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NATIONAL REPORT OF THE GRAZING IMPACT MONITORING OF MONGOLIA

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LEAD AUTHORS:

Munkhtsetseg Dorj, Agency for Land Administration and Management Geodesy and Cartography.

Budbaatar Ulambayar, Mongolian National Federation of PUGs

Bulgamaa Densambuu, Green Gold, Animal Health Project, SDC

CO-AUTHORS:

Enkh-Amgalan Tseelei, Green Gold, Animal Health Project, SDC

Sumjidmaa Sainnemekh, Mongolian National Federation of PUGs

Dul Baatar, Agency for Land Administration and Management Geodesy and Cartography.

EDITORS:

Erdenebaatar Batjargal

Sabine Schmidt

CONTACTS:

Munkhtsetseg Dorj. Agency for Land Administration and Management Geodesy and Cartography.

Budbaatar Ulambayar, Mongolian National Federation of PUGs

Bulgamaa Densambuu, Green Gold, Animal Health Project, SDC

Sumjidmaa Sainnemekh, Mongolian National Federation of PUGs

M: info@gazar.gov.mn, info@greenmongolia.mn

W: www.gazar.gov.mn, www. greenmongolia.mn

F: https://www.facebook.com/gazar.gov.mn, www.facebook.com/ Green Gold- Монголын ногоон алт

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ABBREVIATIONS

MCUD - Ministry of Construction and Urban Development
MoFALI - Ministry of food, agriculture and light industry
MNET- Ministry of Nature, Environment and Tourism
ALAMGaC - Agency for Land Administration and Management Geodesy and Cartography
NAMEM - National agency for meteorology and environmental monitoring
MULS - Mongolian university of life science
SDC-Swiss Agency for Development and Cooperation
GGAH-Green gold-animal health project
PUG-Pasture user groups
ESD - Ecological site descriptions
ESG - Ecological site group
RUA- Rangeland use agreement

FOREWORD

For Mongolian pastoralism, the urgent need has been to return to ecologically oriented and environment friendly ways. The first priority was a comprehensive assessment of the state of grazing land through applying quantitative indicators of the productivity, resilience and recovery of land rather than quantitative measurements of poor information value such as degradation, deterioration and exhaustion of capacity to provide livestock with sufficient feed reserves. The foundation for pastoral livestock husbandry to be successful is to incorporate effective and sustainable methods of smart and rational use of the natural grazing resources, relevant research findings and principles of community-based conservation into the land management policy, planning, implementation and evaluation at all levels.

A significant increase in the number of livestock has led to a decrease in both the quality and quantity of pasture fodder resources over the last decades In this situation, the SDC Green Gold-Animal Health project has developed and implemented the theoretical and practical basis for a multifaceted management approach to balancing seasonal schedules and grazing pressure to the carrying capacity of rangelands, by resting and rotational use of pasture, and adjusting stocking rates to estimated annual carrying capacity.

Since 2015, the Agency for Land Administration and Management, Geodesy and Cartography has been implementing the “Grazing land changes and grazing impact photo monitoring” project in cooperation with the Green Gold project, as part of its mandates pursuant to the Law on Land of Mongolia to introduce the rangeland use agreements and to establish a national monitoring network.

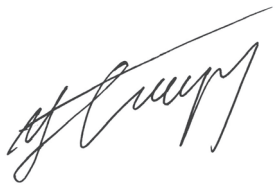
Important progress has been achieved and many interlinked measures have been introduced for assessing the state of grazing lands and making management decisions accordingly.

Now, changes in quality and productivity of grazing land as a result of rangeland use practices are evident through photo monitoring, carrying capacity and stocking rates are determined based on the rangeland resilience capacity for which a classification has been introduced, rangeland rehabilitation through changes in use is being practiced, and the implementation of rangeland use agreements by the contracted users, the pasture user groups, is routinely evaluated.

The outcomes of the joint work, which aimed to create information needed for the development of the soum annual land management plan and to ensure the coordination of the relevant government agencies have been compiled as a report and handout and made available to the public. Systematic capacity building of human resources and further expansion of the introduced grazing land monitoring system along with ensuring its sustainability are critical for the successful implementation of the above-mentioned measures.

The inputs provided by the “Green Gold- Animal Health” project, by government and non-government organizations, aimag, soum and capital city land management departments and officers of soum administrations, researchers, herder organizations, herders and livestock owners who cooperated in the assessment of grazing impact through photo monitoring are deeply appreciated and I am sure that great successes in the responsible work towards implementaton of a sustainable rangeland management will be achieved.

Ts.Gankhuu
The Director of the Agency for Land Administration and Management, Geodesy and Cartography



REPORT SUMMARY

Mongolia is amongst the fewer nations that preserved nomadic livestock husbandry. Nevertheless, the changes in the social, political and economic systems of the country have led to a steady increase in the number of livestock following the transfer of livestock to private ownership and the shift to a free market system. As a result, decrease in the frequency and distances of seasonal migrations of herder families and herds, have increased the pressure on rangelands and accelerated damages.

The questions, we face in an effort to introduce optimal use of grazing resources while reducing degradation of rangelands, and to manage livestock production adapted to climate change and market demands are related to how much rangeland resources will be available, how many heads of livestock can be supported, how much rangeland has been deteriorating, whether the degraded rangelands will recover, and how long it will take to rehabilitate degraded rangelands.

The Green Gold-Animal Health project of the Swiss Agency for Development and Cooperation (SDC), which has taken the first step towards sustainable rangeland management, has developed a new assessment, monitoring and management procedures that aims to understand and improve rangeland health across Mongolia, in collaboration with relevant ministries, agencies and universities.

In order to implement the new methodology and procedures for rangeland monitoring sustainably and to provide information on changes of the rangeland health at the national level, the National Agency for Meteorology and Environmental Monitoring (NAMEM) is now enabled to undertake the assessment of the health of rangelands at 1516 plots that represent the bags, the primary administrative unit, using a nationally standardized methods for the primary data collection, analysis and interpretation.

The theoretical basis for the determination of the health of rangeland and the development of comprehensive spatial management recommendations tailored to rangeland use and local conditions and the new concept currently known as Ecological Site Description have been developed by researchers from universities and research institutes, specialists of the Agency of Land Management, Geodesy and Cartography (ALAMGaC) and the NAMEM (National Agency for Meteorology and Environmental Monitoring) in collaboration with the Green Gold-Animal Health Project. It has been approved as a basic model for the Mongolian context and has been adopted at the national level.

Based on the above-mentioned rangeland ecosystem monitoring results, the first and second rangeland health reports were prepared in 2015 and 2018 under

the title "National Rangeland Health Report of Mongolia" and submitted to the relevant government ministries and agencies for official use and presented to the public as well.

As highlighted in the latest report, based on the 2016 rangeland monitoring data, 42 percent of all monitoring plots were found to be "healthy" or "not degraded", 13.5 percent were found to be slightly degraded, 21.1 percent were moderately degraded, 12.8 percent were severely degraded, and 10.3 percent were irreversibly degraded.

Compared to 2014, the base year of the first report, the level of rangeland degradation has increased. The number of non-degraded and slightly degraded rangeland monitoring plots has decreased by 10 percent, and the number of heavily and irreversibly degraded plots has increased by 4.3-5.9 percent.

More than half of the degraded rangeland can be fully restored within 10 years if the current grazing regime is adjusted to the optimal stocking rate. The second report, on the other hand, found a 5 percent increase in the size of the irreversibly degraded rangelands.

A new, comprehensive approach called resilience-based rangeland management was introduced to initiate management changes leading to recovery towards desired rangeland states.

Resilience-based rangeland management is a comprehensive set of activities aimed at ensuring the sustainability of livestock products, such as meat, wool and cashmere, and ecosystem services in the face of environmental and social changes and evolutions.

For a successful introduction of the resilience-based rangeland management, harmonization of activities and policies at national level among MOFALI, MNET and MCUD, and at local level among herders and local administration is vital.

Herder organizations function as the primary unit and provide a solid foundation for implementation of resilience-based management rangeland. With the introduction of Rangeland Use Agreements (RUA), a tool to reinforce this approach through the introduction and implementation of effective use of rangeland and optimal planning of the herd size and productivity management, more than 900 PUGs nationwide now use 49.0 million ha, or one-third of the total rangeland of Mongolia under a long-term conditional contract with the soum Governor.

The agreement is a key tool for making the users accountable for rangeland use by managing pressure on rangeland in order to maintain and improve its condition through optimal use.

Althought many herders comment on the need to reduce the number of livestock and to adjust it to the carrying capacity of the rangelands, they do not know where to start or how to organize it. In addition to incentive to reduce rangeland overstocking, herders are in dire need of professional advice and support.

Identification of the changes in the attributes of rangeland in a timely manner with the detection of patterns of these changes can prevent potential risks such

as rangeland degradation and fodder shortages, thereby providing possibilities for making land management plans more realistic and implementable.

Under the goals to implement the statements of the Law on Land of Mongolia: 23.2.10. "to monitor land protection, rehabilitation and land management" and "23.2.21 to operationalize a monitoring network responsible for identifying and evaluating land characteristics and quality, as well as for controlling and monitoring changes thereof at the state level", we are presenting the first report of the "Photo monitoring system for the photomonitoring of grazing land changes and grazing impact". It is based on the results of the implementation of the national program "Establishing a system for rational use, protection and rehabilitation of land and establishing a national network for monitoring land condition and quality assurance".

Since 2015, with the support of SDC Green Gold-Animal health project, the ALAMGaC launched the "Assessment of rangeland change by photo monitoring" program and this activity has been extended to 5128 monitoring plots in 320 soums of 21 aimags and 6 districts of the capital city representing soum, bag, PUGs and seasonal rangelands where monitoring has been undertaken on a regular basis.

Of the total 94.4 million ha of rangeland assessed with the photo monitoring program nationwide, 47 percent or 44.2 million ha have been maintained in a healthy condition thanks to appropriate utilization. The introduction of optimal use, in the meanwhile has resulted in a partial recovery of 20.6 million ha over the past 5 years. However, there are 29.5 million ha of severely degraded rangeland that need to be rehabilitated.

There is still ample opportunity to adjust the existing policies and management to adapt to climate and changes in land use, as well as to improve rangeland conditions to level which could ensure the future of Mongolia's pastoral livestock and food security. The key is not to miss these opportunities, but to act decisively and quickly.

1 RANGELAND HEALTH ASSESSMENT AND MONITORING

1.1 Rangeland health assessment and monitoring

The National Agency for Meteorology and Environmental Monitoring (NAMEM) the institution responsible for nationwide rangeland monitoring covering 1550 monitoring plots representing all baghs, the lowest levels of the administrative territorial unit in Mongolia. NAMEM has achieved significant progress to

i) institute measurement of internationally-accepted core indicators that are standardized nationally;

ii) develop a reference database of different rangeland types that provides a basis for interpreting monitoring data and determining what is "healthy" or "degraded"(ecological site descriptions); and

iii) build capacity to provide policy makers and users with timely updates and information on changes in rangeland state, the risk of rangeland degradation and the possible rehabilitation of degraded rangelands through the quoting on the monitoring data

iv) Monitoring sites at the NAMEM are able to fully represent the ecological and administrative boundaries of Mongolia (Figure.1.1).

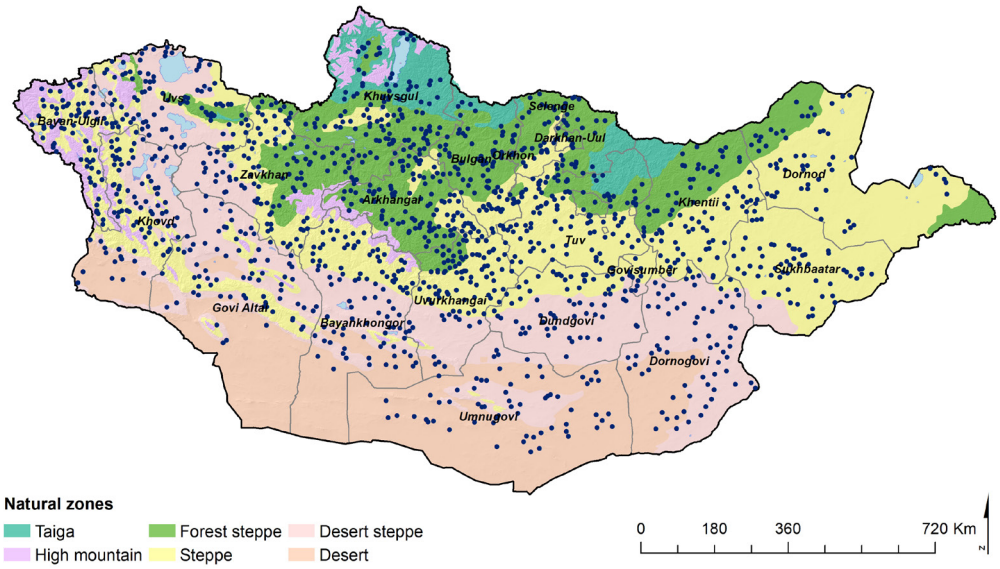


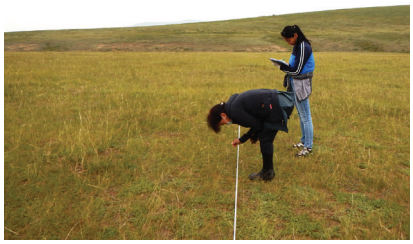
Figure 1.1. Location of the rangeland ecosystem monitoring plots

Meteorology technicians in 320 soums collect the primary data yearly at 1516 sites using the new standardized methodology since 2011. Aimag engineers ensure quality control and enter the monitoring data into the National Rangeland

Monitoring Database (Fig. 1.2).

A national rangeland health report produced on the basis of analyses of the rangeland health information at the rangeland assessment and monitoring database is published every three year, and the rangeland resilience map is updated yearly and released for public use. (http://irimhe.namem.gov.mn/ ; https://eic.mn/wedotinfo). In addition, using the information on the summer maximum yield determined at the monitoring plots, the winter-spring grazing pressure is estimated and mapped and made available for public use.

Data compilation: Soum technicians collect the primary data yearly. Aimag engineers ensure quality control and enter the monitoring data into the National Rangeland Monitoring Database (DIMA)



National database for rangeland monitoring: Customized reports for interpretation of assessment and monitoring data can be produced.

Products for public service:

- Rangeland state outlook.
- Carrying capacity & grazing pressure map
- Rodents and Grasshopper damage map and Other products

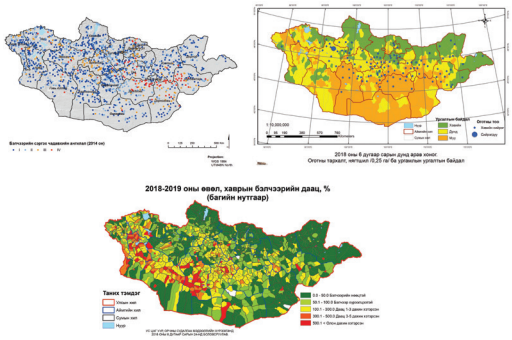


Figure 1.2. The collection, processing of information for the rangeland monitoring data at the national meteorological network and public disclosure

The national monitoring effort of NAMEM provides highly precise, detailed information suitable for interpreting long-term trends in vegetation and ground cover, which can be linked to erosion models (Herrick et al. 2017). The density of observations, however, has not sufficient for management decisions at the local (bag, pasture) levels.

Thus, based on the test results in pilot soums, a photo point monitoring method (Booth and Cox 2008) was developed to provide information on the cover of plant functional groups that is adequate for grazing management decisions and to report vegetation trends at the functional group level.

The method is relatively easy to use, and data from many plots can be collected in a short period of time. It is also possible to combine and compare the data in terms of the theoretical background, concept and model for the analysis of the monitoring data in accordance with the monitoring of rangeland ecosystems in the meteorological network.

1.2. Monitoring of changes in grazing land health and grazing impacts

Since 2013, monitoring pilots long and short-term changes in rangeland health and data processing have been conducted in 15 soums of Arkhangai, Bayankhongor, Bayan-Ulgii, Gobi-Altai, Dornod, Zavkhan, Khovd and Tuv aimags, which represent the major natural zones in Mongolia.

On the basis of the results of the pilots, a decree # A/105 of 2015, of the Head of ALAMGaC has been issued to introduce the "Procedure to monitor and assess the grazing land". In order to implement this decree, an infrastructure to provide graziers, producers, decision makers and users with accurate information on the changes in rangeland quality and productivity due to the patterns of use on aimag, soum, bag and PUG level has been established with the support of SDC Green Gold-Animal Health project. For this purpose, the following activities have been implemented:

- A Sample Point (Booth and Cox) program for photo monitoring methodology and data processing has been developed suitable to the conditions of Mongolia and introduced;
- A manual "Procedures for monitoring and assessment the rangeland health - 2015" was produced;
- An information service window (info window) for integration of the photo monitoring program with the land cadastre database has been established and made available as public information service;
- Training activities for strengthening the capacity of involved specialists were organized.

The advantage of the photo monitoring method for monitoring changes in grazing land health and grazing impact is that it is simple and inexpensive to collect information from a relatively large number of plots in a short period of time, and that it shows indicatively long and short-term changes in the resilience

capacity, the levels of degradation and deterioration of rangeland vegetation in a time dimension.

Every year, photo images are collected from the plots selected as to represent particular types of rangelands (Photo 1.3). Based on information on foliar cover measurements, analyses are conducted with random scale and digital pixel superimposing using Sample Point software (www.samplepoint.org), whereby the data is automatically saved and recorded into spreadsheets.

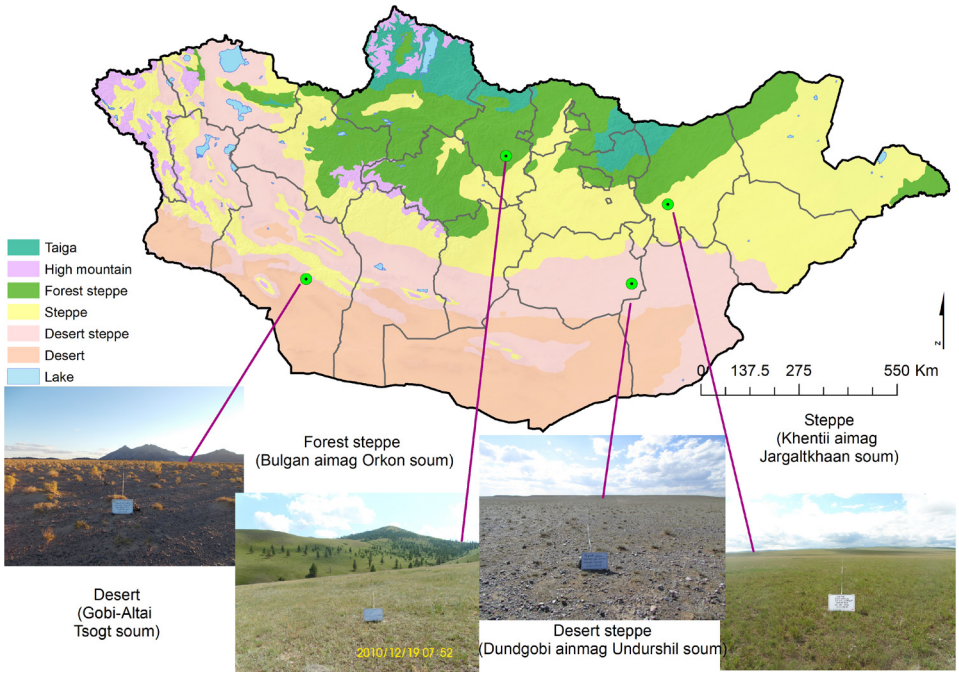


Figure 1.3. Photo monitrong is based on the photo images of the selected sites

According to Section 3.1 of the "Procedures for photo monitoring assessment of rangeland changes", photo monitoring surveys are conducted in the first half of August at the plots representing the following types of rangelands:

1) Winter rangeland
2) Spring rangeland
3) Summer rangeland
4) Autumn rangeland
5) Otor reserve

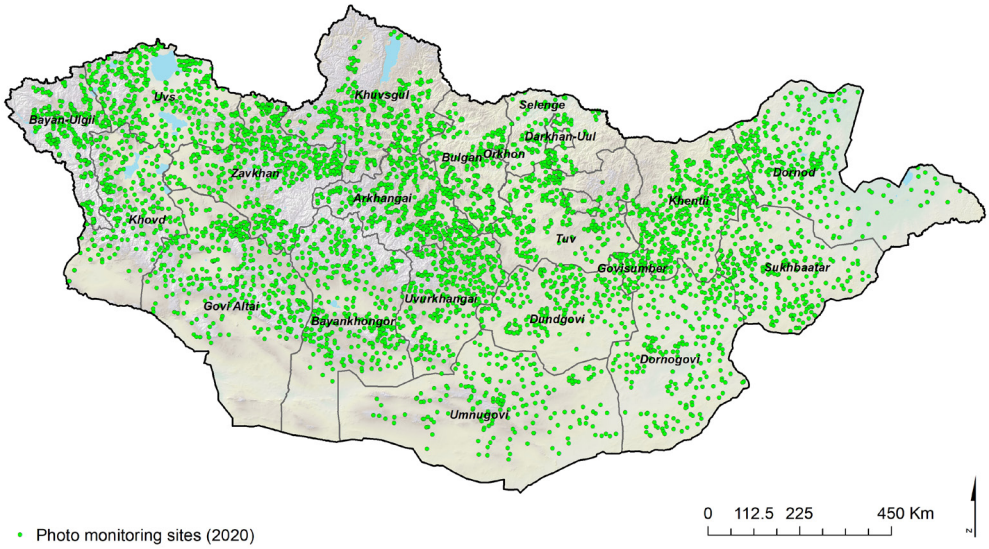


Figure 1.4. Location of photo monitoring plots for monitoring impacts of the use of rangeland

The quality and accuracy of photo monitoring data depends directly on how well the selected plots represent the natural and ecological conditions of the particular location and its grazing patterns and regimes. Therefore, to ensure that all seasonal rangelands of bags and herder organizations are represented and taking into account, the selection of photo monitoring plots and relevant assessments and surveys have been organized with the participation of herders and local specialists. In 2015, when the photo monitoring program was introduced country-wide, 2620 rangeland monitoring plots were established in 205 soums of 16 aimags. By 2020, the number of plots had reached 5128, covering 320 soums of 21 aimags and 6 districts of the capital city (Figure 1.4; Figure 1.1; Table 1.1).

Graph 1.1. Escalation of the photo monitoring plots in numbers, by year

Depending on the natural zones, a single photo monitoring plot represents on average 20,000 ha of rangeland. With this estimate, the 5128 plots located at seasonal rangelands of herder groups and PUGs involved in the photo monitoring program under the integrated land management system exemplify 94.0 million ha, totally (Table 1.1).

Table 1.1. Monitoring plots established under the rangeland photo monitoring program (2015-2020)

№	Aimags	2015		2016		2017		2018		2019		2020	
		Number of soums	Number of plots	Number of soums	Number of plots	Number of soums	Number of plots	Number of soums	Number of plots	Number of soums	Number of plots	Number of soums	Number of plots
1	Arkhangai	19	311	18	280	18	363	18	428	18	381	18	395
2	Bayankhongor	6	24	5	68	16	175	17	168	19	296	19	330
3	Bayan-Ulgii			8	143	1	23	12	181	12	225	12	247
4	Bulgan	16	185	13	155	16	180	16	173	14	164	16	204
5	Gobi-Altai	18	303	18	303	18	299	16	226	18	311	18	339
6	Gobisumber			2	11	3	16	3	41	3	43	3	46
7	Darkhan-Uul	4	27	2	24	3	37	3	40	3	25	3	29
8	Dornod	9	104	5	48	10	152	12	184	13	253	13	256

9	Dornogobi	11	126	11	126	12	182	13	291	14	208	14	226
10	Dundgobi	15	115	15	113	14	130	14	268	15	226	15	213
11	Khentii	18	263	15	212	18	306	16	326	18	301	17	340
12	Khovd	14	189	14	189	8	101	16	190	16	204	17	196
13	Khuvsgul	10	167	10	167	22	414	22	468	23	408	22	384
14	Selenge			6	50	15	65	17	91	17	96	17	94
15	Sukhbaatar			1	6	5	53	12	140	13	183	13	251
16	Tuv	1	21	1	21	8	107	14	99	23	236	26	263
17	Umnugobi	15	143	15	144	15	155	14	159	15	177	15	193
18	Uvs	19	264	19	262	17	344	17	377	19	349	19	341
19	Zavkhan	20	250	20	250	22	357	23	366	21	388	23	440
20	Orkhon					2	5	2	7	2	7	2	7
21	Uvurkhangai	10	128	10	128	15	352	14	373	18	283	18	302
22	Ulaanbaatar									6	17	6	32
Нийт дүн		**205**	**2620**	**208**	**2700**	**258**	**3816**	**291**	**4596**	**320**	**4781**	**326**	**5128**

The grazing land photo monitoring program began with the selection of aimags, districts, soums, bags, PUGs, herder groups, and seasonal rangeland sites. Because of local specifics and management needs, more plots representative to other forms of rangeland use, such as otor reserve rangelands, hayfields, and post-mining rehabilitated areas have been added.

About 18 million ha rangeland, which need to be surveyed and monitored in the future have been identified. (Table 1.2).

Table 1.2. Size of rangeland areas covered by photo monitoring vs unsurveyed

Aimag	Rangeland, (as indicated in the United land fund report)	Rangeland, ha (including rangelands in the specially protected areas)	Rangeland for further survey, ha	Total, ha
Arkhangai	3,737,560	3,747,790	1,078,779	5,531,380
Bayan-Ulgii	3,541,050	4,325,525	749,772	4,570,490
Bayankhongor	8,856,380	10,255,317	594,297	1,597,780
Bulgan	2,484,510	2,397,442	1,080,749	4,873,300
Gobi-Altai	8,608,770	12,394,669	-	14,144,770
Gobisumber	472,600	499,555	-	554,180
Darkhan-Uul	175,540	163,868	153,096	327,500
Dornogobi	9,113,880	8,965,368	1,125,702	10,947,230
Dornod	8,655,730	11,138,860	-	12,359,740

Dundgobi	7,148,090	7,136,824	2,639,460	7,469,030
Zavkhan	6,924,750	6,439,160	2,854,645	8,245,570
Orkhon	39,350	26,732	22,435	84,400
Uvurkhangai	5,689,390	5,663,717	974,015	6,289,530
Umnugobi	11,430,600	14,077,204	-	16,538,050
Sukhbaatar	7,668,470	8,060,210	1,048,567	8,228,720
Selenge	1,610,590	1,398,573	774,154	4,115,260
Tuv	5,177,270	5,644,146	2,941,563	6,958,540
Uvs	4,269,240	5,495,066	-	7,404,240
Khovd	5,058,670	6,490,837	659,219	7,606,040
Khuvsgul	4,386,180	4,614,255	1,442,191	10,062,880
Khentii	5,067,070	6,312,031	300,466	8,032,510
Total	**110,115,690**	**125,247,147**	**18,439,110**	**156,411,570**

The photo monitoring criteria are characterized by their aptitude to accurately identify any changes in rangeland health and quality triggered by the use, and they are easy to observe, measure and process. For example, the following criteria allow for the timely identification of rangeland short-term changes caused by the use and by adjusting management procedures considering the changes. These include:

- Foliar cover at the level of the functional groups and key species;
- Rangeland grass yield;
- Rangeland usage;
- Topsoil movement and shifts.

With the use of the results of current year grazing land photo monitoring, it is possible to assess the effects of the management practices applied to particular grazing areas. For this purpose, the health of the rangeland should be compared with the Reference level of rangeland health of the target year, for example, the year when the utilization of grazing land was altered.

2 NEW PRINCIPLES FOR THE PHOTO MONITORING DATA ANALYSIS AND INTERPRETATION

The data from the rangeland monitoring are assessed through comparison with the standard or reference levels. Information of the rangeland ecological potential serves as a standard for determining the specific characteristics of different types of rangeland, as well as a tool for selecting which management regimes should be adapted for their use. Under the SDC Green Gold project, a concept of "rangeland ecological potential" was developed by a working group consisting of researchers from the US Department of Agriculture, the ALAMGaC, the NAMEM and the Mongolian University of Life Sciences and the Institute of Biology of the Mongolian Academy of Sciences. The phases and methodologies used by the Bureau of Land Management in the USA (Natural Resource Conservation Service of USDA, 2014) were used as the background for this work.

The main phases, over which the "ecological site descriptions" was developed, were:

1) Inventory to measure the existing variability of rangeland vegetation;
2) Classifying ecological site groups based on climate, landform, and soils;
3) Establishing reference and alternative ecosystem states for each ecological site;
4) Providing information about the causes of transitions among ecosystem states and
5) Describing how transitions can be controlled by management.

Based on the specifics of the natural zones and belts, relief, traditional concept of rangeland classification and resistance and response to the grazing, 22 ecological site groups (ESGs) were determined for Mongolian rangelands. By comparing with the state and quality reference levels in a link to the "State and transition models of the dominant rangelands in Mongolia", which developed with relevant ECG, the changes which the rangeland underwent, are estimated (Figure 2.1).

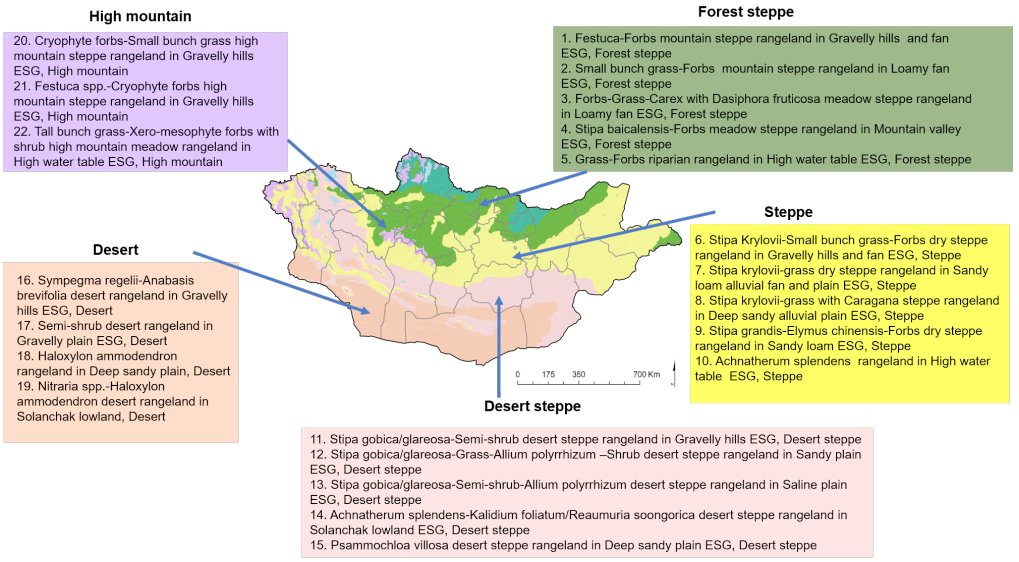


Figure 2.1. A map of classification of the rangelands of Mongolia into 22 ECG

The main principles of the analyses and processing of monitoring data such as "State and transition models of dominant types of rangelands of Mongolia" developed for each rangeland ecological site groups, and "Recovery class concept" are being by the "National photo monitoring network" as well as at the rangeland ecosystem monitoring network at the National meteorology network.

2.1 State and Transition Model of Mongolian rangelands

Information on how the rangelands behave as a result of their use, the risk of degradation due to irrational use, and the potential for recovery through the adjustment of use, are of a paramount importance for the planning and implementing of proper management and protection of rangelands. Apart, the healthy and alternative states of the rangelands in Mongolia and their reciprocal shifts and changes are modelled by major types of with digital data. In addition, information on key indicator species for particular state and potential productivity and recommendations on optimal grazing regimes and technology are provided.

Research and related organizations have officially confirmed that it is feasible to use the "State and transition model of rangeland" for processing of rangeland ecosystem and grazing land monitoring for assessment of health and recovery class of rangelands, planning and implementation of land management at soum level, and monitoring of the grazing impacts.

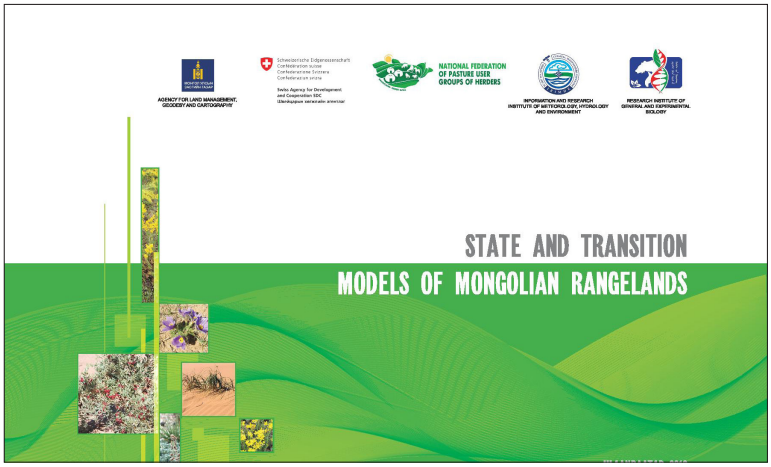


Figure 2.2. The state and transition model of the dominant rangelands in Mongolia

This model has been revised and validated through annual monitoring results of the program and making necessary changes if needed.

Incorporating the transition among the rangeland health states and community phases and the effects of the factors that drive it, into a unified model based on the dominant types of rangelands, provide opportunity to more accurately investigate the functioning of Mongolia's rangeland ecosystem and its long and short-term changes. Taking the quantitative and qualitative data of the key species as the basis, indicating the healthy and alternative states of a "Rangeland state and transition model", their ground cover and grass yield, the health state of the rangelands and the existing community phases are determined. For example, the Festuca-Forbs mountain steppe rangeland in gravelly hills and fan ESG, commonly found in the forest-steppe zone has of four states: "healthy", "sub-dominant altered", "dominant species altered", and "degraded" (Figure 2.3). Based on the cover of key species or thresholds among community phases, monitoring plots are assessed by specific state and community phases. Instead, with the state and transition model, the health and every phase of the community is assessed by the level of degradation and the recovery classes as outlined in the rangeland state and transition model.

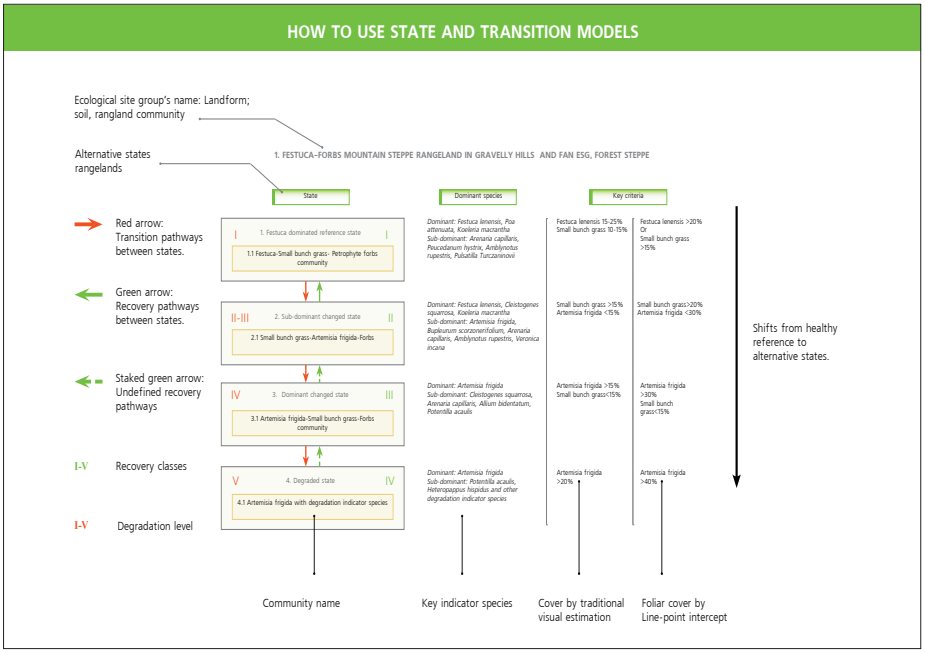


Figure 2.3. The rangeland state and transition model

The rangeland state and transition model contains detailed information not only on the current state of rangeland quality and productivity, but also on the risk of degradation, as well as the potential opportunities for degraded rangeland to recover.

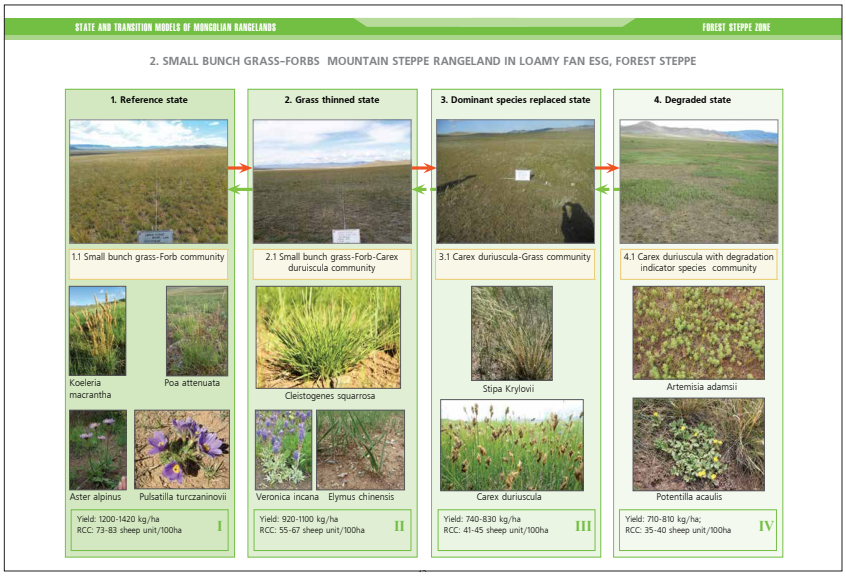


Figure 2.4. A simplified version of the rangeland state and transition model

This model is more friendly for local rangeland users and herders to apply.

2.2 Classification of the "Recovery classes" of rangelands

The development of the Recovery class concept builds on information and assumptions about the reference condition or ecological potential of a pasture area (the plant communities expected to exist at a site in healthy condition) and the process of recovery with a change in management. The recovery classes are analogous to degradation classes already used in Mongolia, but are based on ESDs and provide information about recovery rates based on quantitative measurements. Assigning

a recovery class to a site requires measurements of plant cover and soil surface conditions that are

compared with the information in the appropriate ESD. A state-and-transition model developed for an ecological site group, such as Stipa krylovii-grass with Caragana steppe rangeland in deep sandy alluvial plain, dry steppe (Figure 2.5), can be used to assign recovery classes based on the following criteria and interpretation.

be used to assign recovery classes based on the following criteria and interpretation:

Class 1. The plant community is near reference state (non-degraded) or 1-3 growing seasons are required for recovery from minor changes (slightly degraded); stocking density matches to forage resource (carrying capacity) and to be used under seasonal rotation as needed.

Class 2. The plant community is altered to a negative trend and may be rapidly recovered (3-5 growing seasons) with favorable climatic conditions or a change in management (e.g., stocking rate reduction, seasonal deferment, rotation). The nature of alteration is not regarded as a significant long-term threat to the provision of forage and other ecosystem services.

Class 3. The plant community is changed largely and it may recover in 5-10 growing seasons provided grazing management and organization are effectively changes (stocking rate reduction, seasonal rotation, and short-term rest by removal of grazing). Any alteration represents a significant loss of important ecosystem services (and are clearly related to anthropogenic drivers) and the temporal aspects of the potential recovery.

Class 4. The plant community is altered due to the loss of key plant species, invasion of noxious plant species, or alteration of hydrology that is unlikely to be recovered without intensive interventions such as species removal, seeding, or manipulations to recover hydrological function (i.e. deterioration has exceeded the ecological threshold). Basic ecosystem services have been lost and big sources will be required to recover.

Class 5. The plant community is strongly changed due to extensive soil loss, accelerated erosion rates, or salinization and key species are extinct. Altered plant-soil feedbacks or permanent changes in the soil profile maintain the degraded state persisting to expand. The ecosystem services have been lost and it are regarded as true desertification.

Figure 2.5. The recovery classes of rangeland – in example of Stipa krylovii-grass with Caragana steppe rangeland in deep sandy alluvial plain, dry steppe zone

Class 1: The plant community is near reference state (non-degraded) or 1-3 growing seasons are required for recovery from minor changes (slightly degraded); stocking density matches to forage resource (carrying capacity) and to be used under seasonal rotation as needed.

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2.3 Manuals and Materials

Guidelines and manuals for photo monitoring and related measures were developed as listed below.

"Procedures for monitoring and assessment of the rangeland health" and "Methodologies for photo monitoring of the grazing land health" approved by order A\105 of the ALAMGaC director in 2015 (Annex 1)

"Registration procedure for the rangeland use agreements and photo monitoring results for contracted rangelands" approved by order A\179 of the ALAMGaC director in 2020

Procedures on the "Mapping techniques of rangeland ecological potential" and "Photo album of key indicator species of Mongolian rangelands" approved by order A\268 of the ALAMGaC director in 2017 (Figure 2.6).

Methodologies for photo monitoring of the rangeland health

Illustrated reference of the key species of rangelands in Mongolia

Instruction for registration of rangeland use agreement and rangeland photo monitoring data in the integrated land cadaster information system

Mapping techniques of rangeland ecological capacity

Figure 2.6. These manuals and materials are widely used in routine work by land managers.

3 THE PHOTO MONITORING SYSTEM FOR TRACKING THE GRAZING LAND CHANGES AND IMPACTS OF UTILIZATION

Photo images were collected annually at 5 meter intervals along two parallel 50 meter long tapes by soum land managers and the soum leader of the Association of pasture user groups (APUG). Analysis is performed using Sample Point software to determine the cover of key species and functional groups. The results are entered automatically in the national grazing land photo monitoring database at the ALAMGaC. As of today, monitoring information and photo images of 5128 plots representing seasonal rangelands within the boundaries of over 1500 PUGs in all bags of 330 soums has been collected.

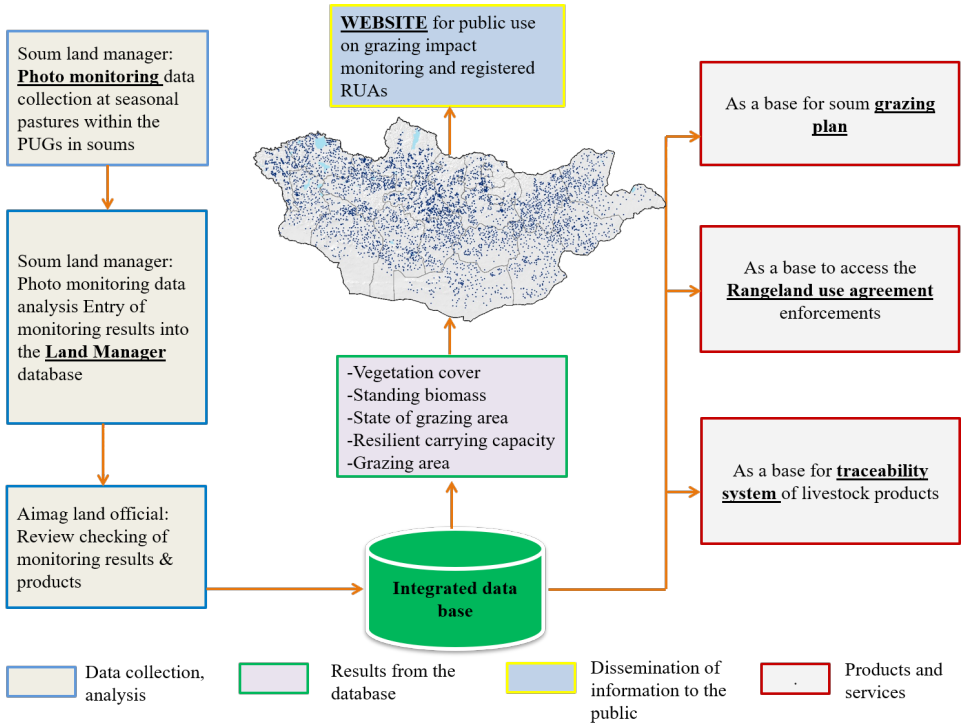
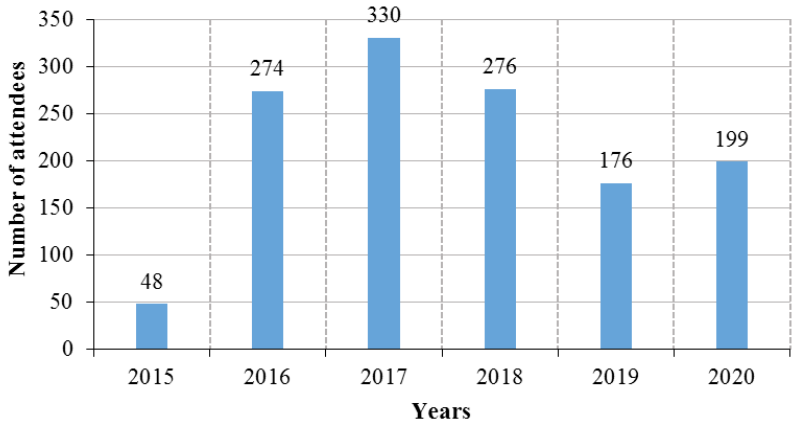


Figure 3.1. The scheme of the functioning of a photomonitoring system at the national land management network

With the support of the SDC Green Gold-Animal Health project, 1303 specialists (as duplicated) of 330 soums of 21 aimags received training in the assessment of grazing land changes by photo monitoring method, in processing of collected data, maintenance of the database, reporting and provision of public information service (Figure 3.1; Figure 3.2; Figure 3.3).



Graph 3.1 The number of attendees of the trainings, by years

As a result of a successful organization of the capacity building training at national and regional levels, the local land management specialists acquired practices and skills as the next:

- Selection of monitoring plots and determination of the landscape attributes;
- Identification and mapping of the ecological potential of the selected monitoring plots;
- Collection of primary digital information;
- Identify the indicator species for each rangeland plant community;
- Entering in data base, and processing the primary data with the Sample Point software analyze and report;
- Use of the monitoring data for rangeland management planning and its impact evaluation.

Figure 3.2. Field training to select monitoring plots, identifying ecological capacity and indicator species, and field data collection

Figure 3.3. Skill development through in-class training in processing digital information of the monitoring plots and for providing information service for users

The on job training center for of land management specialists and to sustain the operation of the photo monitoring program in the land management network was established at the School of Agroecology of the Mongolian University of Life Sciences in 2015. The center is equipped with computing facilities and other training equipment and has a capacity to train up to 25 specialists in one course.

Pursuant to the Memorandum of Understanding signed between the ALAMGaC and the Mongolian University of Life Sciences on the on job training and capacity building of land management specialists, the training center has established a direct connection to the unified land management database under the ALAMGaC, which enables the center possibilities to conduct the trainings of land managers and postgraduate training based on ready-to-digest real time data and fresh information.

4 PROCESSING OF PHOTO MONITORING DATA AND THE INTEGRATED DATABASE

4.1 The "Land manager" Integrated Database

Key activities of the monitoring program of the change and impacts of the grazing include ensuring the sustainable operation of the grazing land monitoring database, maintaining records related to grazing management and use, and evaluating the implementation and effectiveness of grazing land use plans.

Long-term use of grazing land by Pasture user groups and herder groups are becoming under contractual agreements is becoming a more common form of (collective) rangeland management. In this regard, in order to secure informal, customary rangeland use rights, and to hold herders accountable for rangeland use, Rangeland Use Agreements (RUAs) are concluded. RUAs clarify the roles and responsibilities of herders for sustainable rangeland use practice. Using the "Land Manager" (LM) software, RUAs are entered into a database in each Soum, as part of a comprehensive digitalized national database.

The decree of the Soum Governor on the rangeland use agreement, documents about the health of the contracted rangeland, seasonal grazing boundaries of the PUGs and herder groups and grazing schedule, borders of natural zones and ecological potential map, records of annual grazing impact photo monitoring are attached to the "Rangeland use agreement" and stored in the "Grazing land monitoring database", which was developed as a supplement to the "Land Manager" database (Figure 4.1).

The following data for each of the monitoring plots are updated yearly and entered in this database.

1. Name of the administrative unit and the location where the photo monitoring survey was carried out;
2. The percentage of vegetation cover (by functional groups and by key species);
3. Photo image (4 images of the surrounding areas and 9 photos of the 1 sq.m surface;
4. Biological and total yield (kg/ha);
5. The total grazing area, the plot represents, (ha);
6. Duration of use (days) and
7. Expected carrying capacity, in sheep units.

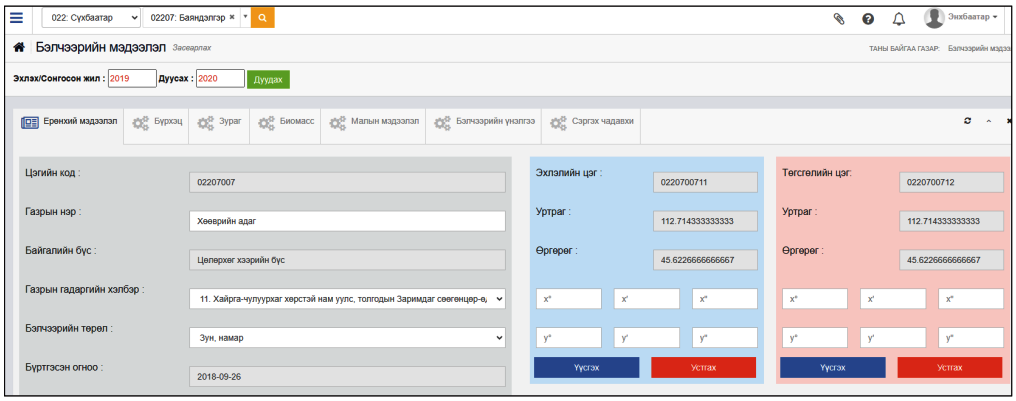


Figure 4.1. The menu of the photo monitoring database

By entering the annual photo monitoring data, an E-archive is created and it is linked to the below provided information about PUGs, the users who contracted the rangeland.

1) List of PUGs and herder group leaders and members
2) Boundary map of PUGs, herder groups and seasonal grazing lands;
3) Records of the request by the PUG and herder group for contracted use of rangeland;
4) Decree of the soum Governor on the contracted use of grazing land, the approved agreement and name list of PUG and herder group members who signed the RUA (Figure 4.2).

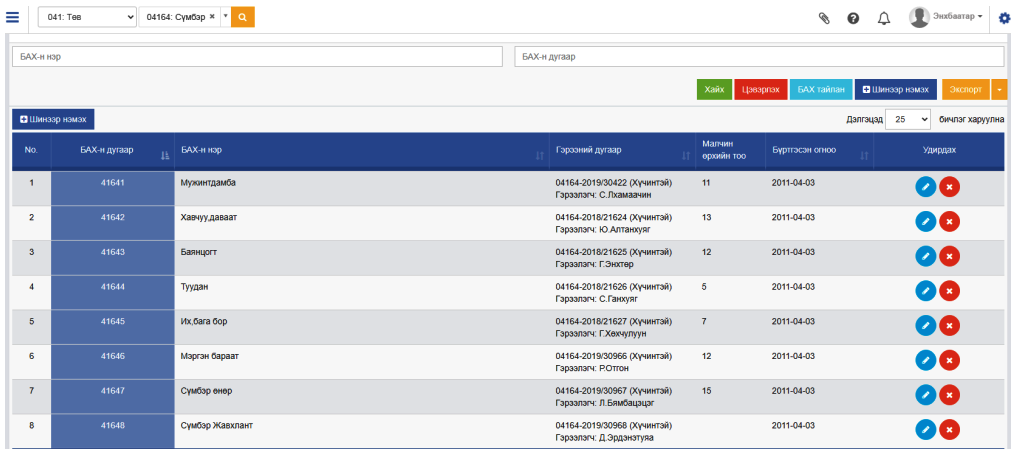


Figure 4.2. The menu of the registration of rangeland use agreements

4.2 Public Information Service

A comprehensive package of data on the management of rangelands has been uploaded to the website www.egazar.gov.mn as public information. Thus, the annual information for each photo monitoring plot can be reviewed and compared by aimags, soums and years according to needs and interests (Figure 4.3; Figure 4.4).

For instance, national photo monitoring information can be viewed in the "National photo monitoring" menu under the "Photo monitoring" menu.

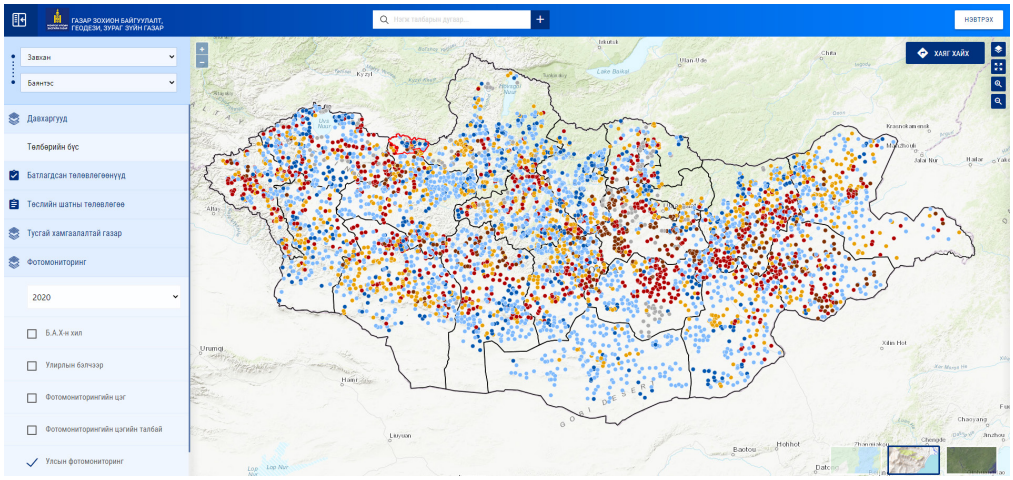
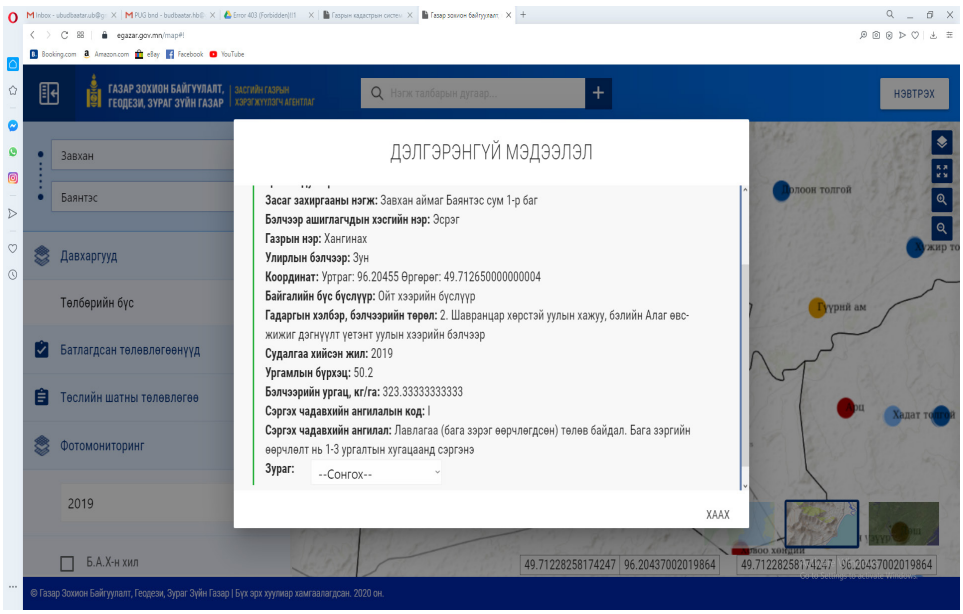


Figure 4.3. Location of the photo monitoring plots, 2020. at:www.egazar.gov.mn



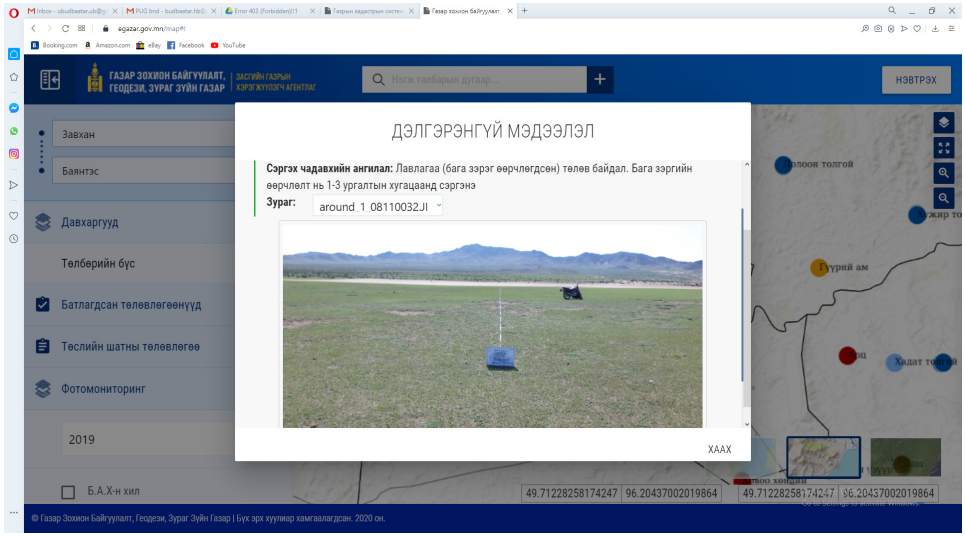


Figure 4.4. Detailed information of a photo monitoring plot in Khanginakh, Bayantes soum, Zavkhan aimag, www.egazar.gov.mn

A whole set of information such as the name of PUG, size of contracted rangeland, name of PUG leader, reference # of the RUA and the date of signing of the RUA can be produced from the publicly accessible website (www.egazar.gov.mn To view the information of the rangeland user group, select the relevant aimag and soum, and then select the "P.U.G boundary" menu in the "Photo monitoring" menu (Figure 4.5).

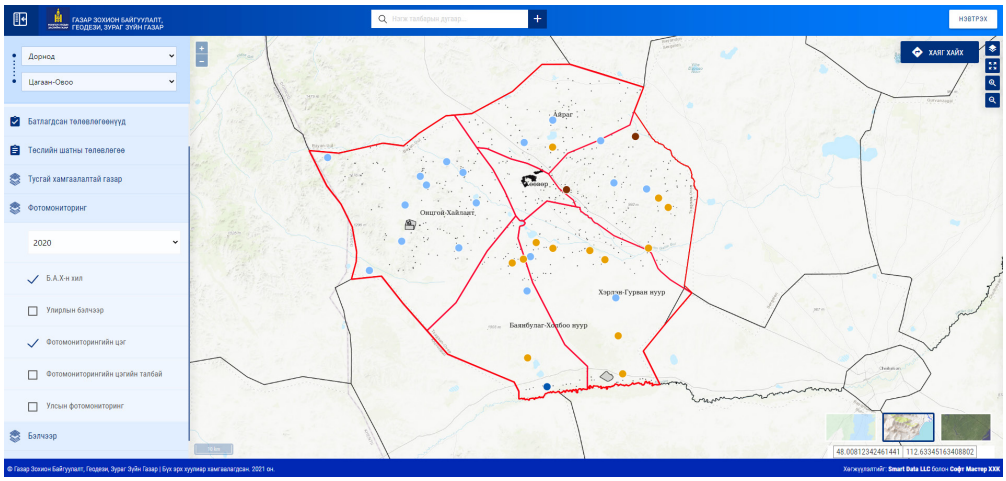


Figure 4.5. A map covering the PUG boundary, location of the photo monitoring plots and recovery class assignment of the rangeland (Tsagaan-Ovoo soum, Dornod aimag)

5 THE CURRENT STATE OF RANGELANDS IN MONGOLIA

5.1 Recovery classes of the grazing impact monitoring plots

All grazing land of each soum, bag, PUG and season of use that are represented by 5128 plots, assigned against a recovery classes and the corresponding state and transition models. Based on the 2020 assignment, the 83.7 percent of the total monitoring plots evaluated in 2020 were found to be altered with respect to the plant species composition of the reference communities for the matched ecological site groups and underwent to varying degrees of deterioration (Figure 5.1). As classified by the recovery classes the 16.3% were found at the level I, 51.1% - at the level II, 16.2% - at the level III, and about 16.4% at the level IV (Figure 5.1).

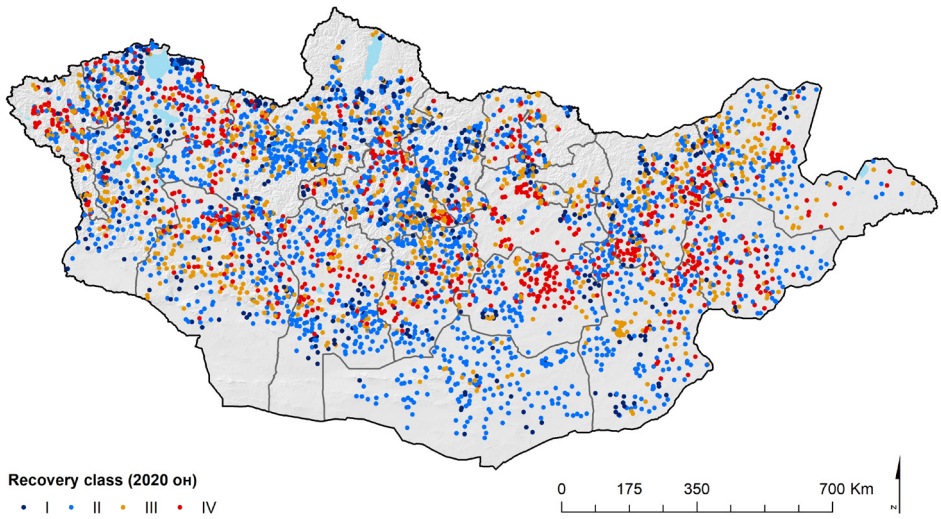
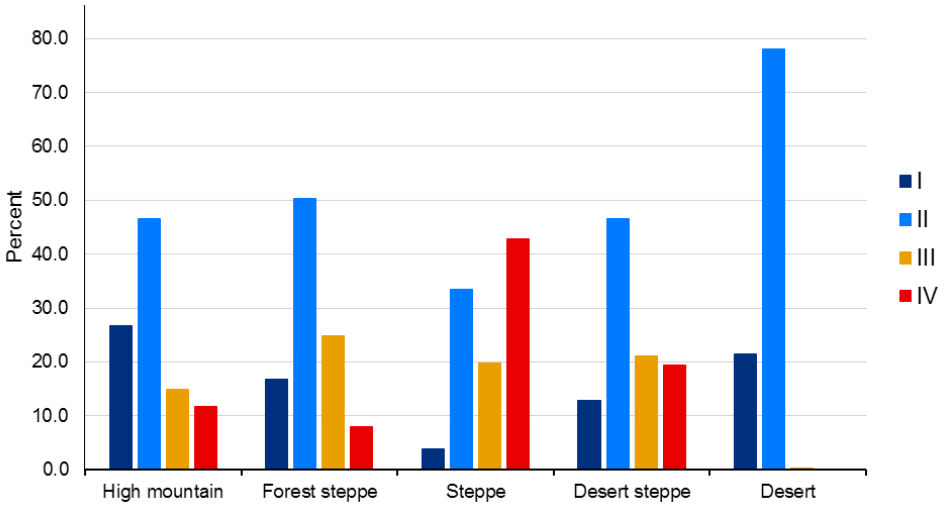


Figure 5.1. Photo monitoring plots assigned by recovery classes, 2020

The 2020 recovery class assignment indicates that 50 % of rangelands are at a slight and moderate level of degradation, This is likely to recover within 3-5 years, but this can be achieved only if the grazing pressure is adequately reduced and a proper regime of utilization is adapted.

When comparing the different natural zones, most of the rangelands in the high mountain and desert regions fall into the recovery class I and II, demonstrating they are comparably healthy and the changes were relatively low. Much of the forest-steppe, steppe and desert steppe rangelands are in a state with significant loss of key species which have become very sparse in the cover as topsoil is eroding. For recovery of these rangelands, at least 5 or more years are needed (Graph 5.1).



Graph 5.1. The percentages of photo monitoring plots classified to different Recovery Classes for each ecological zone, 2020

5.2 Graph 5.1. The percentages of photo monitoring plots classified to different Recovery Classes for each ecological zone, 2020

In all but the most arid rangelands, it is well established that persistent high stocking rates and overgrazing result not only in forage limitations for vulnerable herders but also long-term declines in rangeland health, especially forage productivity 6. Increases in animal numbers also result in falling market prices for fiber and reductions in income61. As incomes decline, herders are motivated to increase animal numbers to make up for lost income. This feedback contributes to skyrocketing animal numbers, and has been referred to as the "circle of devil" 44, 59 which reflects the current image of Mongolia.

Policies to establish moderate stocking rates, on the other hand, can lead to a virtuous cycle of improved forage productivity, livestock productivity, and financial returns 18, 22.

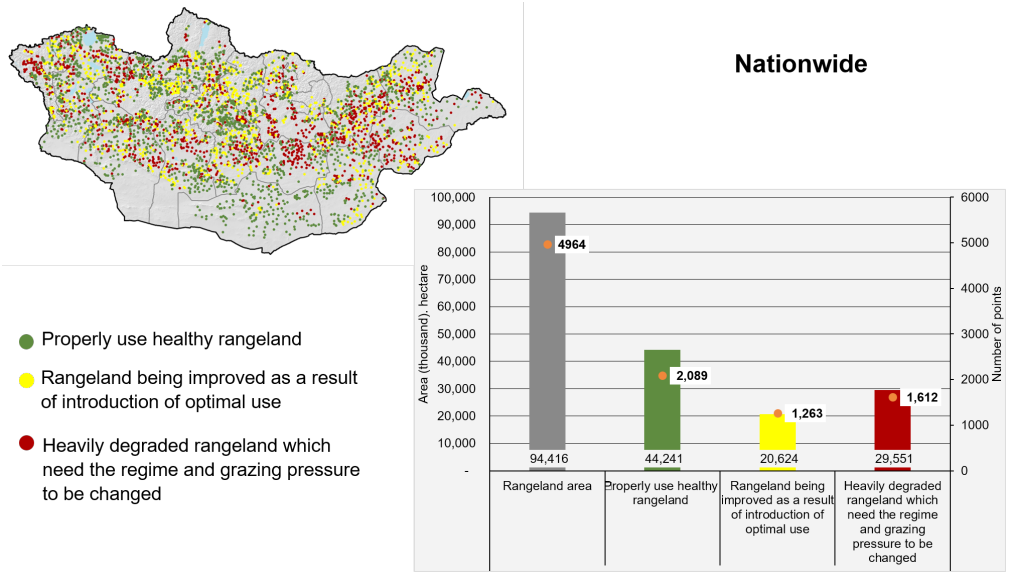
Considering the high resilience capacity of rangeland in Mongolia, it is achievable to rehabilitate about 80 percent of degraded rangelands naturally if measures to reconcile the grazing pressures and regimes to the resilience capacity are taken in a timely manner. However, it has been revealed from the monitoring results that about 16 million ha of rangeland have been degraded where endemic grass species are replaced by unpalatable and annual species and the soil erosion has been advanced to a degree, where recovery would require a high costs and take longer.

During the introduction of the resilience-based rangeland management with short and medium-term objectives, a number of interrelated measures have been implemented.

1. Contracted use of rangeland: Herders sharing common rangelands have joined more than 1500 pasture user groups to jointly plan and implement rangeland management measures. 900 out of them have signed a RUA with the Governor of the soum, under which herders take responsibility for the rational use of the contracted rangeland adjusted to its carrying capacity.
2. Promotion of quality over quantity: The enactment of the Law on livestock head tax has incentivized the reduction of grazing pressure, rational use of rangeland and responsible production. In addition, by re-introducing government subsidies on quality rather than quantitative outputs of livestock raw materials, the law promotes monitoring and regulation of livestock number growth.
3. Improving access to markets for livestock products: By certifying high quality products from healthy livestock grazing on healthy rangelands under the "Responsible Nomads" brand, favorable conditions are created to reach potential national and international producers and buyers. The results of grazing impact monitoring play an important role in monitoring and evaluation of how well the rangeland use agreements have been implemented, whether the herd size and structure of livestock and the grazing pressure has been adjusted to the carrying capacity of rangeland, and to ensure the origin and quality of "Responsible Nomads" certified livestock products.

Grazing impacts of rangeland are described at three levels: (Graph 5.2)

1) Properly used healthy rangeland
2) Rangeland being improved as a result of introduction of optimal use
3) Heavily degraded rangeland for which grazing regime and pressure need to be changed

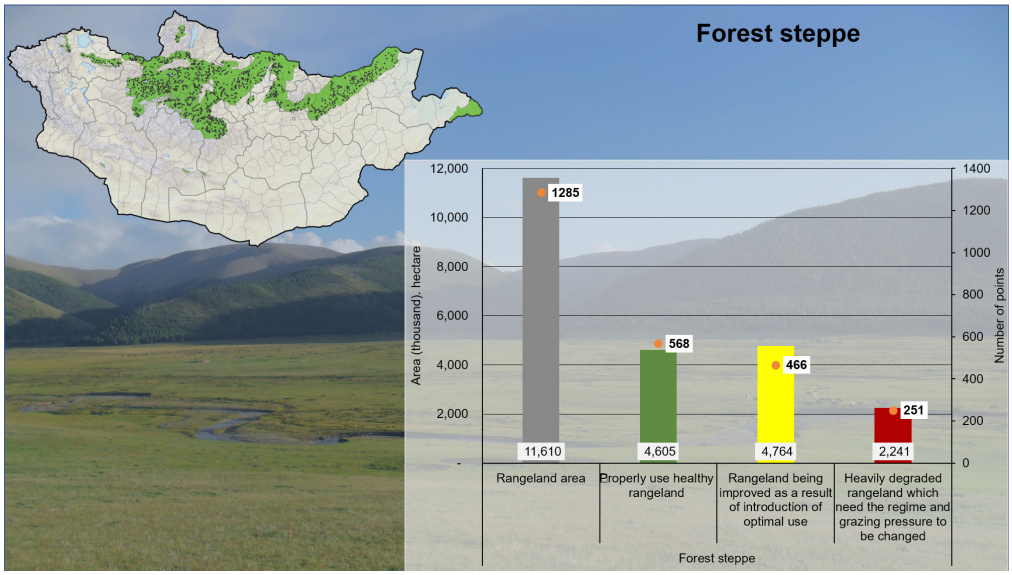


Graph 5.2. Grazing land health depends on the implementation of the soum land management plan and the regulation of rangeland use

Of the 94.4 million ha of rangeland covered by the photo monitoring program, 44.2 million ha of rangeland are generally in good condition, and 20.6 million ha of rangeland have improved as a result of the introduction of rational use. Some 29.5 million ha are severely degraded rangelands that need the current grazing intensity and regimes to be radically changed (Figure 5.2).

The impacts of the current grazing regimes differ across various natural zones and belts. Adaptation of rational use in the forest steppe zone with relatively good fertile soil and milder climatic conditions associated with high recovery potential of vegetation resulted in the rehabilitation of some 4.7 million ha of rangeland in the last 5 years. This obvious result has demonstrated that better management of the utilization could directly contribute to the recovery of degraded rangeland (Graph 5.3).

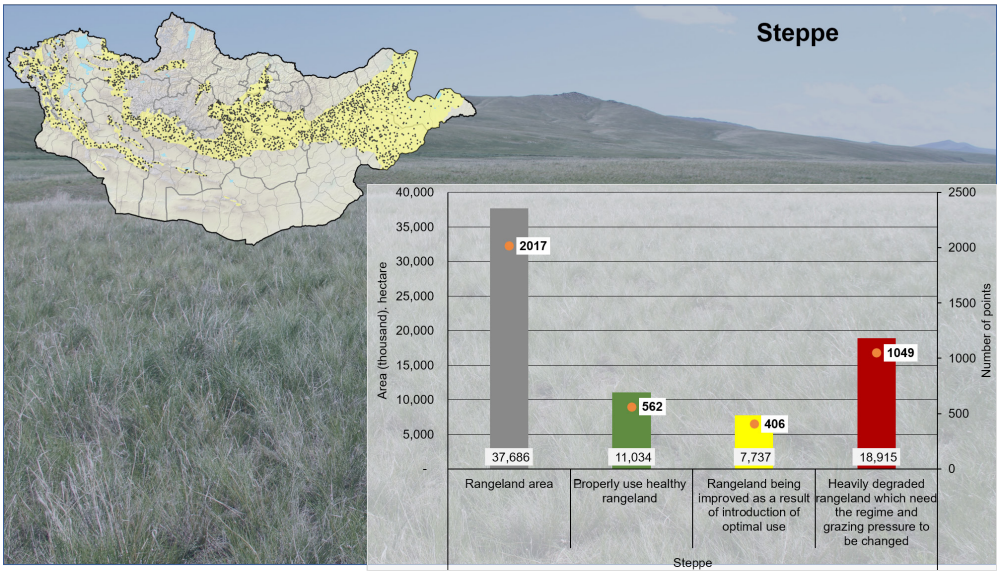
5.3 Grazing impacts across natural zones



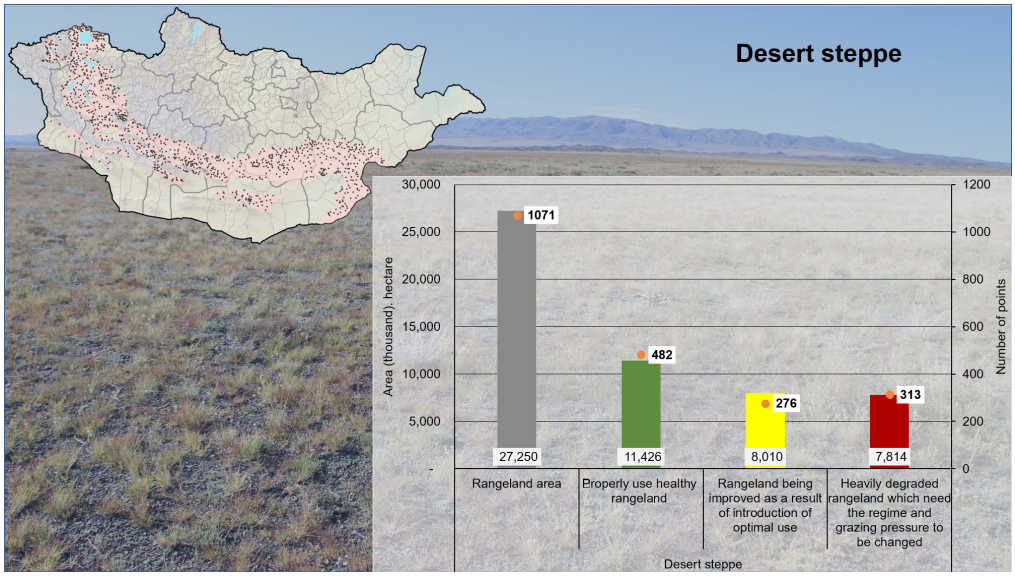
Graph 5.3. Recovery of rangeland in the forest steppe zone with the introduction of rational use, as of the last 5 years

As Figure 5.3 shows the size of rehabilitated rangeland has reached 39 percent of the total rangeland in the forest-steppe zone.

However, the needs to reduce the current level of grazing pressure in the dry steppe and desert steppe zones are rather urgent. While these zones represent the largest rangeland areas, they have the highest number of livestock and stocking density. As the figures for the last 5 years confirm, 7.9 million ha rangeland in desert steppe and 18.9 million ha rangeland in steppe zone have undergone degradation to various levels, equalling 50% of steppe zone rangelands and 28.2% of desert steppe zone rangelands (Graph 5.4; Graph 5.5).



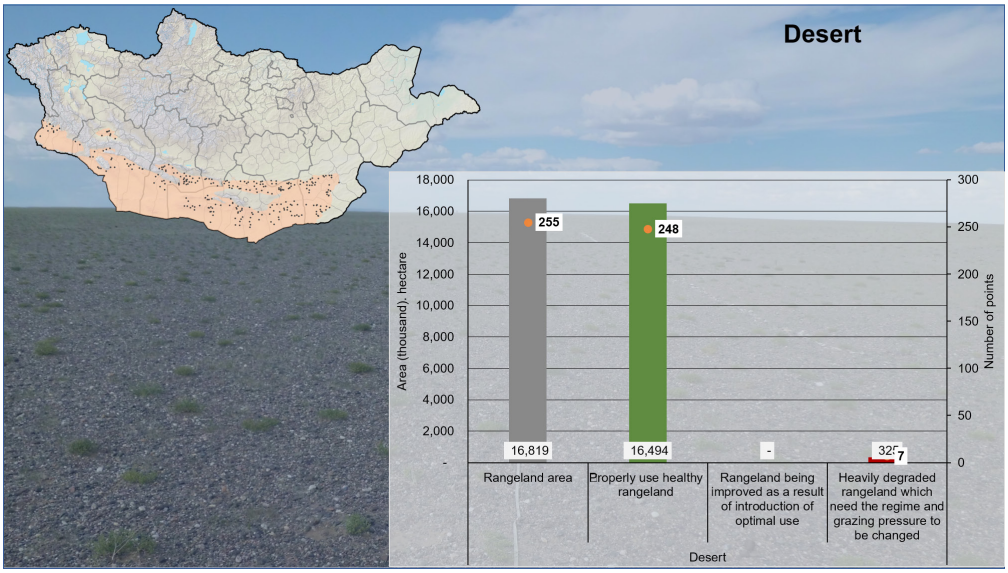
Graph 5.4. Impacts of irrational use: cases of the steppe zone (50% or 18.9 million ha rangeland underwent degradation



Graph 5.5. Impacts of unproper management on the health of rangeland in the desert steppe zone (28.7% or 7.8 million ha rangeland degraded in the last 5 years)

In the desert zone, where the effects of climate factors including precipitation are very high, the situation is different from other zones with the rangeland vegetation cover generally in its original state (Graph 5.6). Having a unique adaptation mechanism that the richness and productivity of plant species are very high in rainy years, the unique adaptation of vegetation cover, greatly

reduced in drought years shows that this region is a very unique ecosystem highly adaptable to ecological changes. But is does not mean that rangelands in the desert areas do not degrade. The rangeland yield depends on rainfall, and that herders' movements and rotations need to be regulated by rainfall as well, so that drought-affected rangelands are somewhat exempt from use and plant recovery is remain relatively good.



Graph 5.6. High correlations between grazing management and precipitation during the growing season, examples of desert rangelands

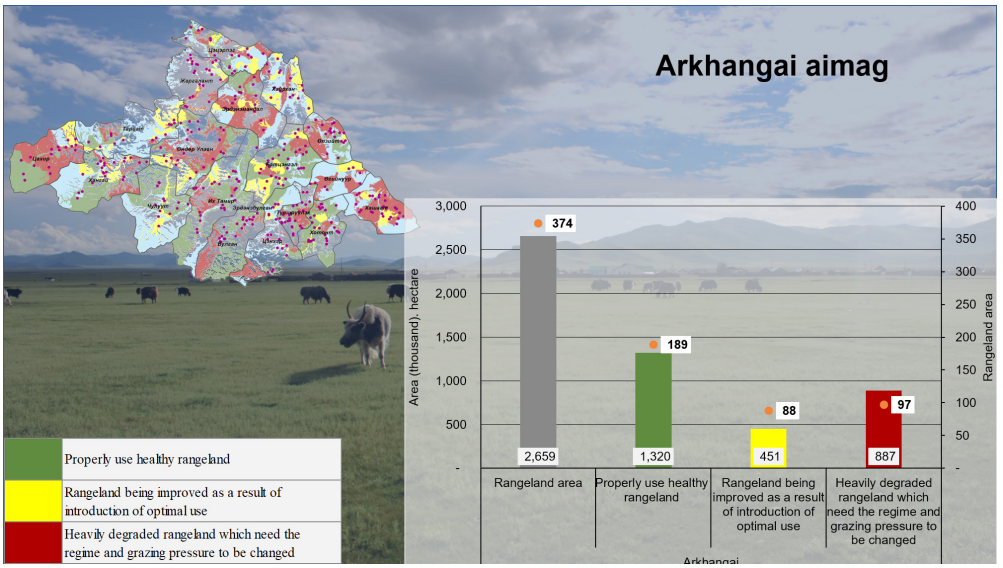
It is important to understand and take into consideration that desert rangelands which are once severely degraded with key species lost, have almost no potential for natural recovery.

Taking examples of the aimags with the highest number and density of livestock, and representing different climatic conditions, it can be analyzed how the current grazing pressures affect the rangelands in different regions.

5.3.1. The central region: Arkhangai and Uvurkhangai aimags

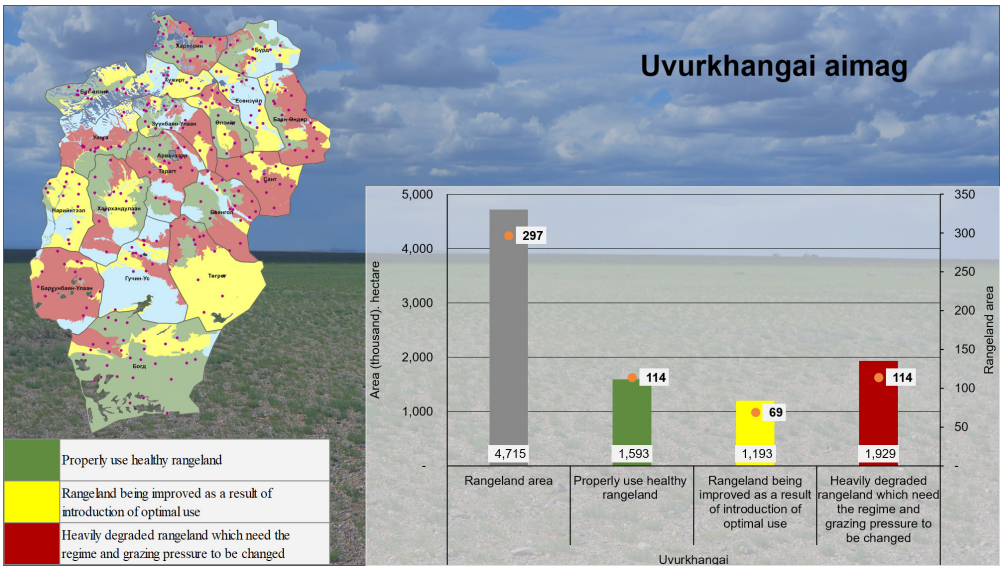
Arkhangai and Uvurkhangai aimags are in the lead by livestock numbers in recent herd growth dynamics. The climatic conditions in these aimags are milder, the distribution of precipitation and the supply of moisture are relatively high. This supports rangeland plants to regenerate. In other words, the potential for degraded rangelands to be recovered is high if the proper grazing management is in place and the grazing pressure is adjusted to the resilient carrying capacity. The results of 2020 photo monitoring indicate that up to half of the total rangeland in Arkhangai and Uvurkhangai aimags (50% and 36% respectively) are in relatively healthy state with only slight changes. Nevertheless, the risk of rangeland degradation remains high. One third of the total rangeland in

Arkhangai aimag and almost half of the rangeland in Uvurkhangai aimag have deteriorated in the last 5 years compared to previous years (Graph 5.7; Graph 5.8).



Graph 5.7. Current grazing management impact on the health of rangeland in Arkhangai aimag

A 1/3 or some 887.8 thousand ha out of the total rangeland in Arkhangai are heavily degraded and in urgent need to reduce the current grazing intensity.



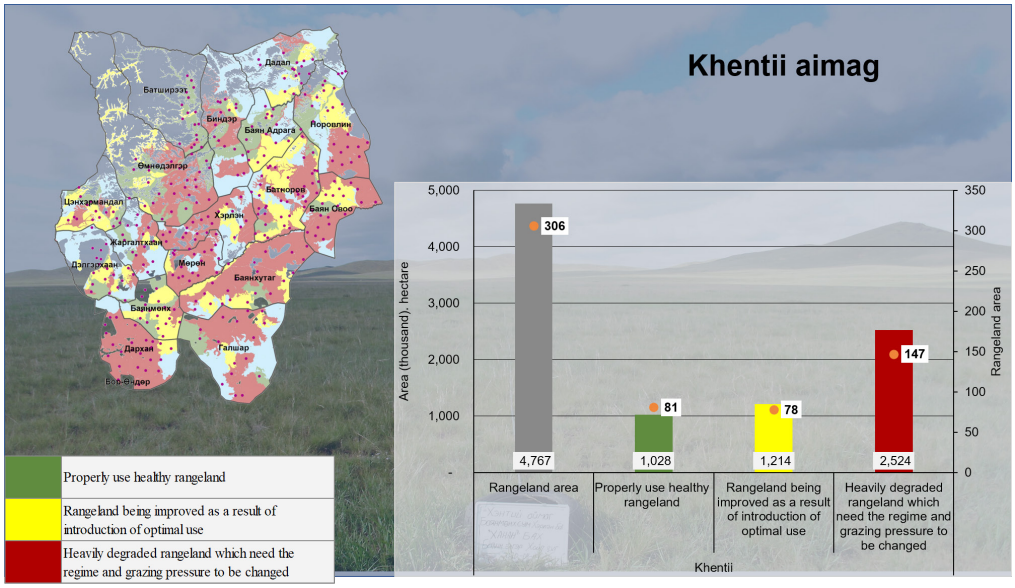
Graph 5.8. Current grazing management impact on the health of rangeland in Uvurkhangai aimag

Having almost half of total rangeland or 1.9 million ha, severely degraded, Uvurkhangai aimag urgently needs to change the current grazing regime and management.

5.3.2 The Eastern zone: Khentii and Sukhbaatar aimags

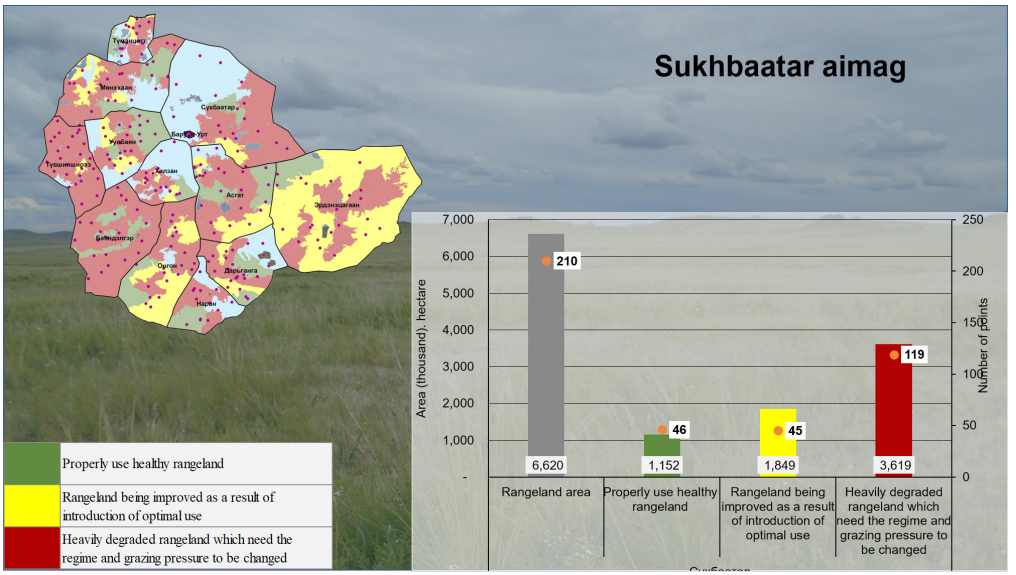
The steppe rangelands in the eastern region, which has relatively favorable climatic conditions, are affected by the impacts of climate change and stocking density has been increasing steadily in recent years. Rapid growth of livestock in the region is further driven by the influx of herders from western and central, and the Gobi aimags.

The monitoring data shows that as the grazing intensity grows, the quality and productivity of rangeland in the region has been rapidly declining (Graph 5.9; Graph 5.10). Currently, only 20% of rangeland are in healthy state. In general, degraded rangelands that need to be rehabilitated and improved account for more than half of the rangelands. This indicates that the situation is likely to worsen.



Graph 5.9. About 2.5 million ha rangeland have been degraded which is equal to good half of total grazing land in Khentii aimag.

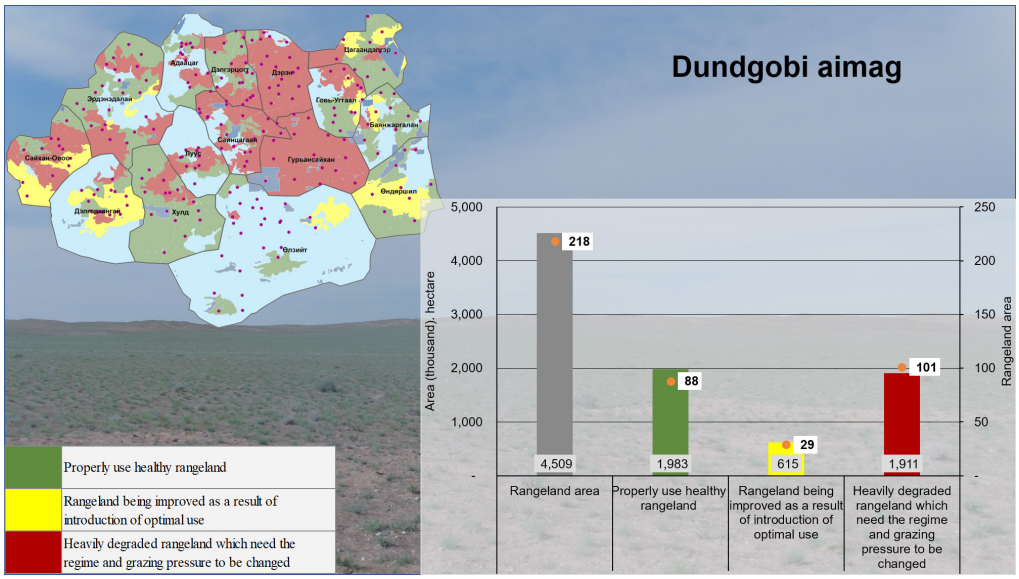
The needs to initiate decisive changes in the grazing regimes in Sukhbaatar aimag are clear from the fact that almost half of total rangelands (– 49%) in this aimag has been degraded heavily (Graph 5.10). The state of deterioration of rangelands in Sukhbaatar aimag



Graph 5.10. State of current grazing management and deterioration of rangeland in Dundgobi aimag

5.3.3 Desert steppe - Dundgobi aimag

For Dundgobi aimag, which receives the lowest quantity rainfall and experiences the highest frequency of drought, it is important to maintain the quality and productivity of rangelands through properly planned conservative management. The 2020 photo monitoring data suggests that there has been a deterioration of rangelands that stretches across the territory through several soums including Gurvansaikhan, Saintsagaan and Deren. The size of rangelands improved through measures to regulate and change grazing pressure is very small - only 14 percent. This indicates that natural recovery is either slow or impossible because of poor rainfall moisture supply (Graph 5.11).



Graph 5.11. State of current grazing management and deterioration of rangeland in Dundgobi aimag

The high proportion of degraded rangeland, amounting to 42% of total rangeland of Dundgobi aimag has become the greatest challenge for this aimag. No efficient actions and measures yet to improve livestock feed supply through rehabilitation of degraded rangelands have been in place.

6 POLICY RECOMMENDATIONS

6.1 Rangeland health indicators provide a sound basis for herders and local stakeholders to discuss and agree on the relationship between stocking rates, grazing management, and rangeland conditions. This information can be used to make decisions to adjust animal numbers and grazing plans by organizing sales of extra animals, preparation of additional forage for winter, and plans for grazing rotations. Herders increasingly agree that stocking rate adjustments are needed to sustain or improve rangeland condition. However, because of poor animal health and limited market access, opportunities for off-take are limited. There is an urgent need to improve the quality and marketing of animal and meat products;

6.2 A series of stakeholder discussions on the rangeland legal environment among herders, local authorities and experts were organized by MOFALI with the support of the FAO and the Swiss Agency for Development and Cooperation in 2016, 2018 and 2020. The discussions show that 75% of herders, local authorities and experts agreed that it is (specifically) necessary to enact a separate law to regulate grazing. More than 70% of the respondents commented that the most pressing and challenging issue is exceeded rangeland carrying capacity. In this context, it is necessary to adopt and implement the Law on rangeland in a timely manner and take urgent policy measures to reconcile the number of livestock with the resilient carrying capacity of rangelands;

6.3 The sustainable production of meat, fiber, and other environmental goods and services in Mongolia requires polycentric governance of rangelands, involving local, regional, and national institutions with expertise in rangelands, animal health, marketing, policy, and technology. The organization of herder communities in the form PUGs, the affiliation of PUGs to marketing cooperatives facilitated by the National Federation of PUGs, and the use of Rangeland Use Agreements provides a solid platform operationalize a sustainable supply of livestock products from Mongolian rangelands.

6.4 Provision of adequate supports towards strengthening of the institutions, which were established by herders on their own initiative and economic interests, and improving linkages with the projects and programs in synergistic goals and activities, would be an important policy initiative to address many challenging issues.

6.5 An obvious achievement was the rehabilitation of 20.6 million ha rangelands across the country in the last 5 years through applying the resilience based rangeland management and the adoption of the accountability measures for herders and livestock production under the rangeland use agreement. Based on this and other experiences, it has become necessary to introduce legal instruments and economic incentives towards the rehabilitation and improvement of 29.5 million ha rangelands that have undergone deterioration;

6.6 Determined and urgent actions are needed to exploit the potential and advantages for making smart policy and managerial changes so as to ensure the future of Mongolian pastoral livestock production and food security through conservation of health and conditions of rangeland, adaption to climate change, rationalizing of the rangeland management in responsible and accountable ways is secured;

6.7 Curb and reverse the rangeland degradation and degradation processes, for the protection of herders' livelihoods. For the actions, step-by-step policy and premium measures should be taken to cover the following issues and challenges:

- pre-estimated and planned herd size reduction;
- implementation of rangeland use practices through adoption of herd management strategies managed by the owners;
- technical support to feed preparation;
- policy and incentive support to increase livestock sales, to improve and develop public policy on proper rangeland utilization an livestock quality management.

6.8 In order to reap the long-term benefits of management, a legal framework for community-driven resilience-based rangeland management should be enacted.

CONCLUSIONS

· National-level 2 monitoring networks are functioning: (i) the rangeland ecosystem monitoring network, covering 1550 plots representing all bags, which exists at the national hydrology and meteorology network, and (ii) the national photo monitoring network for "Rangeland change and impacts of the use", covering 5128 plots in the national land management network. Although the purpose and design of these monitoring networks are different, it is feasible to aggregate and compare the data because they are similar in terms of data processing theoretical background and classifications.

· The results of photo monitoring conducted in 2020 to assess the changes in grazing land health and grazing impact, in 94.4 million ha rangeland nationwide, show that 44.2 million ha of rangeland are maintained in healthy state and the state of 20.6 million ha rangeland has improved since 2016, the baseline year. Nevertheless, effective actions to rehabilitate 29.5 million ha of severely degraded rangeland are urgently needed.

· Strengthening the photo monitoring network to monitor the grazing impact on rangelands, will enable:

- ✓ National-level 2 monitoring networks are functioning: (i) the rangeland ecosystem monitoring network, covering 1550 plots representing all bags, which exists at the national hydrology and meteorology network, and (ii) the national photo monitoring network for "Rangeland change and impacts of the use", covering 5128 plots in the national land management network. Although the purpose and design of these monitoring networks are different, it is feasible to aggregate and compare the data because they are similar in terms of data processing theoretical background and classifications.
- ✓ The results of photo monitoring conducted in 2020 to assess the changes in grazing land health and grazing impact, in 94.4 million ha rangeland nationwide, show that 44.2 million ha of rangeland are maintained in healthy state and the state of 20.6 million ha rangeland has improved since 2016, the baseline year. Nevertheless, effective actions to rehabilitate 29.5 million ha of severely degraded rangeland are urgently needed.
- ✓ Strengthening the photo monitoring network to monitor the grazing impact on rangelands, will enable:

Being able to monitor both of the long term changes of rangeland ecosystem functioning and ecosystem service and short term changes caused by utilization/ grazing, the new page opened in rangeland research in Mongolia. In particular, the State and transition model of Mongolian rangelands that built on long term research results on vegetation composition with their potential shifts providing a reference and potential alternative states with community phases allows any changes/ shifts and recovery of rangelands to be tracked and identified.

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Annex 1.

Annex #1, of Decree of the Chairman of the Agency for Land Management, Geodesy and Cartography, of ... 2015

GUIDELINE FOR THE EVALUATION OF RANGELAND CHANGES BY PHOTO MONITORING

One. General Provisions

1.1 The guideline shall be followed in assessing changes in rangeland by means of photo monitoring (hereinafter to refer as the photo monitoring) for the tracking the process of, and timely detect any changes in the health and productivity of rangelands, in the implementation of prevention of undesired changes and adjustment of rangeland use, evaluation and conclusion, establishing of operational database, and provision of information to users;

1.2 The monitoring will be used to create a multi-year data series through statistical processing based on surface cover data to monitor changes caused by the impact of the patterns of the use of rangelands;

1.3 The results of the current year monitoring shall be generated through the comparison with the reference level of rangeland health;

1.4 The monitoring report will be used as the baseline information source to monitor the typical functions of rangeland management, assess the impacts of rangeland use, evaluate the implementation of rangeland use agreements, and develop soum annual land management plan and monitor its implementation.

Two. The legal definition of the terms

The terms shall be interpreted as the following:

2.1 "The reference rangeland health" refers to plant communities that have been relatively stable over a long period and that able to retain the primary characteristics of the givem environment (the first study conducted at the site)

2.2 "Indicator plant groups" is a group of plants that may represent the state of the environment and its changes.

2.3 "Monitoring description" means conclusions and recommendations on the health and quality of rangeland for each monitoring plots and the purpose of rangeland use.

2.4 "Ground cover" means the percentage of the surface covered with vegetation, limestone and gravel.

Three. Selection of the monitoring plots

3.1 The monitoring plot is selected to be representative the type of rangeland and the following purposes.

- Winter rangeland
- Spring rangeland

- Summer rangeland
- Autumn rangeland
- Otor reserve rangeland
- Rangeland under contracted use (PUGs, herder groups, partnerships)

3.2 Determine rangeland health and changes by comparing the data collected in accordance with the approved photo monitoring methodology with the reference level of the relevant type of rangeland.
3.3 The monitoring plot may overlap with the unit area of the "State Inspection of Land State and Quality" and plot for the description of an unit.
3.4 No monitoring plots shall overlap with the points represented bag at the national Hydrology and Meteorology Network.

Four. Monitoring criteria

4.1 Monitoring criteria shall be defined that they can accurately capture any changes in the health and quality of the land and are contributive to undertake observations, measurements and processing.
4.2 Monitoring shall be undertaken based on the following criteria.
1. State of range trampling;
2. Topsoil migration and shift Өнгөн хөрсний нүүдэл шилжилтийн байдал;
3. Condition of grasses of rangeland.
4.3 State of range trampling and topsoil migration and shift shall be conducted either at the relevant monitoring plot or based on the results of field observations.
4.4 Assessment of the rangeland state shall be based on the abundance of indicator plant groups in the rangeland communities. Plant groups indicative to the changes in the state of rangelands are to be determined differently by natural zones
4.5 The monitoring description shall include information of rangeland productivity in terms of annual yield per ha /kg/ and rangeland carrying capacity in sheep units.
4.6 Additional criteria to those specified in 4.2 of this guideline may be used to determine possible changes in the health and quality of rangeland.

Five. The monitoring: stages and timescale

5.1 The monitoring work shall be performed over the following stages:
1. Preparation;
2. Field study and collection of information/data;
3. Data processing;
5.2 During the preparation phase, to carry out a review backdate information and data on the rangeland health and quality, identify the size and boundaries of rangeland to be covered by the monitoring, pre-identify plots for observation and measurement, and prepare a working map.
5.3 During the field study and data collection phase, conduct an on-site assessment of the health of the rangeland and the changes it has undergone and document by photographing the cover of surrounding and study areas.
5.4 During the data processing phase, create a database assembling aggregation and

evaluation of information collected, compiling the surface image (vertical photo) for each monitoring plot, and determining the total percentage of vegetation cover and indicator plant groups. To establish the database, the changes in rangeland state are to be assessed.

5.5 Monitoring shall be carried out within the first 10 days of August, when the maximum yield of rangeland plants will be achieved.

5.6 The implementation of the monitoring program shall follow the "Guideline for rangeland photo monitoring".

Six. Organization of monitoring and participation of rangeland users

6.1 Governors of aimags, the capital city, soums and districts shall organize monitoring activities in their respective territories within the period specified in 5.5 of this Guideline and expenses required for these measures shall be financed from the local budget.

6.2 In the monitoring, representatives of National agency for meteorology and environmental monitoring in aimags and the capital city, Food and agricultural Authority, soum and district stations and guards, soum Agriculture unit, rangeland users, business entities and organizations shall be involved.

6.3 Aimag, soum and district state administrative organizations in charge of land issues and soum land officers shall be responsible for implementation of annual monitoring.

6.4 No in-person participation of representatives of citizens and business entities specified in 6.2 of this Guideline in monitoring shall not be reasons suspend or postpon the monitoring activity.

Six. Validation of the monitoring report and results

7.1 The monitoring report shall including 3 the following documents.

1. Table for statistic information of the health and quality of rangeland;
2. Aggregation table of rangeland monitoring assessment;
3. Rangeland monitoring description;

7.2 Rangeland monitoring description can be used to keeping a rangeland certification passport.

7.3 The current year monitoring reports of soum, district, aimag and capital city for shall be discussed and wrapped up by the Citizens' Representatives Khural of respective level and its Presidiums.

7.4 The state organization in charge of land management of aimags and the capital city shall aggregate the monitoring data and reports by soums and districts and submit to the state administrative organization in charge of land management attached with the "Unified Land Fund report" by January 15.

7.5 The rangeland specialist in charge of the district land management office and soum land officer shall write up an annual monitoring report and deliver it by December 15. The Governors of soum and district, soum land officer and the Chairman of district state administrative bodies in charge of land matters shall endorse the report and submit it to the state administrative body in charge of land issues of aimag and the capital city.

7.6 The monitoring report by the aimag and capital city shall be prepared by the

Land management, construction and urban development authority and Property relations department of the capital city and shall be endorsed by Chairman of aimag and capital city department.

7.7 The state administrative organization in charge of land issues of aimag, the capital city and district and soum land officer shall to disseminate the results of the monitoring activities to the public through mass media and take other measures if necessary.

Eight Disputes and Responsibilities

8.1 Any disputes arisen from issues related to monitoring shall be resolved jointly by the Governor of the appropriate level and the state administrative authority in charge of land issues of aimag and the capital city.

8.2 If a citizen, economic entity or organization requests to re-do the monitoring, the monitoring shall be carried out at expense of the requester.

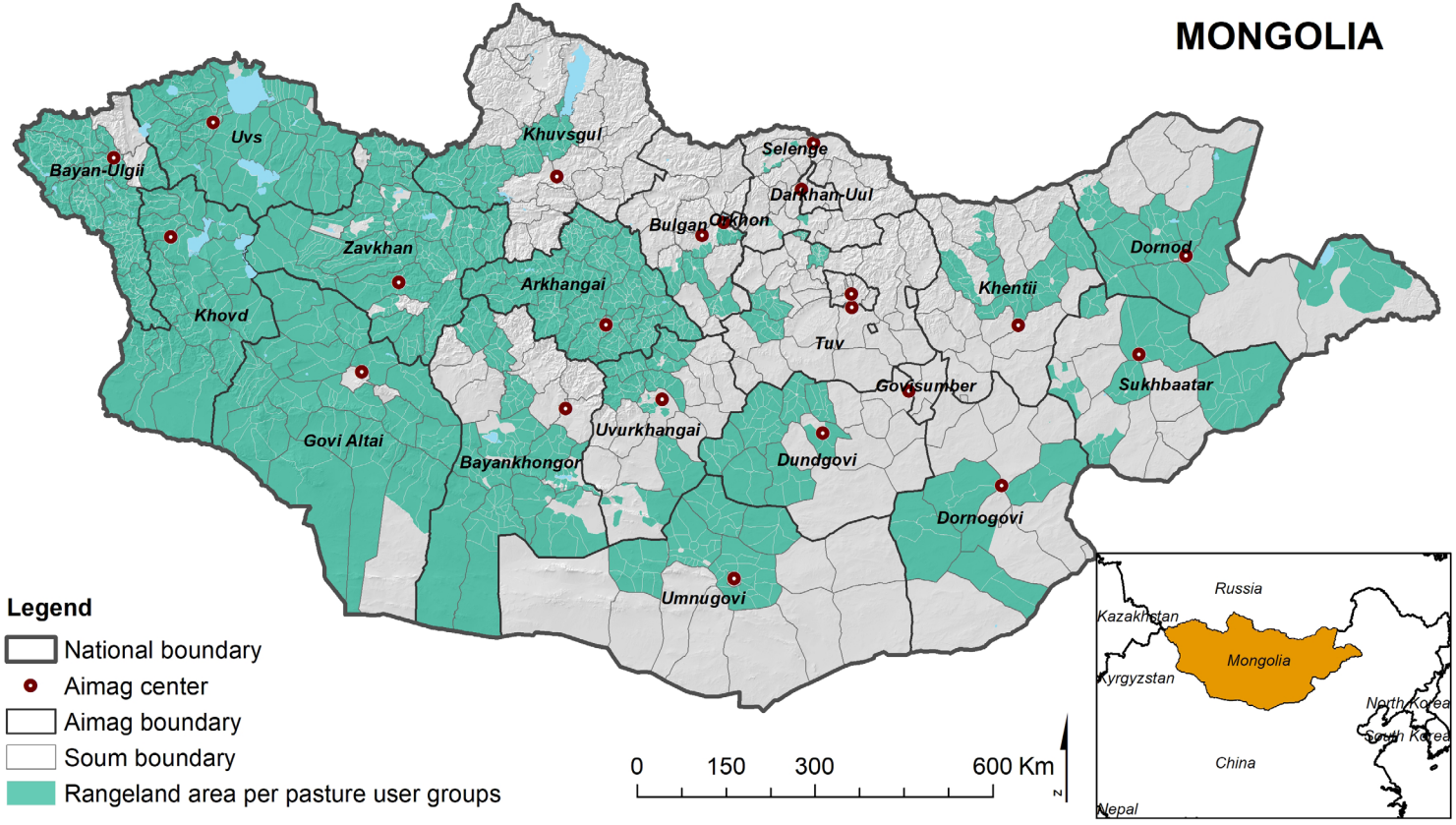
8.3 The executive officer in charge of rangeland monitoring shall be responsible to produce an objective and well-founded definition in accordance with the "Methodological guidelines for rangeland photo monitoring".

Annex 2. Rangeland area covered & not covered by the monitoring program

№	Aimags	Total area, ha	Rangeland area, ha (according to the report of the Unified Land)	Rangeland area, ha (including the grazing land in protected areas)	Grazing land covered by photo monitoring program, ha	Grazing land in ha represented by monitoring plot	Properly used healthy rangeland		Rangeland being improved as a result of introduction of optimal use		Heavily degraded rangeland for which grazing regime and pressure need to be changed		Rangeland area that is not covered by monitoring program, ha
							in hectare	Number of monitoring plots representing the grazing land	in hectare	Number of monitoring plots representing the grazing land	in hectare	Number of monitoring plots representing the grazing land	
1	Arkhangai	5,531,380	3,737,560.	3,747,790	2,658,781	7,109	1,320,446	189	451,381	88	886,953	97	1,089,009
2	Bayan-Ulgii	4,570,490	3,541,050	4,325,525	2,791,278	12,461	439,670	46	945,675	52	1,405,933	126	1,534,247
3	Bayankhongor	11,597,780	8,856,380	10,255,317	8,262,083	25,113	3,848,980	145	2,098,921	68	2,314,183	116	1,993,233
4	Bulgan	4,873,300	2,484,510	2,397,442	1,403,761	7,842	378,903	57	743,843	90	281,015	32	993,681
5	Gobi-Altai	14,144,770	8,608,770	12,394,669	8,943,731	26,858	4,949,579	145	1,316,387	77	2,677,765	111	3,450,938
6	Gobisumber	554,180	472,600	499,555	499,555	10,407	175,875	13	53,438	8	270,241	27	-
7	Darkhan-Uul	327,500	175,540	163,868	22,444	3,741	21,720	4			723	2	141,424
8	Dornogobi	10,947,230	9,113,880	8,965,368	7,988,178	39,941	3,610,571	87	2,231,471	59	2,146,136	54	977,190
9	Dornod	12,359,740	8,655,730	11,138,860	9,774,340	27,379	4,260,608	117	3,018,215	152	2,495,516	88	1,364,521
10	Dundgobi	7,469,030	7,148,090	7,136,824	4,508,630	20,682	1,982,858	88	615,047	29	1,910,725	101	2,628,194
11	Zavkhan	8,245,570	6,924,750	6,439,160	4,070,105	11,866	1,966,877	154	1,026,855	90	1,076,373	99	2,369,054
12	Orkhon	84,400	39,350	26,732	16,915	3,383	1,704	1	12,429	3	2,782	1	9,817
13	Uvurkhangai	6,289,530	5,689,390	5,663,717	4,715,375	15,877	1,593,178	114	1,193,346	69	1,928,851	114	948,342
14	Umnugobi	16,538,050	11,430,600	14,077,204	12,453,545	71,163	11,704,895	160	109,902	3	638,749	12	1,623,659
15	Sukhbaatar	8,228,720	7,668,470	8,060,210	6,619,903	31,523	1,152,434	46	1,848,641	45	3,618,828	119	1,440,307
16	Selenge	4,115,260	1,610,590	1,398,573	836,436	10,326	107,572	14	372,150	35	356,715	32	562,137
17	Tuv	7,404,240	5,177,270	5,644,146	2,235,707	13,229	171,991	28	577,801	54	1,485,915	87	3,408,438
18	Uvs	6,958,540	4,269,240	5,495,066	4,504,812	16,623	1,578,876	117	1,179,454	62	1,746,482	92	990,254
19	Khovd	7,606,040	5,058,670	6,490,837	4,399,451	10,231	2,618,853	105	814,206	37	966,392	41	2,091,386
20	Khuvsgul	10,062,880	4,386,180	4,614,255	2,943,989	7,198	1,327,131	168	800,517	127	816,340	114	1,670,266
21	Khentii	8,032,510	5,067,070	6,312,031	4,766,604	15,577	1,028,085	81	1,214,434	78	2,524,085	147	1,545,426
	Total	156,411.57	110,115,690	125,247,147	94,415,622	19,491	44,240,807	1,879	20,624,114	1,226	29,550,702	1,612	29,844,517

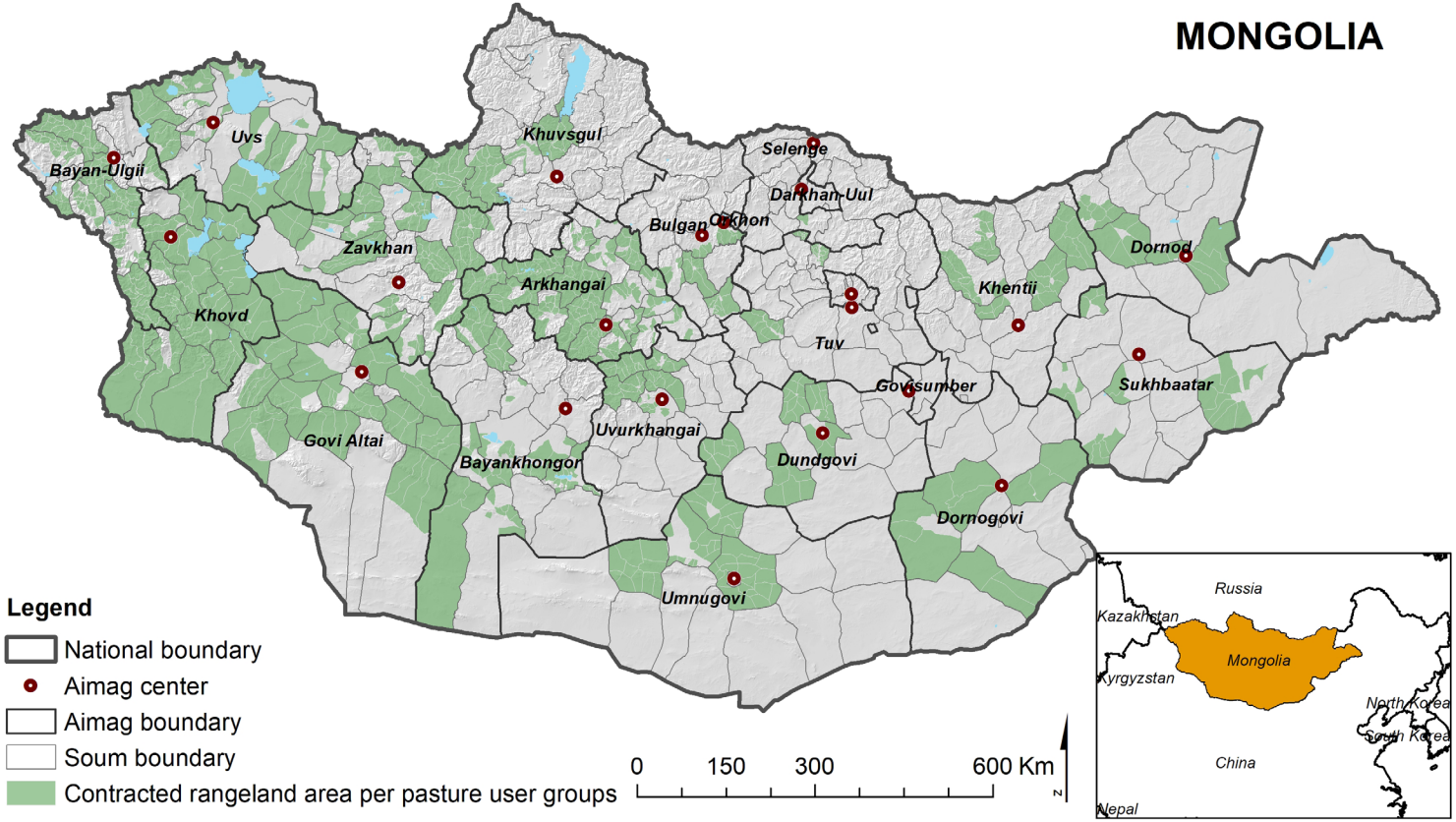
Annex 3

Location map of PUGs registered in the state land cadastral data base
(1509 PUGs in 170 soums of 18 aimags)



Annex 4

Map of PUGs with Rangeland use agreement registered in the state land cadastral data base (909 PUGs in 170 soums of 18 aimags)



Annex 5 Total grazing area and its classification by usage

№	Aimag	Rangeland area, ha (according to the report of the Unified Land)	Rangeland area, ha (including the rangeland in protected areas)	Rangeland area per pasture user groups	Contracted rangeland area per pasture user groups
1	Arkhangai	3,737,560	3,747,790	3,649,726	2,506,955
2	Bayan-Ulgii	3,541,050	4,325,525	3,564,249	5,044,061
3	Bayankhongor	8,856,380	10,255,317	6,597,929	3,006,809
4	Bulgan	2,484,510	2,397,442	794,714	535,890
5	Gobi-Altai	8,608,770	12,394,669	10,966,686	7,163,379
6	Gobisumber	472,600	499,555		
7	Darkhan-Uul	175,540	163,868		
8	Dornogobi	9,113,880	8,965,368	3,620,198	3,259,329
9	Dornod	8,655,730	11,138,860	6,514,962	6,514,962
10	Dundgobi	7,148,090	7,136,824	3,122,616	1,781,151
11	Zavkhan	6,924,750	6,439,160	6,084,670	2,637,317
12	Orkhon	39,350	26,732		
13	Uvurkhangai	5,689,390	5,663,717	3,339,008	838,648
14	Umnugobi	11,430,600	14,077,204	3,401,471	2,504,196
15	Sukhbaatar	7,668,470	8,060,210	3,936,758	1,504,982
16	Selenge	1,610,590	1,398,573	105,141	22,799
17	Tuv	5,177,270	5,644,146	591,276	313,739
18	Uvs	4,269,240	5,495,066	5,391,224	3,011,971
19	Khovd	5,058,670	6,490,837	6,319,395	5,870,189
20	Khuvsgul	4,386,180	4,614,255	1,401,386	1,116,202
21	Khentii	5,067,070	6,312,031	1,622,264	1,345,047
	Total	110,115,690	125,247,147	71,023,672	48,977,626