VI.4 Regional Economic Thresholds in Grasshopper Management

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Rangeland grasshopper treatment programs traditionally have started when an economic threshold (ET) was reached. In 1939, Parker defined 8 grasshoppers/yd^2 as the density of grasshoppers at which economic damage to the rangeland begins. Therefore, this density became a "trigger" for beginning consideration of a treatment program. Until recently, the 8 grasshoppers/yd^2 intervention level was used for evaluating grasshopper treatment programs on public rangelands throughout the Western United States.

Recent definitions of ET's and economic injury levels (EIL's) by economists and entomologists have shown that these concepts are dynamic in nature and must be evaluated for each site under consideration for treatment. Key economic parameters to evaluate include ranch type, rangeland productivity, cost of alternative sources of forage for livestock, and nontreatment options available to the rancher. Biological parameters for evaluating an ET and/or EIL depend on density of grasshopper species, life stage at time of treatment, mix of economic/noneconomic species, and presence of beneficial insects. Other factors of importance are closeness to waterways and presence of rare and endangered species.

The Grasshopper Integrated Pest Management Project has provided estimates of ET's for eight important range-type regions in the Western States. Within these range-types, typical ranches are defined—ranches that characterize the predominant ranching practices of the area, as discussed in chapter VI.3. Between range-types, ranches vary considerably with respect to amounts, types, and costs of forage used. Livestock production and management strategies also differ between range ecoregions. An evaluation of these typical ranches through Hopper shows how the economic justification for treating rangeland grasshoppers changes between locations and ranching systems.

Range-Type Regions

The range-type regions included in Hopper are those identified by U.S. Department of Agriculture, Animal and Plant Health Inspection Service (APHIS), Plant Protection and Quarantine (PPQ) personnel as having recurring grasshopper infestations. Nine typical ranches are defined for the eight generalized range-type regions. While county lines were used to designate the range-type regions, the regions should be considered to represent a general area. Similarly, local variation may cause some ranches within the defined area to be different from the typical ranches used to characterize ranching in the eight areas. See figure VI.4–1 for details.

Northern Great Plains.—Rangelands within the Northern Great Plains range-type vary between 2.2 and 3.3 acres per animal unit month (AUM). The grazing season is approximately 8 months long; cattle are placed on grazing lands about May 1 and continue to graze until December 31. On the typical ranch, half the forage comes public land, a quarter from private grazing lands, and the remaining quarter from hay and crop residue.

Ranchers are typically cow–calf operators. Calving begins in March. Most ranchers raise their own herd replacements. On average, about 86 percent of the cows bear a calf each spring.

Northern Highland Prairie.—Here grazing lands average about 4 acres per AUM. Since elevations in the Northern Highland Prairie are somewhat higher than in the Northern Great Plains, the grazing season is shorter. Grazing begins about May 1 and continues through early September.

There are two typical ranches defined for this range-type. One is a cow–calf ranch that gets 23 percent of needed forage from public grazing lands. Hay stocks are produced for winter feeding needs, and private rangeland supplies the balance of forage AUM's (56 percent) for the livestock. A calf crop of 85 percent is achieved, with the calving season starting in March.

Another typical ranch has both a cow–calf enterprise and a range sheep enterprise. This ranch receives 41 percent of forage AUM's from public rangeland, no hay is produced, and private grazing lands supply the balance of forage needs. Lambing begins about May 15; a lambing crop of 122 percent is the norm. The calving season for this ranch starts in March, with a calving percentage of 80 percent.

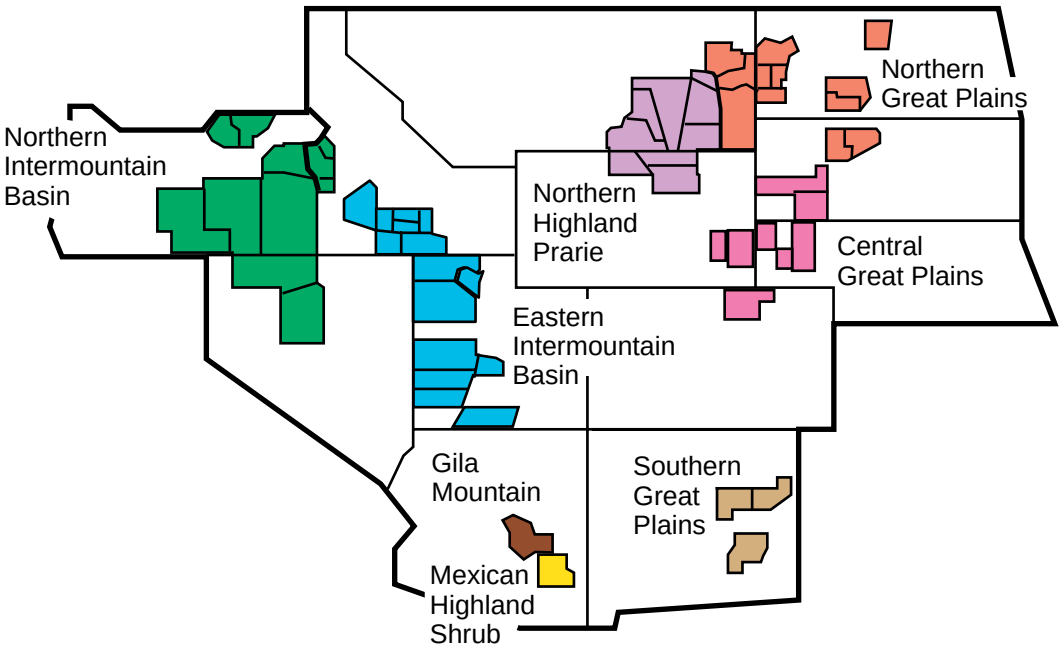

Figure VI.4–1—Map of the Western United States showing the eight generalized range-type regions.

Central Great Plains.—This region is characterized by highly productive rangelands of predominantly warm-season grass species. The typical ranch of about 2,200 acres of grazing land is a cow–calf operation with a 6-month summer grazing season. Grazing land can support approximately 1 animal unit (AU) per acre. Ranchers feed hay (supplying 14 percent of the total AUM's of forage) in the winter to supplement crop residue grazing. Public grazing land is available to only a portion of the ranches. Livestock graze on rangeland owned by the rancher and rangeland leased from other landowners.

Southern Great Plains.—The Southern Great Plains ranch has both cow–calf and sheep enterprises. There is an 8-month grazing season, with 34 percent of the total AUM's of forage coming from public rangelands. The typical ranch includes about 15,600 acres. Privately owned rangelands supply 26 percent of needed forage, and raised hay stocks supply the remaining 40 percent. The rangeland has a productivity rating of about 12 AU's per section (640 acres). The grass and forb species in this area are predominantly warm season, and most vegetative growth occurs in July, when the monsoon rains come.

Mexican Highland Shrub.—The typical ranch for this region is a cow–calf operation. Of total forage needed, 34 percent comes from public grazing land and 13 percent from privately owned grazing land. Another 10 percent is supplied by leasing private rangeland from other landowners. Raised hay stocks furnish the remaining 43 percent of forage. The elevation is low, and summers are very hot. Vegetative growth occurs when the monsoon rains come in late summer. Almost all plant species present are warm season. The grazing season is 9 months long.

Gila Mountains.—Grazing needs are satisfied for this cow–calf ranch with a year-round grazing season. Grazing land provides enough grazable forage to support an

AU for each 6.5 acres. There are no hay stocks produced. The split between public and private grazing lands is about 50–50. The grass cover in this region has high percentages of both warm- and cool-season grasses. Most vegetative growth occurs in late July with the onset of summer monsoon rains.

Eastern Intermountain Basin.—The typical ranch for the Eastern Intermountain Basin region is a cow–calf ranch that receives about 7 percent of its total forage supplies from public rangelands, 32 percent from leased private rangelands, 41 percent from owned rangeland, and 20 percent from hay produced on the ranch. Rangelands carry about 1 AUM/12 acres. The grazing season is year-round, with hay stocks supplementing the rangeland forage supplies during the winter. Public rangelands are used during the spring months.

Northern Intermountain Basin.—A cow–calf ranch was defined for this region. The grazing season starts in mid-April and runs until early November. Rangelands carry 1 AUM/9–10 acres. Public rangelands supply 44 percent of the total forage needs of the cow herd. Raised hay stocks supply 22 percent of the forage and are used in the winter months. Privately owned rangelands and leased private rangeland supply the remainder of forage needs (34 percent).

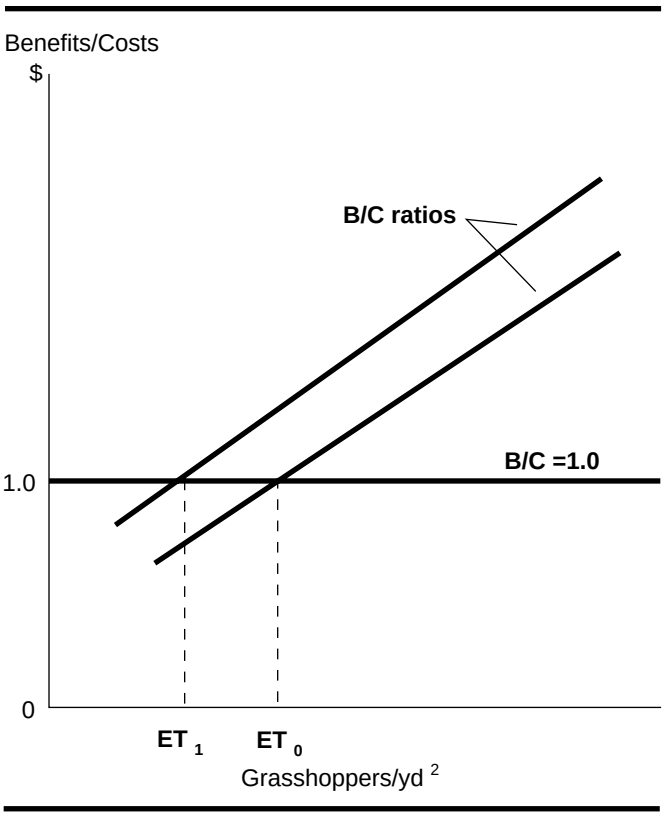

Figure VI.4–2—The relationship of benefit–cost ratios to economic thresholds.

Results

The ET is the point at which the incremental damage caused by rangeland grasshoppers becomes equal to the incremental cost of applying treatment programs (see chapter VI.3). The ET varies from year to year at a given site; during a given year, it varies between sites. Benefits are measured in terms of the prevention of grasshopper-caused reductions in net returns from rangeland (forage production). Costs are the dollars required to conduct a grasshopper treatment program.

In figure VI.4–2, how the ET is determined is illustrated by ET_0. The ET is reached when the ratio of benefits (B) to costs (C) is equal to 1; B/C = 1.0. At grasshopper densities that are less than where B/C = 1.0, damages are occurring but the cost of applying a treatment exceeds the amount of damage experienced. Only when the ratio of B to C reaches 1.0 or higher does treatment become economically justified.

Several factors may cause the ET to vary between years on any of the range-types shown on the map. A drought year will make grazable and harvested forage more valuable; the B/C line shown in figure VI.4–2 will shift to the left, indicating that the ET is reached at a lower grasshopper density (ET_1) than would occur during a year with normal precipitation. The cost and sources of forage to replace that destroyed by grasshoppers will also cause the ET to vary from year to year. If the cost of hay or leased grazing land decreases, the ET at which the B/C = 1.0 will shift to the right or to greater grasshopper densities.

Within a given year, variation in the productivity of rangeland results in a different ET for each range-type. The mix of cool- and warm-season forages and the emergence and maturing of grasshoppers relative to the growth of grasses also causes variation between sites. Further, the species mix of grasshoppers between grass feeders and mixed-forage feeders results in between-site variation in the grasshopper density at which the ET is

reached. The ET is quite sensitive to the species composition of grasshoppers so it becomes very important to identify the species of grasshoppers present in the nymphal survey (fig. VI.4–3).

The ET is a dynamic number which changes from year to year and place to place. The conditions may be such that a given grasshopper density is sufficient to reach the ET one year; conditions may have changed by the next year to where that density of grasshoppers does not meet the ET. The ET also can be expected to be different among each of the range types represented in Hopper.

Figure VI.4–3—Monitoring and identifying grasshopper populations while the insects are in the nymph (young) stage allows pest managers to make timely decisions. Knowing species composition is important for calculating the economic threshold. (APHIS photo by Mike Sampson.)