; Loren Frances, Dr. T. C. Bjornn, Idaho Cooperative Fishery Research Unit, University of Idaho, Moscow.

The primary purposes of this Conservancy-funded study are a) to describe the aquatic ecosystem as it exists on preserve waters and upstream tributaries, b) to assess primary productivity, c) to assess the abundance and distribution of aquatic insects and the role they play in the stream ecosystem, and d) to investigate in detail the status of the fishery and the fish stocks in Silver Creek.

Answers to questions surrounding the gradual but long evident decline in the creek's fishery are of paramount importance in the designing and institution of a long range management program. Reasons for this decline and approaches to current management of fish stocks are fraught with disagreement, confusion and, above all, a very real lack of conclusive information. Aside from the information that will be gathered pertaining to age structure, recruitment and other aspects of the status of the fish population it is felt that information bearing on primary productivity, in conjunction with other studies, will yield valuable clues to the reasons and rates of decline in aquatic quality. (Summary report, Appendix C.)

2. Silver Creek Fisheries Investigations; Idaho Department of Fish and Game; Fisheries Research Division.

This study, with field work completed in the fall of 1977, awaits only data compilation and analysis for publication. Results should be available at some time during the upcoming winter.

Study purposes were concentrated on analyzing fish distribution and abundance, total harvests and use estimates, and angler opinions, preferences and/or attitudes on Silver Creek. This study divided Silver Creek into five sections based on differences in habitat, fishing regulations and hatchery releases. Section #1 included all of Silver Creek upstream from Kilpatrick bridge, i.e. that stretch of the creek running through Conservancy-owned land.

While both of the above studies are at this time incomplete some preliminary data is available.

1. Both studies indicate that the Conservancy waters harbor a large percentage of young fish, an indication of high productivity and good reproduction.

2. Preliminary Fish and Game Department statistics indicate that a) Section #1 may be the most heavily fished area on Silver Creek over the course of the season and b) it may have the best fish-per-hour catch effort, approximately 1.25 fish/hour. Approximately 94% of the fish caught in Section #1 were wild rainbow trout.

3. Preliminary angler preference and opinion data has revealed the following general attitudes toward management of the fishery in Section #1:

a. A little over half of those anglers contacted considered the fishing to be good; approximately one-third considered it fair.

b. Nearly 80% opposed the release of hatchery-reared catchables in this section.

c. 75% were in favor of the currently existing catch-and-release regulations. 60% of those anglers contacted along the length of Silver Creek favored catch-and-release regulations on Conservancy waters. Excluding those interviewed in Section #1, the regulation has a 66% majority in favor of it.

Comments

The complexity of the problems surrounding the condition of the fishery on upper Silver Creek is enormous. To arrive at an understanding of the overall situation will require an understanding of innumerable variables. Unfortunately the effects of many of these potentially important variables are unknown. Some of these questions which, at the present time, have only been dimly illuminated at best include:

1. What direct effects has the siltation problem had on productivity in the creek? There appear to be abundant aquatic macroinvertebrates and good vegetation growth in the stream. Even at the relatively depressed level existing on the creek now as compared to the past there is no readily apparent reason for the continuing decline in fish sizes. What is actually responsible for the relative absence of larger fish?

2. For approximately fifteen years, through the 1950's and early 1960's, fish from various stocks were planted in upper Silver Creek. One source, the large Richfield irrigation canal running out of Magic Reservoir, has been salvaged on an annual basis for many years. Following the end of the irrigation season and prior to the canal's drying up, the larger fish have been removed from the pools and, historically, released in Silver Creek. The effect on the fishery of an input of high numbers of two-to four-pound fish would seem to be, at least superficially, very beneficial. It does, however, make it much more difficult to assess changes in the natural fishery over time and to establish relationships between the fishery's current status and the past.

3. The effects of the irrigation dam on the Purdy ranch approximately one-half mile downstream from Kilpatrick bridge are, at the present time, poorly understood. The dam is largely removed in the late fall and the boards are reinserted in the spring. Opinions as to the effects of the practice are varied. One body of opinion holds that the removal of the dam in the fall is responsible for a considerable flushing action, allowing the removal of large amounts of accumulated silt from the area on the dam's upstream side. The removal of the dam may also retard further sil accumulation during the period in late winter and early spring when the creek and its tributaries exhibit their highest turbidity, i.e. removing the dam in late fall is a positive action.

The opposing viewpoint holds that removal of the dam is a negative action having adverse effects on the ecosystem. By way of background: several Idaho Department of Fish and Game studies in the past (Bell,1967 and Gebhards,1963) tie much of the productivity in the stream to the aquatic vegetation. It affords cover for the fish species but, more importantly, it is the

Most of the above questions about the status and condition of the creek's fishery seem related, not just to one another, but to the questions concerning aquatic quality and sedimentation and to the pattern established in land use change over the past 25 years. It again emphasizes the inter-relationships that dominate the issue of restoration on Silver Creek and the importance of dealing with its problems on a watershed basis.

3. Reproduction, Movements, and Food Habits of Great Blue Herons in South-Central Idaho; Nancy M. Warren, Dr. Maurice Hornocker, Idaho Cooperative Wildlife Research Unit, University of Idaho, Moscow.

Nancy Warren's field study, funded in large part by The Nature Conservancy, is concerned with gathering detailed information on breeding biology, mortality, food habits, habitat preferences and activity patterns, juvenile dispersal and the overwintering activities of the local heron population. Her study is focused in large part on the preserve's heron rookery located in the aspen grove adjacent to Sullivan's Lake, especially during and immediately following the nesting period in spring and early summer. After the young have fledged and left the rookery study efforts have been concentrated on gathering information on habitat preferences and daily activity patterns.

The 1977 nesting period produced 48 young from 19 nests, 14 of which were successful. The ratio of 3.4 young per successful nest is somewhat higher than reported in the literature. An expected young per nest ratio would be somewhere between 1.7 and 2.2.

Food pellets were collected at the heronry to determine food habits and items fed to the young. At this time analysis of these food pellets is incomplete.

Systematic surveys, conducted since mid-July, have been made on the Silver Creek drainage. 75% of the herons sighted on these surveys have been on the tributary creeks, 17% on the preserve itself, with the remainder on the lower downstream sections.

The field work for the heron study is slated for completion by the fall of 1978 with publication expected sometime that winter.

4. Silver Creek Aquifer Recharge Study; University of Idaho Water Reserach Division, Snake River Research Station

This study, now completed and soon to be released, was initiated because of concern over recent changes in land use and irrigation methods in the Bellevue Triangle, that area overlying the huge aquifer that recharges Silver Creek. Concern has been expressed that the flows and water quality in Silver Creek may be deteriorating to a point where a very real threat will soon be posed to the aquatic resource.

The study will, after the collection of basic data, analyze real and potential problems and review and offer several alternative solutions and the implications of each. The results of this study are of the utmost importance to what happens to Silver Creek in the future and many of the questions it hopes to answer may shed light on the problems posed here. The recharge study will, at any rate, provide much information pertinent to Conservancy objectives and it is strongly recommended that its findings be reviewed for inclusion in a final version of this plan.

Recreation

Historically, recreational use of the area encompassing the Silver Creek Preserve has centered around waterfowl hunting and troutfishing. Its existence as an entity separate from the surrounding ranches is due, in fact, to its long-time excellence in providing these pursuits. Although intensely farmed through the years, both the Union Pacific Railroad and the Sun Valley Company were very aware of Silver Creek's special attributes and its attraction to sportsmen, and utilized it accordingly. Intensive consumptive use of the preserve is no longer compatible with its refuge status, however, and the following thoughts on legitimate use are offered as guidelines for future management decisions.

1. Hunting - The Silver Creek Preserve exists, in large part, as a refuge for wildlife. Its abundant water and diverse vegetational types make it a haven for a wide variety of migratory and resident species. The state-instituted hunting closure that has been in effect for the past two years should be intensely supported in the future with the goal of a permanent closure as a major objective. While difficult to quantify, circumstantial evidence exists to suggest that these hunting closures are partially responsible for greatly increased waterfowl production over the past two nesting seasons.

2. Fishing - Silver Creek seems custom-made for fly fishing. Its abundant, diverse and seemingly continual mayfly hatches, its mirror-like surface, wadeability and almost uniform depth render it ideal for the sport.

Fly fishing, in itself, poses at the present time, no threat to the preserve integrity. What does, and will, need continual analysis are the regulations governing the take of fish from

Conservancy waters. This has already been discussed in the section outlining existing studies. For the time being, at least for the next three to four years, catch and release is recommended as the most sensible regulation due to the almost complete lack of conclusive data on currently existing fish stocks.

A further and somewhat less tangible aspect of angling on the preserve deserves mention here. At the present time, under existing fishing pressures, visitor restrictions, such a quota system, are unnecessary. This, however, should be monitored on an annual basis with the following thoughts in mind.

First, and most obviously, restrictions should be initiated if and when it is established that the resource cannot handle whatever numbers may be utilizing it. Resource, in this context, is taken to mean not only fish but the overall preserve ecosystem, e.g. nesting birds and aquatic vegetation. This point is mentioned here because, at the present time, the predominant users of the preserve are fishermen.

Much more difficult to gauge and define, resource in this context can also be taken to mean the total experience of fishing Silver Creek. To many people there is an aspect of fly fishing which is personal and involves the solitude necessary to establish a relationship with the stream. This experience can be easily diluted if public use begins to rise above a certain, as yet undefined, point. Use restrictions of this type are often not the most desirable management tool but may be necessary at some future time if providing a quality fishery remains an important Conservancy objective. Often overlooked, this aspect of a quality fishing experience may be as important as the health and vitality of the fish population itself as to the fishermen.

While fishing is likely to remain the most conspicuous and important recreational use of the preserve the opportunity for the development of several non-consumptive alternatives exists and should be encouraged. The most obvious of these are nature study and environmental education, and photography.

The construction of a preserve headquarters, scheduled for the near future, will facilitate the availability of information and activities pertaining to environmental interpretation.

The construction of several photographic blinds in important waterfowl areas would, likewise, encourage this pursuit and provide a spot from which to simply observe unseen the activities of the preserve's abundant bird life.

While not typically a recreational issue per se, the importance of the matter of interpretation should not be under-emphasized. Besides providing the interested visitor with some desired information, a proper interpretive approach can awaken the preserve user to the fact that Silver Creek means much more than fish. By detailing the Silver Creek program, i.e. benefits inherent in the restoration of grass and marshlands, research into sedimentation and other problems, and eventual goals, interpretive material has the potential to awaken people to the complexity of ecosystems and the worth of marshes and other "wastelands". This is what Aldo Leopold refers to as "the promotion of perception". The cultivation of this attitude fulfills an important Conservancy purpose, is helpful in soliciting public support, including financial, for future programs, and engenders an aesthetic appreciation for a non-consumptive approach to preserve use.

Proposed Facilities and Physical Improvements

There are at present several structures, remnants of past use, within the preserve boundaries. These include two very rundown, small cabins at the tip of the west arm of Sullivan's Lake; a dilapidated access bridge across Silver Creek still passable to foot traffic; a set of extremely sturdy and very usable corrals on the northeast corner of the property, and several sections of neglected barbed wire fencing that run into the preserve and serve absolutely no purpose.

It is recommended that the cabins and the barbed wire fencing be removed. The bridge across Silver Creek, while at present a potential hazard to visitors, may be restorable for continued use as a foot bridge and may have benefit as such. If restoration proves unwise, mainly because of excessive expense, the bridge should be removed due to its condition and potential danger.

The corrals in the northeastern corner should remain. Patrolling the preserve on horseback is both a viable and compatible alternative to patrolling on foot. If future preserve managers utilize this method the existing corrals will assume an important role.

While structures and/or facilities should be kept at a minimum there are several that are both necessary and beneficial when considering management objectives. There are discussed below.

Preserve Headquarters

The recommended location of a preserve headquarters is on the southeast corner of the property, on the south side of the road and against the base of the hills. This is an ideal location for several reasons. While still on Conservancy property, it is separated by the road from the preserve proper. The site is slightly elevated, and besides affording a fair overview of much of the eastern half of the preserve, it is much drier than the marshy ground directly below and, hence, a better building site. Its location approximately two hundred yards above Kilpatrick bridge places it near what has evolved as a major focal point for preserve visitors. Nearby power poles and telephone lines will negate any major expense in providing utilities to the site.

Proposed purposes of the headquarters are, at this time, essentially threefold. First, it will provide an opportunity for preserve visitors to contact the preserve manager and vice versa. Questions can be answered, the Silver Creek program explained and discussed, and information exchanged. Second, it will serve as an interpretive center. Display cases, interpretive exhibits, and information on various natural history aspects of the area can be made available to the interested public. And third, it can be used as short-term housing for visiting researchers engaged in work on the preserve.

Access Bridge

With the denial of future access through the Loving Creek Ranch, which largely borders the preserve on the north, it is necessary to construct a bridge across Loving Creek to provide access to the lessee-farmer onto two large fields currently used for the cultivation of barley. This access will continue to be necessary when restoration programs on these two field are put into effect. The bridge is slated for completion by the spring of 1978.

Fencing

The preserve property is completely fenced at the present time with barbed wire in various states of disrepair. Varying lengths of fencing cut laterally into the preserve at several points. Because this existing fencing serves no real purpose, is for the most part in poor repair, and is both a hazard to wildlife (especially deer) and an annoyance to preserve visitors, it should be removed. Pending the availability of the necessary funding it should be replaced with a three-rail log fence similar to that existing currently on the south side of Kilpatrick bridge. This would be esthetically compatible with the preserve purpose, would serve to delineate preserve boundaries for the visitor, and would allow a freer movement of deer in and out of the area.

There is no conceivable reason to fence any area within the interior of the preserve and, aside from the existing corrals mentioned above, all interior fencing should be removed.

Impoundment Structure - Sullivan's Lake

Sullivan's Lake, the large, T-shaped, spring-fed slough directly below the heron rookery, today supports a very sparse growth of aquatic vegetation and small fish numbers. The oral history of the lake indicates that this situation has not always been the case.

According to several sources, Sullivan's Lake, in the past, looked very much as it does today, i.e. very shallow, very little aquatic vegetation, very few fish. Approximately twelve years ago, beavers came into the area, built a dam where the lake flows into the creek and raised the water level about eighteen inches. Within a two-year period after the arrival of the beavers and the subsequent raising of the water level, aquatic vegetation had firmly established itself in the lake; within six or seven years the fish population had grown from tens to hundreds.

About six to seven years following the building of the beaver dam and about six years ago, a Fish and Game Conservation Officer, in response to complaints lodged by local farmers about beaver-related irrigation problems, removed the beaver from Sullivan's Lake. With the removal of the beaver, the dam fell into disrepair, the water level dropped and Sullivan's Lake gradually assumed its present condition.

In an attempt to improve the existing situation an effort has been made to obtain nuisance beaver from other areas for transplanting into Sullivan's Lake. In August 1977 a lone beaver was released into the lake with the hopes that a dam would eventually be re-established. To date no evidence of this type of activity has been discovered.

At the present time two alternatives exist for raising the water level in the lake. The first would be to continue efforts toward obtaining beaver with the objective of acquiring a pair in the hopes that a pair would be more likely to locate in the immediate area.

The second alternative involves the construction of a man-made dam at the lake outlet. Plans are available for the construction of natural-appearing man-made "beaver dams" and if the decision to build some type of control structure at the outlet is reached it is recommended that a structure of this type be seriously considered.

At the present time it appears that excellent funding assistance possibilities exist for these improvements through the Fish and Wildlife Enhancement portion of the Resource Conservation and Development (RC&D) Program of the Soil Conservation Service. These funds will partially underwrite the cost of the preserve headquarters, fencing and, if deemed necessary, any control structure erected on Sullivan's Lake.

In addition, the possibilities of using RC&D funding assistance for grass and marshland restoration, erosion and sedimentation control, streambank plantings, and acquisition of conservation easements is currently being researched and negotiated with the cooperation of the local, state and regional offices of the Soil Conservation Service.

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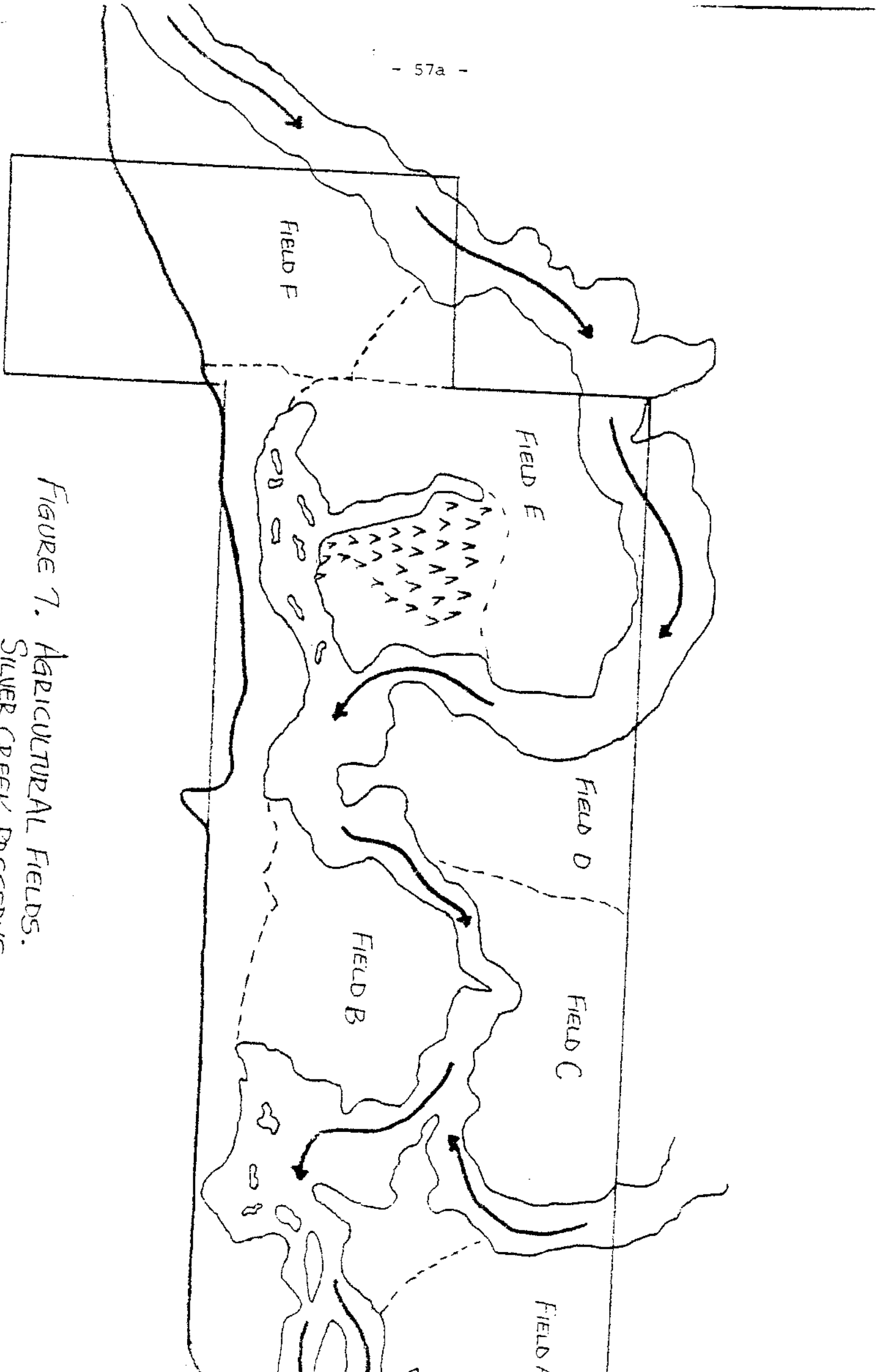

FIGURE 7. AGRICULTURAL FIELDS.
SILVER CREEK PRESERVE