Chapter III.
Identification of Agents of Forest Cover Change

He had found a large map,
Representing the sea,
Without the least vestige of land;
The crew were much pleased
When they found it to be
A map they could all understand.
—Lewis Carroll

This chapter considers the basic effects of three general types of agents affecting forest cover patterns in Soap Creek Valley during the past 500 years: processes and events, wildlife demographics (a type of process), and direct human actions.

TYPES OF AGENTS OF CHANGE

Causes of change to Soap Creek Valley forest cover patterns during the past 500 years were identified, documented, and measured through use of existing oral histories and of accepted oral history research methods. Changes were categorized temporally and spatially as the results of events, demographics, or human actions. Oral history informants (see Table 4) and other consultants (Table 5) considered and/or identified seven types of catastrophic events, four types of wildlife demographics, and seven types of human activities as having caused (or having the potential to have caused) identifiable changes to Soap Creek Valley forestlands. Table 8 lists changes documented for each of the 18 identified potential causes during the past 500 years, whether documentation was derived by Soap Creek Valley oral history research, and the earliest year for which documentation exists.

Events and Processes

Events that affect change in forest cover patterns can be categorized by frequency and intensity as catastrophic, normal, or unusual. Regular series of normal events that result in a given condition are called processes. Processes

Table 8. Causes of change to forest cover patterns, 1500-1999.

Type of change		SCV	O/H	OH/Yr.	Year
Catastrophic events					
1.	Disease epidemics	Yes	No	1918	1832
2.	Floods	No	—-	—-	—-
3.	Landslides	No	—-	—-	—-
4.	Snowstorms	Yes	Yes	1881	1881
5.	Volcanic eruptions	No	—-	—-	—-
6.	Wildfires	Yes	No	1935	1848
7.	Windstorms	Yes	Yes	1931	1931
Wildlife demographics					
1.	Animal extirpations	Yes	Yes	1915	1885
2.	Animal introductions	Yes	Yes	1846	1826
3.	Plant introductions	Yes	Yes	1853	1846
4.	Plant migrations	Yes	Yes	1905	1846
Human activities					
1.	Broadcast burning	Yes	No	1898	1826
2.	Farming and ranching	Yes	Yes	1846	1846
3.	Forestry and logging	Yes	Yes	1890	1890
4.	Hunting and fishing	Yes	Yes	1899	1826
5.	Land subdivision and home building	Yes	Yes	1910	1846
6.	Military and industrial development	Yes	Yes	1928	1857
7.	Transportation and communications	Yes	Yes	1846	1826

SCV Events, processes, or actions that possibly changed Soap Creek Valley forests.
O/H Change is documented in thesis oral histories (see Appendix A).
OH/Yr. Earliest year documentation exists in thesis oral histories.
Year Earliest year of documented forest cover change in Soap Creek Valley.

are a continuous series of actions or events that bring about a certain condition; e.g., the "growth process" that results in mature plants and animals. This section defines these terms and identifies the specific types of events and processes that are documented in this thesis.

Catastrophic events can be defined as "infrequent, high intensity disturbances" (Eddleman 1995). Catastrophic events that affect forest cover patterns include disturbances that radically affect large areas of landscape in relatively short periods of time. The Columbus Day Storm of 1962 and the eruption of Mt. St. Helens in 1980, for example, can be categorized as catastrophic events. These types of events are used in the Soap Creek Valley Oral History Series for two reasons: they can be responsible for rapid and profound changes in forest cover patterns over large areas of a region, and they often constitute important historical markers for a wide range of local people (see Chapter II; Appendix C). For example, although the eruption of Mt. St.

Table 9. Earliest documented forest cover changes, 1826-1931.

Type of change		SCV	O/H	Year	OH/Yr.
No major changes documented for past 500 years					
1.	Floods	No	—-	—-	—-
2.	Landslides	No	—-	—-	—-
3.	Volcanic eruptions	No	—-	—-	—-
Changes documented in thesis oral history references (see Table 1)					
	PRIMARY/SECONDARY SOURCES				
1.	Animal introductions	Yes	Yes	1826	1846
2.	Transportation and communications	Yes	Yes	1826	1846
3.	Hunting and fishing	Yes	Yes	1826	1899
4.	Broadcast burning	Yes	Yes	1826	1898
5.	Disease epidemics	Yes	Yes	1832	1918
6.	Farming and ranching	Yes	Yes	1846	1846
7.	Plant introductions	Yes	Yes	1846	1853
8.	Plant migrations	Yes	Yes	1846	1905
9.	Land subdivision and home building	Yes	Yes	1846	1910
10.	Wildfires	Yes	Yes	1848	1935
11.	Animal extirpations	Yes	Yes	1885	1915
12.	Military and industrial development	Yes	Yes	1857	1928
	PRIMARY SOURCES				
1.	Forestry and logging	Yes	Yes	1890	1890
2.	Snowstorms	Yes	Yes	1881	1881
3.	Windstorms	Yes	Yes	1931	1931

SCV Events, processes, or actions that possibly changed Soap Creek Valley forests.
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Helens had little direct impact on the forests of Soap Creek Valley, many current residents remember when it occurred, the general situation of their life at the time it occurred, and can describe certain local effects of its occurrence, which included distant sounds and light dustings of volcanic ash. By contrast, “normal events” can be characterized as “frequent, low intensity disturbances” (Eddleman 1995). Normal events may affect forest cover patterns more profoundly (yet be less noticeable) than catastrophic events due to their regularity and commonness. Such events include daily and seasonal changes in light, temperature, and moisture availability, fluctuations in local wildlife populations, periodic introductions of plant and animal diseases, and long-term climate. These types of events are generally well recognized and not a focus of this study. It is assumed that most individuals interested in forest cover patterns recognize the importance of normal variations in climate, topography,

solar radiation, erosion, and mortality in the establishment and maintenance of local plant and animal populations.

Landscape changing events that do not normally occur, and are not catastrophic in scale, can be characterized as "unusual." Such events are defined as "infrequent, varying intensity disturbances" (Eddleman 1995). Soap Creek Valley examples include duration of a sudden cold spell (or "Deep Freeze") during October, 1955 (Silen, Olson, & Weber c.1993) and the "Dust Storm" of 1931 (Grant 1990; Rohner 1993; Hanish 1994). These types of events may also profoundly affect forest cover patterns, but are generally unrecognized for that capacity. For example, a longitudinal study of the 1955 cold spell determined that it had measurable long-term effects on individual tree vigor and mortality (Silen et al., c.1993), yet these effects went undetected by Soap Creek Valley subjects, several of whom were foresters, farmers, loggers, and ranchers. Conversely, the Dust Storm was well remembered by at least three Soap Creek Valley subjects and held responsible for fanning several Oregon Coast Range forest fires to the west of The Valley (Grant 1990) and damaging thousands of acres of timber to the northwest (Oregon Department of Forestry 1933), yet this could not be corroborated with scientific literature and seems to have had little effect on local forest cover patterns.

Summary. This thesis provides little focus on "normal" and/or "unusual" events that may or may not affect forest cover patterns. Certain types of regional catastrophic events will be considered for their value as historical markers and potential to affect local forest cover patterns, whether such effects have been noted in the immediate Soap Creek Valley area or not. Events involving factors such as tidal waves or glaciers, therefore, will not be considered simply because their potential to affect local conditions is so unlikely. Although the potential for catastrophic earthquakes or meteor strikes affecting Soap Creek Valley is perceived to be much greater today than it was even five or ten years ago, these types of events have had little or no apparent effect on Soap Creek Valley forest cover patterns in the past and they do not serve as useful historical markers because of the infrequency of their occurrence in this region. (A major geological fault is located in the northeastern portion of the study area, however, (Orr, Orr, & Baldwin 1992) and has the potential to create a memorable marker for local residents and visitors at any given time.)

Wildlife Demographics

Wild plant and animal populations and locations are the results of circumstances and events that are both incremental and profound. Many of the common processes that directly affect wildlife demographics, such as the growth, aging, and reproductive processes unique to each species, are relatively well known and will not be further considered in this thesis. The more pronounced processes of extinction, introduction, and migration of select types of wild plants and animals were of more general interest to oral history subjects and are more closely identified with changes in forest cover patterns; particularly changes to the species, ages, and locations of forest trees and understory vegetation.

Demographic processes, sometimes called "population biology" (Kimmins 1987), are combinations of circumstances and events that affect vigor, numbers, and associations of plants and animals in an area over time. The "conditions" attained by these processes can be defined as "patterns"; i.e., a point-in-time relationship among existing plants, animals, and/or microorganisms and their environment that can be spatially, temporally, or numerically described. Coarse changes in forest cover patterns caused by demographic processes can be divided into two categories; seasonal and persistent. Seasonal changes include effects of species migration or local food availability, are generally well known and recognized, and are not further considered in this study. Persistent changes, which include direct effects of catastrophic events, are often caused by biological processes initiated or mitigated by people as described in this chapter.

Extirpations are long-term (as opposed to seasonal or temporary) local extinctions or exterminations of plants and/or animals. Examples include extirpations of grizzly bears and California condors from western Oregon during the early 1800s. Feral animals are domestic animals that have "gone wild" and exist without direct human care, including wild populations of house cats, house mice, horses, and goats. Wild exotic plants are weeds and domestic plants that have gone wild, spawned "wildings," or become "naturalized" since introduction by people (e.g., dandelions, bachelor buttons, orchardgrass, and wilding fruit trees). All four processes (plant and animal introductions, animal extirpations, and plant migrations) have well-documented histories of being influenced strongly by local human actions. In most instances, results are accidental (e.g.,

honeybees, weeds or nutria escaping human hosts and forming self-sustaining wild populations) as opposed to purposeful. Notable exceptions are exterminations of select species due to their undesirable qualities (e.g., grizzly bears, rattlesnakes, mosquitoes) or to their high market or sporting value (e.g., mink, elk, beaver).

Summary. The Soap Creek Valley Oral History Series identified at least four major types of wildlife demographic processes that have affected (or define) forest cover patterns in Soap Creek Valley:

1) Animal extirpations (esp., vertebrates);
2) Animal introductions (esp., feral, game, and domestic vertebrates);
3) Plant introductions (esp., exotic weed and domestic vascular plants);
4) Plant migrations (esp., native, weed, and domestic vascular plants).

Human Activities

A third type of general agent identified as causing or characterizing changes in Soap Creek Valley forest cover patterns (in addition to catastrophic events and wildlife demographics) is the actions of local human residents and visitors. Such actions can be direct (e.g., plowing a field or logging a stand of trees) or indirect (e.g., selling property to a developer or a national declaration of war are actions that can directly influence whether or not an area is managed, how and why it is managed, etc.), and based on need (e.g., subsistence hunting and fishing and/or gathering firewood for fuel), or driven by cultural values (e.g., planting a lawn or selling logs). For the purposes of this thesis, only actions commonly recognized as directly affecting Soap Creek Valley forest cover patterns are considered, whether driven by human need or by cultural values.

Summary. Examination of Soap Creek Valley data shows that changes to forest cover patterns have been constant and dynamic throughout historical time, and probably throughout prehistoric time as well. In general, historical causes of change can be characterized as events, processes, and/or human activities. Events that have affected Soap Creek Valley forest cover patterns can be roughly divided

into three categories: normal, unusual, and catastrophic. Processes and activities can be similarly subdivided. This study focused primarily on the effects of identifiable catastrophic events, of wildlife demographic processes, and of human activities on The Valley's forest cover patterns.

EFFECTS OF CATASTROPHIC EVENTS

Catastrophic events are defined as "sudden and violent change[s] in the surface of the earth" that can dramatically change forest cover patterns over large areas in short periods of time (Allen 1984). Such changes have been measured in thousands of acres affected, millions of dollars worth of structures destroyed, billions of board feet of timber damaged, and/or dozens, hundreds, or thousands of human lives lost. Examples of well-known catastrophic events in the Pacific Northwest include the Mt. St. Helens eruption of May 18, 1980, which "devastated" about 100,00 acres of land, blew down a billion board feet of timber, and killed at least 70 people (Koenninger 1980), the Tillamook Fire of August, 1933, which burned over 220,000 acres of timber in a single day (Morris 1934; Zybach 1983), and the Columbus Day Storm of October 12, 1962, which blew down over seven billion feet of timber in a few hours time, mostly in western Oregon (Lucia, c.1963).

This thesis considers seven types of regional catastrophic events that may have affected Soap Creek Valley forest cover patterns during the past 500 years: human plagues, floods, landslides, snowstorms, volcanic eruptions (see Chapter I), wildfires, and windstorms (see Tables 8 and 9). The term "regional" is used to include boundaries of the Willamette Valley, Willamette River basin, northwest Oregon, western Oregon, the Oregon Coast Range, the Douglas-fir Region, and/or the Pacific Northwest, depending upon scale, location, nature and/or extent of individual occurrences. .

Disease Epidemics (1770-1999)

Disease epidemics can affect forest cover patterns by directly impacting local plant, animal, and human populations. Effects can also be indirect. For

example, diseases that kill large numbers of trees by massive foliage losses can initially change horizontal and vertical patterns of the forest and result in increased litter and sunlight on the forest floor (Rowley 1990: personal communication; personal observation). Such events may be followed by wildfires, which are often more intense and wider spread than fires in unaffected forests because of greater flammability provided by dead snags and litter compared to healthy trees and green foliage (Oregon Department of Forestry 1933; Morris c.1936; Rowley 1996). In Soap Creek Valley most plant and nonhuman animal diseases seem to have had little impact on local forest cover patterns during historical time. Human diseases are another matter.

Forest cover patterns of Soap Creek Valley were undoubtedly affected by the widespread occurrence of human disease and mortality in the Douglas-fir Region during the 1770s and 1830s (Minto 1900; Scott 1928; Cook 1955; Boyd 1986; 1990; Zybach, et al., 1995). Before the advent of deadly exotic diseases in the 1770s, the Pacific Northwest was one of the most densely inhabited nonagricultural regions in the world, with a total population estimated as high as 200,000 people (Boyd 1990). The advent of smallpox, malaria, measles, influenza and other diseases—introduced by explorers and traders from Europe, Africa, and other areas of the world—proved deadly to many native families and communities. Willamette Valley Kalapuyan peoples (see Figs. 1 and 5; Maps 4 and 10) were decimated by disease, probably malaria, in 1831 and 1832 (Boyd 1990). By 1833, the disease had become endemic in the Willamette Valley and by 1841, a Kalapuyan population estimated to have numbered as many as 16,200 people in the early 1770s (Boyd 1990), had been reduced to barely 600 individuals (Wilkes 1845); over 96% of the people had died within a few generations time, perhaps most of them within a few months of one another in a single year, 1832. The collapse of local families and communities in the Willamette Valley included those located in the Marys River and Luckiamute River basins (Map 10); individuals most likely to frequent Soap Creek Valley on a regular basis and to claim a legitimate jurisdiction over its resources (see Table D.1).

Dramatic reductions in local human populations resulted in substantially reduced needs, opportunities, and/or abilities for broadcast burning (prescribed human fires covering large, contiguous surface areas of land), firewood gathering, and cooking fire escapements in Soap Creek Valley. Local and regional reductions

Fig. 5. Sketch of Kalapuyan male near Marys River tributary, 1841 (Wilkes 1845). This drawing was made by A. A. Agate near present-day Monroe, Benton County, OR (Zybach 1989). The foreground and background plants represent conditions typical of much of the western Willamette Valley and eastern slope Oregon Coast Range during presettlement time (Boyd 1986), including most Soap Creek Valley floodplain and foothills prior to 1846.

in these human activities likely contributed to increased: afforestation of Willamette Valley meadows and prairies (Fig. 6); populations of local game animals (Sondenaa 1991); and incidence of coarse woody debris on forest floors and riparian areas (Crosby 1986). However, these effects began to occur nearly 15 years before initial settlement of Soap Creek Valley by white and black American immigrants in 1846 (Fagan 1885; Moore 1947; Rawie 1995; see Table D.2) and were unnoted in oral histories used for this study.

The persistent effects of Kalapuyan burning are well documented (Boyd 1986) and can be discerned in contemporary drawings (Zybach 1989; see Figs. 5 and 6) and photographs (Grabe 1990; Glender 1994; Cook 1995). The afforestation (the establishment of forest trees in areas with no previous record of being forested) of Soap Creek Valley meadows and prairies that resulted from collapse of local Kalapuyan populations is evidenced by widespread occurrences of Douglas-fir stands established between 1830 and 1845 within The Valley's

Map 10. Nations and languages of western Oregon, c.1788. Map derived from GIS layers established for entire US Douglas-fir Region (Zybach, Barrington, & Downey 1995). The eight Willamette Valley Kalapuyan nations shown are: 4) Atfalati (Tualatin River), 42) Yamel (Yamhill River), 20) Luckymute (Luckiamute River), 7) Chapanafa (Marys River), 21) Lumtumbuff (Long Tom River), 6) Calapooia (Willamette River southern headwaters), 1) Ahalpam (Calapooia and Santiam Rivers), and 2) Ahantchuyuk (Pudding River). The Ayankeld (5; also known as Yoncalla) nation was also Kalapuyan, but located to the south, on the Umpqua River. The Takelma and Latgawa (35 and 19; interior Rogue River valley) nations may have also been Kalapuyan, and shared land management strategies, technologies, and some language similarities with the more northern nations. Soap Creek Valley was the southern-most boundary of the Luckymute peoples and was likely shared with members of the adjacent Chapanafa nation during different seasons of the year. Most of the people belongiong to these 11 named Nations died within a few months time in 1831 and 1832.

Fig. 6. "The Wallamet Valley from a Mountain" 1845 (Mackey 1974). Paul Kane created this painting from a sketch he made from a peak near the Willamette Valley Jesuit Mission in January, 1847 (Kane 1925). The painting is currently in the possession of The Royal Ontario Museum in Canada. Note the presence of white-tail deer and the beginnings of prairie afforestation that followed the decimation of Kalapuyan peoples in the early 1830s. Compare this painting with descriptions by Neall (1977) of the Willamette Valley during the same period of time, in 1845:

> The leading features of the Willamette Valley and the Tualatin plains were peculiar and strange to me as compared with any other country I had seen. Among the striking peculiarities was the entire absence of anything like brush or undergrowth in the forests of fir timber that had sprung up in the midst of the large plains, looking at a distance like green islands here and there dotting the vast expanse of vision. The plains covered with rich grasses & wild flowers looking like our vast cultivated fields, and where the rolling foothills approached the level valley these spurs would be sprinkled with low spreading oak trees, frequently with a seeming regularity that would seem unlike nature's doing, and at a distance like orchards of old apple trees.

boundaries (Nettleton 1956; Johnson 1996: personal communication). The process of conifer afforestation following cessation of Indian burning was noted and described by a number of pioneer settlers in western Oregon. For example,

Warren Vaughn remarked on conditions in 1856, in the Tillamook Bay area northwest of Soap Creek (Vaughn c.1890):

> At that time there was not a brush or tree to be seen on all those hills, for the Indians kept it burned over every spring, but when the whites came, they stopped the fires for it destroyed the grass and then the young spruces sprang up and grew as we now see them.

Another catastrophic human disease outbreak that affected Soap Creek Valley families was the international flu epidemic of 1918 (Crosby 1976). This epidemic did not seem to have an impact on local forest cover patterns, partly because only a relatively small number of local people were directly affected by the 1918 event (Rawie 1994; Vanderburg 1995; Hindes 1996), as compared to near extinction of Kalapuyan families that occurred in the same area nearly 90 years earlier.

In the early 1900s, one other catastrophic loss of local lives, noted by Soap Creek Valley informants, was a dramatic decline in jackrabbit numbers due to "wobbles," or "warbles" (Rohner 1993; Olson; 1994). It is not known what direct or indirect effect the sudden decimation of local jackrabbits had on forest cover patterns, or what the current status of these animals is in Soap Creek Valley.

Summary. Human plagues in the late 1700s and early 1800s appear to have indirectly, but profoundly, impacted Soap Creek Valley forest cover patterns. Although this relationship was unnoted by this study's oral history subjects, several interviewees seemed familiar with prehistoric broadcast burning activities and their lasting effect on early historical Soap Creek Valley landscapes (e.g., Starker 1984; Rowley 1996). Secondary effects of the epidemics likely included decreased: frequency and extent of broadcast burnings, number and extent of campfire escapements, and range and intensity of firewood gathering. These secondary effects are in addition to direct effects caused by reductions in human hunting, fishing, and food plant gathering and processing activities. There is little evidence that other animal or plant diseases played significant roles in affecting Soap Creek Valley forest cover patterns during the past 170 or more years.

Floods and Droughts (15,000 BP-1999)

Between 15,000 and 12,800 years ago, a series of 50 to 100, or more (Allen 1989: personal communication), "cataclysmic" floods coursed down the Columbia River from an origin in western Montana (Allen & Burns 1986). These floods, named "Missoula" for their point of origin, or "Bretz" for their discoverer, filled the Willamette Valley with water, mud, icebergs, and rocks, as evidenced by contemporary existence of glacial erratics and other geological deposits and formations (Allison 1953; Allen 1984; Map 4). The repeated nature of the impoundments (which stretched nearly 100 miles from present day locations of Portland, Oregon to Eugene, Oregon and attained depths over 400 feet above sea level) resulted in a series of soil deposits called Willamette silts (Balster & Parsons 1969). These silts raised the floor of the Willamette Valley to an elevation over 350 feet in the Soap Creek Valley area (Reckendorf 1993; see Map 5).

The Bretz Floods are estimated to have occurred, on average, at 20 to 40 year intervals for over 2,000 years. Ephemeral Willamette Valley lakes that resulted from these events are estimated to have existed only a few days or weeks per flood (Orr et al., 1992). These lakes have been named "Lake Allison" (see Map 4), after their discoverer, Ira S. Allison, an OSC geologist (Allen 1989: personal communication). Maps of glacial "erratics" (rocks borne on Bretz flood tides—probably on icebergs or tree roots—from their origins in Canada, Montana, and Idaho) provided clues needed to theorize the extent of the floods in the Willamette Valley (Allison 1953; 1988: personal communication). At its greatest size, Lake Allison probably extended deep into Soap Creek Valley, creating islands of Coffin Butte and Tampico Ridge (see Maps 2 and 5). Deposits from the floods created the principal agricultural soils in The Valley (Balster & Parsons 1968; Knezevich 1975). These soils were among the first private properties claimed and settled in Benton County and Soap Creek Valley, beginning in 1845 or 1846 (Fagan 1885; Moore 1947; Maps 2 and 5; Table D.2).

Currently, Soap Creek Valley seems to be protected from the effects of large scale flood. The floods of 1861, 1890, 1945, 1964, and 1996 (see Fig. 7), for example, had major effects in other areas of the Willamette Valley and Oregon Coast Range (Benner & Sedell 1997; Taylor 1999: personal communication), but little apparent impact on Soap Creek Valley (see Figs. 7 and 8; Map 2; personal

Fig. 7. Soap Creek floodplain, T. 5 S., R. 10 W., S. 11-14, & 24, 1890-1945. This is one of a series of annotated c.1936 aerial photographs showing the extent of historical flood levels in the Willamette Valley. Compare to Maps 2 and 5. Photos may have been created by USGS or USDA Soil Conservation staff in the mid-1940s (Perry 1989: personal communication). Original series located at OSU Valley Library Map Room. Annotations have been highlighted for purposes of clarity.

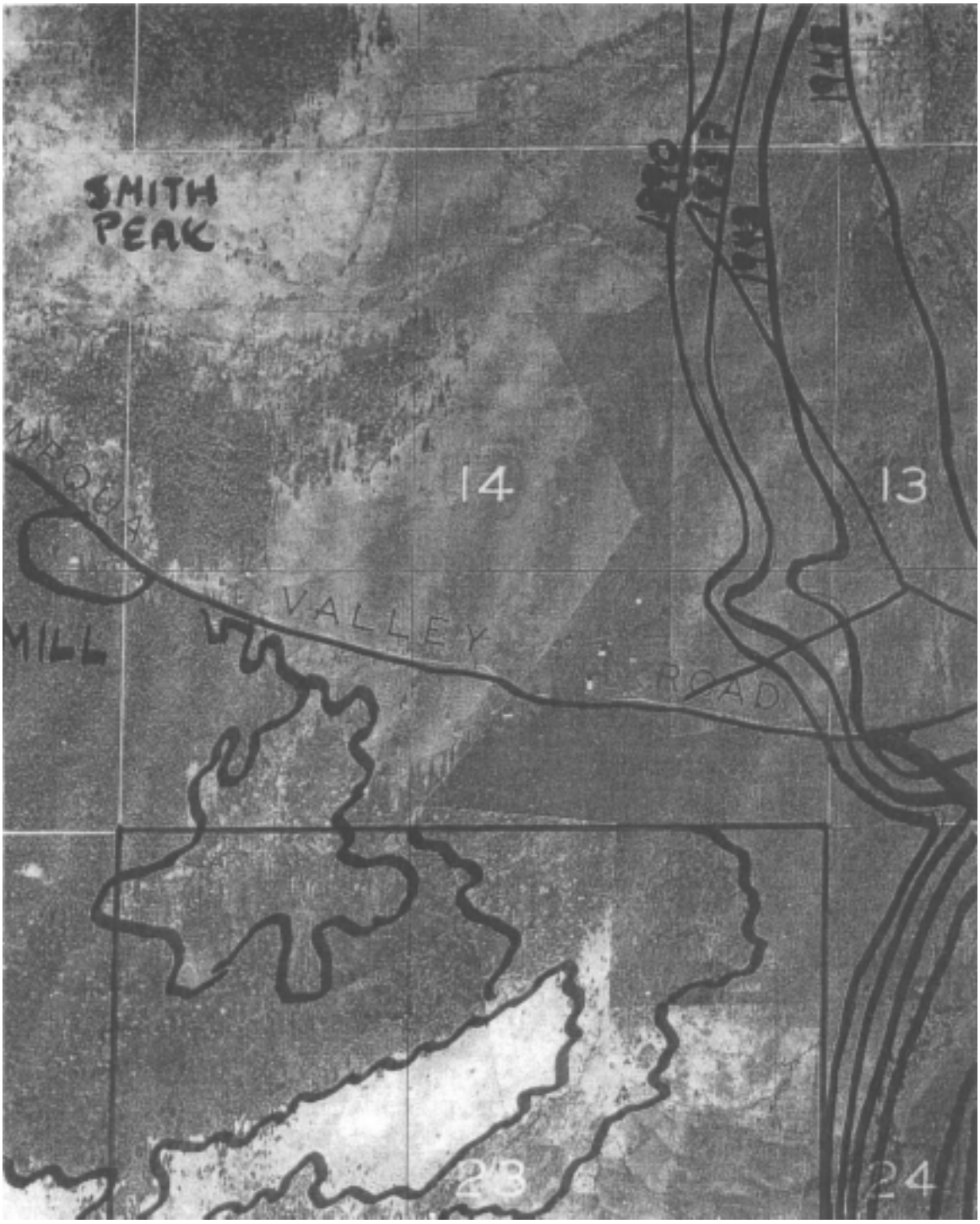

Fig. 8. Soap Creek, SW from Tampico Road Bridge: dry and flood, 1998.
Top Photograph. September 2, 1998: Late summer drought conditions have reduced Soap Creek to a shallow, slow moving stream. Note dry exposure of most creek bed and location of fencing in comparison with bottom photograph. Photograph by author.
Bottom Photograph. December 28, 1998: This peak 1998 flow condition was greater at this location than for either of the 1996 flood events (personal observations), which, in turn, generally equaled or exceeded the greatest flood extents in the Willamette Valley since the 1964 floods (see Table 10; Benner 1998: personal communication). These photographs, in combination with Fig. 7 and Map 5, demonstrate the relative lack of local flood effects in lower Soap Creek Valley when compared to other areas of the Willamette Valley during the same time and day (see Fig. 9). Note that Soap Creek has barely left its banks and the apparent rapid rate of streamflow caused by the drainage of most of Soap Creek Valley south of Tampico Road (see Maps 2 and 5). Photograph by author.

Fig. 8