

BASELINE FLORA AND FAUNA SURVEY AND EVALUATION OF RIVERSIDE  
ENVIRONMENT AT GRANT-KOHR'S RANCH NATIONAL HISTORIC SITE  
DEER LODGE, MONTANA

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Objectives

There are four primary objectives in this study:

1. Baseline survey of flora and fauna at the Ranch;
2. The extent and severity of heavy metal contamination throughout the Ranch;
3. An evaluation of areas along the Clark Fork River within the Ranch that are denuded of vegetation or have little vegetative cover; and
4. To provide a list of possible management alternatives for the denuded areas.

Methods

Flora And Faunal Survey. In the early summer of 1983, the Ranch and the immediate boundary area were divided for sampling into 94 1-hectare plots. Aspect and dominance were recorded within each plot to map the dominant species throughout the Ranch. It was originally anticipated that approximately 120 individual plant species would be collected. However, the vegetative community at the Ranch is much more diverse and yielded nearly 220 specimens. Color slides of individual plant species were taken, and birds and mammals were surveyed throughout the field season.

Heavy Metal Contamination Throughout The Ranch And Evaluation Of Denuded Areas. The heavy metal survey and investigation of denuded areas were conducted on two levels of resolution: An extensive sampling program was designed to determine the contamination levels of vegetation, soils, and animals throughout the entire Ranch area; and an intensive sampling program was used to provide a detailed profile of the heavy metal contamination and plant community structure of a typical site with an impoverished vegetation community.

The extensive study used the same 94 1-hectare grid system as the plant dominance survey. Each hectare was further divided into four 0.25 hectare subplots. A soil subsample (0 - 25 cm in depth) was taken within each subplot and composited to form a single sample for each hectare. Because a presence/absence plant survey indicated that Redtop bentgrass (Agrostis alba) was one of the most widely distributed species and because it is an important forage grass, four subsamples of Redtop were collected and composited for each hectare to be analyzed for metals.

Voles, mice, shrews, and grasshoppers were captured in three zones on the ranch: the heavily contaminated riparian shrub zone, the hay meadows, and a shrub zone on a tributary creek (Cottonwood Creek) which is beyond the primary flood plain of the Clark Fork River but still within the Ranch boundaries.

A check site was selected on the Montana State Prison Ranch, remote from the Clark Fork floodplain and the Grant-Kohrs Ranch, based on the 2 ppm soil-cadmium isopols for the Deer Lodge Valley (Munshower, 1972). These two ranches appear to have similar parent material and have had similar deposition rates of airborne metal pollution resulting from smelting activities. The Prison Ranch thus provides an appropriate control or check plot for quantifying the contamination from the river-transported metal sediments and has been sampled for soils, vegetation, and small mammals.

The intensive study sampling was done on an elongate (110 m by 40 m) denuded zone adjacent to the Clark Fork River on the Ranch. A transect was established along the long central axis with two short transects crossing at right angles to the central axis. Sample points were chosen along the three axes. The density of sampling points was increased in transition zones where the vegetation structure changed rapidly and decreased in portions of the transects where the vegetation structure was constant.

Soils were sampled at three depth increments (0 - 2.5 cm, 2.5 - 25 cm, 25 - 75 cm) at 42 points distributed over the three transects. Redtop bentgrass (Agrostis alba), tufted hairgrass (Deschampsia caespitosa), and willow (Salix sp.) dominated the non-vegetated and adjacent areas. Fifty-eight samples of these plants were taken at the same points as the soil samples. Water birch (Betula occidentalis) was occasionally found in the intensive study site, and three samples were collected. Additionally, three samples of redtop bentgrass and tufted hairgrass were separated into root and short portions to examine metal partitioning.

Plant community structure data were generated from 32 1-meter square (2 m x 0.5 m) quadrants randomly located on the intensive study site. Species presence or absence, density, and cover class were determined.

Plant and soil samples were dried at 50 degrees C for at least 48 hours in a forced draft oven. Plant samples were ground to pass 20 mesh in a Wiley Mill. Soils were pulverized and sieved through 10 mesh in a stainless steel sieve.

Aliquots of the plant and soil samples were digested in sealed pyrex tubes

containing redistilled, concentrated nitric acid at 150 degrees C for 4 hours. The digest was taken to dryness and made up to 10 ml for analysis.

The samples will be analyzed for arsenic, cadmium, and copper levels. Arsenic will be determined by vapor generation Atomic Absorption Spectrophotometry. Cadmium and copper in soil and plant samples will be determined by flame aspiration Atomic Absorption Spectrophotometry. Vegetation samples below the detection limit of flame aspiration will be analyzed with a Carbon Rod Atomizer. A subset of soil samples has been sent to Dr. R. D. Rogers, EG & G Idaho, Inc. to be assayed for the activity of hydrogen-oxidizing microorganisms.

Quality assurance (QA) has been observed in all aspects of this study. Two types of field blanks (scour and rinse blanks) were used for the soil sampling. Scour blanks were taken after cleaning the soil coring tube between samples. The cleaned tube was pushed into a container of moistened laboratory grade silica sand. The silica sand core was then handled like any other soil sample. Rinse blanks were taken by rinsing the coring tube after normal between sample cleaning of the corer.

National Bureau of Standards Reference Materials 1571 (Orchard Leaves), 1645 (River Sediment), and 1646 (Estuarine Sediment) will be analyzed routinely as a check on the analytical procedures. Aqueous Quality Control Standards obtained from the U.S. Environmental Protection Agency will be analyzed at a frequency of 10%, as will reagent blanks, mid-range calibration standards, spikes, and repeat analyses. Control charts will be used to determine if the analytical system is out-of-control.

Daily determinations of precision, accuracy, and bias will be included in the final report.

### Results

Nine species of mammals, including beaver, were positively identified within the Ranch boundaries. During the summer survey 26 bird species were observed at the Ranch. Late winter - early spring observations will supplement the summer survey.

Results of chemical analyses of bird and animal tissue are not complete at this writing.

### Conclusions

In another study, Ray (1983) sampled similar denuded zones on the Clark Fork River upstream and downstream from the Ranch. These zones were similar to those located on the Ranch: Fluvaquents on the 3 to 5-year flood plain; lack of vegetation; fine, silt sized particles; little or no soil profile; frequent lenses of fine sand and silt; and clay-like particles at lower depths.

Both the upstream sites (at Rocker and Racetrack) and the downstream sites

(Garrison and Drummond) exhibited arsenic, cadmium, and copper concentrations 30 to 80 times higher than control site levels.

This metal contamination over the Clark Fork is not isolated, and comparable concentrations are likely to exist at the Ranch. The upstream metals could greatly limit isolated resource management options on the Ranch because future flooding and sediment transport is likely to continue to deposit metals there.

The Butte-Silverbow CERCLA (Comprehensive Environmental Response, Compensation and Liability Act of 1980, Public Law 96-510) or "Superfund" site was recently extended to below Deer Lodge, and now includes the Grant-Kohrs Ranch. The Milltown, Montana CERCLA site, located three miles from Missoula, includes an impoundment on the Clark Fork whose sediments are the likely source of arsenic contamination in groundwater. Tests of Milltown water have shown arsenic levels 10 times higher (50 mg/l) than Federal Drinking Water Standards.

It appears that the heavy-metal contamination in the Clark Fork is not an isolated phenomenon. If soil, vegetation, and biota exceed acceptable metals levels at the Grant-Kohrs Ranch, Ranch Resource managers should consider joining with other land and resource managers in approaching metals contamination as a drainage-wide problem in the Clark Fork.

#### Literature Cited

- Ray, Gary. 1983. Toxic metal enrichments from mining and smelting operations in riverside sediments of the Upper Clark Fork River. Graduate Student Report, Botany 556. Gordon Environmental Studies Lab., Dept. of Bot., Univ. of MT.
- Munshower, F. F. 1972. Cadmium compartmentation and cycling in a grassland ecosystem in the Deer Lodge Valley, Montana. Ph.D Thesis, Univ. of MT, Missoula. 106 pp.