NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF NATURAL RESOURCES AND SPATIAL SCIENCES

DEPARTMENT OF AGRICULTURE AND NATURAL RESOURCES SCIENCES

QUALIFICATION: BACHELOR OF AGRICULTURE	
QUALIFICATION CODE: 07BAGR	**LEVEL:** 5
COURSE CODE: RSC520s	**COURSE NAME:** RANGELAND SCIENCE
SESSION: JANUARY 2020	**PAPER:** THEORY
DURATION: 3 HOURS	**MARKS:** 112

SUPPLEMENTARY / SECOND OPPORTUNITY EXAMINATION QUESTION PAPER	
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MODERATOR:	DR HILMA RANTILLA AMWELE

INSTRUCTIONS
1. Answer ALL the questions.
2. Write clearly and neatly.
3. Number the answers clearly.

PERMISSIBLE MATERIALS
1. All written work MUST be done in blue or black ink
2. No books, notes and other additional aids are allowed

THIS QUESTION PAPER CONSISTS OF 6 PAGES (excluding this front page)

Question 1

1.1 Namibia is affected by bush encroachment on a massive scale. The phenomenon currently affects some 260 to 300 million hectares of the Namibian surface area.
   A. True
   B. False

1.2 The state and transition theory states that: rainfall and its variability plays a more important role than the intensity of grazing.
   A. True
   B. False

1.3 Encroacher bush has a catastrophic effect on Namibia's water resources, drastically reduce water inflow in the underground water reservoirs.
   A. True
   B. False

1.4 Bushes are already part of livestock natural diets all we need to do is to add to the bush substances that will add to its digestive ability
   A. True
   B. False

1.5 20000 tons of firewood mainly from tree are used daily in Namibian households.
   A. True
   B. False

[5]

Question 2

Name an example of an animal species for each of the following:

2.1   A domestic animal that is a selective browser   (1)

2.2   A domestic animal that is a selective grazer   (1)

2.3   A domestic animal that is a bulk grazer   (1)

2.4   A wild animal that is a bulk grazer   (1)

2.5   A wild animal that is a bulk browser   (1)
                                                                                      [5]

Question 3

Define the following:

3.1 Perennial grass   [2]
3.2 Dormancy   [2]
3.3 Bush encroachment   [2]

Question 4

Copy down the table below except for the contents of the third column, and then rearrange the contents of the third column so that the most appropriate conversion fits in the same row..

To convert from:	to:	you:
LSU	kg liveweight	Divide into 75 kg/SSU
Kg liveweight	SSU	Divide into 450 kg/LSU
ha/SSU	ha/LSU	Multiply by 6 SSU/LSU
ha/LSU	kg liveweight/ha	Divide by 75 kg/SSU
kg liveweight/ha	ha/SSU	Multiply by 450 kg/LSU

[5]

Question 5

Discuss the causes of bush encroachment. [15]

Question 6

6.1 Describe how water used to flow through a healthy rangeland. (2)

6.2 Explain what caused the water to flow like that through a healthy rangeland and how it was self-reinforced. (5)

6.3 Explain how humans interfered with natural water flow and the resulting consequences for the rangeland. (5)

[12]

Question 7

7.1 Suppose a farmer wants to graze a paddock of 260 ha for 30 days. He estimates that one LSUday requires the amount of rangeland in a representative square of 28m x 28m. How many LSU can be stocked? (3)

7.2 Suppose a paddock of 370 ha is stocked at 16 ha/LSU for 60 days. What will be the length of the side of a square that represents the amount of rangeland available for one LSUday? (3)

Question 8

8.1 Which out of annual and perennial plants are generally better for livestock, and why? (3)

8.2 Which out of annual and perennial plants are generally better for health of the rangeland, and why? (3)

8.3 Which out of annual and perennial plants are best adapted to cope with harsh conditions, and why? (3)

[9]

Question 9

The influence that the tool of trampling, followed by rest, has on the condition of the rangeland depends largely on the season and the texture of the soil. Explain the differences in response to trampling in the growing season and dry season between sandy and loamy soils, and recommend which soil should rather be trampled more in which season. [10]
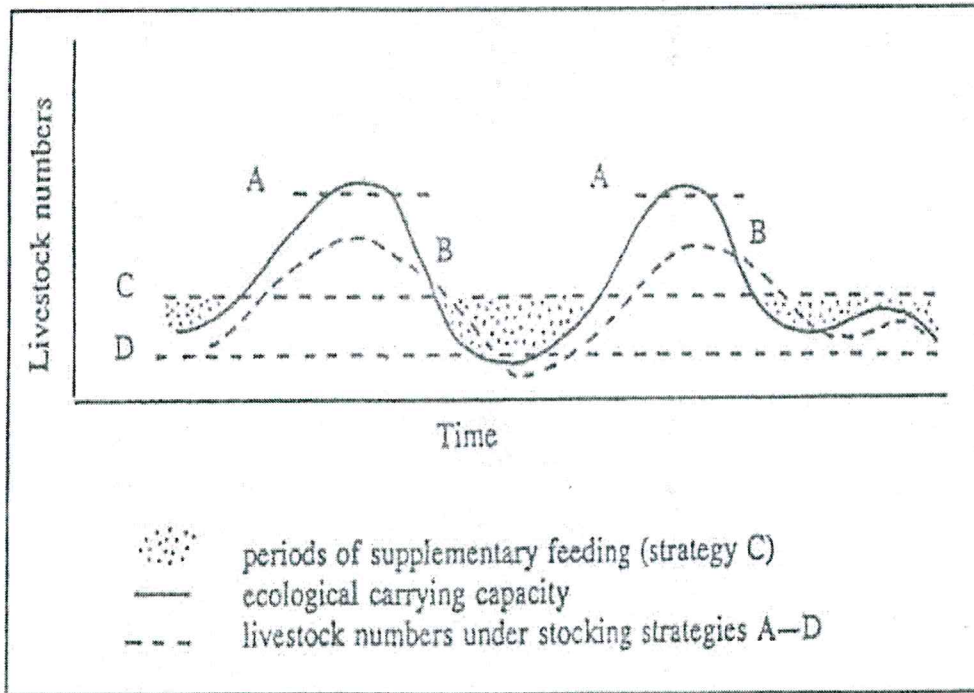
Question 10

Draw a chart that shows the relationship between stocking rate on the x-axis and both production per hectare and production per animal on the y-axis. Label three positions on the chart to show three stocking rates that apply to three different objectives of rangeland management. [7]

Question 11

Explain how large predators such as lions, hunting dogs and hyenas, used to help keep the rangeland in a healthy condition until a few centuries ago.   [10]

Question 12

Different farmers may use different strategies to cope with changing rainfall over the years. Describe each of the four strategies marked A-D in the diagram below and explain the major contrasting implications of each.

[12]

Question 13

Suppose a paddock of 836ha is to be stocked with 125 small mature weaner calves, 109 Karakul weaner lambs of 4 months, 136 Boer goat weaner lambs of 4 months and 6 weaner donkey foals of 6 months. It is the start of the dry season and you estimate that a representative square of 29m x 29m in the paddock contains enough forage for one LSUday. For how many days of the dry season should these animals be kept in the paddock? You may refer to information in Table 5.1, Table 5.3 and Table 5.5 on the last three pages.   10]

TABLE 5.1 - LSU equivalents for grazing beef cattle/ *TABEL 5.1 - GVE-ekwivalente vir weidende vleisbeeste*

Class/ *Klas*	Mass/ *Massa* kg	ME MJ/d	LSU GVE	Approximate number/LSU *Benaderde getal/GVE*
	Small mature size/ *Kleinraam*			
Bull/ *Bul*	600	102,15	1,36	0,73
Cow, non-lactating (3 years)/ *Koei, droog (3 jaar)*	400	75,57	1,01	0,99
Cow, non-lactating (mature)/ *Koei, droog (volwasse)*	500	82,22	1,10	0,91
Cow, in calf (3 years)/ *Koei, dragtig (3 jaar)*	400	75,57	1,01	0,99
Cow, in calf (mature)/ *Koei, dragtig (volwasse)*	500	82,22	1,10	0,91
Cow, with calf (3 years)/ *Koei, met kalf (3 jaar)*	400	91,35	1,22	0,82
Cow, with calf (mature)/ *Koei, met kalf (volwasse)*	500	106,30	1,42	0,71
Weaner calf/ *Speenkalf*	180	33,22	0,44	2,26
Steer (18 months)/ *Os (18 maande)*	300	56,47	0,75	1,33
Steer (mature)/ *Os (volwasse)*	490	82,22	1,10	0,91
	Medium mature size/ *Mediumraam*			
Bull/ *Bul*	600	103,81	1,38	0,72
Cow, non-lactating (3 years)/ *Koei, droog (3 jaar)*	450	84,71	1,13	0,89
Cow, non-lactating (mature)/ *Koei, droog (volwasse)*	525	90,52	1,21	0,83
Cow, in calf (3 years)/ *Koei, dragtig (3 jaar)*	450	84,71	1,13	0,89
Cow, in calf (mature)/ *Koei, dragtig (volwasse)*	525	90,52	1,21	0,83
Cow, with calf (3 years)/ *Koei, met kalf (3 jaar)*	450	104,64	1,40	0,72
Cow, with calf (mature)/ *Koei, met kalf (volwasse)*	525	116,27	1,55	0,65
Weaner calf/ *Speenkalf*	200	39,86	0,53	1,88
Steer (18 months)/ *Os (18 maande)*	350	67,27	0,90	1,11
Steer (mature)/ *Os (volwasse)*	550	91,35	1,22	0,82
	Large mature size/ *Grootraam*			
Bull/ *Bul*	650	122,08	1,63	0,61
Cow, non-lactating (3 years)/ *Koei, droog (3 jaar)*	500	95,50	1,27	0,79
Cow, non-lactating (mature)/ *Koei, droog (volwasse)*	550	98,83	1,32	0,76
Cow, in calf (3 years)/ *Koei, dragtig (3 jaar)*	500	95,50	1,27	0,79
Cow, in calf (mature)/ *Koei, dragtig (volwasse)*	550	98,83	1,32	0,76
Cow, with calf (3 years)/ *Koei, met kalf (3 jaar)*	500	124,57	1,66	0,60
Cow, with calf (mature)/ *Koei, met kalf (volwasse)*	575	136,20	1,82	0,55
Weaner calf/ *Speenkalf*	225	48,17	0,64	1,56
Steer 18 (months)/ *Os (18 maande)*	400	81,39	1,09	0,92
Steer (mature)/ *Os (volwasse)*	585	99,66	1,33	0,75

TABLE 5.2 - LSU equivalents for grazing dairy cattle[1]/ *TABEL 5.2 - GVE-ekwivalente vir weidende melkbeeste[1]*

Class/ *Klas*	Mass/ *Massa* kg	ME MJ/d	LSU GVE	Approximate number/LSU *Benaderde getal/GVE*
	Jersey			
Cow, non-lactating (3 years)/ *Koei, droog (3 jaar)*	300	60,839	0,81	1,23
Cow, non-lactating (mature)/ *Koei, droog (volwasse)*	420	72,094	0,96	1,04
Cow, in calf (3 years)/ *Koei, dragtig (3 jaar)*	300	60,839	0,81	1,23
Cow, in calf (mature)/ *Koei, dragtig (volwasse)*	420	72,094	0,96	1,04
	Ayrshire			
Cow, non-lactating (3 years)/ *Koei, droog (3 jaar)*	400	75,573	1,01	0,99
Cow, non-lactating (mature)/ *Koei, droog (volwasse)*	500	82,217	1,10	0,91
Cow, in calf (3 years)/ *Koei, dragtig (3 jaar)*	400	75,573	1,01	0,99
Cow, in calf (mature)/ *Koei, dragtig (volwasse)*	500	82,217	1,10	0,91
	Friesland/ *Fries*			
Cow, non-lactating (3 years)/ *Koei, droog (3 jaar)*	500	95,504	1,27	0,79
Cow, non-lactating (mature)/ *Koei, droog (volwasse)*	650	111,967	1,49	0,67
Cow, in calf (3 years)/ *Koei, dragtig (3 jaar)*	500	95,504	1,27	0,79
Cow, in calf (mature)/ *Koei, dragtig (volwasse)*	650	111,967	1,49	0,67

Method of calculation/ *Berekeningswyse*

● Intakes of Jerseys and Ayrshires were derived from the intakes of small mature size cattle/*Innames van Jerseys en Ayrshires is afgelei van die innames van kleinraambeeste*

● Intakes of Frieslands were derived from the intakes of large mature size cattle/*Innames van Friese is afgelei van die innames van grootraambeeste*

● Where masses among types did not correspond for similar production functions intakes were scaled through $W^{0,75}$ (Graham, 1972)/*Waar massas tussen tipes by dieselfde produksiefunksies nie ooreengestem het nie, is die innametyfers relatief tot $W^{0,75}$ (Graham, 1972) aangepas*

[1] Milk production systems are largely intensive; consequently only non-lactating and in-calf cows were viewed in the grazing context
[1] *Melkproduksiestelsels is grootliks intensief; dus word slegs die droë en dragtige koeie in die weidingskonteks beskou*

TABLE 5.3 - LSU equivalents for grazing sheep
TABEL 5.3 - GVE-ekwivolente vir weidende skape

Class/Klas

	Mass/Massa kg	ME MJ/d	LSU GVE	Approximate number/LSU Benaderde getal/GVE
Woolled sheep/Wolskape				
Ram/Ram	64	14.49	0.19	5.18
Ewe, non-lactating/Ooi, droog	47	10.89	0.13	6.89
Ewe, pregnant/Ooi, dragtig	47	10.89	0.15	6.89
Ewe, with lamb/Ooi, met lam	47	15.01	0.20	5.00
Weaner lamb (4 months)/Speenlam (4 maande)	20	7.16	0.10	10.47
Wether (2-tooth)/Hamel (2-tand)	40	10.60	0.14	7.07
Wether (6-tooth)/Hamel (6-tand)	50	11.29	0.15	6.64
Dual-purpose sheep/Vleiswolskape				
Ram/Ram	105	18.35	0.25	4.09
Ewe, non-lactating/Ooi, droog	65	12.96	0.17	5.79
Ewe, pregnant/Ooi, dragtig	65	12.96	0.17	5.79
Ewe, with lamb/Ooi, met lam	65	18.45	0.25	4.06
Weaner lamb (4 months)/Speenlam (4 maande)	25	8.83	0.12	8.49
Wether (2-tooth)/Hamel (2-tand)	55	12.76	0.17	5.87
Wether (6-tooth)/Hamel (6-tand)	85	12.76	0.17	5.87
Mutton sheep/Vleisskape				
Ram/Ram	90	17.18	0.23	4.37
Ewe, non-lactating/Ooi, droog	53	11.58	0.15	6.48
Ewe, pregnant/Ooi, dragtig	53	11.58	0.15	6.48
Ewe, with lamb/Ooi, met lam	53	16.88	0.23	4.44
Weaner lamb (4 months)/Speenlam (4 maande)	25	8.54	0.11	8.78
Wether (2-tooth)/Hamel (2-tand)	50	11.97	0.16	6.26
Wether (6-tooth)/Hamel (6-tand)	65	11.58	0.15	6.47
Karakul/Karakoele				
Ram/Ram	75	15.11	0.20	4.96
Ewe, non-lactating/Ooi, droog	50	11.39	0.15	6.59
Ewe, pregnant/Ooi, dragtig	50	11.39	0.15	6.59
Ewe, with lamb/Ooi, met lam	50	16.59	0.22	4.52
Weaner lamb (4 months)/Speenlam (4 maande)	22	7.85	0.11	9.55
Wether (2-tooth)/Hamel (2-tand)	50	12.27	0.16	6.11
Wether (6-tooth)/Hamel (6-tand)	60	11.97	0.16	6.25

TABLE 5.4 - LSU equivalents for grazing goats
TABEL 5.4 - GVE-ekwivclente vir weidende bokke

Class/Klas

	Mass/Massa kg	ME MJ/d	LSU GVE	Approximate number/LSU Benaderde getal/GVE
Boer goats/Boerbokke				
Ram/Ram	90	16.69	0.22	4.48
Ewe, non-lactating/Ooi, droog	65	12.96	0.17	5.79
Ewe, pregnant/Ooi, dragtig	65	12.96	0.17	5.79
Ewe, with lamb/Ooi, met lam	65	18.45	0.25	4.06
Ewe, with twins/Ooi, met tweeling	65	20.31	0.27	3.69
Weaner lamb (4 months)/Speenlam (4 maande)	23	8.76	0.12	8.55
Castrate (2-tooth)/Kapater (2-tand)	55	12.76	0.17	5.87
Castrate (6-tooth)/Kapater (6-tand)	70	12.95	0.17	5.79
Angora goats/Angorabokke				
Ram/Ram	49	11.18	0.15	6.71
Ewe, non-lactating/Ooi, droog	33	7.92	0.11	9.43
Ewe, pregnant/Ooi, dragtig	33	7.92	0.11	9.43
Ewe, with lamb/Ooi, met lam	33	10.85	0.15	6.90
Weaner lamb (4 months)/Speenlam (4 maande)	12	4.52	0.06	16.60
Castrate (2-tooth)/Kapater (2-tand)	31	8.19	0.11	9.17
Castrate (6-tooth)/Kapater (6-tand)	43	10.10	0.14	7.41

Method of calculation/Berekeningswyse

• Intakes of Boer goats were derived from the intakes of dual-purpose sheep/ Innames van Boerbokke is afgelei van die innames van vleiswolskape
• Intakes of Angora goats were derived from the intakes of woolled sheep. Innames van Angorabokke is afgelei van die innames van wolskape
• Where masses among types did not correspond for similar production functions intakes were scaled through $W^{0.75}$ (Graham, 1972)
Waar massas tussen spesies by dieselfde produksiefunksies nie ooreengestem het nie, is die innamesyfers relatief tot $W^{0.75}$ (Graham, 1972) aangepas

TABLE 5.5 - LSU equivalents for grazing horses, mules and donkeys
TABEL 5 5 - GVE-ekwivalente vir weidende perde, muile en donkies

Class/Klas	Mass/Massa kg	ME MJ/d	LSU GVE	Approximate number/LSU Benaderde getal/GVE
(a) Shetlands				
Foal, weaner (6 months)/ *Vul, speen (6 maande)*	55	19,4	0,26	3,85
Mare, non-lactating (3 years)/ *Merrie, droog (3 jaar)*	110	31,0	0,41	2,40
Mare, non-lactating (5 years)/ *Merrie, droog (5 jaar)*	140	29,6	0,40	2,55
Mare, with foal (3 years)/ *Merrie, met vul (3 jaar)*	110	41,8	0,56	1,80
Mare, with foal (5 years)/ *Merrie, met vul (5 jaar)*	140	41,5	0,55	1,80
Stallion or gelding (3 years)/ *Hings of reun (3 jaar)*	115	31,8	0,42	2,35
Stallion or gelding (5 years)/ *Hings of reun (5 jaar)*	150	30,5	0,41	2,45
(b) Larger ponies and donkeys **(b) Groter ponies en donkies**				
Foal, weaner (6 months)/ *Vul, speen (6 maande)*	125	33,7	0,45	2,25
Mare, non-lactating (3 years)/ *Merrie, droog (3 jaar)*	295	49,6	0,66	1,50
Mare, non-lactating (5 years)/ *Merrie, droog (5 jaar)*	320	46,3	0,62	1,60
Mare, with foal (3 years)/ *Merrie, met vul (3 jaar)*	295	67,0	0,89	1,10
Mare, with foal (5 years)/ *Merrie, met vul (5 jaar)*	320	64,8	0,86	1,15
Stallion or gelding (3 years)/ *Hings of reun (3 jaar)*	315	52,4	0,70	1,45
Stallion or gelding (5 years)/ *Hings of reun (5 jaar)*	340	51,2	0,68	1,45
(c) Light horses and mules **(c) Ligte perde en muile**				
Foal, weaner (6 months)/ *Vul, speen (6 maande)*	190	50,4	0,67	1,50
Mare, non-lactating (3 years)/ *Merrie, droog (3 jaar)*	460	70,4	0,94	1,05
Mare, non-lactating (5 years)/ *Merrie, droog (5 jaar)*	500	67,1	0,90	1,10
Mare, with foal (3 years)/ *Merrie, met vul (3 jaar)*	460	95,0	1,27	0,80
Mare, with foal (5 years)/ *Merrie, met vul (5 jaar)*	500	94,0	1,25	0,80
Stallion or gelding (3 years)/ *Hings of reun (3 jaar)*	490	76,9	1,03	1,00
Stallion or gelding (5 years)/ *Hings of reun (5 jaar)*	530	72,5	0,97	1,05
(d) Medium draft horses **(d) Medium trekperde**				
Foal, weaner (6 months)/ *Vul, speen (6 maande)*	265	64,3	0,86	1,15
Mare, non-lactating (3 years)/ *Merrie, droog (3 jaar)*	650	90,1	1,20	0,85
Mare, non-lactating (5 years)/ *Merrie, droog (5 jaar)*	705	88,1	1,18	0,85
Mare, with foal (3 years)/ *Merrie, met vul (3 jaar)*	650	121,0	1,61	0,60
Mare, with foal (5 years)/ *Merrie, met vul (5 jaar)*	705	124,0	1,65	0,60
Stallion or gelding (3 years)/ *Hings of reun (3 jaar)*	690	99,1	1,32	0,75
Stallion or gelding (5 years)/ *Hings of reun (5 jaar)*	750	96,7	1,29	0,80
(e) Heavy draft horses **(e) Swaar trekperde**				
Foal, weaner (6 months)/ *Vul, speen (6 maande)*	325	79,2	1,06	0,95
Mare, non-lactating (3 years)/ *Merrie, droog (3 jaar)*	790	113,0	1,51	0,65
Mare, non-lactating (5 years)/ *Merrie, droog (5 jaar)*	860	106,0	1,41	0,70
Mare, with foal (3 years)/ *Merrie, met vul (3 jaar)*	790	152,0	2,03	0,50
Mare, with foal (5 years)/ *Merrie, met vul (5 jaar)*	860	149,0	1,99	0,50
Stallion or gelding (3 years)/ *Hings of reun (3 jaar)*	840	120,0	1,60	0,65
Stallion or gelding (5 years)/ *Hings of reun (5 jaar)*	915	114,0	1,52	0,65

Method of calculation/ *Berekeningswyse*

• Data of Willoughby (1975) and Van der Merwe (1970) concerning mass for age, intakes and nutritional requirements were used/ *Gegewens van Willoughby (1975) en Van der Merwe (1970) vir massa vir ouderdom, innames en voedingsbehoeftes is gebruik*
• Mules and donkeys were grouped, according to mass, with some horse types/ *Muile en donkies is by sekere perdetipes ingedeel volgens hul beraamde massas*
• Voluntary intakes on natural pasture with an average DE content of 55 % were predicted from the data of Willoughby (1975) and Van der Merwe (1970)/ *Vrywillige innames op veld met 'n gemiddelde VE-inhoud van 55 % is geskat uit syfers van Willoughby (1975) en Van der Merwe (1970)*