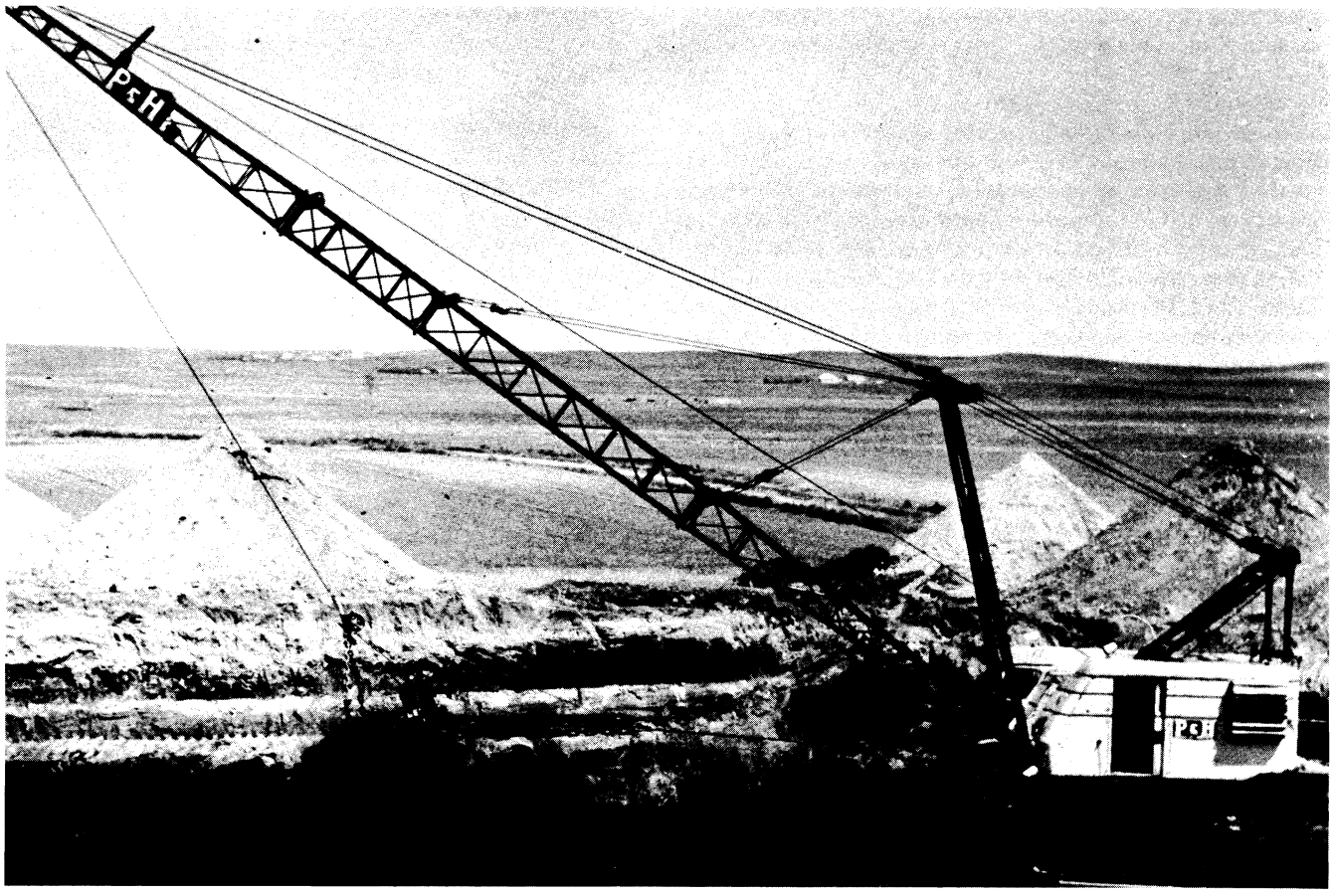

GRAZING RECLAIMED STRIP-MINED SITES

L. Hofmann, R. E. Ries, J. F. Power, and R. J. Lorenz

Grazing will become an important use for reclaimed strip-mined land. Little is known about grazing management on these areas or the effect grazing will have on vegetation and soils. A grazing study, initiated in spring 1976, is providing information to determine some of these effects.

Dr. Hofmann is Research Agronomist, Dr. Ries Range Scientist, Dr. Power Soil Scientist, and Dr. Lorenz Research Agronomist and Director, USDA Northern Great Plains Research Center, Mandan, ND.

This research is partially supported by funds from the Environmental Protection Agency(EPA) and the Surface Environment and Mining (SEAM) program of the U.S. Forest Service.

North Dakota and adjoining states have large acreages underlain with coal suitable for strip mining. After mining and reclamation, much of this land will be used for grazing. These lands, in a sense, can be considered as "new" lands because their "reclaimed" characteristics will differ from their premining characteristics. As a result, plant species which grow after mining may differ from species which grew before mining. Grazing re-

search has been conducted extensively for years in North Dakota, but none has been done on this "new" type of land.

Disturbing land for coal mining has produced a need for new methodology. Chemical analyses of soils, fertilizer requirements and soil amendments, methods of establishing vegetation, and the adaptation of various species may be different. Therefore, possibly grazing management on these lands also may have to be different. A question of major concern is, will abuse of this "new" land by overgrazing have more serious consequences than overgrazing nonmined land? Information to answer this is not presently available.

We initiated a grazing study in 1976 on reclaimed mined land that should provide some of the information. Land mined by the Baukol-Noonan Mining Company near Center, North Dakota was shaped and seeded to a mixture of smooth bromegrass, crested wheatgrass, intermediate wheatgrass, alfalfa, and biannual sweet clover in 1973. In the spring of 1976, the study area was released from bond and returned to its original owners. The Northern Great Plains Research Center, a part of the Science and Education Administration, United States Department of Agriculture, then leased the experimental site.

Three grazing rates were established for the study. Pastures of 1.8 acres, (0.7 hectares), 3.6 acres (1.4 hectares), and 5.4 acres (2.1 hectares) were each grazed with three yearling steers at stocking rates of 0.6 (0.24 hectare), 1.2 (0.48 hectare) and 1.8 (0.72 hectare) acre/animal, representing heavy, moderate, and light grazing intensities, respectively. Within each pasture, two 50- by 100-foot (15- x 30-meter) exclosures were fenced as ungrazed controls. Pastures were grazed in spring because this is the optimum time to graze the cool-season, introduced species which predominate at the site. Grazing was continued until vegetation from the moderate treatment was about half utilized. The effects of the three grazing intensities can be compared with each other and with the ungrazed controls by measuring changes in vegetation, soil, and the response and condition of the animals. All treatments were duplicated, giving a total of six pastures.

Two years' data have been obtained thus far. In 1976, grazing was started on May 25 and ended on July 23 for a 55-day grazing season. On May 25, 1976, all pastures had essentially the same amount of forage available per acre because they had not been previously harvested. In 1977, grazing began on May 26 and ended on June 26 for a 30-day season. Precipitation during this period and for the previous fall and winter was only about half of normal.

Effects of grazing at different intensities in 1976 carried over into 1977. At the end of grazing in 1976, 625, 1880, 2280, and 3330 pounds/acre (756, 2112, 2560, and 3734 kg/ha) of vegetation remained for the heavy, moderate, light, and ungrazed intensities, respectively. At the beginning of grazing in 1977, 650, 1890, 2640, and 2740 pounds/acre (732, 2116, 2958, and 3073 kg/ha) of vegetation dry matter was available for each of the respective intensities. When grazing was completed in 1977, harvestable forage remained in all pastures except those heavily grazed.

The heavy removal of forage by the steers in the heavily grazed pastures in 1976 and again in 1977 was reflected in their average daily gains (ADG) and the beef gains per acre. No statistically significant differences in ADG were recorded in 1976 or 1977 for the light or moderate treatments; each steer gained about 2 pounds/day (0.9 kg). But those grazing in heavily grazed pastures gained 1.5 pounds (0.7 kg) in 1976 and only 0.9 pounds (0.4 kg) per day in 1977. Gains per acre were 149, 86, and 72 pounds (167, 96 and 81 kg/ha) in 1976 and 49, 52, and 36 pounds (55, 58, and 41 kg/ha) in 1977 for the heavy, moderate and light pastures, respectively. The lower production in 1977 reflects a shorter season and probable drought effects. However, the significant observation is the decline in production under the heavy grazing intensity in 1977. The trend towards higher gains per acre as stocking rates were increased in 1976 resembled those obtained from grazing studies on unmined land. But the relative reduction in gain produced per acre under the heavy intensity in 1977 indicated animals lacked adequate forage and were probably losing weight. So far, only the 1977 data includes grazing intensity effects. Additional data are required so that climatic differences, animal differences, and longer-term grazing effects can be fully analyzed. Therefore, similar data will be obtained for three additonal years at which time final effects of grazing intensities on vegetation and animal production can be concluded.

The composition of the vegetation was determined with point frames which estimate the compostion of species and the percentage of plant cover in rangeland. A frame with 10 sliding pins was placed vertically at predetermined locations along six randomly placed permanent line transects within each pasture. Also, each exclosure contained one transect. The first pin in the frame was slid downward until it hit an object which was recorded. The second pin was slid downward, another hit was recorded, and so on. All hits were added and the percentage of each object hit was calculated. These percentages gave an indication of the species composition and amount of cover in each pasture.

Living vegetation was hit 45 per cent of the time in ungrazed exclosures at the close of the 1976 grazing season. Of these live vegetation "hits," 45 per cent were smooth bromegrass, 20 per cent alfalfa, 19 per cent intermediate wheatgrass, 15 per cent crested wheatgrass, and 1 per cent other species. No harvests or clippings had been made prior to the grazing study, so another 45 per cent of the "hits" were litter (dead vegetation or foreign organic matter) and the remaining 10 per cent were bare soil or rocks. Changes in vegetative cover resulting from grazing will be determined by making similar measurements in the pastures and the ungrazed controls each year until the study is terminated in 1981.

Other investigations include changes in chemical and physical properties of the soil caused by grazing treatments. Soil water supply and storage are being measured

by periodic sampling with neutron probes. Penetrometer readings are being used to determine if trampling resulting from grazing intensity affects compaction. Bulk density and root biomass data also are being collected during the study.

The spoil materials at this grazing site have few, if any, properties that restrict plant growth. They were low in sodium and soluble salts and even without the addition of topsoil, good grass stands were obtained. This site may not be representative of many of those expected to be released from bond in the future because this site was reclaimed before topsoil replacement was required by North Dakota law. However, results from this study should provide some indication of what problems may arise as a result of grazing reclaimed mine lands.

To date, we do not have the data to permit us to compile or develop grazing recommendations for reclaimed land. We do not know if special precautions are mandatory or if problems will arise as reclaimed land is again grazed. It will take several years of study before we know the effects of drought or overgrazing. The same basic data will be required that have been gathered for years on unmined land to determine if the effects of grazing mined or unmined land are comparable. Continued monitoring and evaluation of data from this study should supply information necessary to answer questions on the effects of grazing the "new" lands in North Dakota and in other areas in the Northern Great Plains.

Steer grazing pasture on reclaimed strip-mined land.

Continued from Page 2.

manage in a way which will allow the greatest and most sustained production from the most dominant and desirable species. Failure to recognize and manage the range according to known principles results in the slow but certain elimination or lowered production of the desirable plants and an increase in the less desirable. Associated with this change in the composition of the prairie may be loss in soil structure, water intake, loss of nutrients, and increased soil erosion. The end result is a greatly reduced amount of animal product which can be realized from each acre of native rangeland.

Agricultural experiment stations throughout the United States, Canada, and Mexico have only recently begun to recognize the immense importance rangelands will play in the future of animal agriculture. National and regional task force reports indicate a need to increase red meat production from the nation's rangelands by a minimum of 100 per cent over the next two decades. Plans for a more concerted effort by the western states, including North Dakota, have been developed and elaborated by appropriate committees appointed by the different state experiment stations under the auspices of the Great Plains Agricultural Council and federal agencies. One of the major difficulties in instituting rangeland research as such is that rangeland is still being viewed as a commodity instead of the natural renewable resource that it actually is. The obscuring of rangeland and research by fragmentation of effort and division among numerous research problem areas (RPA) within broad resource and commodity designations has greatly reduced or inhibited productive efforts related primarily to the solving of problems unique to rangelands.

New emphasis on integrated beef and grassland research has been instituted and is presently being carried out by several departments from North Dakota State University as multidisciplinary research under the state and federal cooperative efforts supported by a recently created organization known as the Beef and Grass Committee for the state of North Dakota. Cooperative research between the U.S. Forest Service, the Sheyenne Grazing Association, Agricultural Research Service, and the Agricultural Experiment Station is a model of the positive approach to carrying out research which will both satisfy and benefit the many demands and kinds of uses by the different agencies and livestock producers.

The proposed Central Grassland Research Station on the Coteau area of North Dakota is yet another positive indication of the recognition of the necessity to manage the native grassland for its full potential along with the integration of seeded forage grasses and legumes as complementary pastures for a maximized livestock production system. Management techniques utilizing deferred and rotation grazing schemes, fertilization of seeded and selected native ranges, burning, combining different classes of livestock, and more effective livestock distribution systems are proven methods which can be applied by the more intensive and profit minded manager. At the same time, research must move forward in the continuing development of more and better forage grass varieties, breeds of animals, and application of the techniques already mentioned in a more intensive and systematic level of management. It must be recognized that these rangelands can be utilized most effectively and efficiently by the grazing animal by the direct conversion of forage plants to the production of red meat.

The recognition of the critical role that native rangelands now play and the increased demand for red meat production, recreational use, watershed management, wildlife development, energy and coal mining, and natural gene pool preservation at the national and global levels can only serve to urge us to continue our present efforts with ever more diligence and intensity. Nature has provided us with a reliable but very complex system; our challenge is to maintain and perhaps even improve its productive capacity for the benefit of all mankind.