TOPIC 4. COMMERCIAL PRIORITIES

Commercial priorities are higher than wildlife priorities whenever the commercial enterprise is the basis of perpetuating the resource. Agriculture and forestry are two such enterprises in the United States and Canada.

Agriculture involves the raising of cultivated crops and domestic animals for sale. Crops raised include annuals, such as small grains and row crops, short-term perennials, such as hay, and long-term perennials, such as orchards and vineyards. All of these crops are subject to potentially large damages from grazing and browsing animals.

Forestry is a long-term enterprise that may be very much affected by wild ruminant populations. Foraging ruminants affect the establishment of seedlings, they damage saplings by rubbing antlers, and they forage on the terminal buds on both axillary and lateral stems until the trees have grown out of reach.

Relationships between wild ruminants and agriculture and forestry are discussed in the next two UNITS, respectively.

UNIT 4.1: AGRICULTURE

White-tailed deer, mule deer, and elk are the wild ruminant species which have the most potential for causing damage to agricultural crops because they live in areas with intensive farming and ranching, and they are rather adaptable animals.

Elk will damage vegetable gardens, pastures, grainfields, corn fields, orchards, and haystacks (Murie 1951). Some damage may approach total destruction, as in gardens, and some is a sharing of resources, such as pastures.

Mule deer affect the composition of the range by their grazing. Perennial forbs were much more prominant and perennial grasses were more prominant in an area from which livestock were excluded than in an area grazed by livestock. Much of the sagebrush was killed by deer browsing, while plants were much more vigorous and abundant in the livestock pasture (Smith 1949).

White-tailed deer damaged cherry orchards in Michigan very severely (Ruhl 1956). Eleven kinds of fruit trees and shrubs are listed by Cowan (1956) as being part of damage complaints in British Columbia, plus thirteen other kinds of fruit, vegetable, and flower crops, an "obviously incomplete list." Fruit trees are particularly vulnerable to deer damage, with truck crops and forage crops less vulnerable overall but still subject to potentially heavy local damage.

What kind of protection can be provided agricultural crops? Farms and ranches cannot be fenced with deer- or elk-proof fences due to cost considerations. Orchards and gardens, high-density crops, may be fenced, but suitable fencing is very expensive even for small areas. Fencing is about the only sure way to keep deer out, however. Electric fences, though much less expensive than netting, are subject to loss of electrical current and breakage. The current may be shorted out by growing vegetation, and it is shorted out during rainy weather. Electric fence may be easily broken by animals running into it as the wire is light weight. It is generally not reliable enough to protect valuable crops.

Many repellants have been tried. These have been generally unacceptable, and there are practical problems with their use. Rains dilute repellents and wash them off, for example.

LITERATURE CITED

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Murie, O. J. 1951. The Elk of North America. The Stackpole Company, Harrisburg, Pa. 376 p.

Smith, A. D. 1949. Effects of mule deer and livestock upon a foothill range in northern Utah. J. Wildl. Manage. 13(4):421-423.

REFERENCES, UNIT 4.1

AGRICULTURE

SERIALS

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
NZFTA	51---	1	27	cerv	chem contrl n z, intr deer	daniel,mj	1966

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
AMFGA	68-11	13,18,26		od--	orchards versus deer	berry,rn	1948
CAFGA	18--2	136	147	od--	damage to crops in califor	true,g,jr	1932
CAFGA	43--1	100	102	od--	an outriggr type deer fenc	blaisdell,ja; hub	1957
CGFPA	12---	1	22	od--	lit review, orchard damage	harder,jd	1968
FHSCA	16--4	78	82	od--	control deer damages, utah	low,jb	1955
JFUSA	57--1	42	43	od--	a low-cost deer fence	grisez,tj	1959
JFUSA	65--8	564	566	od--	attrctnts, appr damag prob	dasmann,rf; hubb/	1967
JWMAA	22--3	325	326	od--	overhanging deer fences	jones,mb; longhur	1958
JWMAA	27--1	129	132	od--	stream cross struct, fence	blair,rm; /	1963
JWMAA	29--4	885	888	od--	deer fenc construc & costs	halls,lk; boyd,c/	1965
NAWTA	33---	169	181	od--	ceel, influ cattle mgmt on	skovlin,jm; edge/	1968
SCIEA	92---	529	530	od--	electric fences, repel dee	burr,jg	1940
TAGPA	3---5	10	12	od--	react deer pop, graz pract	merrill,lb; teer/	1957
TIMBA	56--1	48	51	od--	increasng problm of damage	anonymous	1955

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
BICOB	6---1	69	70	odvi	morganza floodway opening	yancey,rk	1974
CBTIA	15...	411	420	odvi	zinc dimeth repllnt, crops	baumgartner,ll; p	1949
CNBUA	348--	1	16	odvi	deer herd, land owner,conn	mcdowell,rd; bens	1960

odvi continued on the next page

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
JWMAA	38--3	488	498	odvi	behav respn,intnsv ranchng	hood,re; inglis,j	1974
NAWTA	14---	567	576	odvi	crop protct repllnt, maine	powell,se	1949
NAWTA	14---	604	611	odvi	damage control, herd mgmnt	bump,g	1949
PCGFA	15---	119	122	odvi	new princ, prevnt crop dam	flyger,v; thoerig	1961
PCGFA	16---	45	52	odvi	crop damage, dee, maryland	flyger,v; thoerig	1962
PCGFA	20---	15	18	odvi	forage anal, mngmnt studie	short,hl	1966
PCGFA	20---	233	235	odvi	repell,gardn,orch,field,va	carpenter,m	1966
PCGFA	21---	32	38	odvi	damage, citrus grovs, flor	beckwith,sl; stit	1967
TISAA	57--3	179	181	odvi	effe soybean plants, illin	klimstra,wd; thom	1964
VIWIA	16--2	25	25	odvi	bone tar oil sprays, repel	virginia commissi	1955
VIWIA	28--5	8	9	odvi	control of deer damage	carpenter,m	1967
WLSBA	5---3	107	112	odvi	damag orchards, better mgt	anthony,rg; fishe	1977
WLSBA	6---4	235	239	odvi	willing farmrs incur damag	brown,tl;o decke/	1978
WLSBA	6---4	250	253	odvi	characts damage to soybean	decalesta,ds; sch	1978
WSCBA	4---6	41	46	odvi	damag, brule r valley, wis	welsh,s	1939
WSCBA	10--3	15	15	odvi	bear, damage payments, wis	anonymous	1945
WSCBA	16-10	10	13	odvi	deer repellent tests, wisc	thompson,dr; keen	1951
WSCBA	18--1	3	10	odvi	--and the browse came back	deboer,sg	1953

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
CAFGA	18--2	156	165	odhe	repellents & deer control	true,gh,jr	1933
CAGRA	5---9	7	7	odhe	deer repellents, californi	howard,we; hjersm	1951
CAGRA	7---2	4	4	odhe	plntng to reduce damag, ca	longhurst,wm	1953
CAGRA	10--5	4,	10	odhe	mngng on private land, cal	longhurst,wm; how	1956
JFUSA	48--1	26	30	odhe	wildl-forst relatns, pacif	mitchell,ge	1950
JFUSA	67-11	803	805	odhe	improvm habitat, s w lands	reynolds,hg	1969
JWMAA	13--4	421	423	odhe	lvstck, eff on range, utah	smith,ad	1949
UAECA	121--	3	17	odhe	deer mgt, rang lvstck prod	stoddart,la; rasm	1945

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
NAWTA	33---	169	181	ceel	od,doca,influenc cattl man	skovlin,jm; edge/	1968
SFORA	18--3	184	188	ceel	longev synth twine, nettng	neustein,sa	1964

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
MRLTA	38--1	1	3	alal	dammed waters, moose range	edwards,ry	1957

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
				rata			

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
NAWTA	12---	185	192	anam	range use in western texas	buechner,hk	1947
TRVIA	108-2	266	285	anam	reg numbrs, relat land use	buechner,hk	1961

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
				bibi			

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
				ovca			

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
				ovda			

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
				obmo			

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
				oram			

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
JRMGA	7---4	170	175	dosh	doca, optim use summr rang	hopkin,ja	1954
UTSCB	34--1	27	30	dosh	contrl sagbrush,seeded ran	frischknecht,nc;/	1973

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
NAWTA	29---	404	417	many	summer range relatns, utah	julander,o; jeffe	1964
VEZOA	7---6	10	14	many	changes in landscap, fauna	golov,ba	1973

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
CFGGA	5----	1	71	wldl	crop damage by wldl, calif	biehn,er	1951
ECMOA	24--2	349	376	wldl	ecol suc, aband farml, man	beckwith,sl	1954
JFUSA	60--1	45	46	vert	econ losses caused by vert	howard,we	1962
JWMAA	2---3	79	81	wldl	use of salt, control distr	case,gw	1938
JWMAA	3---1	1	13	wldl	electric fence in managemt	mcatee,wl	1939
JWMAA	23--2	240	241	wldl	damage to crops, unit stat	mcdowell,rd; pill	1959
NAWTA	10---	219	224	biga	livestock on western range	schwan,he	1945
NAWTA	12---	165	174	game	contest,w publ game fields	wagar,jvk	1947
NAWTA	15---	83	93	biga	importn, stckman, lnd mgmt	stoddart,la	1950

OTHER PUBLICATIONS

Rouse, C. H. 1962. Antelope and sheep fences. Interstate Antelope Conf. Trans. December: 45-47.

Sunderstrom, C. 1966. Fence designs for livestock and big game. Intermountain Forest and Range Exp. Sta. Range Improvement Notes 11(2): 3-11.

U. S. Bureau of Land Management. 1965. Position statement on woven wire fencing on the public lands in Wyoming. Bureau Land Mangt., Cheyenne, Wyo. 23 p.

CHAPTER 21, WORKSHEET 4.1a

Agricultural damage by wild ruminants

Damage to agricultural crops by wild ruminants can be substantial. Review the material on ecological metabolism in PART III, Chapter 7, TOPIC 6 to determine the energy required during the part of the year when crops are vulnerable. Usea simple average or a weighted mean metabolic structure (See PART VI, CHAPTER 18, TOPIC 2) to arrive at a "metabolic cost per animal per day." Then answer the following questions.

ELWK?

MBLM?

ELMD?

Number of animals?

Number of days on this agricultural diet?

Fraction of the animal's diet?

Gross energy in the agricultural diet?

Digestibility of the agricultural diet?

Metabolizable energy in the agricultural diet?

Amount of agricultural diet required to meet this energy requirement per day?

Multiply the answer above by the fraction of the animal's diet.

Multiply by the number of days on this agricultural diet.

Multiply by the number of animals on this diet.

The final product above is a direct estimate of the amount of the agricultural diet consumed.

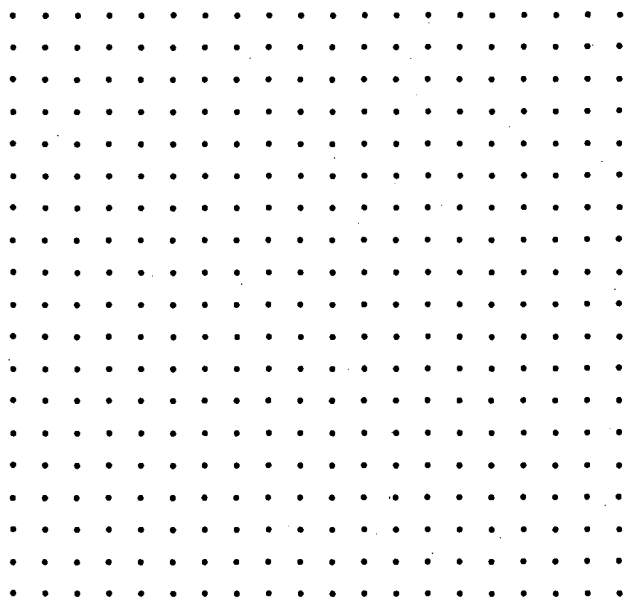
Consider the additional effects of waste, trampling, etc.

Consider the additional effects of foraging on plant productivity.

CHAPTER 21, WORKSHEET 4.1b

The cost of fencing to protect agricultural crops

Fencing may be used to protect high-density agricultural crops such as gardens and orchards. Determine the perimeters of different sizes of fields of different shapes which you may illustrate below. Then determine the costs of fencing in relation to crop production and value.



One acre = 43560 square feet

One acre = 208.7*2 feet

One rod = 16.5 feet

One chain = 66 feet = 20 m

One hectare = 1000 square meters

Choose the scale you wish to use and complete the calculations below.

Dimensions	Area	Perimeter
____x____	____	_____
____x____	____	_____
____x____	____	_____

Answer the following questions to determine the cost.

Perimeter?

Number of corners?

Distance between parts?

Number of parts?

Extra parts for corners?

Cost of parts?

Length of fence?

Cost of fence?

Expected labor costs?

Total cost of fence?

Life expectancy of fence?

Cost per year?

Maintenance cost per year?

Gross value of agricultural crops protected?

Net profit from agricultural crops protected?

Profit margin as percent of gross?

Fence cost as per cent of gross?

Is fencing a good investment?

Is production possible without protection?

Management alternatives?

UNIT 4.2: FORESTRY

The effect of deer and elk on forest reproduction may be much greater than supposed because the injury or removal of young seedlings is not conspicuous. Murie (1951) pointed out over 30 years ago the potential for elk to suppress reproduction until the older trees are gone and there is no young growth to replace them. The eventual removal of forest shrubs effects the cover and landscape for years to come.

An early survey of deer damage to forest reproduction in Wisconsin showed that up to 80% of hard maple reproduction and 33% of white pine reproduction were lost to deer damage. Further, one-half of the conifers were damaged to varying degrees (Ruhl 1956). On the west coast, the most desirable timber trees were also found to be the most palatable to deer (Cowan 1956), and they also concentrated on the burn areas where reforestation is most desirable and necessary.

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Cowan, I. M. 1956. Life and times of the coast black-tailed deer. Pages 523-617 In The Deer of Norrth America, W. P. Taylor, Ed. The Stackpole Compny, Harrisburg, Pa. 668 p.

Murie, O. J. 1951. The Elk of North America. The Stackpole Company, Harrisburg, Pa. 376 p.

Ruhl, H. D. 1956. Hunting the white-tail. Pages 261-331. In The Deer of North America, W. P. Taylor, Ed. The Stackpole Company, Harrisburg, Pa. 668 p.

REFERENCES, UNIT 4.2

FORESTRY

BOOKS

TYPE	PUBL	CITY	PGES	ANIM	KEY WORDS----------	AUTHORS/EDITORS--	YEAR
aubo	acbo	wadc	178	----	clearcuttng, view from top	horwitz,ej	1974

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
FOSCA	1---1	61	67	od--	eff brows, qual hardw timb	switzenberg,df; /	1955
JRMGA	19...	212	214	od--	doca,brush man infl prefer	powell,j; box,tw	1966
JWMAA	16--3	390	391	od--	repellent sprays, foliage	howard,we; hjersm	1952
JWMAA	30--1	109	114	od--	eval mamm repell, brws, nd	dietz,dr; tigner,	1968
JWMAA	33--4	922	926	od--	contrl use,forest, elec fn	tierson,wc	1969
NAWTA	14---	232	238	od--	advances, forest, game mgt	warren,c	1949
NFGJA	11--2	115	118	od--	use of commercial clear-ct	krull,jn	1964
PSAFA	1948-	257	263	od--	forest grazin, eastern for	branble,wc; engli	1948
PSAFA	1957-	101	104	od--	mismanag, threat sust yiel	bennett,al	1957
PSAFA	1957-	137	140	od--	effects, pulpwood cutting	gill,j	1958
PSAFA	1958-	127	129	od--	conflict, integ, man fores	adams,l	1958
TIMBA	56...	48	51	od--	increasing problem, damage	anonymous	1955
VJSCA	10--4	262	262	od--	eff for prac, man, abun, d	quillen,jh,jr	1959
XAFNA	109--	1	33	od--	forestry, pine reg, n jers	little,s; moorhe/	1958
XANEA	33---	1	37	od--	browsing hardwoods,nrth es	shafer,el,jr	1965
XFWWA	1955-	1	13	od--	rabbit, repellents, protec	besser,j	1955
XPNWA	5----	1	8	od--	repell reduce brow, ponder	driscoll,rs	1963

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
BICOB	6---1	69	70	odvi	morganza floodway opening	yancey,rk	1974
JFUSA	29--5	700	708	odvi	damage to n england forest	hosley,nw; crow,/	1931
JFUSA	34--5	472	474	odvi	for mgt, deer req, alleghe	ehrhart,eo	1936
JFUSA	47-11	909	913	odvi	eff on conifer repro, mont	adams,l	1949
JFUSA	54--4	238	242	odvi	manag, deer, ponderosa pin	neils,g; adams,l/	1956
JFUSA	56--2	116	121	odvi	eff stand dens, brow, repr	curtis,ro; rushmo	1958
JFUSA	58--5	385	387	odvi	slash protect seedl, brows	grisez,tj	1960
JFUSA	61-10	741	746	odvi	compar timbr, wildl values	gamble,hb; bartoo	1963
JFUSA	64-12	801	805	odvi	brws infl,loggd n hrdw for	tierson,wc; patr/	1966
JFUSA	68--5	298	300	odvi	brwsng, hrdwd regen, appal	harlow,rf; downin	1970

odvi continued on the next page

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
JFUSA	68-11	692	694	odvi	deer habtat mgt,eastrn for	jordan,js	1970
JFUSA	68-11	695	700	odvi	deer densty contrl,for mgt	behrend,df; matt/	1970
JFUSA	68-11	701	704	odvi	improv hab,cut conif swmps	krefting,lw; phil	1970
JFUSA	71-12	752	757	odvi	manag hab, loblol-shrtleaf	halls,lk	1973
JWMAA	4---1	77	79	odvi	simple repellent, conif pl	weiss,s	1940
JWMAA	17--4	487	494	odvi	eff sim damag, conif, hare	krefting,lw; stoe	1953
JWMAA	21--1	75	80	odvi	eff brow, repro, hardw-hem	stoeckeler,hj; s/	1957
JWMAA	23--4	450	451	odvi	prevent browsng, pine plnt	mcneel,w,jr; kenn	1959
NAWTA	20---	539	551	odvi	manag, deer, ponderosa pin	neils,g; adams,l/	1956
NYCOA	10--1	30	31	odvi	the forest and the game	hall,ag; weight,f	1955
PMACA	19---	....	....	odvi	deer yards, uppr pen, mich	wakeman,mc	1933
PSAFA	1947-	210	214	odvi	cedar swamp managmnt, mich	bartlett,ih	1948
PSAFA	1948-	257	263	odvi	e forest grazi prblm, penn	bramble,wc; engli	1949
PSAFA	1957-	101	104	odvi	mismng, sustaind yield, pa	bennett,al	1958
PSAFA	1965-	229	233	odvi	mng, sustaind yield, brows	shaw,sp; ripley,t	1966
PVPCB	7....	229	234	odvi	bird, mamm probs, se pine	campbell,te	1976
TNWSD	27---	1	18	odvi	deer dens contr, adirondac	behrend,df; matt/	1970
WSCBA	12-10	3	23	odvi	damage, forest reprod surv	deboer,sg	1947
XANEA	308--	1	8	odvi	impact on hardwood regener	marquis,da	1974
XARRA	89---	1	51	odvi	brows, ponderosa pine plan	adams,l	1951
XARRA	105--	1	3	odvi	brows, natural conifer see	adams,l	1951

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
FOSCA	22--2	106	121	odhe	genetic resistan, doug fir	dimock,ej,II, si/	1976
JFUSA	61--1	53	54	odhe	repellnts effctv, pine, sw	heidmann,lj	1963
JFUSA	61-10	734	740	odhe	odvi, timbrlnds, n rockies	pengelly,wl	1963
JFUSA	64--5	322	326	odhe	eff sim dee bros, doug-fir	crouch,gl	1966
JFUSA	72--5	282	285	odhe	eff logging, fora val, col	regelin,wl; wall/	1974
JRMGA	30--5	352	356	odhe	doca, forage selec compari	currie,po; reich/	1977
JWMAA	36--4	1025	1033	odhe	forag use, relativ to logg	wallmo,oc; regel/	1972
JWMAA	41--3	543	559	odhe	ceel,use nat,mod piny pine	short,hl; evans,/	1977

odhe continued on the next page

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
NAWTA	30---	310	321		odhe reseeded forest,meadow, az	hungerford,cr	1965
NOSCA	52--3	233	235		odhe deer & forest reprod, wash	amaral,m	1978
XARRA	141--	1	4		odhe response, altern-strip cle	wallmo,oc	1969

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
JFUSA	51--9	620	623		ceel od, the tree farm program	hagenstein,wd	1953
JFUSA	72-12	764	766		ceel odhe, odvi, patch cut pine	patton,dr	1974
NOSCA	46--1	59	66		ceel od, veg, soils in exclosur	tiedemann,ar; ber	1972
SFORA	22--1	14	17		ceel maurading deer, scotland	grant,pch	1968
SFORA	26--1	37	42		ceel management, economic, dile	viscount of arbut	1972
SISRB	15...	1	54		ceel damage to scots pine from	lavsund,s	1974
TDSKA	78--2	239	250		ceel dosh, forestation, norway	bortnes,g	1970
TTFPB	13---	39	64		ceel eff fire, vert herb, scott	miller,gr; watson	1973
XFIPA	129--	1	15		ceel aspen mortality, wint rang	krebill,rg	1972
ZEJAA	23--4	214	218		ceel bark damage, red timb valu	anonymous	1977

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
					alal		

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
					rata		

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
					anam		

CODEN VO-NU BEPA ENPA ANIM KEY WORDS---------- AUTHORS---------- YEAR

bibi

CODEN VO-NU BEPA ENPA ANIM KEY WORDS---------- AUTHORS---------- YEAR

ovca

CODEN VO-NU BEPA ENPA ANIM KEY WORDS---------- AUTHORS---------- YEAR

ovda

CODEN VO-NU BEPA ENPA ANIM KEY WORDS---------- AUTHORS---------- YEAR

obmo

CODEN VO-NU BEPA ENPA ANIM KEY WORDS---------- AUTHORS---------- YEAR

oram

CODEN VO-NU BEPA ENPA ANIM KEY WORDS---------- AUTHORS---------- YEAR

ECMOA 14--3 255 270 doca 10 yr stud grz, ungrz wood dambach,ca 1944

CODEN VO-NU BEPA ENPA ANIM KEY WORDS---------- AUTHORS---------- YEAR

JFUSA 53--6 436 438 many lessons, europ, fores mngm johnson,fw; adams 1955

JSWCA 27--6 250 254 many clrcttng, beneficial aspct resler,ra 1972

VEZOA 7---6 10 14 many chan landsc, fauna, poltav golov,ba 1973

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
JFUSA	34--2	98	103	wldl	correlatn forstry & wldl m	gabrielson,in	1936
JFUSA	47--9	698	699	wldl	foresters as wldl managers	gabrielson,in	1949
JFUSA	51--6	440	443	wldl	modif for prac, hab better	swift,e	1953
JFUSA	60--1	13	15	wldl	industrial forestry, south	kitchens,jh,jr	1962
JFUSA	60--1	15	17	wldl	indus forstry, lake states	hurd,es	1962
JFUSA	60--1	18	20	wldl	indust forestry, northeast	bennett,al	1962
JFUSA	65-11	807	813	----	forest cover and logging	young,ja; hedric/	1967
JFUSA	68--5	270	273	wldl	forest wildlife responsibi	shaw,sp	1970
JSWCA	27--6	255	258	wldl	clearcttng, detrim aspects	pengelly,wl	1972
JWMAA	21--1	101	103	wldl	interpret overbrowsing, no	webb,wl	1957
JWMAA	35--4	644	657	wldl	manag criter, oaks, wildli	goodrum,pd; reid/	1971
JWMAA	39--3	557	562	wldl	brows, herbage, intens man	wolters,gl; schmi	1975
NAWTA	27---	368	376	wldl	recent forest manag trends	gould,wp	1962
NAWTA	27---	402	412	----	tim-wildl coor con, eas fo	giles,rh,jr	1962
NYCOA	7---6	8	8	wldl	chemi-peeling and wildlife	cook,db	1953
PSAFA	1947-	200	205	game	controlled burning, michig	smith,nf	1948
PSAFA	1954-	138	141	wldl	wisc coop forest wildl pro	bulfer,de	1954
PSAFA	1962-	167	171	wldl	wldlf-fores mgt, wldl resp	mcginnes,bs; ripl	1962
TTFPB	5----	177	194	wldl	disc of wl man, fire, land	komarek,r	1966
XFNNA	33---	1	3	wldl	atlantic white cedar, jers	little,s; somes,h	1965
XFPNA	6----	1	28	mamm	protecting for trees, seed	radwan,m	1963
XGNFA	14---	1	13	wldl	timber cut, sust yield, wo	roach,ba	1974

CHAPTER 21, WORKSHEET 4.2a

The cost of protecting reforested lands from damage by wild ruminants

The WORKSHEET after the previous UNIT includes questions on costs of protecting agricultural crops. Review those questions. Then describe the protection needed for reforested stands, choose the methods to be used to protect the stands, and set up a WORKSHEET of your own in the space below.

CLOSING COMMENTS

This CHAPTER has focused on the habitat. Additional information and lists of SERIAL references are found in PART IV, CHAPTER 13: PRIMARY PRODUCTION AND FORAGE FOR WILD RUMINANTS. The effects of man's activities, both intentional and unintentional, direct and indirect, on the habitat has a marked impact on wildlife populations. The next CHAPTER includes discussions and references on BIOLOGICALLY-BASED SPECIES MANAGEMENT.

Aaron N. Moen
March 20, 1982

GLOSSARY OF SYMBOLS - CHAPTER TWENTY-ONE

bMTR = b value for the mortality rate

bPOP = b value for the population

bRPR = b value for the reproductive rate

MTRT = mortality rate

NAIP = number of animals in the initial population

PRDN = predicted N; predicted number of animals in the population

RPRT = reproductive rate

YAPN = years ahead to predict the population

GLOSSARY OF SERIAL CODENS - CHAPTER TWENTY-ONE

Serials are identified by five-character, generally mnemonic codes called CODEN, listed in 1980 BIOSIS, LIST OF SERIALS (BioSciences Information Service, 2100 Arch Street, Philadelphia, PA 19103).

The headings for the lists of SERIALS are:

CODEN VO-NU BEPA ENPA ANIM KEY WORDS---------- AUTHORS---------- YEAR

The volume and issue numbers (VO-NU) are given after the CODEN entry, followed by beginning page (BEPA), ending page (ENPA), species discussed (ANIM)1, KEY WORDS from the title, AUTHORS [truncated if necessary, slash (/) indicates additional authors], and YEAR.

ABSZA Annales Botanici Societatis Zoologicae Botanicae Fennicae Vanamo
AGJOA Agronomy Journal
ALCNA Alabama Conservation
AMFGA American Fruit Grower
AMFOA American Forests
AMNAA American Midland Naturalist (US)
ANKIA Animal Kingdon, New York Zoological Society Bulletin
ATRLA Acta Theriologica (Poland)
AZWBA Arizona Game and Fish Department Wildlife Bulletin (US)

BICOB Biological Conservation
BNMFD New Mexico Department of Game & Fish Bulletin
BOREA Botanical Review (US)
BPURD Biological Papers of the University of Alaska Special Report
BRYOA Bryologist (US)
BSETB Botanical Society of Edinburgh Transactions (Scotland)
BYMOA Byulletin Moskovskago Obschestva Ispyrtatalei Prirody Otdel Biologicheskii (USSR)
BZOBA Bonner Zoologische Beitraege

CAFGA California Fish and Game (US)
CAFNA Canadian Field Naturalist (Canada)
CAGRA California Agriculture
CBTIA Contributions from the Boyce Thompson Institute
CFGGA California Department of Fish and Game, Game Bulletin
CGFPA Colorado Division of Game, Fish, and Parks Special Report (US)
CNBUA Connecticut Storrs Agricultural Experiment Station Bulletin
CNJMA Canadian Journal of Comparative Medicine and Veterinary Science
CNSVA Conservationist
CPLSA Canadian Journal of Plant Science (Canada)
CWRSB Canadian Wildlife Service Report and Management Bulletin Series
CZOOA Carnets de Zoologie

ECMOA Ecological Monographs
ECOLA Ecology
EVCNA Environmental Conservation
EXJOA Explorer's Journal

FHSCA Farm and Home Science
FNQBA Faune du Quebec
FOSCA Forest Science (US)
FRCRA Forestry Chronicle (Canada)
FUNAA Fauna (Oslo)

ICNSA Iowa Conservationist
IGWBA Idaho Department of Fish and Game Wildlife Bulletin
IUCSB International Union for Conservation of Nature and Natural Resources Publications New Series

JAGRA Journal of Agricultural Research (Washington, DC)
JAPEA Journal of Applied Ecology (England)
JBRGA Journal of the British Grassland Society (England)
JFUSA Journal of Forestry (US)
JOMAA Journal of Mammalogy
JRMGA Journal of Range Management
JSWCA Journal of Soil and Water Conservation
JTBIA Journal of Theoretical Biology
JWMAA Journal of Wildlife Management

LESOA Lesovedenie (USSR)

MDCBA Minnesota Department of Conservation Technical Bulletin
MDCRA Michigan Department of Conservation Game Division Report
MFNOA Minnesota Forestry Notes
MOCOA Missouri Conservationist
MRLTA Murrelet, The
MRYCA Maryland Conservationist
MUZPA Miscellaneous Publications, Museum of Zoology, University of Michigan

NAWLA National Wildlife
NAWTA North American Wildlife and Natural Resources Conference, Transactions of the (US)
NCANA Naturaliste Canadien, Le
NEJZA Netherlands Journal of Zoology (Netherlands)
NFGJA New York Fish and Game Journal (US)
NMWIA New Mexico Wildlife
NOSCA Northwest Science (US)
NPKMA National Parks Magazine

NPSMD United States National Park Service Scientific Monograph Series
NYCOA New York Conservationist
NZFTA New Zealand Forest Service, Forest Research Institute Technical Paper
NZJFA New Zealand Journal of Forestry
NZSRA New Zealand Science Review
NZTBA New Zealand Journal of Science and Technology Section B

OCRNA Ocrotirtea Naturii
OFWRA Ontario Fish and Wildlife Review (Canada)
ORYXA Oryx

PASCC Proceedings of the Alaskan Scientific Conference (US)
PCGFA Proceedings of the Southeastern Association of Game and Fish Commissioners (US)
PIAIA Proceedings of the Iowa Academy of Science (US)
PMACA Papers of the Michigan Academy of Sciences, Arts and Letters
POASA Proceedings of the Oklahoma Academy of Science
PORSA Proceedings of the Oregon Academy of Science
PSAFA Proceedings of the Society of American Foresters (US)
PVPCB Proceedings of the Vertebrate Pest Conference
PZESA Proceedings of the New Zealand Ecological Society

QBMAA Michigan Agricultural Experiment Station, Quarterly Bulletin

RRFBA Report Reelfoot Lake Biological Station of the Tennessee Academy of Science
RWLBA Roosevelt Wildlife Bulletin

SALKA Science in Alaska Proceedings Alaskan Science Conference
SCBUB Sierra Club Bulletin
SCIEA Science
SFORA Scottish Forestry
SISRB Institutionen for Skogskzoologi Rapporter och Uppsatser
SRBSB Supplemento alle Richerche di Biologie della Selvaggina
SWNAA Southwestern Naturalist (US)

TAGPA Texas Agricultural Progress
TCNSA Transactions of the Cardiff Naturalist's Society
tdbca Transactions of the Desert Bighorn Council
TDSKA Tidsskrift for Skogbruk
TIMBA Timberman
TISAA Transactions of the Illinois State Academy of Science (US)
TNWSD Transactions of the Northeast Section, The Wildlife Society (US)
TRVIA Terre Vie (La Terre et la Vie)
TTFPB Tall Timbers Fire Ecology Conference, Proceedings (US)

UABPA Biological Papers of the University of Alaska
UAECA Utah Agricultural Experiment Station Circular
UASPA Proceedings of the Utah Academy of Sciences, Arts and Letters
UCPZA University of California Publications in Zoology
UTSCB Utah Science (US)

VEZOA Vestnik Zoologii
VILTA Viltrevy (Sweden)
VIWIA Virginia Wildlife
VJSCA Virginia Journal of Science
VMUBA Vestnik Moskovskogo Universiteta Seriya VI Biologiya Pochvovedenie

WCDBA Wisconsin Conservation Department Technical Bulletin
WGFBA Wyoming Game and Fish Commission Bulletin
WLMOA Wildlife Monogrphhs (US)
WLSBA Wildlife Society Bulletin
WMBAA Wildlife Management Bulletin (Ottawa) Series 1 (Canada)
WSCBA Wisconsin Conservation Bulletin

XAFNA Northeastern Forest Experiment Station, Station Paper
XAMPA U S D A Miscellaneous Publication
XANEA U S Forest Service Research Paper NE (US)
XARRA U S Forest Service Research Note RM (US)
XASRA U S Forest Service Research Note SE (US)
XATBA U S D A Technical Bulletin
XDAFA U S D A Farmer's Bulletin
XFIPA U S Forest Service Research Paper INT (US)
XFNCA U S Forest Service Research Paper NC (US)
XFNNA U S Forest Service Research Note NE (US)
XFRMA U S Forest Service Research Paper RM (US)
XFWLA U S D I Fish and Wildlife Service, Wildlife Leaflet
XFWWA U S Fish and Wildlife Service Special Scientific Report - Wildlife
XGNFA U S Forest Service General Technical Report NE (US)
XNFSA U S National Park Service Fauna of the National Parks of the United States, Fauna Series
XPNWA U S Forest Service Research Note PNW (US)

ZEJAA Zeitschrift fuer Jagdwissenschaft
ZORVA Zoologisk Revy (Sweden)

The headings for the lists of BOOKS are:

TYPE PUBL CITY PAGE ANIM KEY WORDS---------- AUTHORS/EDITORS-- YEAR

All essential information for finding each book in the library is given on just one line. The TYPE of book could have either AUTHORS (aubo) or EDITORS (edbo). Publishers (PUBL) and CITY of publication are given with four-letter mnemonic symbols defined below. The PAGE column gives the number of pages in the book; ANIM refers to the species discussed in the book (given as a four-letter abbreviation of genus and species), and KEY WORDS listed are from the title. The AUTHORS/EDITORS and YEAR of publication are given in the last two columns.

aakn	Alfred A. Knopf	New York, NY	nyny
acbo	Acropolis Books, Ltd.	Washington, DC	wadc
acpr	Academic Press	New York, NY	nyny
cite	Cambridge Institute of Terrestrial Ecology	Cambridge, England	caen
cnpc	C. C. Nelson Pub. Co.	Appleton, WI	apwi
cscs	Charles Scribner's Sons	New York, NY	nyny
dnhp	Doubleday/Natural History Press	New York, NY	nyny
fost	Forest and Stream Publishing Co.	New York, NY	nyny
gbri	Gillespie Brothers, Inc.	Stamford, CT	stct
jwis	John Wiley and Sons, Inc.	New York, NY	nyny
macm	MacMillan Co.	New York, NY	nyny
mfgd	Montana Fish and Game Department	Helena, MT	hemt
mhbc	McGraw-Hill Book Company, Inc.	New York, NY	nyny
monp	The Monumental Press	Baltimore, MD	bama
naus	National Audubon Society	New York, NY	nyny
nhfg	New Hampshire Fish and Game Dept.	Concord, NH	conh
nmgf	New Mexico Game and Fish Dept.	Santa Fe, NM	sfnm
oxup	Oxford University Press	London, England	loen

pnfr	U. S. Pacific Northwest Forest and Range Experiment Station	Portland, OR	poor
qupr	Queen's Printer	Ottawa, Ontario	oton
ropr	Ronald Press	New York, NY	nyny
stac	The Stackpole Company	Harrisburg, PA	hapa
ucap	University of California Press	Berkeley, CA	beca
unbp	University of Nebraska Press	Lincoln, NE	line
uopr	University of Oklahoma Press	Norman, OK	nook
utop	University of Toronto Press	Toronto, ON	toon
uwyp	University of Wyoming Press	Laramie, WY	lawy
vipr	Viking Press	New York, NY	nyny
wiin	Wiley-Interscience	New York, NY	nyny
wimi	Wildlife Management Institute	Washington, DC	wadc
winp	Winchester Press	New York, NY	nyny
wiso	The Wildlife Society	Washington, DC	wadc
yaup	Yale University Press	New Haven, CT	nhct

GLOSSARY OF ANIMAL CODE NAMES

Wild ruminants are referred to in this CHAPTER by a 4-character abbreviation from the family, genus and genus-species. These are listed below under Abbreviation.

Scientific names of North American wild ruminants are those used in BIG GAME OF NORTH AMERICA, edited by J.C. Schmidt and D. L. Gilbert (1979: Stackpole Books, Harrisburg, PA 17105, 494 p.), and may be different from the scientific names given in the original literature.

The abbreviations used for North American wild ruminants are listed below.

CLASS: MAMMALIA

ORDER: ARTIODACTYLA	Abbreviation
FAMILY: CERVIDAE	cerv
GENUS: Odocoileus (deer)	od--
SPECIES: O. virginianus (white-tailed deer)	odvi
O. hemionus (mule deer)	odhe
GENUS: Cervus (Wapiti, elk)	ce--
SPECIES: C. elaphus	ceel
GENUS: Alces (moose)	
SPECIES: A. alces	alal
GENUS: Rangifer (caribou)	
SPECIES: R. tarandus	rata
FAMILY: ANTILOCAPRIDAE	
GENUS: Antilocapra	
SPECIES: A. americana (pronghorn)	anam
FAMILY: BOVIDAE	bovi
GENUS: Bison (bison)	bi--
SPECIES: B. bison	bibi
GENUS: Ovis (sheep)	ov--
SPECIES: O. canadensis (bighorn sheep)	ovca
O. dalli (Dall's sheep)	ovda
GENUS: Ovibos	
SPECIES: O. moschatus (muskox)	obmo
GENUS: Oreamnos	
SPECIES: O. americanus (mountain goat)	oram

The abbreviations used for European wild ruminants are listed below.

CLASS: MAMMALIA

ORDER: ARTIODACTYLA	Abbreviation
FAMILY: CERVIDAE	cerv
GENUS: *Capreolus* (roe deer)	ca--
SPECIES: *C. capreolus*	caca
GENUS: *Dama* (fallow deer)	da--
SPECIES: *D. dama*	dada
GENUS: *Cervus* (Wapiti, elk)	ce--
SPECIES: *C. elaphus* (red deer)	ceel
GENUS: *Alces* (moose)	
SPECIES: *A. alces*	alal
GENUS: *Rangifer* (caribou)	
SPECIES: *R. tarandus*	rata
FAMILY: BOVIDAE	
GENUS: *Bison* (bison)	
SPECIES: *B. bonasus*	bibo
GENUS: *Capra* (ibex, wild goat)	cp--
SPECIES: *C. aegargrus*(Persian ibex)	cpae
C. siberica (Siberian ibex)	cpsi

OTHERS

Abbreviations for a few other species and groups of species may appear in the reference lists. These are listed below.

Axis axis (axis deer)	axax
Elaphurus davidianus (Pere David's deer)	elda
Cervus nippon (Sika deer)	ceni
Hydropotes inermis (Chinese water deer)	hyin
Muntiacus reevesi (Chinese muntjac)	mure
Moschus moschifer (Chinese musk deer)	momo
Ammotragus lervia (Barbary sheep)	amle
Ovis nivicola (snow sheep)	ovni
Ovis musimon (moufflon)	ovmu
Ovis linnaeus (Iranian sheep)	ovli
Rupicapra rupicapra (chamois)	ruru
big game	biga
domestic sheep	dosh
domestic cattle	doca
domestic goat	dogo
domestic ruminant	doru
mammals	mamm
three or more species of wild ruminants	many
ruminants	rumi
ungulates	ungu
vertebrates	vert
wildlife	wldl
wild ruminant	wiru

JULIAN DAY: MONTH AND DAY EQUIVALENTS*

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Day
1	001	032	060	091	121	152	182	213	244	274	305	335	1
2	002	033	061	092	122	153	183	214	245	275	306	336	2
3	003	034	062	093	123	154	184	215	246	276	307	337	3
4	004	035	063	094	124	155	185	216	247	277	308	338	4
5	005	036	064	095	125	156	186	217	248	278	309	339	5
6	006	037	065	096	126	157	187	218	249	279	310	340	6
7	007	038	066	097	127	158	188	219	250	280	311	341	7
8	008	039	067	098	128	159	189	220	251	281	312	342	8
9	009	040	068	099	129	160	190	221	252	282	313	343	9
10	010	041	069	100	130	161	191	222	253	283	314	344	10
11	011	042	070	101	131	162	192	223	254	284	315	345	11
12	012	043	071	102	132	163	193	224	255	285	316	346	12
13	013	044	072	103	133	164	194	225	256	286	317	347	13
14	014	045	073	104	134	165	195	226	257	287	318	348	14
15	015	046	074	105	135	166	196	227	258	288	319	349	15
16	016	047	075	106	136	167	197	228	259	289	320	350	16
17	017	048	076	107	137	168	198	229	260	290	321	351	17
18	018	049	077	108	138	169	199	230	261	291	322	352	18
19	019	050	078	109	139	170	200	231	262	292	323	353	19
20	020	051	079	110	140	171	201	232	263	293	324	354	20
21	021	052	080	111	141	172	202	233	264	294	325	355	21
22	022	053	081	112	142	173	203	234	265	295	326	356	22
23	023	054	082	113	143	174	204	235	266	296	327	357	23
24	024	055	083	114	144	175	205	236	267	297	328	358	24
25	025	056	084	115	145	176	206	237	268	298	329	359	25
26	026	057	085	116	146	177	207	238	269	299	330	360	26
27	027	058	086	117	147	178	208	239	270	300	331	361	27
28	028	059	087	118	148	179	209	240	271	301	332	362	28
29	029	[060]	088	119	149	180	210	241	272	302	333	363	29
30	030		089	120	150	181	211	242	273	303	334	364	30
31	031		090		151		212	243		304		365	31

* For leap year, February 29 = JDAY 60. Add 1 to all subsequent JDAYs.

LIST OF WORKSHEETS - CHAPTER TWENTY-ONE