Grazing rate Calculation

The classification of grazing intensity (GI) was based on local herbage productivity and daily hay intake per sheep unit method grazing intensity calculation use the following formula published by agriculture industry standard NY/T 635–2002 (Ministry of Agriculture of the People's Republic of China):

$$\mathrm{GI}(\text{sheep } ha^{-1}) = \frac{A \times Y \times R}{D \times B}$$

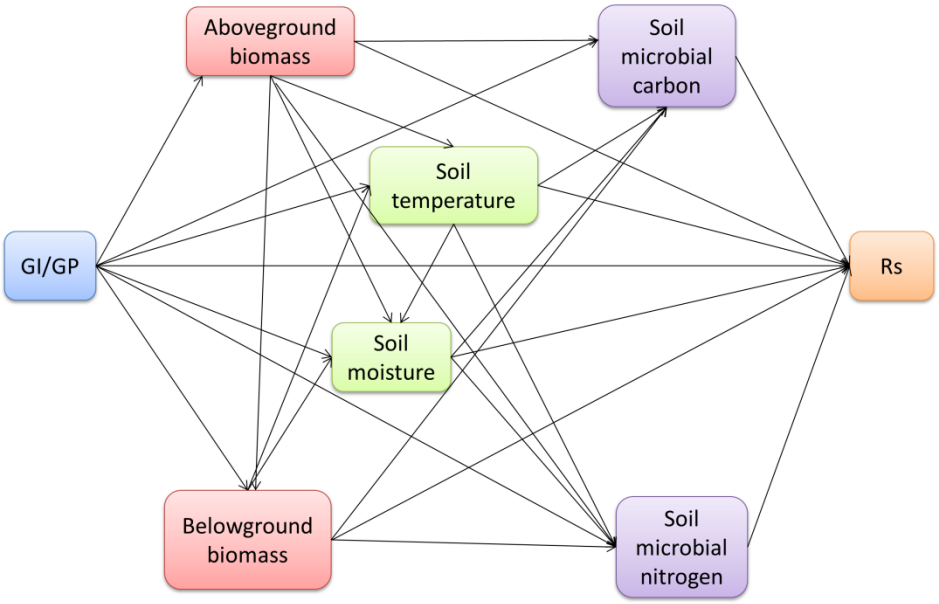
Where A is available rangeland area (ha), Y is edible forage yield (kg ha^{-1}), R is proper utilization rate of rangeland (%), D is days of grazing (d), B is daily hay intake per sheep unit (kg d^{-1}).

Supplementary Table 1. Daliy variation in measured values of soil respiration (Rs) at the warm grazing site from May 2010 to December 2011 with different grazing intensities (GI).

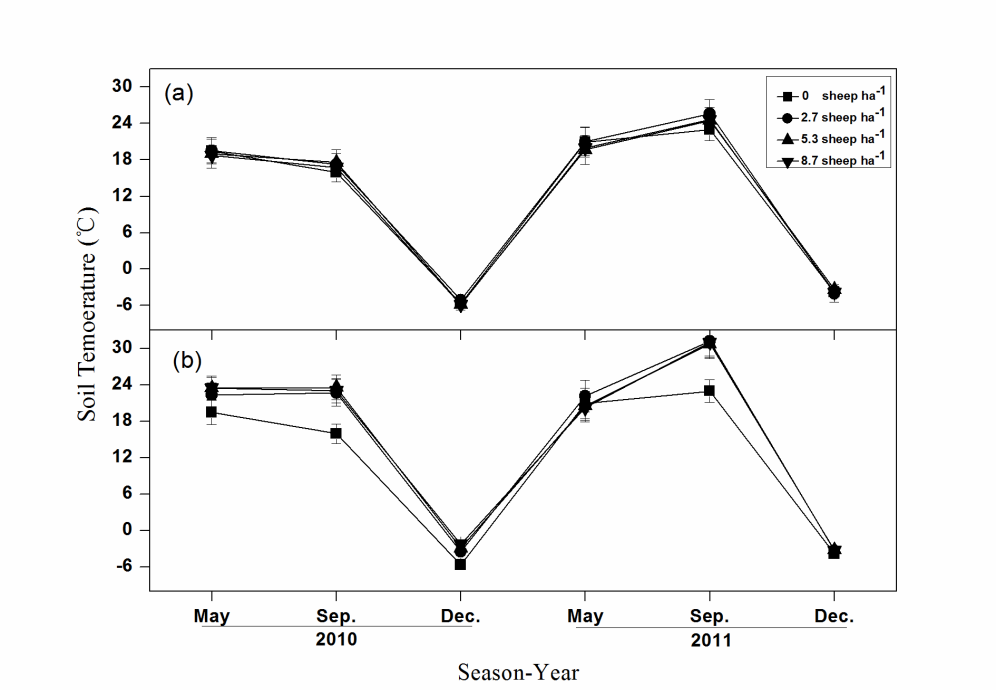
Year	Month	GI (sheep ha^{-1})	Rs ($\mu mol\ CO_2\ m^{-2}s^{-1}$)					Daily Total C efflux ($g\ CO_2\ m^{-2}d^{-1}$)
			Maximum	time	Minimum	time	Mean ± SE	
2010	May	0	0.90	10:00	0.48	6:00	0.75 ± 0.06	0.77
		2.7	0.86	10:00	0.49	6:00	0.67 ± 0.04	0.69
		5.3	1.02	10:00	0.41	6:00	0.69 ± 0.06	0.72
		8.7	0.82	10:00	0.39	6:00	0.63 ± 0.03	0.65
	Sep	0	1.69	14:00	0.60	22:00	1.16 ± 0.05	1.20
		2.7	1.38	14:00	0.54	22:00	0.99 ± 0.08	1.03
		5.3	1.41	14:00	0.49	22:00	0.91 ± 0.09	0.94
		8.7	1.62	12:00	0.45	22:00	1.04 ± 0.09	1.08
	Dec	0	0.32	14:00	0.16	6:00	0.25 ± 0.04	0.26
		2.7	0.37	14:00	0.23	6:00	0.28 ± 0.04	0.29
		5.3	0.25	14:00	0.17	6:00	0.22 ± 0.03	0.23
		8.7	0.360	14:00	0.099	6:00	0.23 ±0.08	0.24
2011	May	0	0.55	10:00	0.31	22:00	0.42 ± 0.05	0.44
		2.7	0.68	10:00	0.30	6:00	0.44 ± 0.04	0.46
		5.3	0.58	10:00	0.21	6:00	0.39 ± 0.04	0.40
		8.7	0.58	10:00	0.15	6:00	0.35 ± 0.03	0.36
	Sep	0	1.69	16:00	1.02	22:00	1.35 ± 0.08	1.40
		2.7	1.84	16:00	0.81	6:00	1.34 ± 0.09	1.39
		5.3	1.58	14;00	0.69	6:00	1.16 ± 0.09	1.20
		8.7	1.62	16:00	0.78	6:00	1.14 ± 0.06	1.18
	Dec	0	0.30	14:00	0.16	6:00	0.24 ± 0.04	0.25
		2.7	0.22	14:00	0.084	6:00	0.16 ± 0.04	0.16
		5.3	0.34	14:00	0.185	6:00	0.24 ± 0.05	0.25
		8.7	0.27	14:00	0.16	6:00	0.22 ± 0.03	0.22

Supplementary Table 2. Daliy variation in measured values of soil respiration (Rs) at the cold grazing site from May 2010 to December 2011 with different grazing intensities (GI).

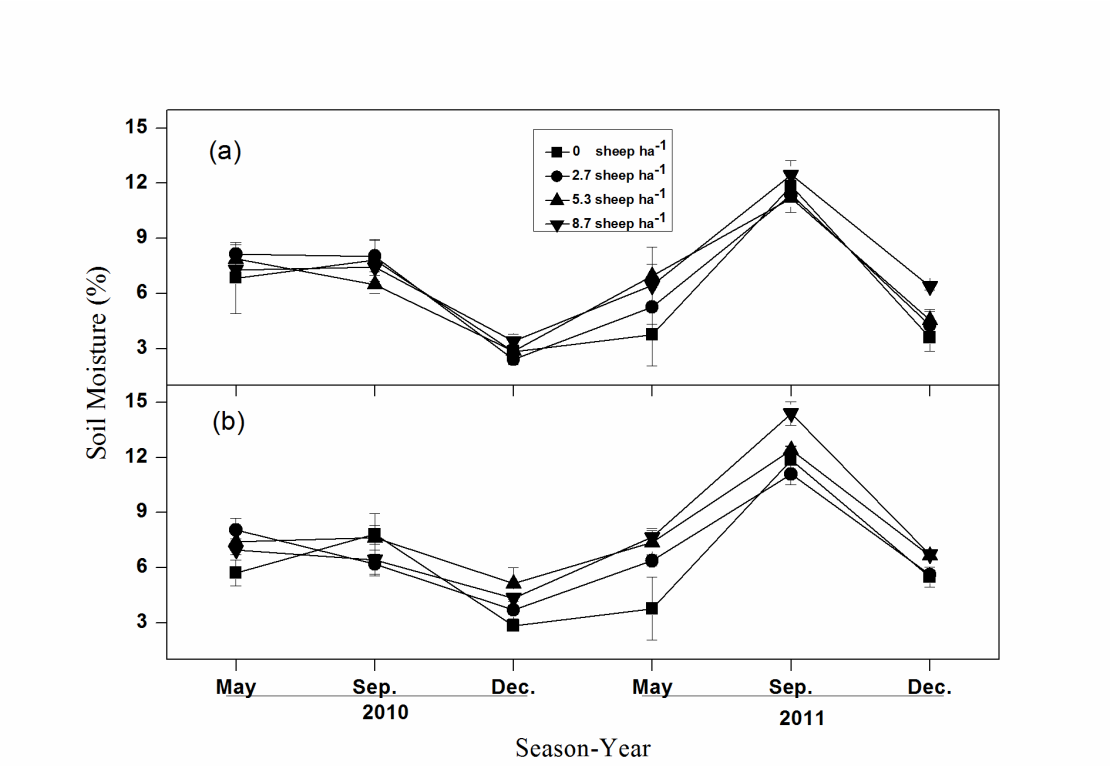
Year	Season	GI (sheep ha^{-1})	Rs ($\mu mol\ CO_2\ m^{-2}\ s^{-1}$)					Daily Total C efflux ($g\ CO_2\ m^{-2}\ d^{-1}$)
			Maximum	time	Minimum	time	Average ± SE	
2010	May	0	0.90	10:00	0.48	6:00	0.75 ± 0.06	0.77
		2.7	2.17	16:00	1.35	22:00	1.74 ± 0.08	1.81
		5.3	1.90	16:00	1.27	6:00	1.71 ± 0.05	1.78
		8.7	1.87	16:00	1.13	6:00	1.60 ± 0.05	1.66
	Sep	0	1.69	14:00	0.60	22:00	1.16 ± 0.11	1.20
		2.7	1.86	14:00	1.23	6:00	1.53 ± 0.05	1.59
		5.3	2.11	16:00	1.18	22:00	1.63 ± 0.06	1.69
		8.7	2.02	14:00	1.07	6:00	1.55 ± 0.09	1.61
	Dec	0	0.32	14:00	0.16	6:00	0.25 ± 0.04	0.26
		2.7	0.46	14:00	0.34	6:00	0.39 ± 0.04	0.41
		5.3	0.38	14:00	0.30	6:00	0.34 ± 0.02	0.35
		8.7	0.37	14:00	0.26	6:00	0.33 ± 0.03	0.34
2011	May	0	0.55	10:00	0.31	22:00	0.42 ± 0.05	0.43
		2.7	0.69	16:00	0.31	6:00	0.45 ± 0,03	0.47
		5.3	0.61	10:00	0.23	22:00	0.44 ± 0.03	0.46
		8.7	0.61	10:00	0.25	6:00	0.42 ± 0.03	0.44
	Sep	0	1.69	16:00	1.02	22:00	1.35 ± 0.08	1.40
		2.7	1.02	16:00	0.72	6:00	0.89 ± 0.03	0.93
		5.3	1.01	10:00	0.77	6:00	0.89 ± 0.03	0.92
		8.7	0.95	10:00	0.68	22:00	0.81 ± 0.03	0.84
	Dec	0	0.30	14:00	0.16	6:00	0.24 ± 0.04	0.25
		2.7	0.28	14:00	0.19	6:00	0.25 ± 0.03	0.26
		5.3	0.34	14:00	0.17	6:00	0.25 ± 0.05	0.26
		8.7	0.23	14:00	0.18	6:00	0.21 ± 0.02	0.21



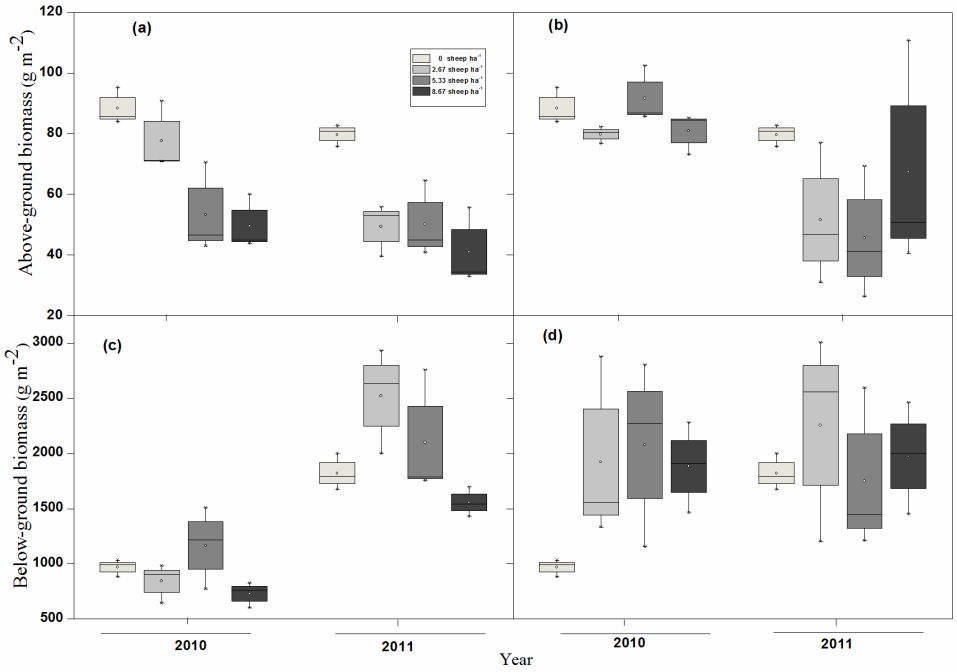
Supplementary Figure 1 An a priori conceptual model of how grazing intensity (GI), grzing regime (GP) altered soil respiration (Rs), soil microbial carbon and nitrogen. The model contains all possible pathways that cause changes in the abiotic and biotic variables and soil respiration. Box represents variables Arrow direction indicates the hypothesized direction of causation.



Supplementary Figure 2 Seasonal dynamics of soil temperature (a) in warm season grazing plots; (b) in cold season grazing plots; Vertical bars represent the standard error of the measurement mean (n=9) for each observation date.



Supplementary Figure 3 Seasonal dynamics of soil moisture (a) in warm season grazing plots; (b) in cold season grazing plots; Vertical bars represent the standard error of the measurement mean (n =3) for each observation date.



Supplementary Figure 4. Aboveground biomass within (a) warm season grazing plots; (b) cold season grazing plots; belowground biomass within (c) warm season grazing plots; (d) cold season grazing plots from 2010 to 2011. Horizontal lines in boxes show medians and dashed whiskers show data extremes. Open circles and solid whiskers show means ± propagated standard errors.