TOPIC 5. CALCULATIONS OF FORAGE REQUIRED, MINERAL BASE

Calculations of forage required in relation to mineral requirements may be made in the same way that they were made for energy and protein requirements. There are no examples in the literature, however, and limited data on which to base calculations. Rather than ignore the possibility of mineral-base calculations, UNITS 5.1-5.4 are included here, with the serials list so additions may be made as references become available.

UNIT 5.1: EFFECTS OF VARIATIONS IN DIETARY MINERALS

The availability of dietary minerals fluctuates through the annual cycle. Using what little information is available on the mineral composition of forages, evaluate the effects of dietary minerals on forage intake in the same way as for energy and protein.

REFERENCES, UNIT 5.1

EFFECTS OF VARIATIONS IN DIETARY MINERALS

SERIALS

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

JWMAA 35--3 469 475 od-- nutrnt intk, chapar, desrt urness,pj; green/ 1971

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

JWMAA 40--4 610 625 odvi adap to natur occ sodi def weeks,hp,jr; kirk 1976

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

JRMGA 30--3 206 209 odhe food hab, sem-des gras-shr short,hl 1977

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

ceel

```
CODEN VO-NU BEPA ENPA ANIM KEY WORDS----------------- AUTHORS---------- YEAR
JWMAA 37--3 279  287  alal importnce of nonbrows food leresche,re; davi 1973

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
JOMAA 22--1 47   53   biga criter, propr win forag us swift,lw          1941
JZAMD 9---3 96   98        nutrit value of hard water fowler,me         1978
```

UNIT 5.2: EFFECTS OF VARIATIONS IN MINERAL REQUIREMENTS

Mineral requirements vary through the annual cycle, especially because of the metabolically demanding processes of antlerogenesis and lactation. These variations may be analyzed in the same way the energy and protein variations were in the two previous TOPICS. The space below may be used for ideas and notes when making these evaluations.

REFERENCES, UNIT 5.2

EFFECTS OF VARIATIONS IN MINERAL REQUIREMENTS

SERIALS

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
JWMAA	20--3	221	232	odvi	nutr req, growth, antl dev	french,ce; mcewe/	1955
JWMAA	35--1	57	62	odvi	basal diet for nutr resear	ullrey,de; johns/	1971
NAWTA	22---	119	132	odvi	nutrient requirements	mcewen,lc frenc/	1957
NAWTA	34---	137	146	odvi	eff nutr, clim on sou deer	short,hl; newsom/	1969
PAABA	600--	1	50	odvi	nutr req for grwth, antler	french,ce; mcewe/	1955
PAARA	262--	1	5	odvi	seas fluct in feed consump	long,ta; cowan,r/	1965
TNWSD	1965.	1	13	odvi	n hamp nutr studies, aims,	silver,h; colovo/	1965

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

SZSLA 21--- 117 128 rata aspcts of nutr, semi-domes steen,e 1968

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

UNIT 5.3: EFFECTS OF SEASONAL VARIATIONS IN MINERAL RESERVES

Translocation of minerals occurs when dietary intake is not sufficient to meet the demands for growth. The amounts mobilized may be subtracted from the daily requirements to determine the forage required. The calculations of fat reserve mobilization (UNIT 3.3) is a good example to follow.

REFERENCES, UNIT 5.3

EFFECTS OF SEASONAL VARIATIONS IN MINERAL RESERVES

SERIALS

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

JWMAA 40--4 610 625 odvi adap to natur occ sodi def weeks,hp,jr; kirk 1976

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

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

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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

UNIT 5.4: NOMOGRAPHIC PREDICTIONS OF FORAGE REQUIRED, MINERAL BASE

Nomograms may be developed for predicting the forage required based on mineral metabolism. The concepts are the same as in UNITS 3.4 and 4.4.

One final comment on the prediction of forage required to meet metabolic needs. If the diet were perfectly balanced in proportion to the nutrient needs of the animal, then the answers would be the same when calculating intake on energy, protein, and mineral bases. Such a perfect balance does not exist, of course. Independent calculations on different nutrient bases make interesting comparisons as differences stimulate one's thinking about the accuracies of the calculations, processes used by the animal to overcome negative balances for short periods of time, and other sources of errors and variations in the calculations. Such analyses are not simple. They are mentally stimulating, and the better ecological accountants will undoubtedly arrive at better answers as more calculations are completed.

REFERENCES, UNIT 5.4

NOMOGRAPHIC PREDICTIONS OF FORAGE REQUIRED, MINERAL BASE

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

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

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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

CHAPTER 12 has included information on food habits, preferences, forage consumption, and passage rates, with demonstrations of calculations of forage required on energy, protein, and mineral bases. Food habits and preferences permit one to calcualte diets. The extensive lists of serials with references on nutritive characteristics in TOPICS 1 and 2 of CHAPTER 11, and the ways to determine diet digestibilities (TOPIC 3, CHAPTER 11) all make it possible to predict forage required. The concepts and methods discussed in CHAPTERS 11 and 12, plus the discussions of forage production in CHAPTER 13, make it possible to evaluate carrying capacities in CHAPTER 20.

Aaron N. Moen
April 10, 1981

GLOSSARY OF SYMBOLS USED - CHAPTER TWELVE

AVDC = Average digestibility coefficient

CPFO = Crude protein in the forage

DECO = Digestible energy coefficient
DPCO = Digestible protein coefficient
DWFK = Dry-weight forage consumed in kilograms

ELMD = Ecological metabolism per day

FGCP = Forage consumption
FOEQ = Forage equivalent

GEFO = Gross energy in the forage

IFMW = Ingesta-free metabolic weight
IFWK = Ingesta-free weight in kilograms

JDAY = Julian day

KMER = Kilocalories mobilized from energy reserves

MBLM = Multiple of base-line metabolism
MECO = Metabolizable energy coefficient
MEFO = Metabolizable energy in the forage
MPCO = Metabolizable protein coefficient
MPFO = Metabolizable protein in the forage

NTMD = Nitrogen metabolism per day

PRCT = Preference category

UEGD = Urea entry rate in grams per day
UEGH = Urea entry rate in grams per hour
UGKW = Urea in grams per kilograms of body weight
UPER = Urea recycled as a percent of entry rate

WLKG = Weight loss in kilograms

GLOSSARY OF CODENS - CHAPTER TWELVE

CODEN

ABSZA Annales Botanici Societatis Zoologicae Botanicae Fennicae Vanamo
AGJOA Agronomy Journal
AMFOA American Forests
AMNAA American Midland Naturalist
ATICA Arctic
ATRLA Acta Theriologica
ATYBA Annales Univesitatis Turkuensis Series A II. AS262 A11 Ser. A,2 (1)
AZATA Arizona Agricultural Experiment Station Technical Bulletin
BIBAA Bird-Banding
BJNUA British Journal of Nutrition
BLRPA Black Rock Forest Papers
BMAEA Montana Agricultural Experiment Station Bulletin
BPURD Biological Papers of the University of Alaska Special Report
CAFGA California Fish and Game
CAFNA Canadian Field Naturalist
CBPAB Comparative Biochemistry and Physiology A Comparative Physiology
CGFPA Colorado Division of Game, Fish, and Parks Special Report
CJFRA Canadian Journal of Forest Research
CJZOA Canadian Journal of Zoology
CNJNA Canadian Journal of Animal Science
CWOPA Canadian Wildlife Service Occasional Paper
DRGBA Danish Review of Game Biology
ECMOA Ecological Monographs
ECOLA Ecology
ELPLB Ekologia Polska
FEPRA Federation Proceedings
FOSCA Forest Science
IUCSB International Union for Conservation of Nature and Natural Resources Publications New Series
JAASA Journal of the Alabama Academy of Science
JANSA Journal of Animal Science
JAPEA Journal of Applied Ecology
JFUSA Journal of Forestry
JOMAA Journal of Mammalogy
JRMGA Journal of Range Management
JTBIA Journal of Theoretical Biology
JWMAA Journal of Wildlife Management
JZAMD Journal of Zoo Animal Medicine
JZOOA Journal of Zoology
LCHNB Lichenologist
MOCOA Missouri Conservationist
MRLTA Murrelet, The
NATUA Nature
NAWTA North American Wildlife and Natural Resources Conference, Transactions of the,
NCANA Naturaliste Canadien, Le
NEJAA New Jersey Agriculture
NFGJA New York Fish and Game Journal

NMWIA	New Mexico Wildlife
NPOAA	Norsk Polarinstituut Arbok
OFBIA	Ontario Field Biologist
OIKSA	Oikos
PAABA	Pennsylvania Agricultural Experiment Station Bulletin
PAARA	Pennsylvania State University College of Agriculture Agricultural Experiment Station Progress Report
PCGFA	Proceedings of the Southeastern Association of Game and Fish Commissioners
PECTD	Polish Ecological Studies
PMASA	Proceedings of the Montana Academy of Sciences
POASA	Proceedings of the Oklahoma Academy of Science
PPASA	Proceedings of the Pennsylvania Academy of Science
PSAFA	Proceedings of the Society of American Foresters
QRBIA	Quarterly Review of Biology
SFORA	Scottish Forestry
SWNAA	Southwestern Naturalist
SZSLA	Symposia of the Zoological Society of London
TAXNA	Taxon
TISAA	Transactions of the ILlinois State Academy of Science
TLPBA	Theoretical Population Biology
TNKKA	Trudy Nauchno-Issledovatel'skogo Instituta Sel'skogo Khozyaistva Krainego Severa
TNWSD	Transactions of the Northeast Section, The Wildlife Society
TSASA	Transactions of the Kansas Academy of Science
UTSCB	Utah Science
XANEA	U S Forest Service Research Paper NE
XARRA	U S Forest Service Resaerch Note SE
XASEA	U S Forest Service Research Paper SE
XFIPA	U S Forest Service Research Paper INT
XFNNA	U S Forest Service Research Note NE
XFPNA	U S Forest Service Resaerch Paper PNW
XFWLA	U S D I Fish and Wildlife Service, Wildlife Leaflet
XIBPA	US-IBP (International Bilogical Program) Analysis of Ecosystems Program Interbiome Abstracts
XPMWA	U S Forest Service Research Note PNW
ZEJAA	Zeitschrift fuer Jagdwissenschaft

LIST OF PUBLISHERS - CHAPTER TWELVE

blsp	Blackwell Scientific Publications	Oxford, England	oxen
crcp	CRC (Chem. Rubber Co.) Press	Cleveland, OH	cloh
hocl	Hollis & Carter Ltd.	London, England	loen
iucn	IUCN	Morges, Switzerland	mosw
nhfg	New Hampshire Fish & Game Department	Concord, NH	conh
whfr	W. H. Freeman Company	San Francisco,CA	sfca

LIST OF WORKSHEETS - CHAPTER TWELVE

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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.