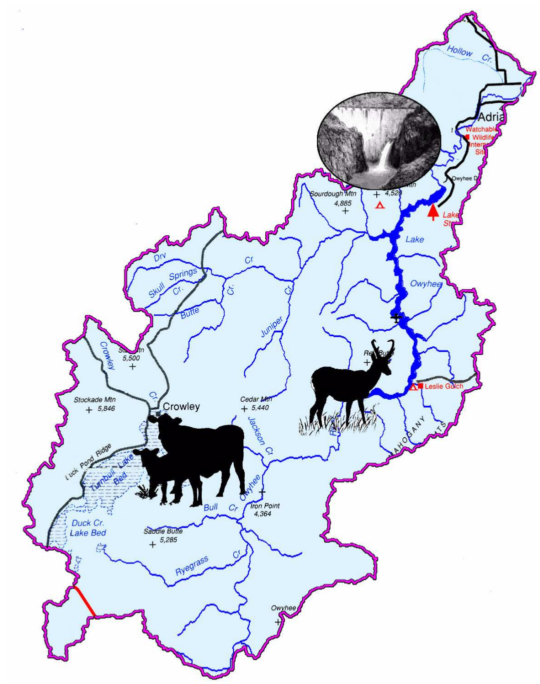

Lower Owyhee Watershed Assessment

XIII. Sediment Sources

Contents

XIII. Sediment sources

Sediment enters rivers from runoff of water from the basin that is being drained. The greatest movement of sediment to the rivers is dependent upon extreme storm events that create substantial surface runoff. This section will consider runoff as well as the resulting sediment loss, or erosion, from rangelands and cropland.

A. Erosion

The sediment load transported by a river is obvious to most observers. Crystal clear stream water is not carrying substantial amounts of sediment, while murky brown waters are a result of a large sediment load within the river. The sediments in rivers come from erosion of soil and rock. The make up of the soils within the lower Owyhee subbasin is not well known, as discussed in the soils section of the background component of this assessment. Sediments within the Owyhee River also come from sediment contributed from further upstream. Wind erosion contributes a very minor amount of sediment directly to the rivers.

"Erosion is an intrinsic natural process but in many places it is increased by human land use."[20] All of the river canyons and gullies we see as scenic locations today were created by natural erosion (Figure 13.1). The goal of assessing sediment sources and erosion is not to halt the movement of sediments, but to mitigate the effects of modern human activities on soil loss.

Figure 13.1. Natural erosion processes shaped the deep Owyhee River canyon.

Management of sediment losses requires an understanding of how erosion functions naturally, what creates surface runoff within the lower Owyhee subbasin, and what cultural practices are management options.

1 What increases the amount of erosion during storms?

Erosion is the natural process by which sediment is moved down slope. Gravity is the major force in action, as in a rock fall. But, erosion is normally accomplished by water with the assistance of gravity. Two major factors contributing to how much erosion occurs are the slope of the land and type of precipitation. The greater the slope of the land, the more likely it is to undergo erosion. Steep slopes will lose more sediment than flat plains. High intensity and volumes of precipitation also increase the amount of erosion.[6] When heavy rains occur, the soil can not absorb all of the water and so some of the water starts running across the surface of the ground. If there is a large amount of surface runoff or the surface runoff is across a steep slope, this water will begin scouring the ground it is moving over and pick up sediment. Individual particles of sediment are small enough to be carried in the water and moved off of the land.[6]

The geological context of the lower Owyhee subbasin is that it is in the early stages of formation (see the geology section of the background component of this assessment). One implication is that erosion has not progressed very far in smoothing the landscape, so there are steep slopes that increase erosion risks. Another implication is that soils have only started to form, limiting the ability of the landscape to support vegetation and exposing the newly formed soils to erosion.

2 What will decrease the amount of erosion during storms?

The amount of erosion which occurs is largely controlled by the vegetative cover and type of soil. Vegetation and plant litter hold soils in place.[4] Soil that is being held in place is much harder to erode and will only be influenced by much more intense storm events.

Soils vary in the amount of clay, silt and sand they contain. Soils high in clay are harder to erode because the particles are held together more firmly and a greater force must be exerted by runoff to dislodge clay than silt or sand. Soils with a predominance of sand or coarser particles tend to absorb water very quickly, thereby reducing erosion.

Very large storm events have the power to dislodge both large particles and those which are held together firmly by forces in the soil. The influx of this sediment to the river system occurs over a short time period as the additional moving water has the force to carry these particles.[6]

3 Forms taken by erosion

When looking at the ground to see where erosion is happening, there are three types of soil movement to look for.[4,9] Sheet erosion moves sediment off the surface of a large area of ground and is generally more common in flat areas. Rill erosion consists of more or less parallel erosion paths across sloping ground. Gully erosion cuts through sediments in low areas where water accumulates during runoff events, creating features we call gullies.

Identification of what type of erosion has occurred will suggest the types of actions which can be taken to prevent erosion. In nature the quantity and speed of runoff water determine the form taken by erosion, and slopes will show a progression from sheet erosion at the top where they are nearly flat, to rill erosion on the slope, and finally gully erosion along the steepest incline.[4] On furrow irrigated fields the erosion occurring is analogous to rill erosion.

a. Management of sheet erosion

> "Sheet erosion can be prevented by maintaining plant cover and maximising infiltration of ponded water through the maintenance of soil structure and organic matter. Organic matter acts as a glue, stabilising pore spaces which transmit surface water deeper into the soil and thus reduce the volume of ponded water available for erosion."[3]

b. Management of rill erosion

> "Once runoff has been initiated, rill erosion can be prevented by either reducing flow velocity, or hardening the soil to erosion. . . . Flow velocity can be reduced by either reducing the flow volume or roughening the soil surface. Increasing surface roughness through the use of grassed waterways and grassed filter strips causes entrained soil particles to fall out of suspension. Flow volume can be reduced by not allowing sheet flow

to accumulate. Techniques such as ripped mulched lines and contour drains prevent runoff building up enough volume and speed to detach and entrain soil particles. . . . Where options to reduce runoff volume or velocity are limited, surface soils may be protected from scouring by hardening the surface."[2]

c. Management of gully erosion

"Once established, gully erosion can be difficult to control. In most cases a combination of approaches, including the use of vegetation, fencing, diversion banks and engineering structures are required. . . . Vegetation is the primary, long-term means by which gully erosion can be controlled. All gullies need to be fenced from stock and revegetated along the gully floor, sidewalls and surrounding areas. Establishing vegetation on gully sidewalls is often difficult due to moisture stress. Consideration should be given to supplying irrigation to get vegetation established."[1]

Suggestions from Tasmania, Australia include, revegetating the gully floor with rapidly growing grasses and the sidewalls with trees, revegetating the catchment above the gully, and using irrigation hydroseeding and mulching.[1] In areas where the gully erosion can not be controlled with vegetation, "gully erosion may be able to be controlled if runoff can be diverted and safely disposed of."[1] However this requires engineering expertise and carries the, "risk of transferring instability from one area to another."[1] While we may think of Tasmania as being a world away, similar erosion problems are found in many semi-arid regions of the world and their solutions are the same.

B. Sources of runoff water

The sources of water entering the rivers in the lower Owyhee subbasin have not been delineated. In addition, the amount of sediment carried by runoff and streams varies based upon the source. This is a data gap.

Sediments entering the river might be classified in three ways: that coming from springs and seeps, that originating in storm events, and that being transported in water from irrigation tail ditches. Water from underground aquifers, such as springs and seeps will carry little to no sediments. Thunderstorms and rapid snow melt can produce massive surface runoff. This runoff will likely carry sediment from the area it passes over. The floods that may result in narrow stream channels also have the potential to scour sediments from the banks of the channels.

Irrigation tail ditches will carry sediments from the fields that the irrigation water ran across. This is of concern to water quality since the soil may contain high quantities of phosphorus, nitrogen, bacteria, and pesticides.

C. Cultural practices related to soil losses

Erosion on rangeland has not been scientifically studied in the lower Owyhee subbasin. However, erosion can be observed by anyone, particularly those who use the same areas year after year. Current problems have been noticed by local residents.

Large sediment loads delivered to the rivers are the result of either extreme storms or other problems.

1 Current problems and concerns

Human land use, particularly related to vehicle travel is seen as a major source of sediment in the lower Owyhee subbasin.

a. Unimproved roads

Unimproved roads through rangelands create problems with erosion. Often the placement of dirt roads has developed as a matter of convenience, with no planning to minimize their effects on soil loss. Unimproved roads can erode more than improved roads. Improved roads will have runoff ditches along the sides which funnel water off the road and onto the range.

Unimproved roads erode in the tire tracks, collecting water running off the landscape and acting as sediment sources.[10] This happens because once water is in the wheel ruts, it can not escape. Water often flows within the wheel ruts for great distances, eroding deeper and deeper gullies into the land. Over time the erosion along one set of wheel tracks will lead drivers to move off of the existing road to drive on adjacent land. Those who use the range on a frequent basis notice that this problem becomes more pronounced with the steepness of the slope. Steep slopes have greater need of cuts designed to direct water off of the road at regular intervals.

Simple gutter improvements creating ways for water to escape from the wheel ruts of unimproved roads will decrease erosion.[10] Extensive descriptions for rural home owners, ranchers and rangeland managers on how to care for and improve rural roads are provided in the online publication "A Ditch in Time".[10] Many of the unimproved dirt roads in the lower Owyhee subbasin are already acting as gullies and will likely continue to do so even without vehicle traffic because the gullies will not magically grow plants to hold the soil in place.

b. ATV tracks and off road recreation

Off road recreation by both small 4 wheelers and large 4x4 vehicles disturbs the surface of the soil. Repeated use of an area for off road recreation kills vegetation. Soil compaction, which results from vehicles driving over the soil, greatly increases the chance of precipitation flowing across the surface of the land.[4] These factors leave areas used for off road recreation extremely susceptible to erosion from rainstorms or snow melt. Areas which have been used repeatedly for off road recreation contribute increased amounts of sediment.

c. Stream bank erosion

Steambank scouring can be a natural process. This scouring can also be aggravated by excessive animal pressure on riparian vegetation, leaving stream banks excessively vulnerable to erosion.

d. Irrigation-induced erosion

Irrigation-induced erosion is a major source of sediment from irrigated farm ground in the lower Owyhee subbasin. Runoff water from fields irrigated below the Owyhee Dam is returned to the river through a system of tail ditches. There has been concern that field runoff contains high amounts of sediments. In addition agricultural runoff water can carry chemicals that have been applied on crop fields into the river.

e. Accumulation of sediment in the Owyhee Reservoir

When water enters the Owyhee Reservoir it slows and loses the power it had to carry sediments. This means that the sediments are deposited on the bottom of the reservoir. It is an increasing concern to residents that the Owyhee Reservoir is acting as a catch basin for sediments. Primarily the concern is that all of the mercury carried by runoff water from the Silver City area since the construction of the Owyhee Dam in 1932 has settled onto the bottom of the reservoir along with sediments carried by the river. This seventy nine year accumulation of mercury is showing it's presence in the water quality and fish quality (see the water quality component of this assessment).

f. Confined animal feeding operations

Concern has been expressed that sediments at confined animal feeding operations are extremely susceptible to erosion and that during storm events the sediment might be lost into the rivers, carrying with it a high concentration of animal wastes.

2 Possible solutions to current problems

a. Unimproved roads

Unimproved roads through rangelands eventually need to be repaired or replaced. Simply prohibiting vehicle traffic will not halt erosion which is already carrying sediment off the road. As replacement and repairs are necessary, minimal design considerations can be implemented to divert water strategically from the roadway at reasonable intervals. In some places, routes can be chosen with less erosive potential.

b. ATV tracks and off road recreation

Education of ATV and other off road vehicle users could be more energetic and effective.

c. Stream bank protection

The effects of cattle grazing along the main stem of the Owyhee River above the dam have been eliminated by their exclusion from access to the river. Major private investments have placed watering troughs across the landscape away from the river's edge and other riparian areas.

Below the dam, grazing pressure along the river is low.

Problems of livestock pressure on riparian vegetation exist in the Dry Creek drainage.

d. Irrigation-induced erosion

Irrigation induced erosion in Malheur County has been diminished and continues to diminish. Practices to reduce this erosion have been developed and are being implemented. Progress to reduce irrigation induced erosion is extensively documented in the Irrigated Agriculture component of this assessment. See the discussions of practices that have reduced irrigation-induced erosion including:

1. Laser leveling
2. Straw mulch
3. Gated pipe
4. Weed screens
5. Application of PAM to reduce irrigation-induced erosion
6. Surge irrigation
7. Sedimentation basins and pump back systems
8. Changes in irrigation systems to sprinkler and drip irrigation
9. Irrigation scheduling
10. Constructed wetlands

Major advances have been made in the reduction of sediment in runoff water by using straw mulching, the use of PAM, laser leveling, and upgrades in furrow irrigation systems.[13] Laser leveling makes fields flatter, and flatter fields are less subject to erosion because the water in furrows is moving slowly. Straw mulch and surge irrigation both slow the movement of water through irrigation furrows.[17] Slower water has less power to pick up and move sediment. Gated pipe allows for more uniform irrigation in furrowed fields so that the amount of water flowing down each row can be regulated and reduced. PAM, as an additive in irrigation water, binds sediment particles in furrows together, reducing the amount of sediment that can be picked up by irrigation water.[16] Weed screens are used to remove garbage from the water so that narrower openings on gated pipe or smaller siphon tubes can be used in irrigation.

Possibly the best way to deal with concerns with runoff water from agricultural fields is to eliminate the runoff all together. This can be done with controlled water application. If all of the irrigation water applied to a field stays on the field, there will be no run-off and no worry of accompanying chemicals.[19] Both sprinkler irrigation and drip irrigation systems can be designed to eliminate runoff from agricultural fields.[5,12,13] These cultural practices are used by many farmers.

Irrigation scheduling is combined with all types of irrigation systems so that water is applied in the proper quantity when needed by the crops.[14,15,21] Scheduling is accomplished by measurements of evapotranspiration at weather stations or by in-field measurements of soil water potential.[11] Evapotranspiration shows how much water plants consume and is based on local weather conditions including temperature and humidity. Growers can get this data for the Treasure Valley daily from the Malheur Experiment Station and AgriMet.[7] Soil water potential measures how much water is accessible to the plants from the soil in a given field.[18] Sensors that make these measurements have been growing in popularity with growers in Malheur County.

An additional method to eliminate most sediments from agricultural fields returning to the rivers is through the use of settling ponds in constructed wetlands or catchment ponds with pump-back systems. Settling ponds allow the sediment to fall out of suspension in the water and gather on the bottom of the pond.[13] After sediment has settled, water is returned clean to the tail ditch system.

e. Accumulation of sediment in the Owyhee Reservoir

Clean up of sediments already in the reservoir would be very costly. The most effective immediate measure would be to eliminate further introduction of mercury to the reservoir. This requires that clean up occur at the source of the mercury in the Silver City region. (See the water quality component of this assessment).

f. Confined animal feeding operations

The Oregon Department of Natural Resources confined animal feeding operations permit program is designed to address waste management at confined animal feeding operations (CAFO).[8] Waste removal programs are designed to protect water quality of ground water and surface runoff. All of the operations in the lower Owyhee subbasin which are large enough to require them have been issued CAFO permits.

D. Questions that need to be answered about soil losses

How much vegetation is needed on the rangeland to avoid erosion related to thunderstorm events? Do different types of vegetation have different amounts of sediment losses?

What is the difference in sediment loss between rangeland on a flat plain and that on the slope of a hill? How does grazing affect sediment losses?

How is the amount of soil erosion changing with invasive weeds? With juniper cover?

How much vegetation is needed along a stream bank for stabilization? What species of vegetation that are adapted to local environmental conditions would grow in these places?

What types soils in the lower Owyhee subbasin are most susceptible to erosion?

To what extent are there soil loss problems following wildfires and controlled rangeland burnings?

There is no survey of locations within the lower Owyhee subbasin with erosion or any documentation of whether the current erosion rate is what would be expected to occur naturally or is aggravated by anthropomorphic activities. Only the latter would be amenable to remediation. Naturally occurring erosion has been substantial and is responsible for much of the beauty and incredible landscape of the lower Owyhee subbasin.

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