Chapter IV.
Theoretical Accounts of Forest Cover Change

There are strange things done in the midnight sun
  By the men who moil for gold;
The Arctic trails have their secret tales
  That would make your blood run cold;
The Northern Lights have seen queer sights,
  But the queerest they ever did see
Was that night on the marge of Lake Lebarge
  I cremated Sam McGee
—Robert Service

What did the forests of Soap Creek Valley look like before the arrival of people? When did The Valley's land area emerge from the depths of the ocean for the final time? When could The Valley first become recognizable as "a valley?" What species were present in its original forests? What species were present, in what numbers, and where, when The Valley was first visited by people? Were those first people preceded, or followed, by their own purposely-set fires?

These are the types of questions that can (and probably should) be asked in efforts to determine "initial conditions" (Giere 1979) of Soap Creek Valley forestlands, or to measure the relative impact of subsequent human actiities on The Valley's forest cover patterns. The possible answers to these questions lead to additional sets of queries, depending on which theories are used to develop reasonable results. This form of research is called "the method of multiple hypotheses" (Chamberlin 1965), and differs significantly from theses based on a single hypothetical question.

This chapter discusses the basic types of theories used to formulate questions and test findings for this study. Two models are constructed for these purposes. The first model is a map of possible forest conditions for Soap Creek Valley that might develop in the absence of human activity. It is used as a test of initial conditions for 1500 and for 1826, and to provide a relative measure of the historical effects of human actions in The Valley (Naveh & Lieberman 1994). The second model is a systems diagram of possible interrelationships that exist between human needs and values, human actions, and their potential impacts on local wildlife populations and habitat patterns. Both models are compared to cause-and-effect findings described in Chapter III and to cumulative effect findings described in Chapter V.

FOREST COVER TRENDS AND CONDITIONS

The condition of Soap Creek Valley forests can be described for a point in time, whereas trends describe prevailing changes in conditions over a period of time. Appendix D lists The Valley's landowners for points in time in 1841, 1853, 1929, and 1990. General trends for the period of time covered by these ownerships (1841 to 1990) include increasing numbers of full-time residents, decreasing sizes of individual ownerships, increasing numbers of residential structures, and so on. From these findings it is reasonable to surmise that even more homes will be constructed in Soap Creek Valley—on smaller parcels of land, for even more residents—in the forseeable future. In this manner, identifiable trends become useful for predicting possible future conditions, a basic precept of modern science. Because the future is unknown, however, all predictions are, by definition, theoretical. One test of a predictive theory is to simply wait for the future to develop and then match actual conditions with previously predicted results. If conditions are not the same, the theory must be wrong; conversely, if they are the same, then the theory may be—but is not necessarily—true. Another method of testing predictive theories, without waiting for the future to transpire, is to use them to predict past conditions, which can often be documented. Theories that accurately predict the past are likely more capable of predicting the future than theories that produce inaccurate or unlikely results. This section describes a number of theoretical methods for predicting forest cover patterns, both past and future, and compares results with past conditions of Soap Creek Valley documented in Chapter III.

Method of Multiple Hypotheses

A "working premise" among some (often self-described as "postmodernist," "social constructionist," "deconstructionist," and/or "poststructuralist") researchers today is that theoretical "conflict is good [because] complacency among academics perpetuates an intellectual status quo that serves only a privileged few" (Ray 1996). The principal aim of such researchers is to identify "questions" and "assumptions," rather than "answers" and "facts." This perspective is consistent with Chamberlin's (1965) "method of multiple working hypotheses," first developed over 100 years ago, in the 1880s.

In an article first published in 1890 (Chamberlin 1965), Chamberlin described three basic methods of conducting scientific research: 1) the method of the ruling theory, 2) the method of the working hypothesis, and 3) the method of multiple working hypotheses. These methods are still in use today. The first method, which can be described as "making the facts fit the theory," or "cooking" the results of one's findings, remains both in disrepute and in common practice. Examples of this approach can be found in many places, including current news media, instructional texts, legal courts, and even scientific journals. Individuals seeking equal time for teaching "creationist theory" as given to teaching evolution in public schools are good examples of "ruling theory" proponents (Goodman 1999). In order to explain the existence of dinosaur fossils, for instance, followers of "creationist science" have claimed that humans and dinosaurs must have coexisted at one time, or that the fossils were created at the same time as people (calculated to be 6005 BP by a 13th century church bishop), as a "test of men's faith in the existence of God." Most modern scientists seem to discount such claims, yet may adhere to their own pet theories and beliefs. The method of the working hypothesis, perhaps the scientific methodology most commonly used at this time, is based on first developing a single hypothesis and then attempting to determine whether it is true or false. Chamberlin (1965) notes:

> Conscientiously followed, the method of the working hypothesis is a marked improvement upon the method of the ruling theory; but it has its defects—defects which are perhaps best expressed by the ease with which the hypothesis becomes a controlling idea. To guard against this, the method of multiple hypotheses is urged. . . The effort is to bring up into view every rational explanation of new phenomena, and to develop every tangible hypothesis respecting their cause and history.

This description is consistent with current postmodernist methods, with their common focus on developing as wide an array of research questions and assumptions as practical (Ray 1996). Another difference between the method of the working hypothesis and the method of multiple hypotheses is that the former is often "proved," or disproven, through the use of statistics (requiring quantified findings), while the latter develops assumptions and questions based on the "weight of available evidence" (Botkin et al., 1993). This thesis employs the method of multiple hypotheses as its basic approach, as demonstrated by the series of questions that opens this chapter and by the identification of multiple causes of forest cover change documented in Chapter III,. Findings are both qualitative and quantitative, but results are based on subjective assessments of the total, and can be readily discounted or supported as existing information is augmented or reconsidered.

Possible Conditions of Prehistoric Forests

The beginning point for this thesis is 1500; a point in time preceding historical documentation of Soap Creek Valley forest cover patterns by more than three centuries, and preceding most documented eyewitness accounts of the same phenomena by more than four centuries. Because of this circumstance, descriptions of forest conditions for that time remain largely conjectural. Such descriptions are also necessarily based on the beliefs, biases, and assumptions of individuals that attempt to make them.

Prehistoric forest conditions in Oregon have been defined as "natural" by a number of regional scientists and governmental agencies (FEMAT 1993). This word is often used to describe conditions in environments without human presence (Kimmins 1987; Naveh & Lieberman 1993), but is also used to describe consitions in North America that preceded White exploration and settlement, or events outside human control and/or influence; e.g., lightning-caused fires, volcanic eruptions, or climate. Botkin (1992) lists three basic kinds of "natural" areas in the US: 1) as first viewed by Europeans; 2) as set aside to conserve specific species; and 3) as "truly isolated from direct human influences." The latter category presumes the existence of "direct human influences" for the first two conditions. In a later work, Botkin (1996) presents three possible types of prehistoric human influence on "natural" western Oregon forests (in this instance, he uses the definition "as first viewed by Europeans" to interpret the journals of Lewis and Clark during their visit to western Oregon in the Winter of 1805-06): 1) native forests were continuous and Indians "had essentially no impact" on them; 2) that, due to natural ("nonhuman," or "truly isolated from direct human influences") disturbances, forests were <u>not</u> continuous; still, Indians "had essentially no effect on such a forested region"; and 3) "natural (nonhuman) fire and storm damage were the rule and were dominant factors" that were merely "supplemented by the actions of the Indians." He then states a fourth, unnumbered, possibility (Botkin 1996):

> Some argue further that the forests of the Pacific Northwest as seen by Lewis and Clark were very much the product of intentional actions by the Indians, and that their character was primarily the result of Indian management, and that this management led to more open conditions than would have otherwise occurred.

We will use this latter description as "Botkin's fourth possible condition" when considering the affects of human and nonhuman disturbances on prehistoric Soap Creek Valley forests and forest cover patterns. Botkin's first possible condition—that biological processes and climatic events have very little long-term effect on forest cover patterns—is shown in Chapter III as not true for Soap Creek Valley. Available evidence can be used to consider Botkin's three remaining possibilities: that nonhuman processes and events affected prehistoric cover patterns, but that people were essentially inconsequential; that nonhuman processes and events affected forest cover patterns, and such effects were modified slightly by human actions; and that prehistoric people were the principal shapers of forest cover patterns.

Successional and Climax Forest Theories

Most current predictions of prehistoric forest conditions in the Pacific Northwest rely on climax theory models that depict forests as consistently and predictably evolving through a "successional" series of "seral stages" of "native" plant and animal "communities" toward a "steady-state," "old-growth," "non-declining, even-flow," "maximum potential age" condition (Franklin 1981; Kimmins 1987; Franklin & Dyrness c. 1988; Spies and Franklin 1988; Hunter 1990). Such predictions show a pattern for prehistoric and early historical western Oregon that features a "blanket" of conifer forest over most of the landscape that is characterized by large, old (even "ancient"), trees, mostly Douglas-fir (FEMAT 1993). This condition would be similar to the "potential" forest condition discussed in Chapter I, and is called a “climax” condition. The measurement of “potential” or “potential maximum age” vegetation, then, is a measure of forest conditions almost completely devoid of human influence or other disturbance. This condition is admittedly theoretical because: “True climax forests are rare, but examples of old-growth forests 400 to 700 years in age are common and allow us to draw some conclusions about climax species” (Franklin 1981). “Potential vegetation,” by some definitions, is entirely theoretical as it represents “a conceptual abstraction and construction of vegetation that would become established if man suddenly disappeared” (Naveh & Lieberman 1994).

By using a climax theory predictive model, we might reasonably expect that—in the absence of people and their actions—Soap Creek Valley would be heavily forested with a multilayered canopy of large, old, hemlock and cedar trees, a few giant Douglas-fir trees and groves, numerous large snags, a few scattered openings with grasses, ferns, and young seedlings, and a substantial amount of coarse, woody debris (“CWD”) on the forest floor, in Soap Creek, and in its tributaries.

Landscape Disturbance and Even-Aged Forest Theories

“Even-age,” “disturbance,” or “landscape disturbance” theories of forest development, in contrast to climax theories, use terms such as “association,” “age-class,” “resiliency,” “dynamic,” “opportunistic,” “value,” and “history” to describe forest evolution (Raup 1966; Stout 1981; 1994; Zybach 1996b). The basic idea of landscape disturbance theory is that the natural forest environment is dynamic, resilient, and unpredictable, and that large numbers of contiguous trees are routinely killed in short periods of time due to a wide variety of circumstances. Whether even-aged stands are a function of people “disturbing the vegetation” (Stout 1981), and/or of nonhuman “natural disturbances” (FEMAT 1993; Naveh & Lieberman 1994), the idea remains essentially the same: that, whether caused by fire, flood, wind, volcano, clearcut, plow, or other means, forests are periodically destroyed en masse, only to regenerate in opportunistic and even-aged response to their predecessor’s destruction. This model is probably best described by Raup (Stout 1981), in which disturbed sites are repopulated by adjacent assemblages of “tolerant” plants and animals that have successfully adapted to local disturbance patterns. This form of species resiliency assumes long-term survival advantages from the types of catastrophic events, climate changes, freak weather events, disease outbreaks, and other natural and cultural disturbances that have characterized Soap Creek Valley forest history (see Chapter III). Raup states that a basic feature of North American forests is that they are either even-aged, or else "have one or more well-defined age classes in them" (Stout 1981). This conclusion is echoed by the observations of Pinchot (1987), Munger (1940), and Andrews & Cowlin (1940) in the Pacific Northwest.

Discussion. A basic difference between climax forest and landscape disturbance theories is the composition of vascular plant species that populate an area of forestland following a "stand replacement event." Climax theory predicts there will usually be a gradual shift of seral stages over time "from herbaceous plants to shrubs, then shade-intolerant trees, and then shade tolerant trees" (Hunter 1990). Disturbance theory assumes most of the trees that will grow to dominate a site are established almost immediately following a disturbance, and that the area can be generally characterized thereafter by the age of such trees (Stout 1981). As a result of this difference: 1) trees are likely to be much older in climax conditions than disturbed conditions, 2) there is less diversity of tree species in a disturbed conifer forest than in a climax conifer forest, and 3) only two or three major, even-aged tree canopies typically characterize a disturbed forest, compared to "multiple layers" of all ages in a climax forest.

Systematic Theories of Events, Cycles, and Periods

Forests can also be viewed systematically; as open biological systems of interdependent parts that interrelate in recognizable patterns over time (Naveh & Lieberman 1994). Such systems can be viewed episodically, to illustrate how people and wildlife respond to catastrophic events and other disturbances; cyclically, to illustrate the tendency of living systems toward equilibrium and a return to former conditions over time; and periodically, to illustrate how identified components interrelate over a given length of time (Hansen 1961; Naveh & Lieberman 1994). Systems are typically conceptual in nature and have predictive limitations for artificially bounded areas, such as Soap Creek Valley. Another problem with systems is in the conceptualization process itself, where

Bertalanffy has warned that “a purely technological and mechanistic systems approach” may lead “to further dehumanization and making human beings even more into replaceable units” (Naveh & Lieberman 1994).

FORESTS WITHOUT PEOPLE

How do human activities compare to other types of disturbances affecting Soap Creek Valley forest cover patterns? Initial comparisons support the contention that human actions have had a greater impact on local forest conditions than either catastrophic events or wildlife demographics (see Chapter III; Raup 1966; Stout 1981; 1994; Zybach 1988; 1994b; Anderson 1993; Peterson 1994). In order to measure the relative effects of human activities on Soap Creek Valley forestlands, it can be helpful to consider what the forest might be like if it were not subjected to any human influences at all (Naveh & Lieberman 1994). Such a consideration, when compared to actual forest conditions, is also a good test of Botkin’s first and second possible conditions of prehistoric Soap Creek Valley forests (Botkin 1996), which assume little or no human impacts on natural conditions. Map 19 was constructed by using basic tenets of climax forest theory (FEMAT 1993) in conjunction with current potential vegetation theory (Naveh & Lieberman 1994), but with the supposition that people have not been present in, or had an impact on, Soap Creek Valley forests for the entire 500-year period of this study.

Predictive Assumptions for Soap Creek Valley Forests

As described in Chapter I, Soap Creek Valley is one of the most protected areas in the Willamette Valley, the Oregon Coast Range, and the Douglas-fir Region. It is buttressed from fire and high winds on all sides by thick ridges of basalt reaching heights over 2000 feet above the surface and floodplains of the Willamette River, and is isolated from other forests and large fuel build-ups by Kings Valley on the east, the Luckiamute Valley to the north, the greater Willamette Valley to the east, and the Marys River basin to the south. All adjacent drainages are characterized by long flat stretches of wet soils and low-growing plants within close proximity to Soap Creek. The forests of Soap Creek Valley are also isolated from major urban populations and primary transportation corridors and, until recent years, had a relatively modest number of human inhabitants. It would seem likely that these combined environmental conditions should create a greater likelihood of developing old-growth or "ancient forest" conditions when compared to other areas of western Oregon; particularly other eastern-slope sub-basins of the central Oregon Coast Range. In other words, forested areas in northwest Oregon that have greater numbers of human residents or visitors, that are regularly subjected to catastrophic flooding and landslides, and/or have more exposure to high winds and periodic lightning storms, would seem more likely to have fewer and/or younger trees than Soap Creek Valley forests.

For the purposes of this analysis, Map 19 has been made with little consideration of tree ages, vertical forest structure (canopy layers), or wildlife diversity. Those topics will be more thoroughly considered in Chapters V and VI.

<u>Climate, 1788-1999</u>. Map 19 has been constructed with the assumption that Soap Creek Valley seasonal and long-term climate for the past 212 years is within the "normal range of variation" (FEMAT 1993). The Willamette Valley has one of the lowest rates of lightning strikes in the US; according to Morris, they are "rare over most of western Oregon" (Boyd 1986). Virtually all of the historic "Great Fires" and historical prairie fires of great magnitude in western Oregon can be traced to sources of known, or greatly suspected, human ignition, rather than lightning (Morris 1934; Pyne 1982; Zybach 1988). Seasonal patterns of rain, occasional snowstorms, windstorms, and drought, are discussed in Chapter III. It is assumed they have affected Soap Creek Valley's "potential" forest cover patterns to some degree.

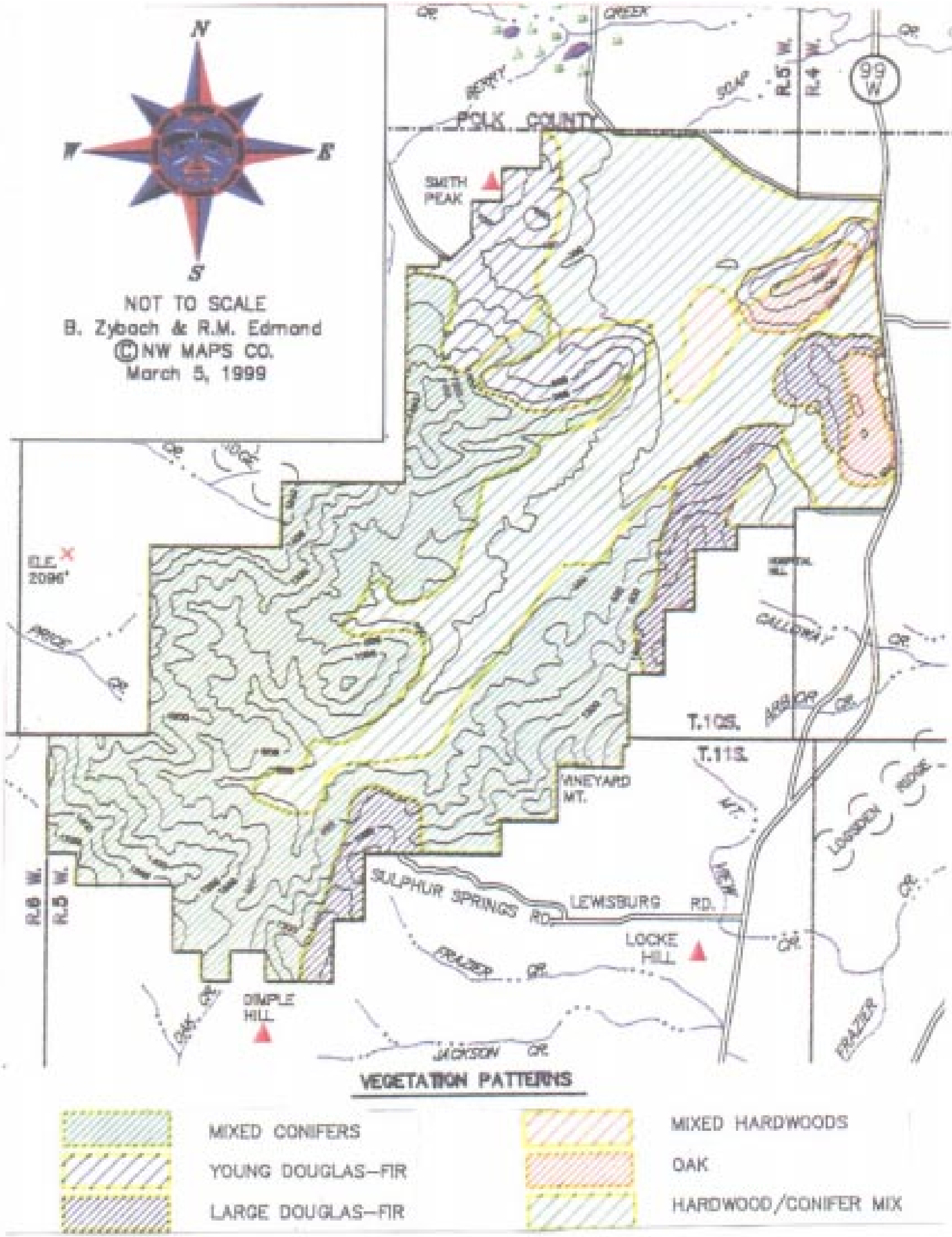
<u>Catastrophic Events, 1788-1999</u>. Most definitions of "catastrophic" all but fail to exist in Soap Creek Valley without considering human fire, plagues, and property losses. The term catastrophic event, then, is particularly suited for measuring forest cover change in terms of human values, rather than by other standards. For the purposes of constructing Map 19, however, winds and snowstorms of the past few centuries (and a few lightning-caused fires) will be considered normal, and somewhat regular, events for Soap Creek Valley.

Wild Animals, 1805-1845. As discussed in Chapter III, many animals, including honeybees, elephants (Fig. 11), ungulates, and beavers (Fig. 15), are capable of dramatically changing forest cover patterns. Archaeological evidence of extinct animals that have been butchered and/or cooked by people is a major indication of Paleoindian cultures (those that existed thousands of years ago; see Fig. 3). For the purposes of this analysis, it was assumed that extinct ice age animals would have "naturally" died out anyway, without influence of human contact. Local wild animals are presumed to be the same, or similar species, as existed shortly before European settlement. However, this latter assumption, with or without considerations of human-caused extinctions, is unlikely and probably impossible. For example, the c.1800 whitetail deer populations in the Willamette Valley were likely dependent on Kalapuyan burning to maintain desirable habitat. When domestic animals and white farmers became established in the Willamette Valley, whitetail deer were eliminated almost immediately (Longwood 1940; Storm 1941); the local deer population has been almost entirely blacktail since the 1870s or 1880s. Other ungulates and prairie animals, including butterflies, songbirds, rodents, and raptors, would also have reduced numbers or difficult survival chances with conversion of most grasslands to conifer forests; an assumed condition in the absence of people and their fires.

Dominant Tree Species, 1500-1845. The principal forest tree species are assumed to be the same as first surveyed in the 1850s (see Appendices E, F, and G; Tables 14 and 15). For conifers, principal species would be Douglas-fir, grand fir, western hemlock, and western redcedar. Hardwoods species include be Oregon white oak, bigleaf maple, red alder, Oregon ash, and black cottonwood (see Tables E.3 and F.1).

Understory Vegetation, 1826-1859. Shrub and grass species are assumed to be the same as existed before possible introduction of European grasses in 1826, and as first surveyed in the 1850s (see Appendices E, F, and G). For conifers, understory trees included western yew, hemlock and "pine" (possibly grand fir). For hardwoods, understory species included madrone, dogwood, chittum, choke cherry, Indian plum, ferns, and vine maple. Prairie plants include bunchgrasses, camas, tarweed, blackberries, and strawberries. For wetlands, camas, onions, sedges, rushes, and skunk cabbage are assumed to be native (see Tables E.3 and F.2).

Map 19. Soap Creek Valley "potential" forest cover pattern. This speculative pattern, constructed with a basic assumption of no human influence or occupation, can also be labeled "climax forest" or "naturally functioning ecosystem," among other terms in current use. It is representative of Botkin's first and second possible forest conditions (Botkin 1996) for the 1500 and 1826 times of initial conditions for this study (Giere 1979).



Map 19 was constructed using the theories and assumptions described above, combined with data summarized in Chapter III, and with my own knowledge and experience. The following sections describe specific portions of Map 19, as listed on the map's legend:

Oak and Grass: Fire and East Wind History

Oak savannah and grassy prairie lands in the Willamette Valley were maintained by Kalapuyan broadcast burning practices from earliest historical time until the 1850s (see Figs. 5 and 6; Boyd 1986). This practice may have terminated somewhat sooner in Soap Creek Valley, due to its settlement by livestock owners in the mid-1840s. The elimination of Indian burning in the mid-1800s, followed by reduced livestock grazing in the early 1900s, resulted in the rapid and steady afforestation of Soap Creek Valley prairies and meadows by oak and Douglas-fir (Fig. 21). In the absence of human intervention, it is quite possible that oak trees would all but disappear in Soap Creek Valley through successional processes shown in Figs. 17, 20, 21 and 22. Occasional lightning fires, either caused by direct hits to Soap Creek Valley, or brought in by easterly winds from the north, might provide sufficient clearing for some grassy plants and prairie animals; in such an instance, oak refugia would most likely be in the shallow, warm, dry, and exposed southern slopes of Coffin Butte and Tampico Ridge (see Map 2; Table 2). In time, even these areas would seem threatened by conifer shading between lightning fire events (Lord 1939; Sprague & Hansen 1946).

Douglas-fir: Fire and South Wind History

Douglas-fir typically exists in relatively pure, even-age stands and groves of trees (Andrews & Cowlin 1940; Munger 1940). Without human intervention, Douglas-fir depends on periodic stand replacement fires, windstorms, or volcanic eruptions for regeneration. Without these events, Douglas-fir canopies tend to break apart into openings that develop one or more age classes of such understory species as redcedar, western hemlock, grand fir, yew, bigleaf maple, and alder; i.e., mixed conifer conditions (Kimmins 1987).

The Columbus Day Storm of 1962 blew down several areas of trees; sufficiently large in size to regenerate naturally to Douglas-fir (Lord 1939), given the right conditions of seed, sunlight, and moisture (Munger 1940; Kummel, Rindt, & Munger 1944; Isaac 1949). In the undocumented assumption that such storms arrive from the south every century or two, the areas marked "large Douglas-fir" represent the possibility of maintaining stands through periodic windstorms and occasional lightning fires. The area marked "young Douglas-fir" represent the greater likelihood of stand replacement fire coming in from the northeast on an east wind, rather than from the south or from some other direction. Persistence of Douglas-fir seed trees in older, mixed conifer stands is due to age and size potentials. Subsequent to stand replacement fire, landslide, and/or hurricane events, the taller, older Douglas-fir are best able to cast their seed the furthest distances (Kummel et al., 1944; Isaac 1949).

Mixed Hardwoods: Fire and Flood History

The marshy, occasionally flooded ground north and west of Coffin Butte (Glender 1994) featured almost pure ash and camas stands in the early 1840s and 1850s (Elder 1853). Annual and other periodic flooding may be sufficient to eliminate most competition from conifers (see Fig. 20) within the area marked "mixed hardwoods." Better drained soils, with some alluvial flooding from tributary channels, might contain significant stands of Douglas-fir, redcedar, grand fir, and even western hemlock, in addition to bigleaf maple, willow, crabapple, choke cherry, Indian plum, cottonwood, alder, and possibly chittum. Fire would most likely enter this area from the northeast, on an east wind. Beaver activity would likely be greatest in this area, as would concentrations of bear, deer, rodent, raptor, reptile, and amphibian populations (Storm 1941; Sondenaa 1989: personal communication).

Mixed Conifers: Fire and Landslide History

Areas of mixed conifer are among the most protected in Soap Creek Valley (see Map 5), and therefore more likely to develop old trees and climax forest conditions. Trees are protected from western and southern windstorms by perpendicular ridges, from east wind-borne fires by the lack of nonhuman sources of ignition, from floods by elevation and slope, and from excessive solar radiation by the shadows cast from steep draws and east-west ridgelines. In fact, these portions of Soap Creek Valley appear to be among the most protected areas from nonhuman disturbances in the Willamette Valley (personal observation). Long-lived drought-resistant conifers would likely dominate the overstory of these areas, with Douglas-fir and grand fir being the most prevalent. Cedar would likely be present in many areas, and an understory of yew would also persist. Most hardwoods would be shaded out by larger and faster growing conifers over time, and overstory seed sources would tend to regenerate disturbed areas. There is a decided lack of hemlock in Soap Creek Valley at this time (personal observation), but reliable accounts exist of a large stand of these trees being present in the southeastern part of the basin in the early part of the century (Olson 1994; Rowley 1998: personal communication).

Summary. A secondary objective of this thesis is to provide a graphic depiction of the definition for "forestland" in Chapter I. Map 19 provides a basis for measuring human influence on Soap Creek Valley forest cover patterns and reflects (with the exclusion of direct human influences) known and assumed conditions in Soap Creek Valley during the past 500 years. Chapter V contains several forest cover maps based on documented historical conditions for specific points in time that are similar in scale and format to Map 19. Thus, relatively accurate and detailed comparisons can be made between theoretical "climax forest" conditions and those in which human activities take place.

FOREST PRODUCTS AND WILDLIFE HABITAT

This section provides a basis for considering Botkin's (1996) third and fourth possible conditions of prehistoric Soap Creek Valley forest cover patterns. (For the purposes of this thesis, the terms "forest cover patterns" (see Chapter I) and "wildlife habitat patterns" are used interchangeabley.) Discussion includes consideration that forest cover patterns reflect, to some degree, the values and technologies of local people who inhabit them and the possibility that wildlife habitat patterns (including locations, varieties and populations of wild plants and animals) are a partial function of human forest management objectives.

Changes in Forest Product Uses and Values

Human activities have been primary shapers of vegetation cover patterns in Soap Creek Valley for over 150 years (see Chapter III), and likely for as many years as people used The Valley before then (Pyne 1983; Kay 1995). Historical activities have been largely driven by local subsistence needs (e.g., food harvesting and processing, and firewood gathering), changing cultural values (e.g., log manufacturing, livestock grazing, homesite development, and community waste disposal), and external events (e.g., epidemic diseases, human migration, and international war). The degree and methods of human-based effects on Soap Creek Valley forest cover patterns have been largely regulated by the number and cultural practices of human occupants at a given time, available technologies (e.g., prescribed fire, tractors, and chain saws), and regional market conditions (e.g., edible roots, mammal furs, feathers, livestock, agricultural crops, and homes). It is assumed that overt human changes to Soap Creek Valley forest cover patterns include changes in local forest product uses and harvests.

Primary forest products extracted from Soap Creek Valley forests during the past 500 years are listed in Table 18. In general, product use is in accord with local survival strategies: prehistoric cultures derived a broader range of products needed for day-to-day survival (water, food, fuel, and shelter), and post-settlement cultures focused more on year round habitation (e.g., houses, fences and pastures) and regional markets (e.g., pulp and logs). Changes in technology also influenced local product use and manufacture. Examples include the change from stone tools to metal tools that corresponded to the introduction of European trade items in the early 1800s and directly affected local beaver, elk, condor, bear, wolf, and whitetail deer populations (Storm 1941); the change from firewood to fossil fuels and electricity for heat and cooking during WW II that directly affected the amounts of dead wood found in forested areas adjacent to Soap Creek Valley homes and roads (see Fig. 21); and the more recent discovery of medicinal value of yew for treating cancer that resulted in local policy restrictions on the harvest of that species (OSU College of Forestry Forest Planning Team 1993).

<u>Summary</u>. Uses and values associated with forest products are not direct causes of change to forest cover patterns in Soap Creek Valley. Rather, they are

drivers that stimulate and define human activities which, in turn, influence forest structure, composition, and extent (Raup 1966; Stout 1981; Zybach 1994b). If, when, where, and to what degree such activities have taken place in Soap Creek Valley has been the result of many factors, mostly unpredictable (Gleick 1987; Naveh & Lieberman 1994). In general, the needs and values of Soap Creek Valley residents and visitors, combined with external demands for surplus Soap Creek Valley forest products and factored by available labor and technologies (including communications), have formed a significant basis for altering and/or maintaining local forest cover patterns (see Chapter III). Opportunities and limitations provided by wildlife demographics, by the effects of catastrophic events, and/or by other conditions and circumstances, add definition to the processes of managing local forestlands for human products. Forest cover patterns of Soap Creek Valley can be interpreted as a direct reflection of local human populations, needs, and values, no matter what point in time is considered (Raup 1966).

Forest Product Values and Forest Cover Changes

The interrelationship of human populations, forest product extraction, and forest cover patterns can be viewed systematically. This type of condition can be termed a "symbiotic relationship," and is based on "structural-functional theory." Put simply, this theory "implies a relationship between two factors that is believed essential for the continuance of each and to the structure that contains them" (Schvanaveldt et al., 1993). Fig. 35 is a systems diagram that can be used to illustrate the structural-functional relationship between people and forest cover patterns in Soap Creek Valley. For example, Fig. 35 shows how information about local resources that exists in a number of forms on several scales can be transformed into local human actions that directly alter biological forest cover patterns. The cornerstone of the diagram is common human need for forest products, including fuel, food, water, and oxygen (see Table 18). On a strict subsistence level (an almost purely theoretical condition that has probably rarely, if ever, occurred in Soap Creek Valley), survival is "every man for himself." In this condition, basic products are identified and used almost exclusively for the immediate needs of individual survivors. In more complex social circumstances (such as characterize most human history and prehistory), the identification, harvest, manufacture, storage, and trade of products also becomes more complex.

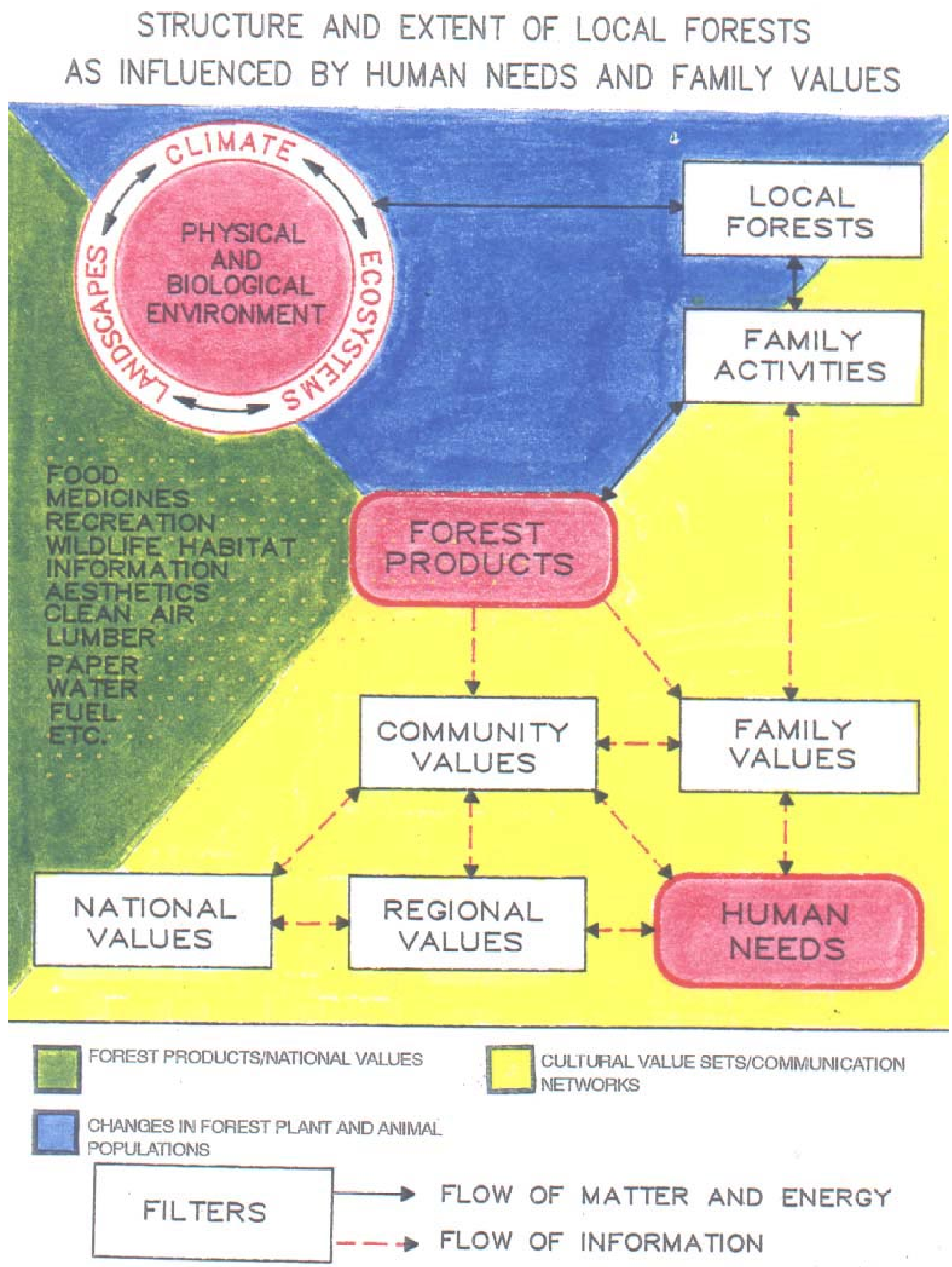
Table 18. Primary Soap Creek Valley forest products, 1500-1999.

Forest Products		Kalapuyan	Pioneer	Modern	Total
		KALAPUYAN			
1.	Dyes	1500-1855			356
2.	Tools	1500-1855			356
3.	Weaving materials	1500-1855			356
		ALL			
4.	Firewood	1500-1855	1846-1899	1900-1941	442
5.	Food	1500-1855	1846-1899	1900-1915	416
6.	Lumber and poles	1500-1855	1846-1899	1900-1999	500
7.	Medicine	1500-1855	1846-1899	1980-1993	414
8.	Recreation and aesthetics	1500-1855	1846-1899	1900-1999	500
9.	Rock	1500-1855	1846-1899	1900-1999	500
10.	Waste disposal	1500-1855	1846-1899	1900-1999	500
11.	Water	1500-1885	1846-1899	1900-1999	500
		PIONEER & MODERN			
12.	Fence posts		1846-1899	1900-1940	95
13.	Fields and pasture		1846-1899	1900-1941	96
14.	Logs		1890-1899	1900-1999	110
15.	Rural residences		1846-1899	1900-1999	155
		MODERN			
16.	Pulp and chips			1930-1999	70
17.	Urban residences			1966-1999	35

Kalapuyan — Assumes prehistoric residents were Kalapuyan, or used similar products.
Pioneer — Begins with first log homes, fences, and wagon roads in 1846.
Modern — 20th century advent of electricity, automobiles, telephones, and TV.
Total — Number of years used in Soap Creek Valley during past five centuries. This measure provides some idea as to the cumulative effects the harvesting of specific types of products might have over time.

Activities are driven partly by individual need, but also by family and community values, local markets, regional laws, and national policies (Raup 1966; Stout 1981). Combinations of these cultural influences, existing almost solely as information, become key determinants as to what actions, if any, will be taken in Soap Creek Valley forestlands by local family members during the day, week, month, and/or year (see Fig. 35). Because values change (and assuming basic needs are fairly constant, or at least are directly related to the age, gender, and number of people in Soap Creek Valley at a given point in time), human activities are likely to change, in response, as well.

Fig. 35. Diagram of forest products/forest cover interrelationships. This diagram illustrates how local human needs, changing human values (Raup 1966; Stout 1981), and resultant forest product extractions (see Table 18) combine to alter the physical and biological environments of forested areas (Zybach 1994b), including Soap Creek Valley (Zybach 1993a).



Specific types of human activities, as described in Chapter III, have direct influences on local wild plant and animal populations (e.g., Figs. 14, 18, 19, 22, 25, 32, and 33), thereby altering local forest cover patterns. Fig. 35 shows how changed forest cover patterns can influence adjacent and regional environments, thereby potentially affecting climate, visible landscapes, and entire ecosystems. The scale of influence depends on the scale, amount, and type of change.

Summary. Information about human needs and values, in combination with local human populations, influences local levels of forest product use. Activities related to product harvesting, manufacture, storage, use, and/or trade have a direct effect on local forest cover patterns, thereby affecting other areas of the environment as well. This pattern reflects established interrelationships between human needs, cultural values, human communications, available technologies, climate, wildlife demographics, and wildlife habitat structures. The pattern is systematic, dynamic, and largely unpredictable, therefore, future conditions remain unpredictable as well.

Discussion. In general, both the weight of documentary and theoretical evidence support Botkin's fourth condition for prehistoric time; that the forests of Soap Creek Valley were "very much the product of intentional actions by the Indians, and that their character was primarily the result of Indian management, and that this management led to more open conditions than would have otherwise occurred" (Botkin 1996). The same assessment can be made for historical time, although the processes are better documented and the results are more apparent. This assessment is examined in greater detail in Chapter V.