V.5 Local Movement of Grasshoppers Between Public Rangeland and Irrigated Pastures in Southern Idaho

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On the ground or in flight, grasshoppers have great powers of mobility that allow them to disperse in a way that aids their survival (Dingle 1980, Drake and Farrow 1988, Farrow 1990, Joern 1983, McAnelly and Rankin 1986, Parker et al. 1955). During major outbreak years, ranchers and farmers have noted "clouds" of grasshoppers migrating from one area to another. The exact origin of the migrating grasshopper bands, direction and distance traveled, and the reasons why they disperse are poorly understood for most North American grasshopper species (Riegert et al. 1954, Shotwell 1941). Chapman et al. (1978), Dingle (1972), Southwood (1981), and Uvarov (1977) have given general accounts of insect migration. Laboratory studies have been used to help understand grasshopper flight in confined environments (Riegert 1962).

But the study we conducted is about more localized movement of grasshoppers across the narrow transitions between public rangeland and privately owned, irrigated pastures. A general perception exists that grasshoppers migrate from highly disturbed, overgrazed public rangeland to the more lush, irrigated cropland–pastureland, causing considerable damage to the latter (fig. V.5–1). In southern Idaho, the boundaries between private and public lands, most of which are managed by the U.S. Department of the Interior's Bureau of Land Management (BLM), are long and irregular and usually marked by a fence. Nearly 2 million acres (809,717 ha) make up the BLM Shoshone District. This district is located in the sagebrush–grass ecoregion of southern Idaho. Areas having deeper and more productive soils are largely under private ownership.

The question of whether grasshoppers migrate from public to private land or vice versa and the reasons for localized movements formed the basis for our study. Numerous factors potentially influence the direction and extent of grasshopper migration. Some of these factors include soil moisture; plant composition, height, quality,

Figure V.5–1—An Idaho study provided new information on the belief that grasshoppers migrate from public rangelands to privately owned pastures.

and moisture; vegetative cover; wind velocity; grazing disturbance; predators, inter- and intraspecific competition; grasshopper age and physiological state; and genetically related behavior, such as egg-laying. Our investigations and interpretations were limited to plant cover, composition, moisture content, and height, particularly as they related to grazing of public rangeland and adjacent irrigated pastures.

The Study Area

We studied the lesser migratory grasshopper, *Melanoplus sanguinipes*, and used adults because they display the greatest powers of mobility. The study took place in and adjacent to a 321-acre (130-ha) sprinkler-irrigated pasture bordered on the north, east, and west by BLM rangeland. Studies centered on the west border in 1991 and east border in 1992 to test for directional movements of grasshoppers in response to different rest-rotation grazing regimes, range conditions, prevailing winds, and irrigated pasture conditions.

In 1991, 2 populations of 500 adult *M. sanguinipes* each were differentially marked with fluorescent markers and released in the centers of 2 adjacent 98.4×98.4-ft (30×30-m) plots separated by a fence. The west-side plot was on BLM rangeland that had been rested (not grazed) since the previous year. The east-side plot was on a well-utilized (currently grazed), legume–grass, irrigated pasture. In 1992, 2 populations of 400 grasshoppers each were marked and released in a similar manner, except the plots were on the east side of the irrigated pasture. Again, extensive grazing occurred on the sprinkler-irrigated pasture at the time of the study. Extensive grazing on the BLM pasture during early summer had resulted in a dry, depleted rangeland condition consisting mostly of heavily cropped crested wheatgrass. After releasing marked grasshoppers, we counted them during the night, thus minimizing movement resulting from investigator disturbance. We counted all the marked grasshoppers within the plot borders at 24, 48, and 96 hours after release.

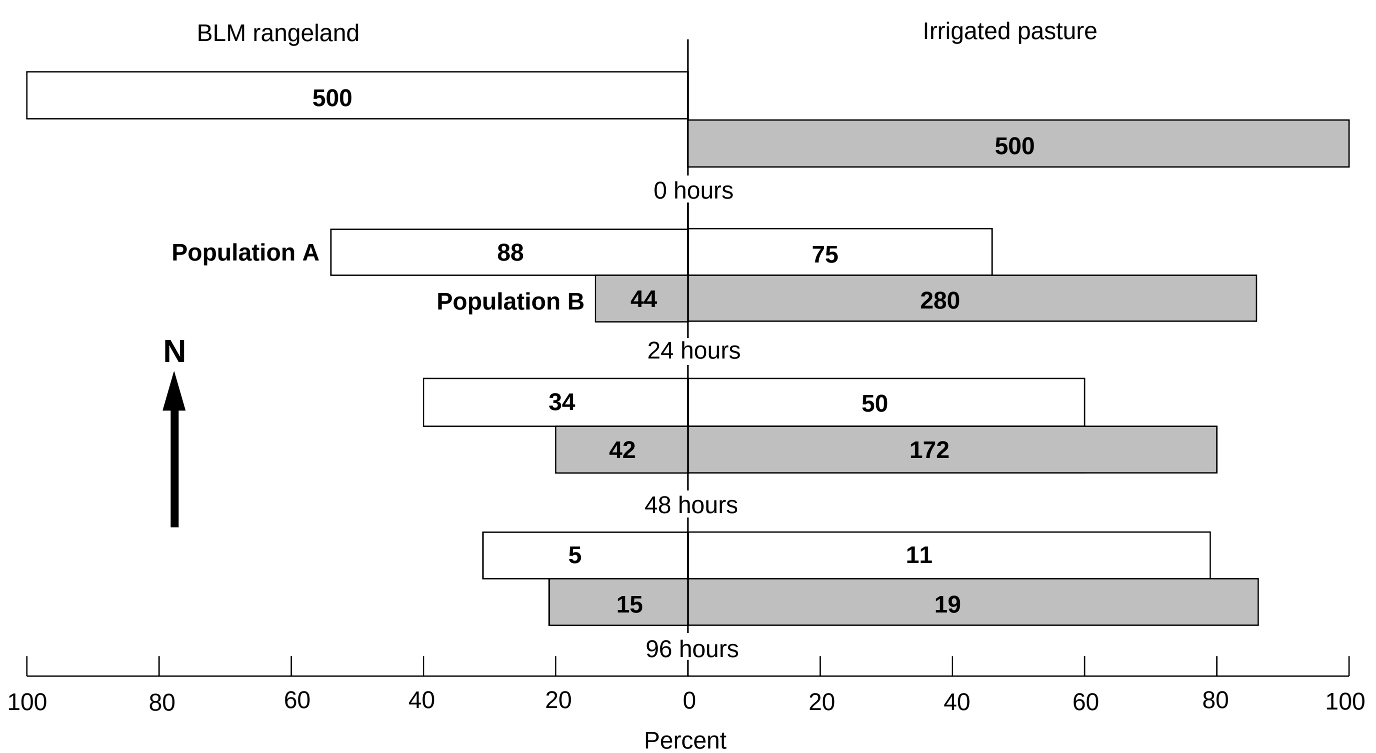

Figure V.5–2—Percent distribution of marked grasshoppers within adjacent rangeland and irrigated pasture plots at 24, 48, and 96 hours after their release, 1991. Numbers inside bars are actual counts.

What We Found

Grasshopper movement between private and public lands differed markedly between the 2 years with regard to “net” directional dispersal. Because the marked populations were not confined to specific plots, the insects’ ultimate movement could be in any direction from the release point and could extend beyond the plot perimeters. For purposes of interpretation, we recorded only marked grasshoppers within adjacent plots. Figures V.5–2 and –3 graph the results on a relative basis (percent of total marked) for each time interval.

In 1991, with prevailing winds from the south to southwest ranging from 6 to 12 miles per hour (mi/hour) (10 to 19 km/hour), net movement of marked populations was easterly from the BLM rangeland to the irrigated pasture (fig. V.5–2). The grasshoppers released in the irrigated pasture showed a much higher affinity for that habitat than grasshoppers released in the BLM plot; however, there was a noticeable presence of grasshoppers from the irrigated pasture in the BLM plot at all times. Only 3 and 5 percent of the marked populations were accounted for in the adjacent plots after 96 hours, indicating a progressive outward dispersal from the release points in all directions.

Because the BLM plot was rested during the spring and summer months preceding the study, the vegetative condition was fair overall, with good plant height and fair cover. The irrigated plot had greater plant cover and moisture content than the BLM plot. Distribution of grasshoppers within the plots correlated significantly with plant height but not with the percent of moisture or cover (bare ground).

In 1992, dispersal patterns were profoundly different from the previous year (fig. V.5–3). Strong, gusty winds from the west and southwest ranged from 14 to 24 mi/hour (23 to 39 km/hour) during the period of study. We recovered only two marked grasshoppers in the heavily grazed BLM plot during the 96-hour test and

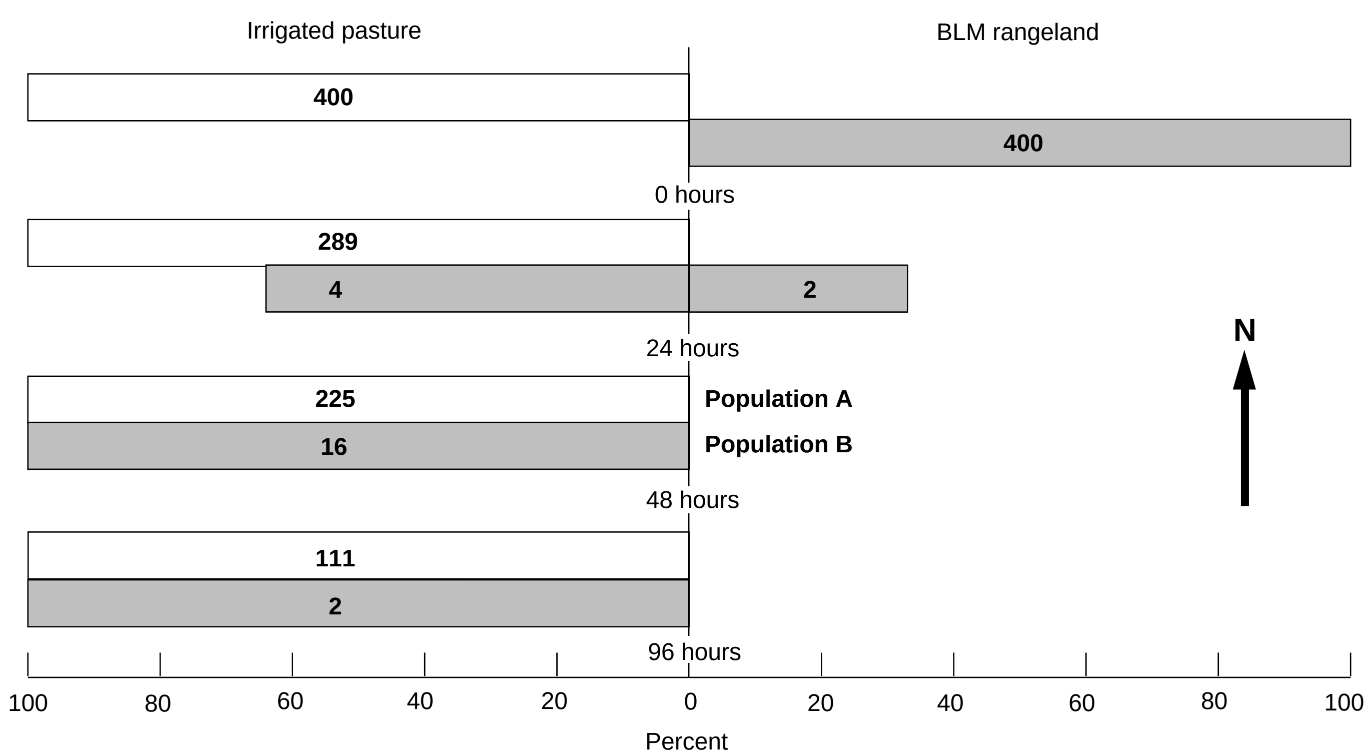

Figure V.5–3—Percent distribution of marked grasshoppers within adjacent BLM rangeland and irrigated pasture plots at 24, 48, and 96 hours after their release, 1992. Numbers inside bars are actual counts.

found 12 of the marked grasshoppers from the BLM plot in the irrigated pasture plot. Conversely, we found no grasshoppers from the irrigated pasture in the BLM plot and noted a very high level of retention of grasshoppers within the irrigated pasture with more than 25 percent still accounted for after 96 hours. The heavily grazed BLM plot was clearly unfavorable to the grasshoppers. Nearly all had moved from the plot within 24 hours or were lost to predation, a factor not readily measurable. The BLM plot was nearly a monoculture of heavily cropped crested wheatgrass. A diversity of weedy forbs was generally absent from the plot, undoubtedly contributing to its objectionable habitat quality for *M. sanguinipes*, which is a mixed feeder preferring forbs.

We believe that strong, westerly to southwesterly, gusty winds aided the dispersal of grasshoppers from the BLM plot in a general downwind direction (northeasterly), even though positive chemical cues were likely coming from the highly diverse, succulent, irrigated pasture to the west. Again, we emphasize the significance of much higher plant height (nearly 3 times greater), plant diversity (mixture of weedy, invasionary plants, grasses, and pasture legumes), and greater vegetative cover (about 2.5 times greater); all are contributing factors to the high retention of grasshoppers in the irrigated pasture compared to the heavily grazed BLM plot, in spite of high, gusty winds.

Conclusions

As to the question of whether grasshoppers migrate from public rangeland to adjacent irrigated pastures, the answer is "not always." Numerous factors operate individually or together to influence the direction, distance, and magnitude of grasshopper migration. The present study addressed only public rangeland and irrigated pastures. Other types of crops adjoin public rangeland and provide interesting challenges for future studies. A basic axiom of life applies to grasshoppers as with most other mobile organisms on rangeland: When the requirements of survival are limiting (for example, depleted habitat) grasshoppers will migrate, either actively or passively, (wind-aided movement) in search of more favorable habitat conditions.

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