



NEEDS AND SUITABILITY ASSESSMENT FOR HAY LAND PLANNING

I.Myagmarjav^{1*} and P.Myagmartseren²

¹School of Agroecology, Mongolian University of Life Sciences, Ulaanbaatar, Mongolia

²School of Arts and Sciences, National University of Mongolia, Ulaanbaatar, Mongolia

*Corresponding author: myagmarjav@mul.s.edu.mn

ABSTRACT

The paper addresses planning issues of hay land based on new methods of suitability and need's assessment of local area. In order to develop the hay land future use and planning for 2023 of Erdenetsagaan soum, Sukhbaatar aimag, the assessment of the haymaking situation, the number of livestock growth and needs of nutritional resources for animal husbandry were calculated. According to the tested new suitability assessment of hay land, 4.37 percent or 74164 ha of land are most suitable, and 29.21 percent or 496014.3 ha are unsuitable. In order to calculate the nutritional needs of livestock in the future, the demand of green fodder for hay cut is estimated at 6712 t in 2023. The need for this fodder supply requires 8391 ha hay fields in 2023. Thus, demand (6712 t hay from 8391 ha of field) of green fodder will be supplied after proper implementation of plan (74164 ha suitable field to hay land usage).

KEYWORDS: Suitability evaluation, need's calculation, green fodder planning analysis

INTRODUCTION

Mongolian livestock are consuming more than 95 percent of fodders from natural pasture, and rest of 2-5% belong to the supplementary hay fodder and overgrazing increases chronic malnutrition, illnesses, and mortality [1]. For the purpose of increase and preparation of supplementary nutrient during cold season, it is important to identify the areas that can be used for haymaking and to plan future use and protection management of hay land. In winter, hay fodder prepared from natural pastures is an important source of feed for livestock during the dzud and other natural disaster. The assessment of the suitability is

the process of determining the ideal use of the most favorable future conditions for land use with specific criteria [2]. However, there is no methodology for assessing suitability of hay land in our country. Therefore, we have developed a new hay land suitability assessment methodology. Due to importance of to calculate the potential location of haymaking and nutritional needs of livestock when planning the hay land, we are introducing newly developed needs assessment and planning methodology in pilot area of Erdenetsagaan soum.

METHODS AND MATERIALS

The following research methods were used for the newly developed hay land planning approach, which is based on the assessment of the suitability and the number of livestock up to 2023's and their estimated fodder rate.

- Suitability assessment is based on multicriteria analysis techniques of geographical information system (Baban and Wan-Yusof, 2003) [3]. Assessment concludes two phases of data preparation and multi-factor analysis. The first phase will establish the baseline constraints for the basic planning requirements. The second step is to

analyze multivariate of factors by weighting the AHP (Analytical Hierarchy Processing) software [4].

- Calculation of the number of livestock and livestock growth analysis had been processed by the guidelines of Ministry of Food and Agriculture about the calculation of appropriate composition and rate of the livestock number [5].
- Introducing hay land use planning based on the suitability and future needs assessment of hay fodder is main approach of our newly developed planning methodology. Multi-

criteria analysis method is used when many factors are used in the suitability assessment. Compared to many factors, one is more important than the other, and the weight is higher.

- Analytical hierarchy process was used to rank indicators (Saaty 1977) [6]. This method

identifies the weight value by the matrix of the criteria for the indicator. The criteria selected by ranking were used to determine the value of the relative weight to influence the use for the hay field.

RESULT

Based on the new assessment of the suitability of hayfields and the calculated number of livestock up

to 2023, the hay land planning was carried out based on the estimated need of livestock fodder supply.

1. Hay land suitability assessment

According to the literature study (State Land Use Planning, Survey, Project Design Institute, 1988 [7], Purevtseren et al. 1990 [8]) for the site selection of hayfields several factors counted most important. Using the literature study review above mentioned we had been selected five factors for the suitability assessment such as: grass yield, soil moisture, stoniness, plant protein and plant nutrition unit.

According to the ranking based on the literature study, the most important of these factors are vegetation yield, soil moisture, and the lowest valued factors are stoniness, plant protein and nutrition unit. Finally, the factors that are to be ranked according to the importance of selecting a suitable place for the hay land are calculated in table 1.

Table 1.

Ranking and weighting of factors for hay land suitability

No	Factors	Ranking	Relative weight
1	Yield	1	0.4163
2	Soil moisture index	2	0.2618
3	Stoniness	3	0.1610
4	Protein	4	0.0985
5	Nutrition unit	5	0.0624

CR=0.0203

Assuming the value of the weighted matrices is calculated by the consistency ratio (CR) of 0.0203 is

assumed that the ratio between the factors is well-consisted.

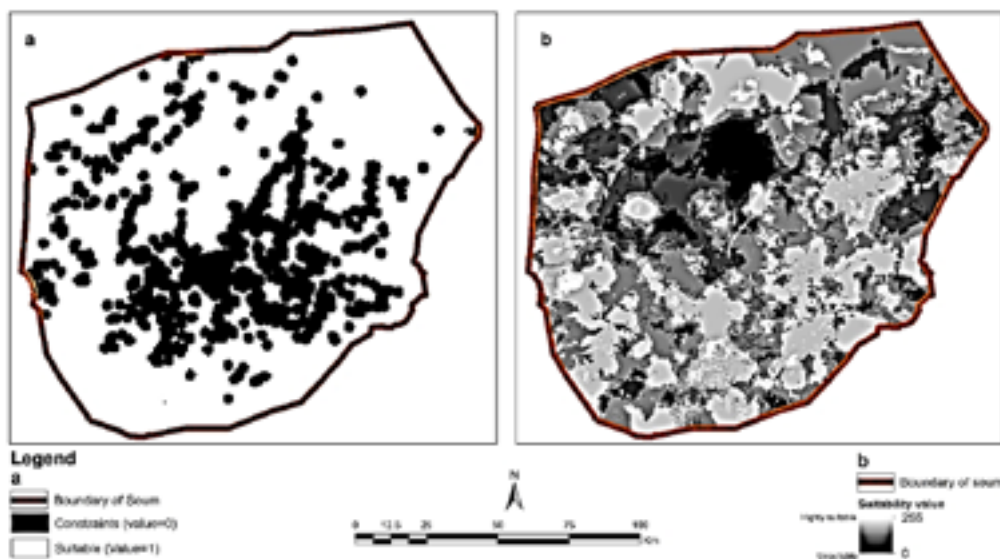


Figure 1. Hay land suitability constraint and factor map

The figure 1 of the above factors (table 1) was taken with the help of radiometric correction all the pictures were taken from 0 to 255 values, and the higher the values are the more suitable for hay land use. As they all contained the whole range of values

between 0 and 255, the maps produced could serve as continuous representations of hay land suitability score. The summary of the constraint situation and factor assessment of the suitability of hay land has been combined and presented in figure 2.

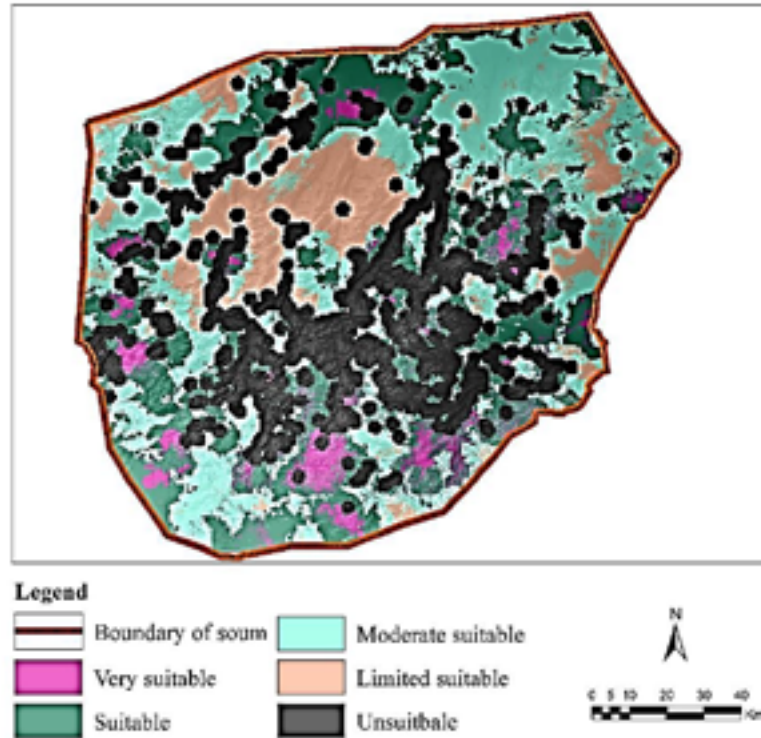


Figure 2. Final suitability assessment map of all factors evaluated with constraint consideration

The suitability of the hay land had been estimated in following classes: most suitable, suitable, moderately suitable, limited and unsuitable (table 2).

Table 2.

Final assessment result of the hay land suitability			
No	Suitability classes	Area, ha	Percentage
1	Most suitable	74164.81	4.37
2	Suitable	394430.93	23.23
3	Moderately suitable	528371.47	31.11
4	Limited	205218.49	12.08
5	Unsuitable	496014.30	29.21
Total		1698200	100

According to the tested new suitability assessment of hay land, 4.37 percent or 74164 ha of land are most suitable, and 29.21 percent or 496014.3 ha are unsuitable.

Quantitative Analysis of Fodder Needs

In order to estimate the need for fodder during the planning period, the appropriate livestock structure and circulation had been calculated based on recommendation on proper composition of livestock

and recommendation of herd circulation (Ministry of Food, Agriculture and Light Industry, 2013) [9], and sheep unit conversion and hay fodder amount had been calculated according to the methodology of soum development plans (Land Administration, Geodesy and Cartography Agency, 2017) [10].

Livestock composition and number estimated (table 3) below are the hay fodder need for 120 days of the winter time [5,11].

Table 3.

Livestock			Sheep unit		Total fodder /100 kg/		Need index	Hay fodder /100 kg/	
	2018	2023	2018	2023	2018	2023		2018	2023
	Horse	39655	44123	26172 3	29121 1	502508		559126	0.05
Cattle	22758	23642	11379 0	11821 0	218476	226963	0.05	10923	11348
Sheep	10937 1	14309 2	10937 1	14309 2	209992	274736	0.05	10499	13736
Goat	10780 5	15452 4	97024	13907 1	186287	267017	0.05	9314	13350
Camel	717	893	6166.2	7679	11839	14745	0.05	591	737
Total	28030 7	36627 3	58807 5	69926 5	1129103	3985812		56455	67129

Table 3 presents that the number of livestock in Erdenetsagaan soum will be increased to 699265 sheep unit in 2023. In order to supply the above-mentioned domestic animals, it is necessary to prepare 398581 ton hays for whole year feeding or 5 % of total need (need index) will be 6712 ton during winter season (120 days) in 2023. The Erdenetsagaan

soum is one of the key areas for haymaking in the Sukhbaatar aimag. Consequently, it is possible to prepare these resources using local areas hayfield (table 4), and for the preparation of necessary feedstuffs, it is assumed to require about yield of 800 kg of hay per hectare [7,11].

Table 4.

Livestock			Hay fodder /100 kg/		Required hay land /ha/	
	2018	2023	2018	2023	2018	2023
	Horse	39655	44123	25125.4	27956.3	3140.67
Cattle	22758	23642	10923.8	11348.2	1365.48	1418.52
Sheep	109371	143092	10499.6	13736.8	1312.45	1717.10
Goat	107805	154524	9314.35	13350.9	1164.29	1668.85
Camel	717	893	591.955	737.261	73.99	92.15
Total	280307	366273	56455.2	67129.5	7057	8391

The table above shows that in 2018, 5645 ton and 6712 ton hay fodder in 2023 are needed. The need for hay fields in 2023 [7,11].

this feed supply requires 7057 hectares in 2018 and 8391 ha

Table 5.

№	Hay land use zone	Area, ha	Hay fodder /100 kg/		Required hay land /ha/	
			2018	2023	2018	2023
			1	Current area for haymaking	10343	
2	Suitable areas for haymaking	58785	56455	67129	7057	8391

As shown in the above table, the soum uses 10343 hectares of hayfields for 2017 and is fully capable of providing the necessary feedstuffs for the planning period. Furthermore, there is a potential 58785 ha

reserve area for haymaking purposes, which can be developed as a major hayfield at the national level (Figure 3).

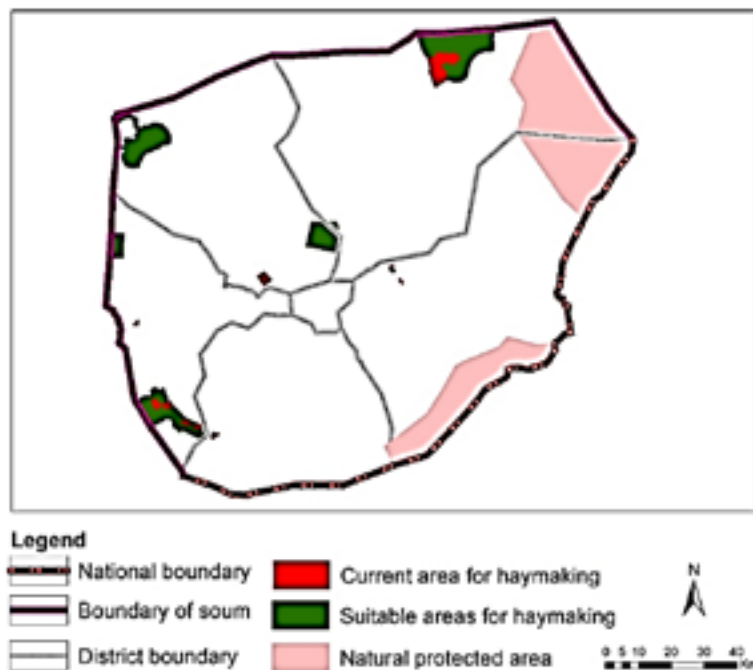


Figure 3. Hay land use planning

DISCUSSION AND CONCLUSION

According to the tested new suitability assessment of hay land, 4.37 percent or 74164 ha of land are most suitable, and 29.21 percent or 496014.3 ha are unsuitable. In order to calculate the nutritional needs of livestock in the future, the demand of green fodder for hay cut is estimated at 6712 t in 2023. The need for this fodder supply requires 8391 ha hay fields in 2023.

Erdenetsagaan soum uses 10,343 hectares of hayfields for 2017 and is fully capable of providing the necessary feedstuffs for the planning period to 2023. Furthermore, there is a potential 58785 ha reserve area suitable for haymaking purposes, which can be developed and transferred from pastureland to hayland as a major hayfield at the soum level in near future.

ACKNOWLEDGEMENT

We would like to thank the Sukhbaatar Aimag Department of Land Administration and the Land Regulation Officer of Erdenetsagaan Soum for their support.

REFERENCES

- [1] Jargal. E. 2018. Does global warming benefit Mongolia? News.mn online magazine. Accessed 2018.03.15 <https://www.news.mn/?id=273419>
- [2] P.Myagmartseren and I.Myagmarjav., 2017. Cropland suitability assessment and confusion matrix evaluation with GIS. *Mong.J.Agric.Sci.*(2017) Vol.21 (02): DOI: <http://dx.doi.org/10.5564/mjas.v21i02.911>
- [3] Baban S.M.J, and Wan-Yusof K., (2003) "Modeling Optimum Sites for Locating Reservoirs in Tropical Environments", *Water Resources Management*, pp. 17, 1–17.
- [4] Brandt, S.A., 2006. AHP v. 2.0. Analytic hierarchy process software. Available from: <http://sab.geovega.se/lattjo.html>
- [5] ALAGaC. 2017 Guidelines: Methodology for developing soum land use development plans.Ulaanbaatar.

- [6] Saaty. T., (1977). "A scaling method for priorities in hierarchical structures". *Journal of Mathematical Psychology*, vol. 15(3), pp. 234–281. DOI:10.1016/0022-2496(77)90033-5
- [7] State Land Use Planning, Survey, Project Design Institute. 1988. "Guidance on mapping and surveying of natural pasture and hay land". Ulaanbaatar
- [8] Purevtseren G. 1990. Land Quality assessment methodology. Project report. Ulaanbaatar. Land Policy Institute.
- [9] Ministry of Food, Agriculture and Light Industry. 2013. Recommendation on proper composition of livestock and recommendation of herd circulation. UB
- [10] Land Administration, Geodesy and Cartography Agency. 2017. Methodology for developing soum development plans. UB Geobotanic Company Ltd. 2018. "Report on the land use development plan of the territory of Erdenetsagaan soum, Sukhbaatar aimag", Ulaanbaatar.