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Food and Role of the European Bison in Forest Ecosystems

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[With 1 Fig. & 2 Tables]

Literature on food components and food requirements of the European bison was reviewed. Problems of the effect of bisons on the forest and of the permissible density of bisons in contemporary forest ecosystems were given special consideration. It was concluded that the following problems should be urgently studied: daily food requirements of the European bison in seasonal and age aspects, the amount of most willingly selected food in biotopes and food habits of the European bison.

I. INTRODUCTION

Information on biology and ecology of the European bison are very scarce and fragmentary. Only the food of the European bison was somewhat more studied but data of early investigators (Brincken, 1826; Jarocki, 1830; Karcov, 1903) are not very informative.

Modern studies on the food of the European bison were carried out near Moscow (Kamenskaja, 1956; Zablockaja, 1957) and in the Caucasus (Krajnova, 1951; Aleksandrov & Golgofskaja, 1965). The data from the Białowieża Primaeval Forest are the relatively least complete.

The purpose of this paper is to review literature concerning the food components and the food requirements of the European bison and to estimate the significance of this animal in the forest. Our preliminary data from the Białowieża Primaeval Forest as well as the data of the State Forest Administration are also included.

II. FOOD COMPOSITION OF THE BISON

The list of plants consumed by bisons was prepared from available published data and from our preliminary observations (Table 1). The list gives the degree of consumption as defined by Krajnova (1951), Kamenskaja (1956) and Zablockaja (1957). Only those plants which are consumed most frequently are indicated by an +. The other

plants listed are consumed often or sporadically and have rather less importance in a bison's diet.

Extensive lists compraising about 200 species were given by Krajnova (1951), Kamenskaja (1956) and Zablockaja (1957). The remaining authors were listing only the plants most frequently eaten by European bisons (from 5 to 25 species) — (Table 2).

Data presented in Table 1 indicate that willow *Salix caprea* L., aspen *Popolus tremula* L. and ash *Fraxinus excelsior* L. are the most preferred trees. European bisons eat their sprouts and thin bark. Less frequently consumed are: oak *Quercus robur* L., linden *Tilia cordata* Mill., hornbeam *Carpinus betulus* L. and spruce *Picea excelsa* (Lam.) Lk. The best liked bushes are: two species of spindle tree, *Evonymus europea* L. and *E. verrucosa* Scop., sorb *Sorbus aucuparia* L., bird cherry *Padus avium* Mill., guelder-rose *Viburnum opulus* L., and three species of currant, *Ribes nigrum* L., *R. rubrum* L. and *R. alpinum* L., while the best liked shrubs are: mistletoe *Viscum album* L., blueberry *Vaccinium myrtillus* L. and heath *Calluna vulgaris* (L.) Salisb. Of the herbs thistle *Cirsium oleraceum* (L.) Scop. as well as raspberries and blackberries *Rubus sp.* deserve mentioning. The order of the remaining species is indicated in the list of plants (Table 1).

Three hundred seventy four plant species were registered as being eaten by European bison within the area contemporary inhabited by this species (including herds of hybrids in the Caucasus). The works published hitherto mention only 83 plant species as the food of a bison in the Białowieża Forest, although 323 plants which can be eaten by it are growing there. Our recently started work on the food composition of the European bison in the Białowieża Forest will certainly increase this list.

The percent of trees and herbs in the diet of the European bison is a controversial question. According to Wróblewski (1927) bisons eat 80% of herbs and 20% of tree sprouts and bark. His data are based on analysis of stomach contents of 10 bisons (including 7 shot animals) from the Białowieża Forest studied between 1907 and 1909. This was later confirmed by Baškirov (1939). However, the latest data of Koročkina (1966) indicate that the average proportions of these two kinds of food in the stomach of a bison are approaching 50% and 50%. Koročkina also noticed seasonal changes in the consumption of tree sprouts and bark (cf. Fig. 1). These discrepancies are most likely due to changes which took place in the undergrowth of the forest. During the studies of Wróblewski (1927) the forest floor was almost empty without young trees and with thinned herbs. This was caused by unreasonable breeding practices resulting in extremely high density of deer and bisons (in 1909 — 80 animals per 1000 ha). Wróblewski (*l.c.*) gave special consideration to this situation. Presently the situation is more closely resembling natural conditions.

Naturally, many other factors including availability of given plant species and offering supplementary food in winter (practiced for many years) are influencing the seasonal rhythm of changes in the diet of the bisons. Zablockaja (1957) observed that at temperature below —15 to —20°C the bisons are not barking.

Table 1.

List of plants consumed by the European bison, with special indication of most frequently eaten (+).

* — do not occur in Białowieża

TREES

1. *Abies nordmanniana* Spach.*	+	14. *Malus silvestris* (L.) Mill.	+
2. *Abies sp.**		15. *Picea excelsa* (Lam.) Lk.	
3. *Acer campestre* L.	+	16. *Pinus hamata* (Stev.) D. Sosn.*	
4. *Acer platanoides* L.	+	17. *Pinus silvestris* L.	
5. *Acer pseudoplatanus* L.*		18. *Pirus communis* L.	+
6. *Alnus glutinosa* (L.) Gaertn.	+	19. *Populus balsamifera* L.*	
7. *Alnus incana* (L.) Mnch.	+	20. *Populus tremula* L.	+
8. *Betula pubescens* Ehrh.		21. *Populus sp.*	+
9. *Betula verrucosa* Ehrh.	+	22. *Quercus robur* L.	+
10. *Carpinus betulus* L.	+	23. *Salix caprea* L.	+
11. *Fagus orientalis* Lipsky*	+	24. *Tilia cordata* Mill.	+
12. *Fagus silvatica* L.*		25. *Ulmus scabra* Mill.	+
13. *Fraxinus excelsior* L.	+	26. *Ulmus sp.*	+

SHRUBS

1. *Calluna vulgaris* (L.) Salisb.		20. *Rhamnus cathartica* L.	
2. *Cerasus avium* (L.) Moench.		21. *Ribes alpinum* L.	+
3. *Cornus sanguinea* L.		22. *Ribes nigrum* L.	
4. *Corylus avellana* L.	+	23. *Ribes rubrum* L.	
5. *Crataegus oxyacantha* L.		24. *Rosa canina* L.	
6. *Cytisus ruthenicus* Fisch.		25. *Rosa sp.*	
7. *Daphne mezereum* L.		26. *Salix aurita* L.	
8. *Evonymus europaea* L.	+	27. *Salix cinerea* L.	+
9. *Evonymus verrucosa* Scop.	+	28. *Salix livida* Whlb.	
10. *Frangula alnus* Mill.	+	29. *Salix viminalis* L.*	
11. *Genista tinctoria* L.		30. *Salix sp.*	+
12. *Ilex aquifolium* L.*		31. *Sambucus nigra* L.	
13. *Juniperus communis* L.		32. *Sambucus racemosa* L.	
14. *Juniperus sp.*		33. *Sorbus aucuparia* L.	+
15. *Ligustrum vulgare* L.*		34. *Vaccinium myrtillus* L.	
16. *Lonicera xylosteum* L.		35. *Vaccinium vitis idaea* L.	
17. *Padus avium* Mill.	+	36. *Viburnum lantana* L.	
18. *Prunus divaricata* Led.*		37. *Viburnum opulus* L.	
19. *Prunus spinoza* L.		38. *Viscum album* L.	+

HERBS

1. *Achillea biserrata* M. B.*		11. *Alectrolophus glaber* (Lam.) Beck.	
2. *Achillea millefolium* L.	+	12. *Alisma plantago-aquatica* L.	
3. *Aconitum anthora* L.*		13. *Anemone fasciculata* L.*	
4. *Aconitum nasatum* Fisch. et Reichb.*		14. *Anemone nemorosa* L.	+
5. *Aconitum orientale* Mill.*		15. *Anemone ranunculoides* L.	
6. *Actea spicata* L.		16. *Angelica silvestris* L.	+
7. *Aegopodium podagraria* L.	+	17. *Anthemis dumetorum* D. Sosn.*	
8. *Ajuga reptans* L.		18. *Anthriscus silvestris* (L.) Hoffm.	
9. *Alchemilla pastoralis* Bus.		19. *Archangelica officinalis* Hoffm.	+
10. *Alchemilla sp.*	+	20. *Arctium tomentosum* Mill.	

21. *Artemisia absintium* L.
22. *Artemisia vulgaris* L.
23. *Asarum europaeum* L.
24. *Asperula odorata* L.
25. *Asperula taurina* L.*
26. *Asperula sp.*
27. *Astragalus arenarius* L.
28. *Astrantia major* L.
29. *Ballota nigra* L.
30. *Bidens tripartitus* L. +
31. *Berteroa incana* (L.) Dc.
32. *Betonica grandiflora* Willd.* +
33. *Betonica officinalis* L. +
34. *Cacalia sp.*
35. *Calamintha vulgaris* (L.) Druce.
36. *Caltha palustris* L.
37. *Calystegia sepium* (L.) R. Br.
38. *Campanula lactiflora* M. B.*
39. *Campanula latifolia* L.
40. *Campanula patula* L.
41. *Campanula persicifolia* L.
42. *Campanula trachelium* L.
43. *Cardamine sp.*
44. *Carduus acanthoides* L.
45. *Centaurea jacea* L.
46. *Centaurea salicifolia* M. B.*
47. *Centaurea scabiosa* L.
48. *Centaurea stenolepis* Kern.*
49. *Centaurea sp.*
50. *Cephalaria brevipalea* (Somm. et Levier) Litv.* +
51. *Cephalaria gigantea* (Ledeb.) Bobr.* +
52. *Cerastium sp.*
53. *Chaerophyllum Schmalhauseni* N. Albov.* +
54. *Chamaenerion angustifolium* (L.) Scop. +
55. *Chrysanthenum leucanthemum* L.
56. *Cichorium inthybus* L.
57. *Cirsium arvense* (L.) Scop.
58. *Cirsium obvallatum* D. C.* +
59. *Cirsium oleraceum* (L.) Scop. +
60. *Cirsium palustre* (L.) Scop.
61. *Cirsium sp.* +
62. *Convallaria majalis* L. +
63. *Convolvulus arvensis* L.
64. *Coronilla varia* L.
65. *Crepis paludosa* (L.) Mnch.
66. *Crepis rumicifolia* Boiss. et Bal.*
67. *Crepis tectorum* L.
68. *Delfinium dasycarpum* Stev.
69. *Dianthus deltoides* L.
70. *Epilobium montanum* L. +
71. *Epilobium palustre* L.
72. *Epilobium roseum* Schreb.
73. *Euphrasia sp.*
74. *Filipendula hexapetala* Gilib. +
75. *Filipendula ulmaria* (L.) Maxim. +
76. *Fragaria vesca* L.
77. *Fritillaria ruthenica* Wikstr.*
78. *Galega orientalis* Lam.* +
79. *Galeobdolon luteum* Huds.
80. *Galeopsis ladanum* L.
81. *Galium cruciata* (L.) Scop.
82. *Galium mollugo* L.
83. *Galium Schultesii* Vest.
84. *Galium uliginosum* L.
85. *Galium vernum* Scop.
86. *Geranium palustre* L.
87. *Geranium pratense* L.
88. *Geranium sanguineum* L.
89. *Geranium silvaticum* L.
90. *Geranium sp.*
91. *Geum rivale* L. +
92. *Geum urbanum* L.
93. *Geum sp.*
94. *Glechoma hederacea* L.
95. *Gnaphalium silvaticum* L.
96. *Gentiana asclepiadea* L.
97. *Hedera helix* L.
98. *Heracleum sibiricum* L.
99. *Hesperis matronalis* L.
100. *Hieracium pubescens* M. B.* +
101. *Hieracium umbellatum* L.
102. *Humulus lupulus* L.
103. *Hypericum maculatum* G.
104. *Hypericum perforatum* L. +
105. *Impatiens noli tangere* L. +
106. *Inula helenium* L.*
107. *Inula salicina* L.
108. *Knautia arvensis* (L.) Coult.
109. *Lactuca sp.* +
110. *Lamium album* L.
111. *Lapsana sp.*
112. *Lathyrus paluster* L.
113. *Lathyrus pratensis* L.
114. *Lathyrus silvester* L.
115. *Lathyrus vernus* (L.) Bernh. +
116. *Lathyrus sp.*
117. *Leontodon autumnalis* L.
118. *Ligusticum alatum* (M. B.) Spreng.* +
119. *Linaria vulgaris* (L.) Mill.
120. *Lothus corniculatus* L.
121. *Lupinus luteus* L.
122. *Lupinus polyphyllos* Ldl.
123. *Lychnis flos cuculi* L.
124. *Lycopus europaeus* L.
125. *Lysimachia nummularia* L.
126. *Lysimachia vulgaris* L. +
127. *Lythrum salicaria* L.
128. *Majanthemum bifolium* (L.) F. W. Schm.
129. *Melampyrum nemorosum* L.
130. *Melampyrum pratense* L.
131. *Melandrium album* (Mill.) Garcke. +
132. *Melitis melissophyllum* L.
133. *Mentha arvensis* L.
134. *Mercurialis perennis* L.
135. *Mulgedium sp.**
136. *Myosotis amoena* (Rupr.) Boiss.*
137. *Myosotis palustris* (L.) Nathorst.

138. *Myosotis silvatica* (Ehrh.) Hoffm.*
139. *Orchis maculata* L.
140. *Orchis militaris* L.
141. *Origanum vulgare* L.
142. *Oxalis acetosella* L.
143. *Paris quadrifolia* L.
144. *Petasites albus* (L.) Gaertn.
145. *Petasites spurius* (Retz.) Rchb.*
146. *Pimpinella saxifraga* L.
147. *Pimpinella sp.*
148. *Pirola rotundifolia* L.
149. *Pirola secunda* L.
150. *Plantago lanceolata* L.
151. *Plantago major* L.
152. *Plantago media* L.
153. *Platanthera bifolia* (L.) Rich.
154. *Polemonium coeruleum* L.
155. *Polygonatum multiflorum* (L.) All.
156. *Polygonatum odoratum* (Mill.) Druce. +
157. *Polygonatum verticillatum* (L.) All.*
158. *Polygonum aviculare* L.
159. *Polygonum bistorta* L.
160. *Polygonum convolvulus* L.
161. *Polygonum hydropiper* L.
162. *Potentilla alba* L.
163. *Potentilla argentea* L.
164. *Potentilla erecta* (L.) Hampe. +
165. *Potentilla sp.*
166. *Primula macrocalyx* Bge.*
167. *Primula officinalis* (L.) Hill.
168. *Prunella vulgaris* L. +
169. *Pulmonaria mollisima* Kern.*
170. *Pulmonaria obscura* Dum.
171. *Ranunculus acer* L.
172. *Ranunculus cassubicus* L. +
173. *Ranunculus repens* L.
174. *Ranunculus sp.*
175. *Roripa silvestris* (L.) Bess.
176. *Rubus caesius* L. +
177. *Rubus fruticosus* L. +
178. *Rubus idaeus* L.
179. *Rubus saxatilis* L.
180. *Rumex acetosa* L.
181. *Rumex acetosella* L.
182. *Rumex confertus* Willd.
183. *Rumex crispus* L.
184. *Rumex optusifolius* L.
185. *Rumex sp.*
186. *Sanguisorba officinalis* L.
187. *Scilla cernua* Red.*
188. *Scrophularia nodosa* L.
189. *Scrophularia sp.* +
190. *Scutellaria galericulata* L.
191. *Selinum carvifolia* L.
192. *Silene inflata* Sm.
193. *Silene nutans* L.
194. *Solidago virga aurea* L. +
195. *Sonchus arvensis* L.
196. *Sonchus oleraceus* L.
197. *Stachys palustris* L.
198. *Stellaria graminea* L.
199. *Stellaria holostea* L.
200. *Stellaria media* Vill.
201. *Succisa pratensis* Mnch.
202. *Symphytum asperum* Led.* +
203. *Symphytum grandiflorum* DC.* +
204. *Symphytum officinale* L.
205. *Tanacetum vulgare* L.
206. *Taraxacum officinale* Web.
207. *Thalictrum aquilegifolium* L.
208. *Thalictrum lucidum* L.
209. *Thalictrum minus* L.
210. *Thalictrum simplex* L.
211. *Tragopogon pratensis* L.
212. *Trientalis europaea* L.
213. *Trifolium hybridum* L. +
214. *Trifolium medium* L. +
215. *Trifolium montanum* L.
216. *Trifolium pratense* L.
217. *Trifolium repens* L.
218. *Trifolium strepens* Cr.
219. *Tripleurospermum inodorum* (L.) Schultz-Bip.
220. *Trollius europaeus* L. +
221. *Turritis glabra* L.
222. *Urtica dioica* L.
223. *Valeriana officinalis* L.
224. *Veratrum album* L.* +
225. *Veratrum lobelianum* Brnh.*
226. *Verbascum thapsus* L.
227. *Veronica anagalis* L.
228. *Veronica chamaedrys* L.
229. *Veronica filiformis* Sm.*
230. *Veronica gentianoides* Vahl.*
231. *Veronica longifolia* L.
232. *Veronica officinalis* L.
233. *Veronica teucrium* L.*
234. *Veronica sp.*
235. *Vicia sativa* L.
236. *Vicia sepium* L.
237. *Vicia silvatica* L.
238. *Vicia sp.* +
239. *Viola arvensis* Murr.
240. *Viola canina* Rchb.
241. *Viola mirabilis* L.
242. *Viscaria vulgaris* Rohl.

GRASSES AND SEDGES

1. *Agropyron repens* (L.) P.B.
2. *Agrostis alba* L.
3. *Agrostis stolonifera* L.
4. *Agrostis vulgaris* With.
5. *Alopecurus pratensis* L.
6. *Anthoxantum odoratum* L. +
7. *Arrenatherum elatius* (L.) P.B. +
8. *Avena sativa* L.
9. *Brachypodium pinnatum* (L.) P.B. +
10. *Briza media* L.

11. *Bromus Benekeni* (Lange) Syme.	+	31. *Holcus mollis* L.	
12. *Bromus inermis* Leyss.		32. *Juncus effusus* L.	+
13. *Calamagrostis arundinacea* (L.) Roth.	+	33. *Juncus filiformis* L.	
14. *Calamagrostis epigeyos* (L.) Roth.		34. *Lolium perenne* L.	
15. *Carex caespitosa* L.		35. *Lolium temulentum* L.	
16. *Carex flava* L.		36. *Luzula pilosa* (L.) Willd.	
17. *Carex leporina* L.		37. *Melica nutans* L.	+
18. *Carex pallescens* L.		38. *Melica picta* Koch.*	
19. *Carex pilosa* Scop.	+	39. *Milium effusum* L.	+
20. *Carex vesicaria* L.		40. *Milium Schmidtianum* C. Koch.*	+
21. *Carex sp.*	+	41. *Molinia coerulea* (L.) Hoench.	+
22. *Dactylis glomerata* L.	+	42. *Phalaris arundinacea* L.	
23. *Deschampsia caespitosa* (L.) P.B.	+	43. *Phleum pratense* L.	+
24. *Elymus europaeus* L.		44. *Phragmites communis* Trin.	+
25. *Festuca gigantea* (L.) Vill.	+	45. *Poa annua* L.	
26. *Festuca montana* M.B.*	+	46. *Poa iberica* Fisch. et Mey.*	
27. *Festuca pratensis* Huds.		47. *Poa nemoralis* L.	
28. *Glyceria lithuanica* (Górski) Linden.		48. *Poa pratensis* L.	
29. *Hierochloe australis* (Schrad.) Roem. et Schult.	+	49. *Poa trivialis* L.	
30. *Hierochloe odorata* (L.) Wahlb.		50. *Poa sp.*	
		51. *Scirpus silvaticus* L.	+
		52. *Secale cereale* L.	
		53. *Secale Kuprijanovii* A. Grossh.	

CRYPTOGAMOUS PLANTS

1. *Dryopteris filix mas* (L.) Schott.		6. *Pteridium aquilinum* (L.) Kuhn.	
2. *Equisetum arvense* L.		7. *Usnea sp.*	
3. *Equisetum palustre* L.		8. *Usnea barbata* L.	+
4. *Equisetum pratense* Ehrh.		9. *Musci et lichens epiphyti*	
5. *Equisetum silvaticum* L.			

FUNGI

1. *Armillaria melea* Vahl.		4. *Boletus scaber* Bull.	
2. *Boletus edulis* Bull.		5. *Cantharellus cibarius* Fr.	
3. *Boletus rufus* (Schaeff.) Quel.		6. *Russula sp.*	

III. FOOD REQUIREMENTS

The daily food requirement of the European bison has been estimated by many authors. Karcov (1903) estimated the daily consumption of hay at 8 kg, while Zablockaja (1957) and Koročkina (1966) suggested 10 to 11 kg. Wróblewski (1927) based his estimation on norms for cattle and calculated that a bison weighing 500 kg would need about 19.5 kg of plants (dry weight) per day. For bisons weighing 250 kg the requirement would be 9.4 kg.

Aleksandrov & Golgofskaja (1965) did an experiment on 4 European bisons and demonstrated that the daily requirement of an adult animal in winter is 9—10 kg of food which is then available while in summer it is from 10 to 15.2 kg of air dry plants.

Table 2.

Number of plant species consumed by European bison (according to different authors).

Kind of food	1903 Karcov,	1919 Kulagin,	1927 Wróblewski,	1926 Sztolcman,	1961 Scibor,	1966 Own data,	Total 1—6	1956 Kamenskaja,	1957 Zablockaja,	Total 7—8	1951 Krajnova,	1965 Aleksandrov & Golgofskaja	Total 9—10	Total 1—10
	1	2	3	4	5	6		7	8		9	10		
	Białowieża							Moscow			Caucassus			
Trees	4	7	3	—	9	14	15	9	13	13	17	13	21	26
Shrubs	4	3	7	4	—	5	17	9	20	21	13	8	17	38
Herbs	—	—	5	15	—	13	26	118	134	170	90	1	91	242
Grasses and sedges	10	3	—	6	—	10	24	23	29	35	21	1	22	53
Cryptogamous plants	1	—	—	—	—	—	1	3	5	5	3	—	3	9
Fungi	—	—	—	—	—	—	—	—	6	6	—	—	—	6
Total	19	13	15	25	9	42	83	162	207	250	144	23	154	374

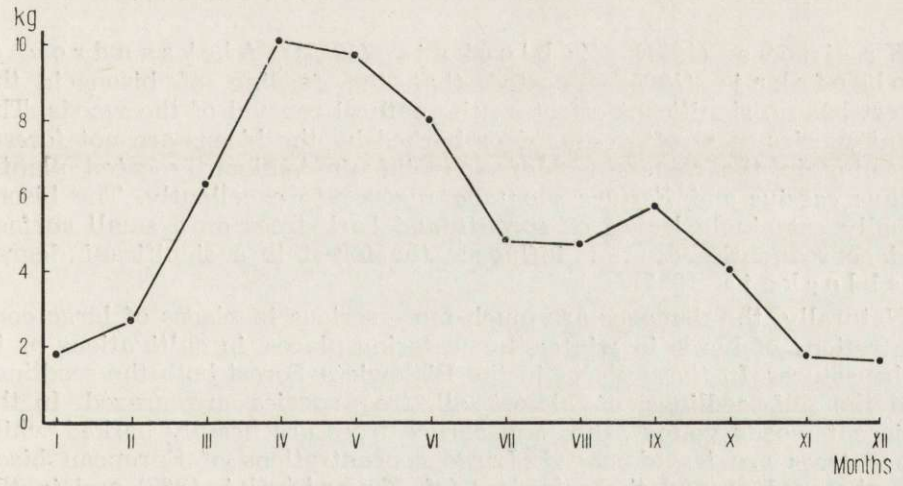

Fig. 1. Trees consumed by European bison in Białowieża Primaeval Forest (Belorussian SSR) in kg per day. Means of the period 1956 to 1958, according to K o r o č k i n a, 1966.

The problem is undoubtedly still open and calls for further experimentation but from the available data it is possible to assume that the daily food requirement of an adult bison is about 10 kg of dry plants.

IV. PERMISSIBLE DENSITY OF EUROPEAN BISONS

Aleksandrov & Golgofskaja (1965) assumed that winter is the most critical period for the survival of the bisons. Therefore, they estimated the amount of food which is available in winter in the Caucasus with special consideration of the amount of evergreen growths of blackberry and of the alpine meadows with reed. From this and the approximate food requirements they estimated the maximal permissible density of bisons. Considering the presence of other ruminants and the grazing of cattle in forest their estimation was 12 to 15 bisons per 1000 ha. The corresponding value for the Caucasus National Park would be about 8 heads per 1000 ha, in average, but it might attain 40—50 heads per 1000 ha in particular habitats during the winter season. According to data of Zablockaja (1957) 30 to 40 ruminants can live per 1000 ha of forest near Moscow.

There is no corresponding data for the Polish part of the Białowieża Primaeval Forest. The above quoted data can only give a rough idea. According to the data of the State Forest Administration in February 1966 the average density of ruminants in the forest was 14 deer, 11 roe-deer and 2 European bisons per 1000 ha. The total is 27 heads per 1000 ha. This density seems not catastrophic and probabely well below the natural capacity of the Białowieża Primaeral Forest biotops.

V. THE ROLE OF THE EUROPEAN BISON IN THE FOREST

Krajnova (1951), Zablockaja (1957), Aleksandrov & Golgofskaja (1965) reported that the feeding of bisons in the forest has no significant effect on the natural reneval of the woods. The plant species most often grazed or barked by the bisons are not forest-forming in the Caucasus. Moreover, the predominantly eaten plants: *Rubus caesius* and *Festuca montana* regenerate excellently. The bisons usually eat single leaves or sprouts and bark trees on a small surface and consequently do not influence the forest to a significant degree (Zablockaja, 1957).

Naturally, the damages are much more serious in places of large concentrations of herds in winter, by watering places, in cultivations or in rich pastures. In these places in the Białowieża Forest both the seedlings and the self-seedlings of almost all tree species are grazed. In the adjacent woods young ashes and spruce trees are heavily barked while other trees are less damaged. Large concentrations of European bison are observed around three feeders (cf. Krasiński, 1967) and in the radius of about 0.5 km all young trees are broken or eaten and trees with thin bark (measuring less than 30 cm 1.5 m above the ground) are barked.

The District State Forest Administration in Białystok made an inventory of damages in winter 1963/64. It was found that 68.07 ha of cultivation were destroyed. The area of cultivations visited by the game (manipulatory area) was 222.23 ha. The damages were undoubtedly done by deer, roe-deer, bisons and domestic cattle.

The effect of European bisons on the woods of the Białowieża Primaeval Forest is an open question and there is a strong need of pertaining studies.

VI. CONCLUSIONS

From the above review of literature it appears that although the European bison survived in natural conditions for the longest time in the Białowieża Forest, the conditions of its living in this habitat are least known. Only preliminary estimations of Zablockaja (1957) suggest that the amount of food in this environment is smaller that in the woods near Moscow and especially in the very rich woods of the Caucasus.

However, in the Białowieża Primaeval Forest a herd of European bisons is living free, developing successfully and increasing in numbers from year to year. This suggests the need of intensive research on the food of bisons in natural conditions and on the amount of food in the forest biotopes most willingly selected by bisons which can be a food base during the winter. Thoroughful research on food requirements depending on season and age of the animals is also of considerable importance (Pucek, 1967). The results of such studies would allow correct estimation of the permissible density of bisons in the Białowieża Forest.

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POŻYWIENIE I ROLA ŻUBRA W EKOSYSTEMACH LEŚNYCH

Streszczenie

Autorzy dokonali przeglądu piśmiennictwa dotyczącego składu pożywienia i zapotrzebowania pokarmowego żubra. Zwrócono uwagę na rolę żubra w lesie, oraz na jego dopuszczalne zagęszczenie we współczesnych ekosystemach leśnych. Stwierdzono, że pilnych badań wymagają takie zagadnienia jak: dobowe zapotrzebowanie pokarmowe żubra w aspekcie sezonowym i wiekowym, zasobność pokarmowa biotopów najchętniej przez żubry wybieranych a także zwyczaje pokarmowe żubra.