Forage Yield in Two Forest Zones of New Brunswick and Nova Scotia[1]

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Highlight

A reconnaissance was made of the forage yield in a series of forest types in New Brunswick and Nova Scotia. Forage yields per acre were comparable to values reported from many studies in western North America, but plant composition differed. Grasslike species constituted a small proportion of total weight in most forest cover types, while ferns provided a high proportion. Correlation of yield with density characteristics of the tree stand was poor.

Considerable literature exists on weight yields of browse and herbage serving as forage for big game and livestock in western and southern North America (Doell and Smith, 1965). Less attention has been given to the food supply, on a weight basis, of herbivores in the wildlands of northeastern America. I conducted a preliminary survey of browse and herbage yield of forest-cover types in northern New Brunswick in July and August 1966, and in southwestern Nova Scotia in 1967.[3]

Study Areas and Methods

Rowe (1959) and Loucks (1962) have discussed physiography and vegetation in New Brunswick and Nova Scotia and Roland (1945) has described the flora of Nova Scotia in detail. Local climate and vegetation are strongly influenced by bodies of salt water and the low, but abruptly rising hill masses. Lowlands cover most of Nova Scotia and eastern New Brunswick and are the most extensive land type in these provinces. Uplands comprise the other prominent land type. They form dissected plateaus from 500 to over 2,000 feet in elevation.

An upland area of northwestern New Brunswick was sampled in or near the Canadian Forestry Service's Research Block No. 3 which has been described by Hughes (1964) at the Green River Field Research Station, and lowlands in southwestern Nova Scotia were sampled on and near the Tobeatic Wildlife Management Area. Sampling in the Green River area was conducted in Loucks' (1962) "sugar maple-yellow birch-fir zone." In the Tobeatic area sampling was in the "red spruce-hemlock-pine zone."

The Green River area displayed a recurring pattern of deciduous stands on ridges, mixed forest on middle slopes, dense coniferous stands on lower slopes and flats. Swamps dominated by northern white cedar (*Thuja occidentalis*)[4] occurred along creek beds and lake shores. Principal deciduous trees were sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*), white birch (*Betula papyrifera*) and yellow birch (*Betula alleganiensis*). Conifers were white spruce (*Picea glauca*), black spruce (*Picea mariana*), northern white cedar and balsam fir (*Abies balsamea*).

At Tobeatic, areas of impeded drainage form muskegs or swamps. Low ridges carry conifers or mixed forest, and some small pure deciduous stands. Deciduous species were red maple (*Acer rubrum*), aspens (*Populus* spp.), red oak (*Quercus rubra*) and white birch. Conifers were red spruce (*Picea rubens*), black spruce, balsam fir, eastern hemlock (*Tsuga canadensis*) and white pine (*Pinus strobus*).

Sample plots were located randomly in forest stands on maps of Canadian Forestry Service research blocks for the Green River survey, and on provincial forest inventory maps for the Tobeatic survey.

Clusters of three plots were established in the field by measuring

[1] Received September 20, 1971.

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[3] The author acknowledges the assistance of G. Baskerville, Canadian Forestry Service; L. Holt, Bowaters Mersey Paper Company; and field assistants J. Maxwell, R. MacLennan, W. Bauman and W. Prescott.

[4] Tree nomenclature follows Hosie (1969) and nomenclature of other plants follows Roland (1945).

Table 1. Forage yield (lb./acre) by categories in 10 cover types of two forest zones in New Brunswick and Nova Scotia. Height range of 0 to 7.5 ft. Year of study stated for each forest zone.

Zones and cover types	Evergreen		Deciduous		Herbage		
	Twigs	Leaves	Twigs	Leaves	Forbs	Grass-like plants	Ferns[1]
Sugar maple—yellow birch—fir zone (1966)							
Mature hardwood	2	10	41	169	56	T[2]	111
Pole-size softwood	2	6	8	14	41	—	19
Cedar Swamp	25	99	41	294	44	23	10
Red spruce—hemlock—pine zone (1967)							
Dense softwood	6	31	11	14	10	T	68
Open softwood	27	122	48	302	122	3	446
Dense mixedwood	24	194	12	43	33	13	210
Open mixedwood	6	26	177	445	77	23	371
Dense hardwood	17	77	42	207	104	171	180
Saplings[3]	5	22	44	282	71	106	283
Brushland[4]	—	—	124	723	146	—	168

[1] Polypodiaceae and Osmundaceae, mostly *Dryopteris* spp. and *Pteridium* spp.
[2] Trace, less than 1 lb./acre.
[3] Young, regenerating stands on clear or partially cut areas, burns or blowdowns.
[4] Deciduous shrub communities occupying rock barrens or severely burned areas.

direction with a hand compass and distance with a steel tape from a topographical feature. Plots were centered 15 feet from the cluster center thus established on magnetic bearings of 0, 120 and 240 degrees.

Yield of the current year at Green River was determined by clipping all herbaceous plants, terminal twig growth and leaves from 3.1 × 3.1 ft. square quadrats. At Tobeatic double sampling (Wilm et al., 1944) was employed, using quadrats of the same size. Green weights of forbs, grass-like plants, the terminal growth of twigs, and leaves of the current year were estimated. One of each six quadrats was also clipped. Clipped material from both study areas was oven dried in a convection oven for 48 hours at 70 C. For the Tobeatic material regressions of actual oven dry weight on estimated green weight were made for leaves, twig terminal growth, grass-like plants, ferns and forbs, by the "ratio-of-means" method described by Blair (1958).

At each plot a point count was taken using a 10-factor wedge prism (Bell and Alexander, 1957). Results were used to estimate basal area and number of trees per acre for stems over 1.5 inch diameter. Mean percentage of crown cover was calculated for each plot from 10 measurements made with a

Table 2. Total forage, winter browse and herbage yields (lb./acre) in 10 forest cover types in New Brunswick and Nova Scotia. Height range 0–7.5 ft. Year of study stated for each forest zone.

Zones and cover types	Mean winter browse[1]	Mean herbage[2]	Mean total forage [3]	St'd. error
Sugar maple—yellow birch—fir zone (1966)				
Mature hardwood	53	167	220	61
Pole-size softwood	16	60	90	16
Cedar swamp	165	77	536	157
Red spruce—hemlock—pine zone (1967)				
Dense softwood	48	78	140	37
Open softwood	197	571	1070	207
Dense mixedwood	230	256	529	156
Open mixedwood	209	471	1125	525
Dense hardwood	136	455	798	137
Saplings[4]	71	460	813	275
Brushland[4]	124	314	1161	181

[1] Deciduous twigs, coniferous twigs and leaves.
[2] Ferns, grass-like plants and forbs.
[3] Including leaves of deciduous woody species.
[4] See type description under Table 1.

FIG. 1. Dense, mature hardwood forest in New Brunswick composed mainly of sugar maple.

FIG. 2. Dense softwood forest in New Brunswick typical of stands sampled in both zones during the present study, composed of red and black spruce and balsam fir.

FIG. 3. Open softwood forest in Nova Scotia. Scattered white pine and red spruce with a dense understory of ferns, and softwood seedlings and saplings.

"moosehorn" instrument (Garrison, 1949). Mean stand height was estimated from clinometer measurements and mean age from annual ring counts of several co-dominant trees at each plot cluster.

Results and Discussion

Forage yields in Nova Scotia and New Brunswick (Tables 1 and 2) fall into the same range as yields in western North American forests (Eddleman and McLean, 1969; Young et al., 1967; Pase and Hurd, 1958). However, composition differs: grasses and grass-like species were less prominent in the New Brunswick and Nova Scotia forest types than in western areas; the weight of ferns was greater than other classes of herbage in most forest types. Principal forb species in terms of biomass in the Green River area were wood sorrel (*Oxalis montana*), Sasparilla (*Aralia nudacaulis*), clintonia (*Clintonia borealis*), wild lily-of-the-valley (*Maianthemum canadense*) and bunchberry (*Cornus canadensis*). With exception of wood sorrel the same species were important in the Tobeatic area. Other species also important in the latter area were goldenrod (*Solidago* spp.), asters (*Aster* spp.), goldthread (*Coptis groenlandica*) and boxberry (*Gaultheria procumbens*). Grass-like species were mostly sedges (*Carex* spp.), but were not classified by species. Bracken (*Pteridium aquilinum*) contributed an important part of the fern biomass, as did species of the genus *Dryopteris*, principally *D. noveboracensis*.

Shrubs, and seedlings and saplings of arboreal species in order of weight of browse produced at Green River were: balsam fir, white cedar, alder (*Alnus* spp.), spruces, sugar maple, beech, mountain maple (*Acer spicatum*), hobble bush (*Viburnum alnifolium*) and hazel (*Corylus cornuta*). The principal woody species at Tobeatic in order of weight, were: spruce, balsam fir, huckleberry (*Gaylusaccia baccata*), sheep laurel (*Kalmia* spp.), alder, hemlock, red maple, white pine and blueberry (*Vaccinium* spp.). In both areas a number of other shrubs were present in very small amounts.

Winter browse yield in the Maritimes was high compared to that reported in the west (Pase and Hurd, 1958; Young et al., 1967)

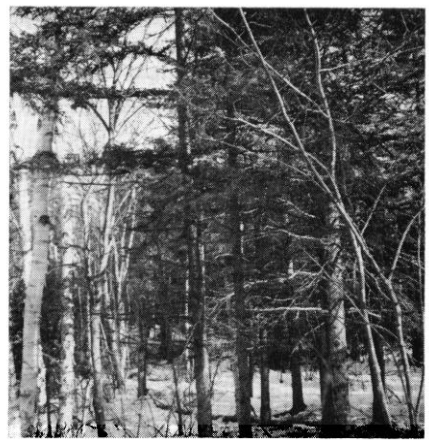

FIG. 4. Dense mixedwood forest in Nova Scotia composed of red spruce, balsam fir, white birch and red maple.

Table 3. Characteristics of the tree overstory (stem over 1.5 inches in diameter at breast height) in stands sampled during forage field reconnaissance in New Brunswick and Nova Scotia.

Zones and cover type	Coniferous basal area (ft^2 acre)	Deciduous basal area (ft^2 acre)	Mean crown cover (%)	Mean stand height (ft)	Mean stand age (yr)	Estimated percentage of study area
Sugar maple—yellow birch—fir zone (1966):						[1]
Mature hardwood	10	80	88	55	97	8
Pole-size softwood	136	19	90	47	56	58
Cedar swamp	143	3	68	53	154	8
Red spruce—hemlock—pine zone (1967):						[2]
Dense softwood	134	14	75	42	64	3
Open softwood	60	6	44	49	87	30
Dense mixedwood	71	46	73	40	67	4
Open mixedwood	40	33	61	64	62	17
Dense hardwood	8	75	54	36	52	1
Saplings[3]	39	9	29	21	28	10
Brushland[3]	2	0	—	—	—	11

[1] Areas calculated for Research Block No. 3 from Hughes 1964:20.

[2] Areas calculated from 1956 Provincial Forest Inventory Data supplied by the Nova Scotia Department of Lands and Forests (R. M. Bulmer, personal communication, March 15, 1967).

[3] See type description under Table 1.

FIG. 5. Sapling stand on an old burn in Nova Scotia composed of red spruce, balsam fir, white birch and red maple.

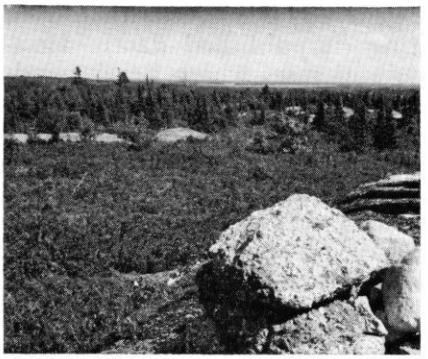

FIG. 6. Brushland community in foreground composed mostly of huckleberry, with an open softwood stand in the background. Nova Scotia.

but it is difficult to compare these data because height ranges and definitions of browse differ.

In some studies high forage yield has been found to be correlated with open stand conditions (Pase and Hurd, 1967); Eddleman and McLean, 1969; Halls and Schuster, 1965). In this study, average values for forest types show the same general trend (Tables 2 and 3) but regressions of individual plot yields against measures of stand density gave poor correlations. Poor correlation between basal area per acre and browse yield was also found in Virginia (Whelan, 1962). Regressions of forage yield on stand density (Pase and Hurd, 1967; Halls and Schuster, 1965) resemble curves of solar radiation reaching forest understories under varying crown closures (Vézina and Péch, 1964). Miller (1965) stated that transmission of solar radiation through forest canopies depends on the biomass of foliage and branches and the way the biomass is distributed in the space occupied by the crown. Crown biomass and arrangement may have been exceptionally variable in the mixed forests sampled in this study, creating different radiant energy environments and possibly differing yields of understory vegetation in stands of similar density. These differences probably account for much of the standard error within cover types (Table 2).

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