CHAPTER 13. WATERSHED FUNCTION SUMMARY

Throughout this document certain principles have been emphasized, principles that have emerged from the watershed assessment process itself. These include:

- The conviction that scientific understanding must be joined with social and economic understanding to produce lasting solutions that have solid community support.
- The insight that overall watershed condition and function -- in both riparian areas and in the uplands -- are the result of dynamic interactions between soil, water, and vegetation.
- The importance of basing restoration, management planning, and even regulatory actions on site-specific analysis, rather than just on generalized judgments about conditions at the watershed scale.
- The importance of focusing on "trend over time," which allows resource managers to determine whether fundamental processes are in place that will produce a stable -- but dynamic -- landscape over the long term.

Although changes from pre-settlement condition have clearly occurred, the challenge for us is to try to determine whether, and to what extent, watershed function has been compromised. Return to pre-settlement condition is not necessarily possible, or even desirable. Ultimately, the goals of future natural resource management actions and watershed restoration should focus on improving and restoring stable but dynamic function to the extent that is practical.

GENERAL GEOGRAPHIC CHARACTERISTICS

The Upper Sprague and Sycan River subbasins cover 1,126 square miles, and drain a varied landscape, from steep-sloped, highly-dissected headwaters to low-gradient floodplains. Within the assessment area lies a variety of aquatic features including perennial, intermittent, and ephemeral streams, constructed ditches, lakes, and marshes. Only 27 percent of the streams in the subbasin are perennial. Most streams are intermittent or ephemeral. The major streams within the watershed flow generally from east to west, from headwaters along Winter Ridge and Gearhart Mountain to the broad valley of the Sprague River near Bly and Beatty. Elevations within the watershed range from 4,304 feet at the confluence of the Sprague and Sycan rivers west of Beatty to approximately 6,700 feet along Winter Ridge.

Average annual precipitation ranges from 10 to 15 inches in the valleys, 16 to 25 inches in nearby hills, and 30 to 40 inches at higher elevation. About 44 percent of the precipitation in the survey area occurs in winter. Snowfall

accounts for 30 percent of the annual precipitation in the valleys and as much as 50 percent in the mountains.

Prior to the settlement of European Americans in the late 19th century, human activity in the Upper Sprague and Sycan watersheds consisted primarily of seasonal subsistence hunting and gathering by Native Americans. Native Americans may have used fire intentionally to encourage certain types of flora and fauna that they considered desirable. Suppression of fire in the late 19th and early 20th centuries had a significant effect on flora, fauna, and the hydrology of the assessment area.

In the late 19th century, the nature of human dependence upon the area's natural resources began to change. The Bureau of Indian Affairs promoted intensive livestock grazing – including horses, mules, sheep and cattle – as early as the 1870s. About the same time, European settlers began to arrive in greater numbers, establishing livestock and hay operations in and around the town of Bly, and grazing the uplands, which were then public domain. Many of the negative effects on riparian vegetation and stream channel function can be traced to this relatively brief period of uncontrolled use.

GEOLOGIC PROCESSES

Although erosion is a natural process, an increase in the amount of erosion due to human activities can compromise stream function because an abundance of fine sediment can fill the spaces in streambed gravel and reduce the habitat quality for fish. Soils within the assessment area are typically high in phosphorous. Stream bank erosion is an important concern in some areas within the Upper Sprague River subbasin, due in part to concerns about phosphorous loading in downstream habitats. There appears to be little active bank erosion within the Sprague River Above Beatty and North Fork Sprague watersheds, but available data are limited. Bank erosion appears to be extensive in the South Fork Sprague and Sycan Marsh watersheds. Many reaches were experiencing bank erosion along half or more of the surveyed reach.

Roads are another potential source of excessive sedimentation. There are 3,500 miles of roads in the Upper Sprague River subbasin, at an average road density of three miles of road per square mile. Approximately 22 percent of the stream miles in the Upper Sprague River subbasin are within 200 feet of a road.

HYDROLOGY AND WATER USE

The available data indicate that changes in vegetation and soil conditions in the Upper Sprague and Sycan watersheds– including forest structure, the prevalence of fire, riparian vegetation conditions, and juniper ecology – have

reduced the capacity for the watershed to retain and safely release available precipitation.

Water is currently withdrawn from both the Upper Sprague and the Sycan rivers for a variety of beneficial uses. Water is used for crops or forage for livestock and for domestic use. Most diversions are for irrigation. It is difficult to establish the precise effect of diversions on stream flow because of the return and reuse of tail-water, and the complicated interaction of groundwater and surface water.

In the Sycan Marsh, channeling and diking may have altered fundamental aspects of the hydrology in the upper reaches of the subbasin to such a degree that completely halting consumptive water use might not result in a return to natural flow conditions.

Where favorable permeable zones for fracture are intersected by streams, groundwater is discharged by large springs. Discharge is widespread in the prominent marshes such as Sycan Marsh and the marsh reaches of the Sprague River valley. There are some data suggesting that development of irrigation wells to substandard specifications may be negatively affecting flow from springs (Bruce Topham, pers. comm.). In some cases, groundwater pumped for irrigation may supplement surface flows.

TERRESTRIAL VEGETATION

Historically, the forested areas were characterized by open stands of large ponderosa pine. At the time of European settlement, the Upper Sprague River subbasin landscape contained only minor components of lodgepole pine, mixed conifer, and true fir forests. Western junipers were most common on pumice sands and areas of rock outcrops.

With the arrival of the railroad in the late 1920s, large-scale logging became feasible in the assessment area, and continued through the 1970s, resulting in substantial changes in the forested uplands. Early tree harvesting greatly reduced the volume of ponderosa pine saw timber in the assessment area. In some cases, logged areas were left unmanaged, resulting in shrub-dominated plant communities, or dense stands of smaller diameter trees. In later years, private-sector foresters paid particular attention to the restoration and protection of riparian areas, resulting in improved high-elevation riparian landscapes in some areas.

As a result of tree harvesting and a dramatically altered fire regime, climax species such as white fir and grand fir were able to grow to much greater densities as compared with pre-settlement conditions. Stream function has been affected because of the reduction in the availability of large wood. Fire suppression also led to increased fuel loadings and more widespread mixed-species (ponderosa pine dominant) stands. Although data from other regions indicate that changes in stand composition and structure increase

susceptibility to insect outbreak, historical records have shown that severe insect outbreaks occurred before significant timber harvest began. Throughout the 20th century, the range and density of juniper increased dramatically, due to fire suppression and reduction in fine fuels.

Site-specific assessments of the uplands by the Working Landscapes Alliance indicated opportunities for land managers who may not have streams or wetlands to contribute to the overall functionality of the watershed. Juniper dominated sites that were assessed were found to be functioning-at-risk or non-functioning hydrologically. As part of the loss of hydrologic function have come losses in plant vigor and productivity and in plant community diversity.

RIPARIAN AREAS

The straightening and diking of significant reaches of the Sprague River and some of its tributaries constituted substantial modifications to riparian and wetland areas. Removal of native riparian vegetation increased bank erosion. These actions reduced or eliminated the ability of certain key stream segments to dissipate the high energies of peak flows by spreading these flows out over a floodplain, or by accessing secondary high flow channels. These actions also reduced the viability of in-stream fish habitat by simplifying streambed topography and flow dynamics.

The data gathered for the watershed as a whole has indicated some general changes in riparian condition, including erosion of channels both outward and downward, local lowering of the water table, disconnection of stream channels from their floodplains, shifts in vegetation communities, and changes in certain key fish habitat features.

As a result of the involvement of the National Riparian Service Team (NRST) and the Working Landscapes Alliance (WLA), considerable attention was devoted to riparian areas during this assessment. The involvement of the NRST and the WLA has allowed us to supplement the large-scale data in this this assessment with information gathered during specific site visits on public and private lands.

Some key findings emerged from specific site assessments conducted during the 2005 field season. First, there was wide variability with regard to conditions and function across the watershed, and even within a particular site. Second, there was evidence at most sites that major changes had taken place in the early part of the last century, and that the sites have been on a gradual upward trend since that early disturbance. Third, there was clear evidence at each site of the potential for substantial and rapid recovery of vegetation conditions with relatively minor shifts in management. And finally, it gradually became clear over the course of the field season that in riparian areas where vegetation conditions and hydrologic function had declined, forage production for livestock had also declined. This was considered to be of critical importance, because strategies could be

developed that would simultaneously contribute to the functionality of the riparian area, as well as to the economic viability of the agricultural operation.

WETLANDS

According to available data, wetlands cover about 60,485 acres (9.5 percent) of the Upper Sprague River subbasin. The largest amount of wetland area is located in the Sycan Marsh Watershed, which contains 27,349 acres of wetland, and in the Sprague River Above Beatty Watershed, with 11,000 acres.

Wetland conditions have changed since pre-settlement times as a result of draining, diking, grazing, forestry, and irrigation. Former willow and woody vegetation has been replaced in many lowland areas by wetland/sedge/wet pasture and meadow/grass/pasture vegetation types. In the higher elevation areas, landscape changes have lowered the water table and enabled encroachment of forests into meadow areas.

The engineered flood control projects implemented by the US Army Corps of Engineers during the 1950s caused significant changes in wetlands in the assessment area. In particular, the South Fork of the Sprague River was diked, straightened, and isolated from its floodplain. These manipulations occurred for most of the reach from Fish Hole Creek to the confluence with the North Fork. As part of this same effort, wetland and riparian vegetation – including native willows, sedges and rushes – were removed.

CHANNEL CHARACTERISTICS

Channel conditions include the cross-sectional profile, the longitudinal profile, the ratio of width to depth, the connection of channel to its floodplain, the sinuosity (or meandering pattern), and vegetation conditions. Each of these components is directly related to how the channel is functioning in terms of its ability to dissipate the energy of high flows. Each is also related to the quality of habitat for fish, because proper function with regard to these conditions results in the development of key habitat features for native species.Modifications of channel characteristics can result either from intentional reconfiguration of channel form to serve other purposes (dikes, reservoirs, dams, etc), or from gradual erosive process stemming from management of riparian areas.

The most intensive channel modifications in the assessment area, resulting from federal flood control projects, have already been discussesd. Several reservoirs exist in the headwater reaches of the Upper Sprague River and are present in the Fishhole Creek, North Fork Sprague, South Fork Sprague, and Sprague River above Beatty Watersheds. Splash dams have been used on both public and private lands in the Upper Sprague River subbasin.

There are stream channels throughout the Upper Sprague River subbasin that have experienced substantial channel modification associated with excessive erosion. Such changes to the channel morphology are associated with a variety of activities, including over-grazing, beaver trapping, removal of riparian vegetation, land clearing, wildfires, and loss of wetlands.

WATER QUALITY

Water quality is directly associated with the viability of habitat for aquatice organisms, as well as other beneficial uses. At the screening level of this assessment, water quality in the major streams of the Upper Sprague River subbasin would be considered impaired with respect to Oregon Department of Environmental Quality (ODEQ) statewide water quality standards for temperature, pH, phosphorus, bacteria, and possibly dissolved oxygen.

Most streams listed by the state as water-quality limited are listed for temperature. Reduced streamside vegetation, reduced wetlands, channel widening, and geothermal springs may contribute to elevated stream temperatures. Groundwater pumping and flood-irrigated pastures may contribute to late-season lowering of water temperatures.

The streams and groundwater of the Upper Sprague River subbasin are relatively high in dissolved phosphorus, due in part to erosion of soils and volcanic bedrock that are naturally high in phosporous.

AQUATIC SPECIES AND HABITAT

The major focus of habitat quality issues within the Upper Sprague River subbasin concerns native fish species, in particular the influence of habitat quality on bull trout (Federally Threatened), Klamath largescale sucker (Federal Species of Concern), Lost River Sucker, shortnose sucker (the later two are Federally listed Endangered Species), redband trout and two currently extinct species of anadromous salmonids, chinook salmon and steelhead trout. Historical evidence suggests that fish populations in the Upper Sprague River subbasin were different from those which exist today.

A variety of factors have contributed to the changes that have occurred. The construction of Chiloquin Dam interrupted normal passage, and the introduction of non-native fish species resulted in competition and hybridization. The loss in stream side riparian zones has lead to changes in fish habitat due to changes in channel form and flow dynamics, reduction in vegetation cover, and increases in stream temperature.

TERRESTRIAL WILDLIFE AND HABITAT

The Upper Sprague River subbasin is noteworthy from a wildlife perspective because it contains a high diversity of species and because it is home to many species that have been classified as rare or deserving of special conservation

status. Both of these factors are due, at least in part, to the location of this subbasin at the intersection of five different ecological regions.

Because the Upper Sprague River subbasin lies near the intersection of five different ecoregions, it is not surprising that the area supports a wealth of animal diversity. It is estimated that 314 species of vertebrates occur in, or have been extirpated from, the assessment area ORNHIC 2005). Table 11-1 summarizes the number of species "closely" or "generally" associated with major habitat types in the assessment area.

Key issues that limit wildlife diversity include a reduction in vegetation complexity (multiple vegetation layers, including large trees), scarcity of snags and down logs, and increasing abundance of noxious invasive plants.

There are 106 vertebrate species present in the assessment area that are considered to be associated with shrub-steppe habitats and 101 species associated with western juniper woodlands (Table 11-1). There is considerable overlap in the species composition of these two arid habitat types.

In some cases irrigated pastures result in benefits to certain species by providing additional vegetation for a longer period during the year. In other cases, grazing can diminish habitat quality for wildlife that depend upon the vegetation structure of shrubs or feed upon the associated plant species.

CONCLUSION

There is no doubt that the Upper Sprague and Sycan watersheds have experienced significant changes over the last century. Some of these changes have been positive, and some have been negative. And in some cases we've changed our minds about whether a given change is a positive or a negative, based on a better understanding of how the natural systems in the area function.

Healthy rivers, streams, riparian zones, wetlands, forests and uplands are critical to maintaining the economic, social, and ecological benefits that residents receive from the watersheds within the subbasin. Although there is growing agreement concerning the benefits provided by watershed functions, there is considerable disagreement about the current condition of the natural resources, appropriate use of these resources, treatments and tools that can be used to restore and maintain healthy ecosystems, and prioritization of ecological and economic concerns.

Disagreement over the management and use of natural resources has recently led to litigation and regulatory actions, which sometimes exclude those most affected by management decisions. Increasingly, collaborative approaches are attempting to build capacity in local communities to confront complex natural resource problems in an integrated fashion.

The most useful lesson we have learned about the assessment area is that local landscapes can be highly responsive to relatively modest shifts in management. Riparian areas and stream channels, in particular, have proven to respond in ways that result in short and long term benefits for both the human and non-human inhabitants of the watersheds. In some cases, more intensive or costly projects may be needed to reach the goals we set for ourselves. But our initial investigation has shown us that there is more potential for rapid improvements than was previously thought to be possible.