FACT SHEET No. 3

Rangeland Watershed Program

U.C. Cooperative Extension and USDA Natural Resources Conservation Service

Nonpoint Sources of Pollution on Rangeland

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Pollution Defined

Pollution is defined as an alteration of the quality of the state waters by waste to a degree which unreasonably affects their beneficial uses or facilities which serve their beneficial uses. Sewage, sewage sludge, garbage, solid waste, chemical wastes, biological materials, radioactive materials, heat, soil, and agricultural wastes can all be pollutants of water. In the Clean Water Act, pollution is categorized by its source as **point** or **nonpoint**. Point source pollution is an observable, specific, and confined discharge of pollutants into a water body. Examples of this kind of pollution are feedlots, food processing plants, and agrichemical processing plants. In contrast, nonpoint source pollution consists of diffuse discharges of pollutants throughout the natural environment. It occurs over extensive areas. As water from rainfall, snowmelt, irrigation, or human activities moves over and through the ground, it picks up and carries away natural and manmade pollutants, eventually depositing them into lakes, rivers, wetlands, coastal waters, and underground sources of drinking water. Nonpoint source (NPS) pollution is usually associated with agriculture, forestry, mining, and urban storm water runoff.

Sources of NPS

Nonpoint source pollution from rangelands may be caused by grazing, roads, construction activities, mining, recreational activities, and natural processes. Concentration of livestock, heavy grazing, and hoof action are potential causes of excessive sediment, heat, nutrients, and pathogens.

Sediment: While erosion on most rangeland in California is well below traditionally accepted tolerance levels, the vast area of rangeland and its critical position in the state's water supply system offers an opportunity to improve water quality throughout the state.

Erosion is a natural process that is accelerated by man's activities. Slopes exceeding the angle of repose naturally erode, especially when vegetation is removed by fire and other disturbances.

Soil erosion and sedimentation are the primary contributors to lowered water quality from rangeland. Pasture and rangeland generally become a source of nonpoint pollution when grazing removes a high percentage of the vegetative cover, exposing the soil surface to erosive action of water and wind. Eroded soil subsequently becomes sediment, creating the potential for water degradation which may lead to impaired uses. Sources of sediment may be divided into upland (sheet and rill), gully, and streambank. The 1984 USDA Soil Conservation Service County Resource Inventory reports that sheet and rill erosion is a problem on one-third of private rangeland in California with erosion averages of 3.3 tons/acre/yr. on 19 million acres. As expected, this type of erosion is a greater

problem in areas of high rainfall and steep slopes. Because of steep slopes, highly erodible soils, and intense storm characteristics, the sediment delivery ration (a measure of the amount of eroded soil delivered to a water body) on rangeland can be relatively high.

Streambank erosion is another source of sediment on rangelands. Over 9,000 miles of streambanks are identified as eroding, and treatment is suggested to reduce erosion.

Roads and other areas of disturbed ground can be major contributors of sediment to streams and lakes. Many roads are located along streams where the muddy runoff from the road is discharged directly into the stream.

Streambanks and associated riparian zones can be subject to heavy livestock use. Trampling and overgrazing of vegetation are frequently associated with streamside instability and accelerated erosion.

Heat: Thermal pollution has two basic sources related to grazing and livestock production. Heavy grazing can result in loss of streamside vegetation that shades streams and helps to maintain cool water temperatures required by many cold water fishes, especially trout, salmon, and steelhead. Drainage of irrigation water that has warmed as it crosses a hay field, pasture, or meadow can raise temperatures of cold water streams. In at least one state any stream that is more than 64°F for more than seven days is classified as water quality limited.

Nutrients: Leaching of nutrients from watersheds is a natural part of nutrient cycling. Nutrients from manure and decaying vegetation can become pollutants, particularly near streams and lakes during the rainy season or periods of runoff. In these locations runoff can carry nutrients into water bodies quickly. Nutrient problems are usually most critical where animals congregate for water, feed, salt, and shade. Nitrate and phosphate are usually the nutrients of concern. Pasture fertilization can be a source of these and other nutrients.

Pathogens: Localized contamination of surface water, ground water, and the soil itself can result from animals in pastures and rangelands. Research reports show that livestock operations may cause increased coliform bacterial pollution in rangeland streams. Although fecal coliforms themselves are not pathogenic, they indicate that pathogens could exist and possibly flourish. Fecal streptococci may also be a reliable and definitive measure of human or animal pollution. The extent of pathogens depends largely on livestock density, timing of grazing, frequency of grazing, and access to the stream. Fecal coliform levels tend to increase as intensity of livestock use increases. Maintaining the health of livestock is critical and proper management of the herd, its byproducts, and exposed land areas is essential.

Grazing strategies that maintain adequate vegetative cover are the best approaches to reducing grazing caused erosion and sedimentation. Dispersal away from streams rather than concentration of livestock appears to be the best means of reducing nutrient and pathogen loading.

Impacts of Grazing Livestock

The pathway from livestock activity to impaired beneficial uses of water is often complex and difficult to understand because the livestock activity that causes a water quality problem may occur over a long period of time at some distance from the point where a water quality impairment is identified. Livestock activities that may lead to impaired beneficial uses fall in three categories: heavy grazing, hoof impacts, and livestock waste concentration. These three categories of impacts are interrelated and in reality cannot be separated but for the purpose of illustration. Figure 1 (see page 4) shows these three categories on the left and the beneficial

uses of water that they impact on the right. The pathways from these impacts to the impaired beneficial uses of water are in the middle.

Heavy Grazing removes vegetation that covers the soil. Vegetation protects the soil from the erosive energy of raindrops. Vegetation acts as a sediment trap. Vegetation increases infiltration rate, getting water into the ground where it can do some good rather than running off as overland flow that can erode soil. Sediment is detached in the uplands by surface runoff and may eventually find its way to a stream, or it may settle out in a new location and be stabilized by vegetation. Sediment is also detached from streambanks by the erosive force of flowing water or the collapse of unstable banks. Loss of streamside vegetation may result in increased heating of the stream, resulting in thermal pollution that adversely impacts cold water fishes.

Hoof impacts can destroy streambank vegetative cover and physically breakdown streambanks. These impacts occur when livestock concentrate repeatedly or in large numbers in a small area for water, shade, or other streamside attractions. Unstable streambanks may slough off into the stream channel. In addition to adding sediment to the water course, this may lead to channel widening or down cutting. Channel widening and down cutting can result in shallower and warmer streams degrading aquatic habitat and destroying important streamside wildlife habitat.

Livestock waste concentration can be a source of pathogen and nutrient pollution, especially if they concentrate in or near streams. A large proportion of nitrogen (protein) and phosphorus ingested by livestock during feeding returns to the environment in feces and urine. If these wastes are well distributed in the watershed, there is a better chance that natural processes will remove or dilute nutrient and pathogen pollutants. If large amounts of these nutrients enter a waterway, they can stimulate algae growth that uses up dissolved oxygen, reducing fish reproduction and survival.

Pathogens present in feces may also enter the waterway. Fecal coliforms, an indicator of potential pathogen presence, may increase in runoff during grazing. Fecal coliforms, *giardia*, *cryptosporidium*, and other pathogens can be found in runoff from grazed watershed as well as ungrazed watersheds.

Pollution Prevention

Livestock induced nonpoint source pollution can be substantially reduced if:

1. Sufficient vegetation is left in the uplands.
2. Sufficient vegetation is left in riparian areas and along streambanks.
3. Livestock are not allowed to concentrate in riparian areas and streams.

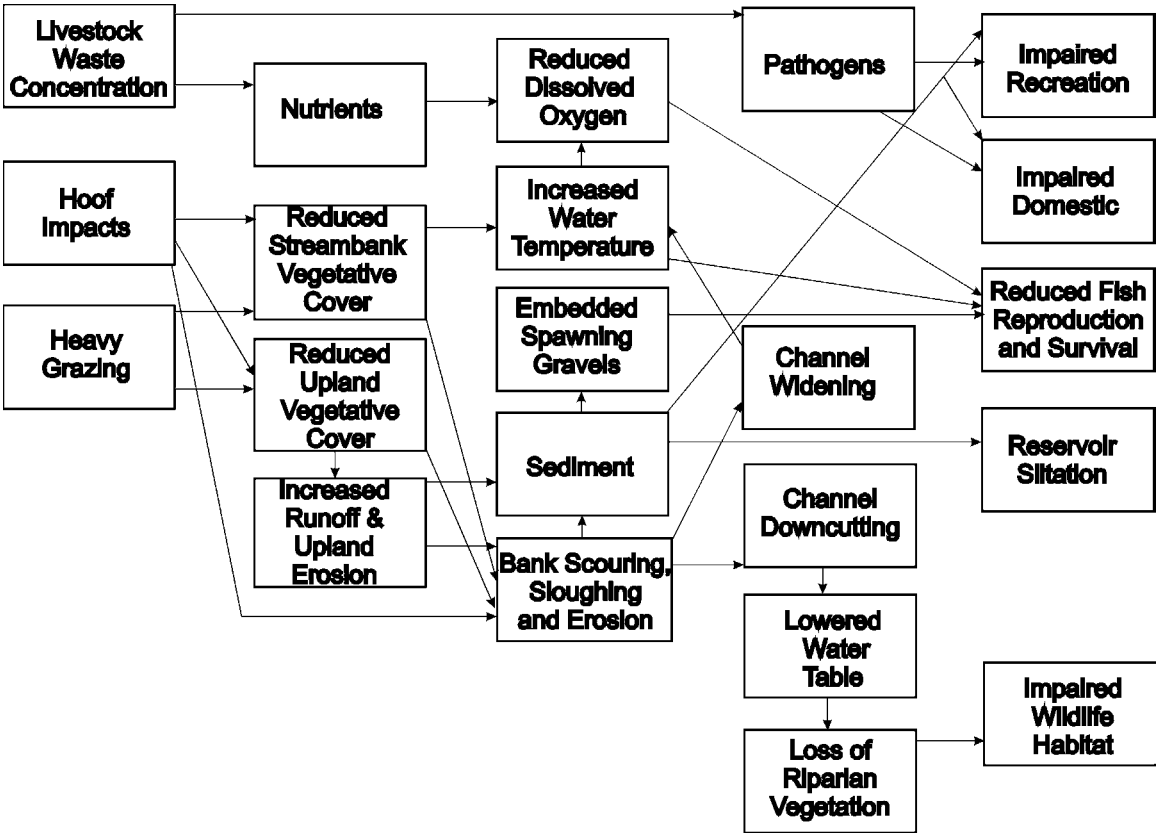

Figure 1. Livestock waste concentration, hoof impacts or heavy grazing (left column) may set off a chain of events that end in the impairment of the beneficial uses of water (right column).