# Discussion of "Biomass and Forage Production from Reclaimed Stripmined Land and Adjoining Native Range in Central Wyoming "by Lang *JRM* 35:755 A Viewpoint

PHILIP R. OGLE AND BOB GIURGEVICH

Lang compared several vegetation parameters between reclaimed stripmined lands and rangelands. We, the authors, have several years experience in the analysis of permits to mine and/or compliance assessment under provisions of the Wyoming Environmental Quality Act. Our experience suggests that there is critical need for derivation of a sound, accurate data base addressing the short-term and long-term success of revegetation practices in Wyoming (and adjacent arid/semi-arid lands). We believe the conclusions drawn by Lang are inadequately documented by the design and execution of the study. The article also conveyed some improper impressions.

## Statutory definition of production:

Lang stated "interpretation of the term production is variable". This statement is correct only from a conceptual standpoint. Guidelines published by the Wyoming Department of Environmental Quality, Land Quality Division (WDEQ/LQD) have specified that aboveground biomass production be collected during pre-mining vegetation inventories. These guidelines were first formally published in 1976; subsequent editions have reiterated the use of standing crop biomass as the appropriate measure of production and as the standard for evaluation of reclamation success. WDEQ/LOD's interpretation of the term production has not been variable.

## Reclamation success standards:

In his conclusions, Lang implied that only production is considered when evaluating reclamation success on coal stripmined lands. Lang's statement in the introductory remarks that production is *one* of the success standards was correct. Since August, 1977, the federal Surface Mining Control and Reclamation Act (PL 95-87) has required assessment of several critical vegetation parameters. The Wyoming State Program for coal mining under PL 95-87 lists the following vegetation parameters for evaluation of reclamation success: vegetation cover, total cover (vegetation and litter and rock), production, species diversity, species composition, shrub density, and the ability of the post-mining communities to support grazing.

Authors are range scientist, Wyoming Department of Environmental Quality, Land Quality Division, Abandoned Mine Lands Program, Cheyenne, Wyo. 82002; and environmental specialist, Wyoming Department of Environmental Quality, Land Quality Division, District III Office, Sheridan, Wyo. 82801.

**Experimental designs:**

Lang concluded (with major qualifications) that "spring seeded areas were more productive than fall seeded areas in this study", but the experiment was not specifically designed to address this question. The author noted that precipitation and other climatic factors may influence seeding success. However, no attempt was made to show that other sources of variation were considered. For example, different methods of handling materials or different physical characteristics of the overburden and/or topsoil materials could directly influence vegetation establishment. Similarly, the 3 separate years of seeding (1973, 1974, 1975) could exert major influences on the results. Since none of these potential influences were "controlled" in the experimental design, the conclusions on seeding time were very tenuous.

**Extent of sampling effort:**

Lang's sampling regime for the revegetated area constituted a sample size of N=1 for each area. Each transect, even though it had 10 1-meter square plots, was statistically a single sample. The sample size for the native range was N=4. Clearly, there is no statistical validity associated with a sample size of N=1. These production estimates cannot be statistically compared. Thus, the conclusions regarding differences in production among vegetation communities were questionable.

*Production and species diversity*

Lang stated that the native range near Glenrock, Wyoming is quite variable and that the most common vegetation type is a sagebrush-grass type. In his sampling effort on the native range it was found aboveground biomass varied largely in response to the amount of big sagebrush *(Artemisia tridentata)* in the harvested plots and that big sagebrush equaled 45.3% of the biomass production while grass and grasslike plants equaled 34.7%. Slightly over 20% of the total aboveground biomass was found to be from species that contribute nothing as forage. In his samples it was found that from 8 to 12 species were common in the sagebrush-grass type.

This description of the native range seems misleading when compared to premining vegetation data from the Dave Johnston Mine 13 miles northeast of Glenrock, Wyoming, where 6 vegetation types were identified and quantitatively sampled. Table 1 shows data compiled from this permit application which indicate several interesting points about the native range communities of the Glenrock area. As can be seen from these data, production of aboveground biomass does tend to increase with an increase in big sagebrush. However, big sagebrush is only a dominant component in the sagebrush shrubland type where woody plants reach a high relative cover of 32.3% and big sagebrush makes up 44.5% of the aboveground biomass. In other communities woody plants (including big sagebrush) range from 4.3% to 21.6% of the aboveground production. Perhaps Lang's samples would have been more meaningful had the variability, within what was classified as a sagebrush-grass type, been more carefully considered.

It is also evident that the number of species present was greater than the 8 to 12 found by Lang. This would tend to discount the conclusion that the reclaimed areas were as diverse as native rangelands.

Table 2 provides cover and species richness data which were collected approximately 20 miles north of Glenrock at the Bear Creek Uranium Mine. These data tend to agree with the data from the Dave Johnston Mine and conflict with Lang's data.

Some reasons the data presented by Lang may not properly describe the native range in the Glenrock area are (1) the small number of samples collected in the native range, (2) sampling of areas where big sagebrush was of particularly high density, and (3) improper delineation of vegetation types.

**Crested and desert wheatgrass on reclaimed areas:**

Lang stated that crested wheatgrass *(Agropyron cristatum)*, and

**Table 1. Descriptive data for three undisturbed (pre-mining) plant communities at the Dave Johnston Mine, Converse County, Glenrock, Wyoming.[1]**

| | Vegetation types | | |
|---|---|---|---|
| | Upland grassland | Sagebrush grassland | Sagebrush shrubland |
| Sample size | 29 | 31 | 25 |
| Total mean production (kg/ha) | 380 | 393 | 529 |
| Relative cover (%) | | | |
| Graminoids | 85.5 | 74.6 | 62.5 |
| Forbs | 2.8 | 2.0 | 2.3 |
| Woody plants | 6.8 | 17.7 | 32.3 |
| *(Artemisia tridentata)* | — | — | — |
| Succulents | 0.6 | 1.3 | 0.6 |
| Above ground production (%) | | | |
| Graminoids | 83.0 | 74.6 | 48.7 |
| Forbs | 12.7 | 3.8 | 3.9 |
| Woody plants | 4.3 | 21.6 | 47.4 |
| *(Artemisia tridentata)* | (0) | (18.6) | (44.5) |
| Succulents | Not clipped | Not clipped | Not clipped |
| Number of species | | | |
| Graminoids | 9 | 10 | 12 |
| Forbs | 17 | 13 | 11 |
| Woody plants | 10 | 8 | 5 |
| Succulents | 1 | 1 | 1 |
| Total | 37 | 32 | 29 |

[1]Source of data was the permit-to-mine application for the Dave Johnston Mine, submitted to WDEQ/LQD 10-8-80. All data were gathered in 1979. Production and cover sampling locations were selected randomly. Production samples were clipped from 0.5 m² plots and cover data were established by using a 10-point sampling frame at 10 m intervals along a 90 m transect.

**Table 2. Descriptive data for two undistrubed (pre-mining) plant communities at Bear Creek Uranium Company's surface mine, Converse County, Wyoming.[1]**

| | Vegetation types | | |
|---|---|---|---|
| | Upland grassland | Sagebrush grassland | Sagebrush shrubland |
| Sample year | 1982 | 1982 | 1980 |
| Sample size | 21 | 20 | 30 |
| Total mean production (kg/ha) | 538 | 390 | 573 |
| Relative cover(%) | | | |
| Grasses | 67.2 | 56.1 | 59.1 |
| Grasslike | 14.9 | 14.5 | 7.6 |
| Forbs | 14.9 | 8.1 | 9.1 |
| Shrubs | 1.1 | 20.8 | 21.2 |
| Succulents | 1.2 | 0.5 | 3.0 |
| Number of species | | | |
| Grasses | 11 | 11 | 8 |
| Grasslike | 2 | 2 | 2 |
| Forbs | 23 | 13 | 12 |
| Shrubs | 2 | 2 | 1 |
| Succulents | 2 | 1 | 1 |
| Total | 40 | 29 | 24 |

[1]Source of data was the permit-to-mine application for the Bear Creek Uranium Mine, submitted to WDEQ LQD 6-17-78. Data were gathered in 1980 and 1982. Production and cover sampling locations wre randomly selected. Production samples were clipped from 1.0 m² plots and cover data were collected by lowering a pin at 2 ft. intervals along a 100 ft. transect.

desert wheatgrass *(Agropyron desertorum)* are well adapted to the area around Glenrock and are very productive, but he qualified these statements with their requirements for special management. He, however, failed to elaborate on other problems incurred when trying to manage crested or desert wheatgrass. It is well documented that after several years of grazing, yields of crested and desert wheatgrass, decrease and outside inputs such as fertilizer are necessary if high productivity is to be maintained. Rauzi et al. (1971) found that the yields of crested wheatgrass were favorable for several years but then declined because of overuse or depletion of available nutrients.

Erosion is also considered a problem on areas having pure stands of crested wheatgrass. McWilliams and VanCleave (1960) concluded from their study that a mixture of native species controlled erosion better than crested wheatgrass alone and provided long-term production.

Lang also indicated that invasion was beginning to occur in the seeded crested wheatgrass stands. The author found 7 to 13 species in these seeded stands and compared those numbers favorably to the adjacent native range. However, as was shown earlier, the number of species found by Lang was low when compared to other studies made in the area. Thus, the author's comparisons between seeded stands and native range may be improper. The usefulness of these invading species cannot be properly judged since they are not listed. It is easy to see that they are not yet a dominant portion of the community since crested and desert wheatgrass make up 83.2% of the aboveground biomass.

## Conclusion

Reclamation success can only be judged with time. If estimates of success are to be made in the short-term, then statistically sound, objective data for undisturbed areas and reclaimed areas are vitally necessary. In the absence of a thorough and statistically adequate sampling effort, it is difficult to judge the usefulness of a data set.

Data from Lang (1982) may provide information on stand establishment and invasion but it is difficult to tell if any other information can be gained from the small number of samples. This is also true of the sampling effort in the native range. Some descriptive information is available from the study but it does not appear to truly provide a precise description of the native range.

Since relatively few data exist on the topic of long-term reclamation success, the publication of poorly substantiated or at best preliminary survey type data greatly hinders progress toward assembly of an accurate, verifiable data base. If the vital question of long-term revegetation success is to be answered, we need precise, statistically sound, objective data.

## Literature Cited

**McWilliams, J.L. and P.E. VanCleave. 1960.** A comparison of crested wheatgrass and native grass mixtures seeded on rangeland in eastern Montana. J. Range Manage. 13:91-94.

**Rauzi, F., L. Landers, and A. Herold. 1971.** Renovating crested wheatgrass stands. Wyo. Agr. Exp. Sta. R.J. 52.