

Are moose 1) energy maximizers or 2) time minimizers?

HERBIVORE OPTIMAL FORAGING

101

TABLE 1

SUMMARY OF THE DATA USED TO SOLVE THE SH, CLUE, AND LP MODELS FOR THE FOUR HERBIVORE DATA SETS

	<i>Microtus</i> ^a Dry Site	<i>Microtus</i> ^a Wet Site	Kudu ^b	Moose ^c
• Digestible energy (kcal)				...*
• t_i (min/g)				
Grass				...
Forbs				...
Herbs (grass + forbs) ...				.09
Shrub leaves				...
Aquatics				.04
Terrestrial (herbs + shrub leaves)				.054
• s (m ² /min)				16.6
• Digestive capacity (g-wet/day)				32900.0
• Food bulk (g-wet/g-dry)				
Grass				...
Forb				...
Herbs (grass + forbs) ...				4.4
Shrub leaves				...
Aquatics				20.0
Terrestrial (herbs + shrub leaves)				4.04
• Foraging time (min/day)				
Predicted				299.0
Observed				307.0
• Cropping rate (min/g)				
Grass				...
Forb				...
Herb (grass + forbs) ...				.12
Shrub leaves				...
Aquatics				.05
Terrestrial (herbs + shrub leaves)				.065
• Energy requirement (kcal/day)				14000.0
• Energy content (kcal/g)				
Grass				...
Forb				...
Herbs (grass + forbs) ...				4.1
Shrub leaves				...
Aquatics				3.8
Terrestrial (herbs + shrub leaves)				4.25

$$4.04T + 20A \leq 32,900$$

$$2) t = 0.065T + 0.05A$$

$$1) E = 4.25T + 3.8A$$

Obj.
fns.

* Nonapplicable values.

^a This study.

^b Owen-Smith 1979; Owen-Smith and Novellie 1982.

^c Belovsky 1978.

^d From similar-sized ruminants, Belovsky, MS.

^e Belovsky 1978.

^f 140W⁷⁵, Moen 1973.

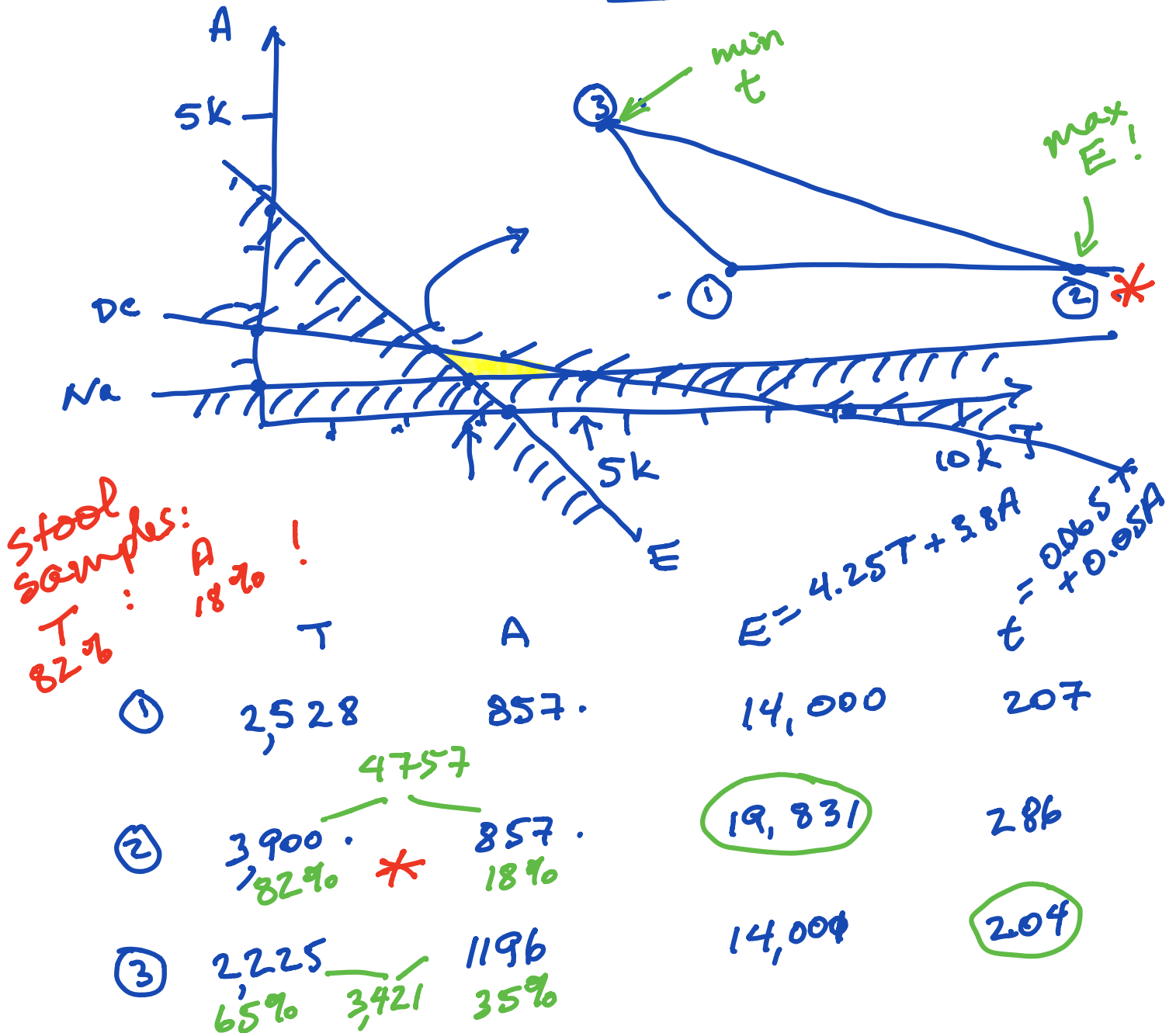
^g Only 43 min used because of digestive capacity limitations, Belovsky 1981b.

Also: require 2.57g/day of Nkt

$$P = 0.003g/g$$

T | A

$$\begin{array}{lcl}
 E \rightarrow \text{s.t.} & 4.25T + 3.8A \geq 14000 & 3,294 \quad 3,684 \\
 D.C. \rightarrow & 4.04T + 20A \leq 32,900 & 8,144 \quad 1,645 \\
 Na \rightarrow & 0.003A \geq 2.57 & - \quad 857 \\
 & 0.003A = 2.57 & \\
 & \underline{A = 2.57 / 0.003 = 857} &
 \end{array}$$



$$\begin{aligned}
 \textcircled{1} \quad & 4.25T + 3.8A = 14000 \\
 & 0.003A = 2.57 \Rightarrow A = 857
 \end{aligned}$$

$$4.25T + 3.8(857) = 14000$$

$$T = \frac{14000 - 3.8(857)}{4.25}$$

$$= 2528$$

$$\textcircled{2} \quad 4.04T + 20A = 32,900$$

$$4.04T + 20(857) = 32,900$$

$$T = \frac{32,900 - 20(857)}{4.04}$$

$$= 3900$$

$$\textcircled{3} \quad 4.04T + 20A = 32,900 \rightarrow A = \frac{32,900 - 4.04T}{20}$$

$$4.25T + 3.8A = 14,000$$

$$4.25T + 3.8\left(\frac{32,900 - 4.04T}{20}\right) = 14,000$$

$$\dots - - - 20 - - -$$

$$4.25T + \frac{3.8(32,900)}{20} - \frac{3.8(4.04)T}{20} = 14,000$$

$$\left(\frac{4.25 - \frac{3.8(4.04)}{20}}{20}\right) T = \frac{14,000 - \frac{3.8(32,900)}{20}}{20} = 2225.189529$$

$$\frac{4.25 - \frac{3.8(4.04)}{20}}{20}$$

$$A = 1196$$

Initial matrix:			
20	4.04	.	32900
3.8	4.25	:	14000
-	.	.	
After first pivot:			
1	0.202	0	1645
0	3.4824	0	7749
0	0	0	0
After second pivot:			
1	0	0	1195.512
0	1	0	2225.19*
0	0	0	0
Solution:			
#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!