TOPIC 2. THE PROTECTIONIST APPROACH

This TOPIC is placed in the CHAPTER dealing with improper use because the protectionist approach can be carried too far. We usually don't think of hunting seasons as "protection," but that is precisely what they are. Hunting seasons are designed to protect the species when the animals are struggling with the effects of winter weather, when they are recovering from winter and are completing the final stages of gestation in the spring, and when the young are being raised in the summer. Further, the length of hunting seasons in the fall are based on population levels and hunter efficiency, as are bag limits.

A properly-regulated hunting season protects the population from over or under exploitation; that is a demonstrated fact. Whether you or I choose to hunt is a personal decision.

When does protection result in improper range use? When the amount of protection results in a net increase in biomass to the level at which the amount of forage required to support that biomass is greater than the amount of surplus forage available.

Too many hunters can reduce the deer population too much. Too many deer, which "hunt" plants, can reduce the plant population too much. Deer biologicst may be considered "friends of plants," just as many anti-hunters are members of "friends of animals." I even suggested that the Northeast Deer Study Group be renamed "Friends of Plants," but my motion was never seconded. The concept, however, is sound.

The effects of overpopulation of deer on plant production and succession are marked, as they can be for any species of wild ruminant that has reached high population densities. These effects are discussed in UNIT 2.1.

The effects of predator removal, which is being "friends of some but not all animals," are discussed in UNIT 2.2. This is one of the oldest "cure-alls" for arresting declines in game populations, but it is not the answer. Neither should we say that predators have no effects on populations; they do.

The effects of underharvesting are discussed in UNIT 2.3. This is probably one of the greatest potential problems that will result in improper range use as undue restrictions are placed on hunting in some areas and general interest in hunting declines with successive generations.

Trophy-hunting only, a challenging goal, may be self-defeating, as discussed in UNIT 2.4. All of these UNITS deal with gradients rather than either/or, all or none alternatives. Shift too much out of balance, improper range use results.

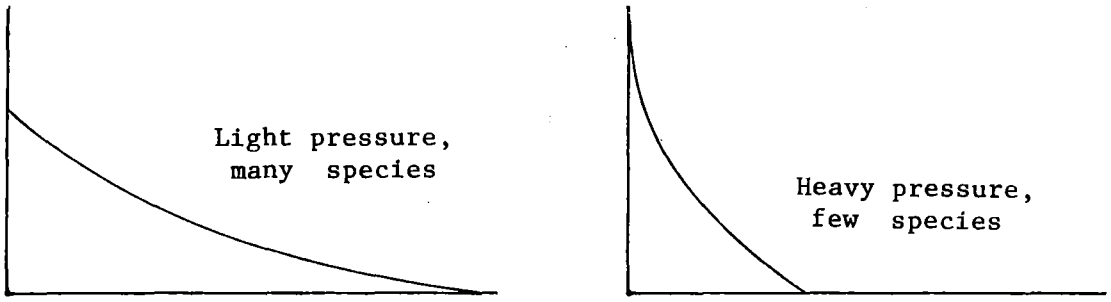
UNIT 2.1: EFFECTS ON PLANT COMMUNITIES

Wild ruminants do not select forage plants at random. There are some rather definitely-preferred species, and some rather definitely-avoided ones. The effect of this selection process is that some plants may be eaten so extensively that they disappear from the plant community and those that are avoided increase. The term applied to the former is "decreasers" and to the latter, "increasers."

Changes in plant community composition do not occur in a year or two, but over a period of years as a ruminant population builds up. During this time, the insiduous effects of grazing may go unnoticed to all but the trained biologist. Biologists, however, sometimes do not maintain continuous contact with the flora for enough years to observe the subtle changes. Changes in plant community composition become obvious only after the population of herbivores has exceeded appropriate levels.

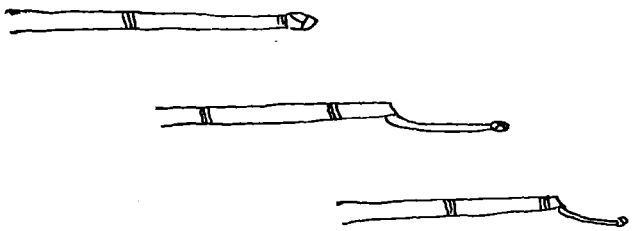
C. W. Severinghaus, recently retired after forty years of employment with the New York State Department of Environmental Conservation, states that white-tailed deer are one of, if not the prime determinant of forest stand composition in many areas of New York State. Species preferred by deer, such as white cedar, are gone in many areas because they simply cannot reproduce when exposed to the browsing pressure. Much less-preferred species, such as beech, reproduce and become relatively more abundant.

It appears that plant community diversity is a function of herbivore pressure. Communities free from grazing or browsing have many more species but fewer individuals of each. Communities subjected to heavy grazing or browsing pressure have many fewer species and many more individuals of the few species present. The relationships are illustrated below.



This relationship might be called the "gardening effect." A faithful gardener pulls the weeds but not the planted vegetables. The result? A few species in abundance, but little diversity. A poor gardener, not very enthusiastic about pulling weeds, lets them all grow. The result? A lot of species, but none that are overly abundant. Analogies are never perfect, but the idea applies in that the species that are left are the result of selection pressure.

Plant communities are organized collections of individuals. The effect of browsing on individual plants is illustrated below. Note that a little browsing may stimulate growth, but a lot of browsing depresses growth.



The whole plant, when overbrowsed, goes from a more open growth-form to a closed and compact one as illustrated in the drawing below.

Little growth occurs in the overbrowsed plant on the right; reserves do not build up enough nor is undisturbed growth allowed because frequent browsing removes meristimatic tissue.

Careful observations wil reveal the effects of excessive removal of plant material from individuals, species, and plant communities. These effects are much more common than is realized by the public, and sometimes more common than realized by biologists. It is hoped that this discussion will alert readers to be more observant and to help them identify these effects more readily in the field. The WORKSHEET at the end of this UNIT will also help.

REFERENCES, UNIT 2.1

EFFECTS ON PLANT COMMUNITIES

SERIALS

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
JWMAA	2---1	1	2	od--	prevntng deer concentratns	cox,wt	1938

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
AMNAA	31--3	697	743	odvi	range vege, livestock, tex	buechner,hk	1944
AUMGA	47--2	74	79	odvi	deer trouble, overpopulatn	cook,db	1945
JWMAA	21--1	101	103	odvi	interpret ovrbrws, n e for	webb,wl	1957
PCGFA	20---	15	18	odvi	forag analyse, mgt studies	short,hl	1966
PCGFA	21---	15	23	odvi	eff ovrpop, huntng,ft knox	dechert,ja	1967
WSCBA	2---9	3	9	odvi	to citizens of wisconsin	mackenzie,hw	1937
WSCBA	8---8	11	19	odvi	overuse, wint range, wisco	feeny,ws	1943
WSCBA	9---6	4	5	odvi	status, range, herd, wisco	feeny,ws	1944

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
JWMAA	11--2	162	177	odhe odvi	survey, ovrpop ranges	leopold,a; sowls/	1947
JWMAA	36--2	571	578	odhe	shrub yield util, wint rng	anderson,ae; med/	1972
NAWTA	9----	167	172	odhe	murders creek herd, ovrpop	mitchell,ge	1944

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
JWMAA	8---1	1	6	ceel	od, results, overstocking	dalke,pd; spencer	1944
JWMAA	13--1	127	134	ceel	irruption of elk, manitoba	banfield,awf	1949

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

PNBAA 86... 25 .... many graz mgt,sandhills prairie sharpe,rs; bragg/ 1976

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

JOMAA 22--1 47 53 biga criteria detrmn overbrwsng swift,lw 1941

JWMAA 21--1 101 103 ---- interprt ovrbrws n e fores webb,wl 1957

CHAPTER 23,- WORKSHEET 2.1a

Plant morphology in relation to browsing

Refer to the sketches on page 22 for the general effect of browsing on plant growth and morphology. Then go into the field and find a shrub, sapling, or tree that has been browsed. Draw the browsed and unbrowsed twig patterns in the space below.

CHAPTER 23,- WORKSHEET 2.1b

Differences in the amount of growth in relation to browsing

The previous WORKSHEET dealt with morphology only. If you are able to find plants that have been browsed rather heavily, select a plant or part of a plant and complete one or more of the following measurements on individual twigs.

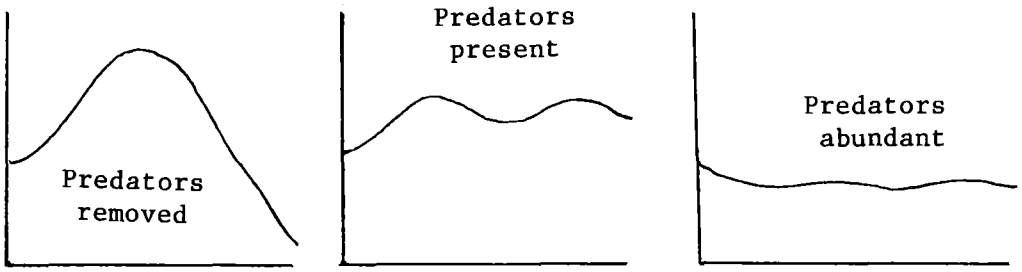
UNBROWSED			BROWSED		
LNGT	DIAM	WGHT	LNGT	DIAM	WGHT

UNBROWSED			BROWSED		
LNGT	DIAM	WGHT	LNGT	DIAM	WGHT

UNIT 2.2: EFFECTS OF PREDATOR REMOVAL

What does predator removal do to cause improper range use? Predation is one of many causes of mortality, and the removal of predators removes one cause of mortality. If other causes do not compensate, higher net population rates of increase result, and the potential for over-population and over-use of range resources exists. Populations of wild ruminants will grow beyond the capabilities of the range to support them, after which there will be a decline in the population, sometimes precipitously.

Just a ruminant populations cannot grow indefinitely because they are limited by the forage base, predator populations cannot grow indefinitely because they are limited by the prey base. Protection may result in initial population growth, but a leveling off and likely decline eventually occurs. Predator removal will not change the form of that relationships, only the shape. The potential effects are illustrated below.



It is hard to trust natural relationships sometimes, and we think the deer, the elk, the moose . . . need our help. Sometimes they do, but we must be careful about the extent to which we "help," and in no case should we enter into such management practices as predator removal without thorough analyses and simulations of the potential effects, not only on the prey population but on other ecological relationships as well.

REFERENCES, UNIT 2.2

EFFECTS OF PREDATOR REMOVAL

BOOKS

TYPE	PUBL	CITY	PGES	ANIM	KEY WORDS	AUTHORS/EDITORS	YEAR
aubo	adwe	repa	48	----	biology of predatr control	howard,we	1974

SERIALS

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
NAWTA	39---	230	240	odvi	intens shrt-trm pred remov	beasom,sl	1974
TWASA	35...	351	366	odvi	deer irruptions	leopold,a	1943

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
ECMOA	11...	229	265	odhe	biotic commmunitie, kaibab	rasmussen,di	1941

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
AUMGA	45--1	14	18	ceel	conservatn spiral, predatr	calahane,vh	1943
NAWTA	9---	173	176	ceel	our big game in winter	murie,oj	1944

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
MUZPA	25---	1	44	alal	the moose of isle royale	murie,a	1934
XNFSA	4----	1	202	alal	ecol, coyote, yellowstone	murie,a	1940

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

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
NAWTA	6----	294	299	anam	predator control, wldl mgt	riter,we	1941
NAWTA	16---	179	190	anam	predator control, antl mgt	arrington,on; edw	1951

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
NAWTA	8----	329	331	biga	predtr contrl, probl areas	randle,ac	1943
QRBIA	21--2	144	177	vert	predation & vert populatns	errington,pl	1946
SCMOA	42...	444	456	----	malthusian princip in natr	mcatee,wl	1936

Other Publications

Udy, J. R. 1953. Effects of predator control on antelope populations. Utah Depart. Fish and Game, Salt Lake City, Utah. Pub. 5. 48 p.

CHAPTER 23, WORKSHEET 2.2a

Effects of predator removal on population growth

WORKSHEETS in PART VI, CHAPTER 19 listed various causes of mortality, and natality and mortality rates were used to determine "b" values for making exponential predictions of population growth.

Refer to those WORKSHEETS and redo the predictions given with variations in mortality rates due to predation, considering the compensatory effects from other causes of mortality. Evaluate the literature on predation (CHAPTER 5, UNIT 3.2) and try to develop some realistic predictions. If field data are not available, use an array of values to generate a family of answers for different combinations of predation and other causes of mortality.

UNIT 2.3: EFFECTS OF UNDERHARVESTING

The previous UNIT dealt with the effects of predator removal, which results in "underharvesting" by natural forces. Similar effects on populations result when underharvesting by hunting occurs; populations grow.

The basic difference between the effects of predator removal and the effects of underharvesting is that predation may occur throughout the year while "harvesting" or legal hunting occurs during only a small part of the year. Thus the standing crop is different through the year, depending on the timing of these sources of or lack of mortality.

Estimations of the effects of underharvesting are easily made with the procedures described in PART VI, CHAPTER 19, UNIT 1.4: EXPONENTIAL PREDICTIONS. Start with a cohort of 100, use a reasnoable weighted mean natality rate and a natural mortality with no hunting to determine a b value, and predict the population one year later. The resulting number, when divided by 100, gives the annual rate of increase as a rate. Add hunting mortality to illustrate the additive effects of hunting. Add hunting mortality and change other sources of mortality to illustrate the compensatory effects of hunting.

Note in the discussion of this method of predicting population in CHAPTER 19 that a 1:1 sex ratio is an underlying assumption in exponential predictions. If sex ratios are significantly different from 1:1, use the methods discussed in CHAPTER 19, UNIT 4.1: ARITHMETIC SUMMATIONS. The former is much quicker than the latter.

The eventual effects of underharvesting a wild ruminant population for several years in succession are declining body weights, body condition, and reproductive rates. Winter mortality will occur under some, perhaps even ordinary weather conditions, ast least in the young-of-the-year age class. The range, too, will change as ruminant populations increase; these effects were discussed in UNIT 2.1.

REFERENCES, UNIT 2.3*

EFFECTS OF UNDERHARVESTING

SERIALS

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

odvi

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

odhe

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

ceel

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

*Please check the SERIAL references listed at the ends of CHAPTERS 19 and 22 for references pertaining to EFFECTS OF UNDERHARVESTING.

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

CLOSING COMMENTS

I enjoy closing a "negative" chapter because I much prefer to direct my attention to positive things, to solutions rather than to problems. Nevertheless, the improper uses of the range that result from the circumstances described are important examples of management practices that should be avoided. Perhaps the one most important point to remember is that no particular management practice, once instituted, is good forever.

Aaron N. Moen
March 17, 1982

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.

AMFOA American Forests
AMNAA American Midland Naturalist
ANKIA Animal Kingdom, New York Zoological Society Bulletin
AUMGA Audubon Magazine

BICOB Biological Conservation

CGFPA Colorado Division of Game, Fish, and Parks Special Report (US)
CNSVA Conservationist

ECMOA Ecological Monographs (US)

FOSCA Forest Science (US)

HILGA Hilgardia

JANSA Journal of Animal Science (US)
JOMAA Journal of Mammalogy (US)
JRMGA Journal of Range Management (US)
JWMAA Journal of Wildlife Management (US)

MUZPA Miscellaneous Publications, Museum of Zoology, University of Michigan

NAWLA National Wildlife
NAWTA North American Wildlife and Natural Resources Conference, Transactions of the (US)
NEJZA Netherlands Journal of Zoology (Netherlands)
NZSTB New Zealand Journal of Science and Technology

PCGFA Proceedings of the Southeastern Association of Game and Fish Commissioners (US)
PMASA Proceedings of the Montana Academy of Sciences
PNBAA Proceedings of the Nebraska Academy of Sciences and Affiliated Societies

QRBIA Quarterly Review of Biology

SCAMA Scientific American (US)
SCMOA Scientific Monthly

* tdbca Transactions of the Desert Bighorn Council
TRVIA Terre Vie (La Terre et la Vie)
TWASA Transactions Wisconsin Academy of Sciences, Arts, and Letters

UAECA Utah Agricultural Experiment Station Circular

WLMOA Wildlife Monographs (US)
WMBAA Wildlife Management Bulletin (Ottowa) Series 1 (Canada)
WSCBA Wisconsin Conservation Bulletin

XNFSA U S National Park Service Fauna of the National Parks of the United States, Fauna Series
XFRMA U S Forest Service Research Paper RM, (US)

*No BIOSIS CODEN

LIST OF PUBLISHERS - CHAPTER TWENTY-THREE

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.

adwe	Addison-Wesley	Reading, MA	rema
stac	The Stackpole Company	Harrisburg, PA	hapa
uwyp	University of Wyoming Press	Laramie, WY	lawy

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
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
herbivore	hrbv
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-THREE