Effect of Two Long-term Mowing Regimes on Vegetation

Matthew C. Perry and Amy S. Deller[1]

Wildlife managers have for many years been interested in the role of mowing as a management technique to benefit wildlife. Patuxent Research Refuge (Laurel, MD) was established in 1936 and has conducted habitat management studies for many years. When the Refuge was established, the Snowden family residence (now called Snowden Hall) was surrounded by neglected overgrown lawns and old farm fields. Snowden Hall was immediately occupied by government workers and the lawns around the building were mowed on a fairly regular basis to maintain a satisfactory appearance. Three residences were constructed northwest of Snowden Hall between 1939 and 1941 and a similar lawn was maintained in front of these buildings. To the southeast of these two lawn areas and across a road, were two meadows that were maintained as hay fields as part of the farm wildlife program conducted at Patuxent.

The meadows were originally mowed 1-2 times a year for a hay crop, but in the mid 1960s the meadows were mowed annually with a brushhog to retard succession of woody vegetation and maintain the meadow habitat. All lawn and meadow areas at Patuxent received annual applications of fertilizer and lime until 1972 when these applications ended.

In 1997, all mowing at Patuxent was halted as a way to reduce maintenance costs. The lack of mowing and the subsequent growth of plants, with diagnostic fruiting parts, allowed a unique opportunity to identify all plants and estimate ground cover for each species. This paper reports the findings of this one-year study that was conducted to determine the dominant plants found growing under two mowing regimes.

Numerous studies have been conducted that evaluate the effect of mowing on vegetation and the resultant wildlife habitat (Frawley and Best 1991, Warner et al. 1992, Edge et al. 1995). Several researchers have implicated the mowing frequency or time of year as a factor causing declines of birds nesting in hayfields (Robbins et al. 1986, Warner and Etter 1989, Bollinger et al. 1990). These studies tend to show advantages to birds by delaying the time of mowing and reducing the frequency of mowing. No studies were found that compared the effects of two different long-term mowing regimes in the same area.

Methods

The mowing regimes for this study included areas that had been mowed with rotary mowers approximately every 2-4 weeks and meadow areas that were mowed approximately once a year with a brushhog. Each regime had two replications. The two lawn areas (Lawn A and B) were 0.63 ha and 0.33 ha and the two meadow areas (Meadow A and B) were 0.54 ha and 0.89 ha in size, respectively. Vegetation was sampled in 20 1-m^2 quadrats that were randomly selected in each area (n=80). All sampling of the plots was conducted between May 27 and June 11, 1997. Percent cover was estimated by species in each quadrat. Ground areas where no plants occurred were recorded as no cover.

On July 11, 1997, vegetation in all quadrats was cut with pruning shears at 10 cm above the ground and placed in paper bags. The bags were placed in an attic for drying from July 1997 to February 1998 during which temperatures ranged from 15-35°C. In February two of the samples were weighed and then placed in an oven at 38°C for six hours and checked several times to

[1]USGS, Patuxent Wildlife Research Center, 11410 American Holly Drive, Laurel, Maryland 20708 USA

determine if a constant weight had been reached. Because of minor changes in weight all other samples were assumed to be dry and were weighed without further drying.

The average percent ground cover of each plant species was compared using a Wilcoxon non-parametric 2-sample test. The average weights of dried plant material from all quadrats were compared using a Student's t-test. A probability level of 0.01 was chosen for determining statistical significance in all tests.

Results

Analyses of data indicated that all but two plant species that accounted for over 1.00% of ground cover, showed significant differences between the two treatments (Table 1). The percent ground cover of the dominant vegetation on the lawn area was 40.0% red fescue [*Festuca rubra L.*], 26.5% white clover [*Trifolium repens* L.], and 18.0% Kentucky blue grass [*Poa pratensis* L.].

The percent ground cover of the dominant vegetation in the meadow area was 33.2% meadow fescue [*Festuca pratensis* Huds.], 9.9% sweet vernal grass [*Anthoxanthum odoratum* L.], 9.2% orchardgrass [*Dactylis glomerata* L.], 6.3% Japanese honeysuckle [*Lonicera japonica* Thunb.], and 5.2% red fescue. White clover was not found growing in the meadow areas. All percent ground covers for the dominant vegetation were significantly different ($P<0.01$) between the two regimes.

Species richness was higher in the meadow regime (74) versus the lawn regime (33). Frequently mowed lawn areas may provide better grazing forage for herbivores, such as geese, rabbits, and deer, however, meadow areas may provide greater biomass (232 vs. 63 g m^{-2}) and greater diversity of plant species. The meadow regime also appeared to have greater seed production and cover which is favored by a wider variety of wildlife species, especially passerine birds and small mammals.

The percent ground cover of the dominant species in the meadow area was 33.2% for meadow fescue, which was only recorded covering 5.0% of the lawn areas. Sweet vernal grass was the second most dominant plant species in the meadow covering 9.9% of the ground compared to 0.8% of the lawn area. Orchardgrass covered 9.2 % of the meadow quadrats, but was not recorded in the lawn areas. The exotic Japanese honeysuckle covered 6.3% of the meadow areas, but was not recorded in the lawn areas. All percent ground covers for the dominant vegetation were significantly different ($P<0.01$) between the two areas. The average percentage bare ground was 1.0% for the lawn area and 9.4% for the meadow areas, which was significantly different ($P<0.01$) between treatments.

Other species that accounted for less than 1.00% of ground cover in both treatments, but were significantly different ($P<0.01$) between treatments included wild onion [*Allium* sp.], dogbane [*Apocynum cannabinum* L.], mouse-eared chickweed [*Cerastium arvense* L.], deertongue, autumn olive [*Elaeagnus umbellata* Thunb.], velvet grass, yellow sorrel [*Oxalis stricta* L.], Virginia creeper, common cinquefoil, dandelion [*Taraxacum officinale* Weber ex F. H. Wigg. group], low hop clover, corn speedwell [*Veronica arvensis* L.], vetch [*Vicia* spp.], and grape [*Vitis* sp.]. The meadow areas had a total of 74 species, whereas the lawn area had only 33 species.

Biomass was significantly greater ($P<0.01$) in the meadow area with less frequent mowing than the lawn area. Weights of vegetation in meadow areas ranged from 103.7 g to 394.8 g, with an average of 232.2 g. Weights of clipped vegetation from the quadrats in the lawn areas ranged from 6.4 g to 166.4 g with an average of 63.0 g. Meadow A had six quadrats with woody vegetation that averaged 64.3 g per plot. The greater biomass produced by the meadow areas was expected.

Table 1. Average percent cover (±1 SD) of plants recorded (>0.05%) in quadrats of lawn and meadow areas[1] of Patuxent Research Refuge, June 1997.

SPECIES[2]		% COVER (±1 SD)	
SCIENTIFIC NAME	COMMON NAME	LAWN	MEADOW
Agrostis sp.	Bent grass	1.0 (0.7)	0.0 (0.0)
Anthoxanthum odoratum L.	Sweet vernal grass	0.8 (0.6)	9.9 (2.4)
Cerastium arvense L.	Mouse-eared chickweed	0.6 (0.2)	tr (tr)
Cynodon dactylon (L.) Pers	Bermuda grass	1.0 (0.7)	0.0 (0.0)
Dactylis glomerata L.	Orchard grass	0.0 (0.0)	9.2 (2.0)
Dichanthelium clandestinum (L.) Gould	Deertongue	1.7 (0.7)	0.0 (0.0)
Festuca pratensis Huds.	Meadow fescue	5.1 (1.3)	33.2 (4.1)
Festuca rubra L.	Red fescue	40.0 (4.1)	5.3 (2.0)
Holcus lanatus L.	Velvet grass	3.5 (0.8)	0.0 (0.0)
Lespedeza cuneata (Dum. Cours.) G. Don	Bush clover	0.0 (0.0)	3.9 (1.6)
Liquidambar styraciflua L.	Sweetgum	0.8 (0.4)	tr (tr)
Lonicera japonica Thunb.	Japan. Honeysuckle	0.0 (0.0)	6.3 (0.9)
Parthenocissus quinquefolia (L.) Planch.	Virginia creeper	0.0 (0.0)	1.9 (0.4)
Plantago lanceolata L.	English plantain	1.7 (0.4)	tr (tr)
Poa pratensis L.	Kentucky bluegrass	18.0 (2.2)	0.4 (0.2)
Potentilla simplex Michx.	Old-field cinquefoil	1.0 (0.3)	0.3 (0.2)
Rosa multiflora Thunb.	Multiflora rose	0.0 (0.0)	1.4 (0.5)
Rubus sp.	Blackberry	0.0 (0.0)	1.5 (1.3)
Rumex acetosella L.	Sheep sorrel	1.5 (0.6)	tr (tr)
Toxicodendron radicans (L.) Kuntze	Poison ivy	tr (tr)	3.1 (0.6)
Trifolium dubium Sibth.	Low hop clover	1.2 (0.3)	tr (tr)
Trifolium repens L.	White clover	26.5 (2.5)	0.0 (0.0)
No Cover		1.0 (0.3)	9.4 (1.3)

[1] All species and no cover significantly different ($P<0.01$) between treatments except Bent Grass and Bermuda grass.
[2] Scientific and common names follow Brown and Brown (1972, 1984).

CONCLUSIONS

Two long-term mowing regimes (60 years of similar management) were evaluated at Patuxent Research Refuge during the summer of 1997 to better understand the influence of mowing on vegetation communities. The results indicated greater species richness in areas with less mowing. The lawn area that was frequently mowed was dominated by plant species that grow to less height than those species in the meadow habitat. Lawn species were typically those that are preferred by grazing species such as geese, rabbits, and deer. Meadow areas had greater diversity of species, more plants that produce seed, and greater overall biomass. Unless managers especially want to favor herbivores that need large grazing areas, it appears from this study that a greater diversity of wildlife would benefit if habitats were mowed less frequently.

Less mowing would also discourage brown-headed cowbirds [*Molothrus ater*], which do not feed in fields with high vegetation, but use lawns extensively.

One concern that managers have with meadow management is the invasion of the areas by woody plants. These habitats in the East cannot be maintained without periodic mowing unless fire management is employed. The advantage of fire management over mowing is that it can be done less frequently and still control invading woody vegetation. Another aspect that was not evaluated in this study is the effect of mowing on nutrient quality of plants. It is most likely that the more frequently mowed areas have less fiber and higher protein in the plants, which would be expected based on numerous other studies (Harlow 1991). To better evaluate the various factors affecting the quality of wildlife habitat by management techniques such as mowing, it would be beneficial to conduct replicated studies with several techniques conducted concurrently.

Acknowledgments

Numerous assistants helped collect the data on this study including B. Bauman, R. Dault, D. Dubois, P. Osenton, J. Rigelman, and C. Stoll. Advice on statistical analyses was provided by J. Hatfield and review of manuscript was conducted by D. Boone, F. Fallon, M. Gormley, R. Hammerschlag, G. Meyer, H. Obrecht, III, and C. Rewa.

References

Bollinger, E.K., P.B. Bollinger, and T.A. Gavin. 1990. Effects of hay-cropping on eastern populations of the bobolink. Wildl. Soc. Bull. 18:142-150.

Brown, M.L., and R.G. Brown. 1972. Woody plants of Maryland. Port City Press, Baltimore, MD. 347 pp.

Brown, M.L., and R.G. Brown. 1984. Herbaceous plants of Maryland. Port City Press, Baltimore, MD. 1127 pp.

Edge, D.W., J.O. Wolff, and R.L. Carey. 1995. Density-dependent responses of gray-tailed voles to mowing. J. Wildl. Manage. 59(2):245-251.

Frawley, B.J. and L.B. Best. 1991. Effects of mowing on breeding bird abundance and species composition in alfalfa fields. Wildl. Soc. Bull. 19:135-142.

Harlow, R.F. 1991. The effect of management treatments on the biomass, nutritive quality, and utilization of deer forages on utility rights-of-way. Ph.D. Dissert. Clemson Univ., Clemson, SC. 114pp.

Robbins, C.S., D. Bystrak, and P.H. Geissler. 1986. The Breeding Bird Survey: its first fifteen years, 1965-1979. U. S. Fish and Wildl. Serv. Resource Publ. 157. 196 pp.

Warner, R.E., and S.L. Etter. 1989. Hay cutting and the survival of pheasants: a long-term perspective. J. Wildl. Manage. 53:455-461.

Warner, R.E., L.M. David, S.L. Etter, and G.B. Joselyn. 1992. Costs and benefits of roadside management for ring-necked pheasants. Wildl. Soc. Bull. 20:279-285.