MONGOLIA BORDER AREA FOREST AND FIELD FIRE RISK ANALYSIS
(Based on the example of the Selenginsky province)

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Abstract: It is very important to develop cooperation between public and private sector organizations, establish multi-stakeholder cooperation and define the roles and responsibilities of stakeholders in forest fire prevention and response measures in the border regions of Mongolia.

In this research paper, the forest drought and forest fire risk in the border areas of Mongolia was developed using satellite data program (MOODIS). The risk was analyzed using forest drought and forest fire index, using Selenga province as an example.

Coordination of the activities of disaster protection units with the state administrative center and local administrative organizations in the field of extinguishing and reducing the risk of forest fires, implementing regulatory legal norms using methods of subordination in vertical and horizontal directions of coordination has also been established.

Keywords: Fire risks, degree of dryness, reduce risk, industry cooperation

Introduction

Forest and field fires are disasters that significantly impact the ecology, environment, and economy of countries worldwide, posing a serious risk to public safety. For instance, according to the mid-term report on the implementation of the Sendai Action Framework for Disaster Risk Reduction (National Emergency Management Agency, 2022), Mongolia's analysis of climate change impacts indicates that from 1999 to 2012, the area covered by forests decreased by 4.1%. During the same period, the frequency of forest and wildfires increased, leading to a 13.3% rise in the area burned. Projections suggest that between 2030 and 2050, areas affected by forest pests may increase by 1.4 to 13 times, and the area impacted by forest fires could expand by 512,000 hectares (International Civil Defence Organization, n.d.).

1. The report identifies one

significant cause of these risks: forest and wildfires resulting from human activities. For example, an analysis of forest fire causes in various countries reveals that human activities account for 95% of forest fires in Europe (http:// icdo.org) 95.7% in China (Natural hazards research journal, 2023), 95% in Mediterranean countries (iForest - Biogeosciences and Forestry, 2013), and 98% in the Balkan region (Guide to Preventing and Protecting Against Forest and Field Fires, 2019).

In many countries of the world, geographic information systems and remote sensing software are used to prevent disasters, forest and wildfires, and provide emergency services.

In the same way, in the case of forest and field fires in our country, by using geographic information systems and remote sensing methods, it is possible to determine the location of the fire, the location of the fire, the size of the area likely to be at risk, and the necessary people and technical equipment to carry out the necessary evacuation and repair the damage can be calculated. It is important to reduce vulnerability, prevent risks, and overcome disasters with less damage.

The program (MOODIS) used in this study is useful to determine the aridity index using satellite data (temperature, soil moisture, plant density) for fire risk determination and forecasting, and the use of satellite data is useful to improve environmental monitoring and management processes.

Main component

Territorial Characteristics of Selenge Province: Selenge Province covers an area of 41152.6 km² and shares its northern border with Russia. It is located adjacent to the western part of the Khangai mountain range and the eastern part of the Khentii mountain range, with an elevation ranging from 600 to 1.200 meters above sea level.

This province is significant, as it contains over 10% of Mongolia's forest resources and 55% of its flowing water.

Selenge Province encompasses 1,607.5 thousand hectares of forest land, where 90.1% of the area is covered by forests. Additionally, 7.3% of the land consists of other areas within the forest reserve, such as forest gaps and strips, while 1.3% has been cleared. Another 1.3% of the land is designated as part of the forest reserve.

2. When analyzing the distribution of forest land by sum, we find that 31.1% of the total wooded area is located in Yeru sum, 19.3% in Mandal sum, 1% in Khuder sum, and 8.9% in Altanbulag sum. The overall composition of the forests is as follows: 30.1% mixed birch and aspen forest, 28.1% pine forest, 25.3% larch forest, 15.3% cedar forest, and 0.1% spruce forest (Land Resources Management Plan for Selenginsky District, 2007)

It is important to note that the border regions of Selenge Province are at a high risk of fire due to various factors, including natural explosions and dryness.

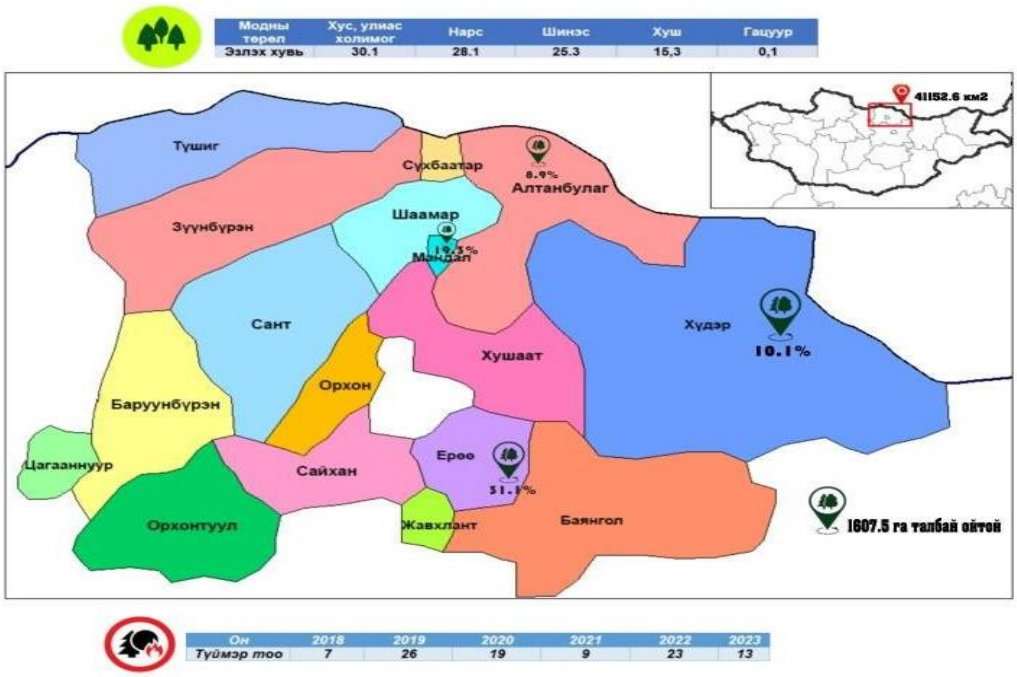


Figure-1. The proportion of forests in Selenge province,number of fires in the last 6 years

Province	2018	2019	2020	2021	2022	2023
Dornogobi		2				
Dundgobi		1				
Selenge	7	26	19	9	23	13
Tuv	2	6	7	2	8	4
Darkhan-Uul		1			2	
Gobisumber			1		1	3

Table-1. The number of forests and wildfires is listed twice.(2018-2023), (Districts by decision of the Governor of that level)

Analyzing the number and frequency of wildfires over the last six years in the northern provinces, it was found that Selenge province experienced a significant number of these incidents. Out of 97 forest and field fires recorded, a very high percentage occurred in the years 2019 and 2022, ranging from 48% to 72%. This indicates that the northern region has a higher risk of forest and field fires compared to other provinces.

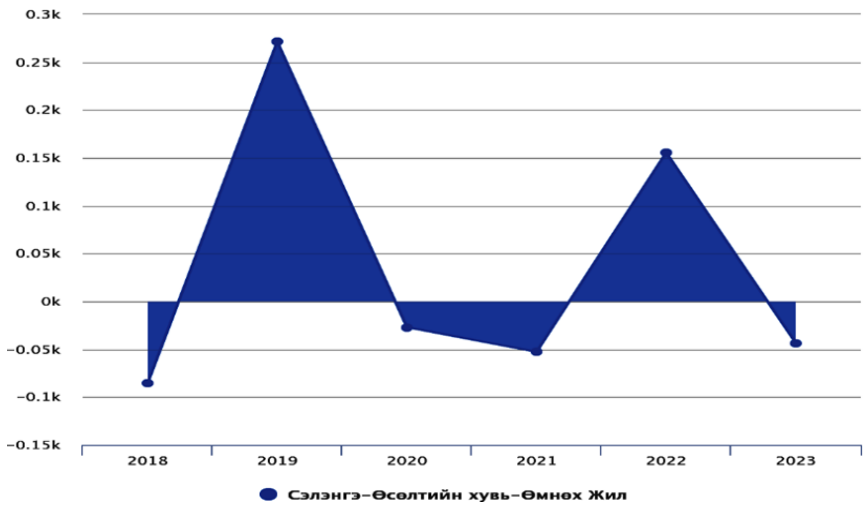


Figure-2. From 2018 to 2023, the occurrences of forest and field fires in Selenge Province are illustrated through graphical representations, highlighting both growth and decline trends.

According to the graph above, forest and wildfires have decreased by 56.5 percent in 2023 compared to the previous year.

Evaluation of current fire risk in forests and grasslands using MOODIS satellite data:

In this research, we utilized the MOODIS software to assess the fire risk of forest and field fires across Mongolia as of September 24, 2024. The evaluation was based on the dryness index.

The relationship between the degree of fire risk and the dryness index is direct: as the dryness index increases, so does the potential fire risk, as indicated by MOODIS satellite data. Therefore, it's crucial to develop strategies for monitoring and managing fire risks based on the aridity index during this research.

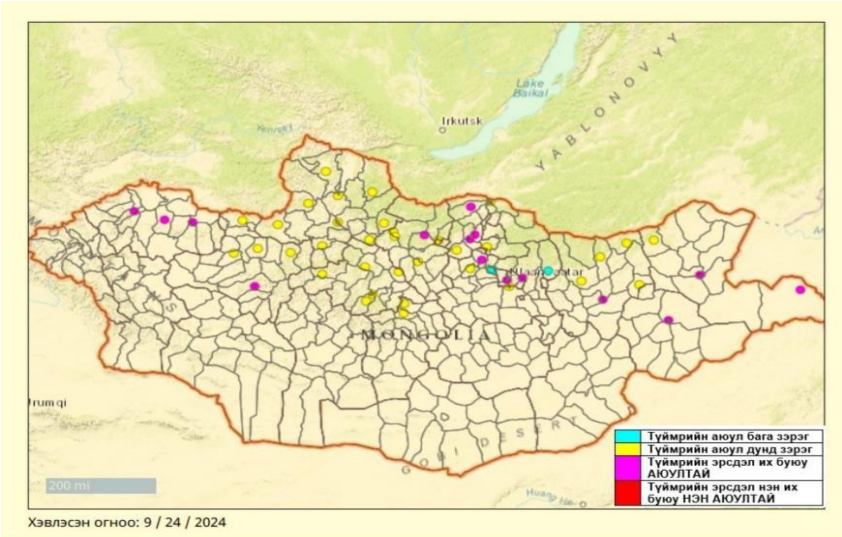


Figure-3. (WGS84 Latitude, Longitude: 41.1952, 121.6187 UTM48 Latitude, Longitude:

1895926.9971, 4695800.0999) Source: https://forest.gov.mn/website/

№	Provice	Soum	Risk level	Dryness index
1	Dornod	Kherlen	High	3259
2	Dornod	Khalkh	High	3238
3	Sukhbaatar	Baruun-Urt	High	3148
4	Selenge	Orkhon	High	2941
5	Uvs	Ulaangom	High	2723
6	Khentii	Bayankhutag	High	2508
7	Zavkhan	Aldarkhaan	High	1945
8	Uvs	Baruunturuun	High	1896
9	Tuv	Erdene	High	1869
10	Selenge	Tsagaannuur	High	1834
11	Selenge	Saikhan	High	1713
12	Selenge	Sukhbaatar	Medium	1704
13	Tuv	Jargalant	High	1662
14	Bulgan	Bugat	High	1516
15	Uvs	Malchin	High	1501
16	Selenge	Orkhontuul	Medium	1178
17	Tuv	Ugtaaltsaidam	Medium	1043
18	Orkhon	Bayan-Undur	Medium	879
19	Selenge	Bayangol	Medium	432
20	Selenge	Baruunkharaa	Medium	432
21	Tuv	Mungun Morit	Low	350
22	Tuv	Bayanchandmani	Low	223

Table-2. Wildfire risk in the total area of Mongolia (by dryness index)

The selected points from the accompanying illustration and table indicate the degree of fire risk and the dryness index for various provinces and districts in Mongolia's forest regions. The aridity index helps assess the dryness of the land surface, which can increase the risk of wildfires.

1. Kherlen and Khalkh Soums (Dornod Province): These sums have the highest dryness indices, measuring 3259 and 3238 respectively, categorizing their fire risk as "dangerous." This heightened risk is attributed to the region's dry climate and vegetation loss.

2. Sukhbaatar, Selenge, and Uvs Provinces: The aridity indices for these provinces range from 2941 to 2723, also falling into the "dangerous" category, indicating an increased fire risk in these areas.

3. Central Province: Some districts in Central Province, such as Ugtaaltsaidam and Mungunmorit, are classified as having "medium" and "low" fire risk, with a dryness index of 1043 and 350. This suggests that the region benefits from more stable water resources and environmental

conditions.

The study concluded that climatic conditions, as indicated by MOODIS satellite data, highlight the importance of managing and preventing forest and wildfire risks based on the dryness index.

The participation, cooperation, and information exchange of relevant parties are very important in forest and wildfires, especially in the prevention and control of cross-border fires, as well as in response planning and management.

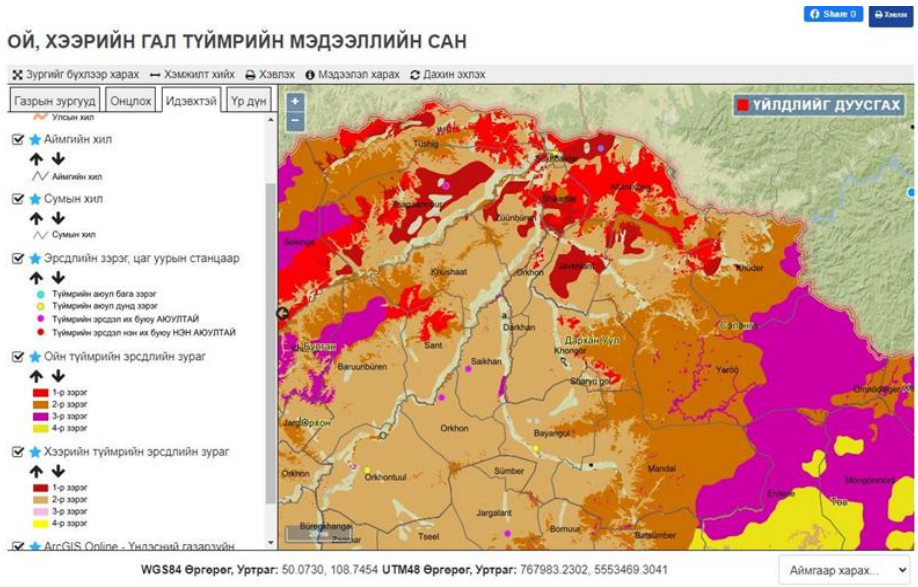


Figure-4. Forest and field fires in Selenge Province the location of the interest zone (point).

The above illustration shows that as of September 2024, there are 30 low-risk points, 224 medium-risk points, and 176 high-risk points in the territory of Selenge province.

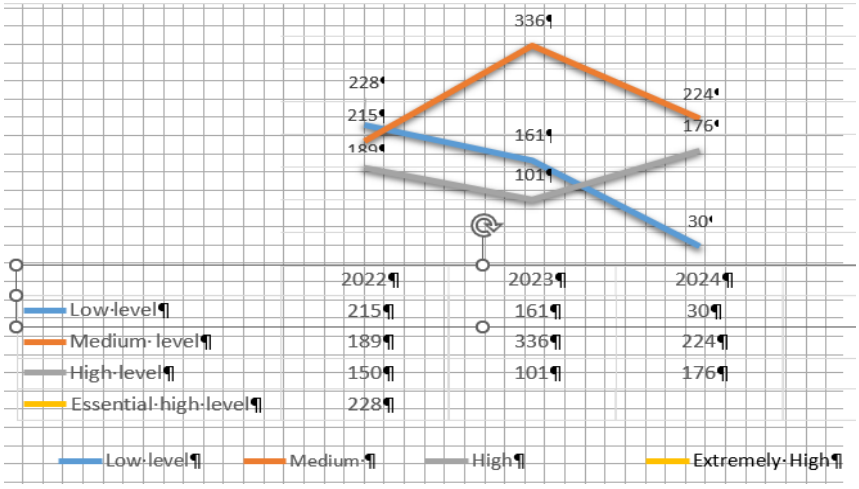


Table-4. Forest and wildfire risk area of Selenge province A comparative study of (dot).

For areas in Selenge province prone to forest and wildfires, attention

to 176 high risk points as of September 2024 highlights the need to enhance regional preparedness for preventive measures.

To reduce the risk of forest and wildfires, it is essential to quickly organize and coordinate interdisciplinary disaster prevention activities, exchange news and information, and optimally distribute resources.

That is why the National Disaster Management Authority is established concurrently on the basis of the central administrative center and local administrative organizations and other relevant organizations by the member of the Government in charge of emergency situations, local administrations in provinces, sums, capitals and other relevant organizations (Accordi Districts by decision of the Governor of that level).

ng to Annex 1 of Resolution No. 347 of 2018 of the Government of Mongolia, 12 state disaster protection services are established. The head of the State Disaster Protection Service shall be the Minister of the respective sector or the head of the agency. There are disaster protection services in aimag, the capital city, soum and districts.

It includes the following:

Disaster Protection Services		Responsible state administration organization
1.Natural and chemical hazards assessment and report service		-The state administrative organization in charge of environment and tourism
2.Construction and urban development service		-The state administrative organization in charge of construction and urban development
3.Road and transportation service		-The state administrative organization in charge of road and transportation development
4.Mining and heavy industry service		-The state administrative organization in charge of mining and heavy industry
5.Population and social protection service	→	-The state administrative organization in charge of labor and social protection
6.Food and agriculture service		-The state administrative organization in charge of food, agriculture and light industry
7.Fuel and energy service		-The state administrative organization in charge of energy
8.Health service		-The state administrative organization in charge of health
9.Information and communication service		-The state administrative organization in charge of communication and information technology
10.Professional and radiation control service		-The state administrative organization in charge of professional Inspection
11.Public order service 12.Advocacy service		-The state administrative organization of Policy

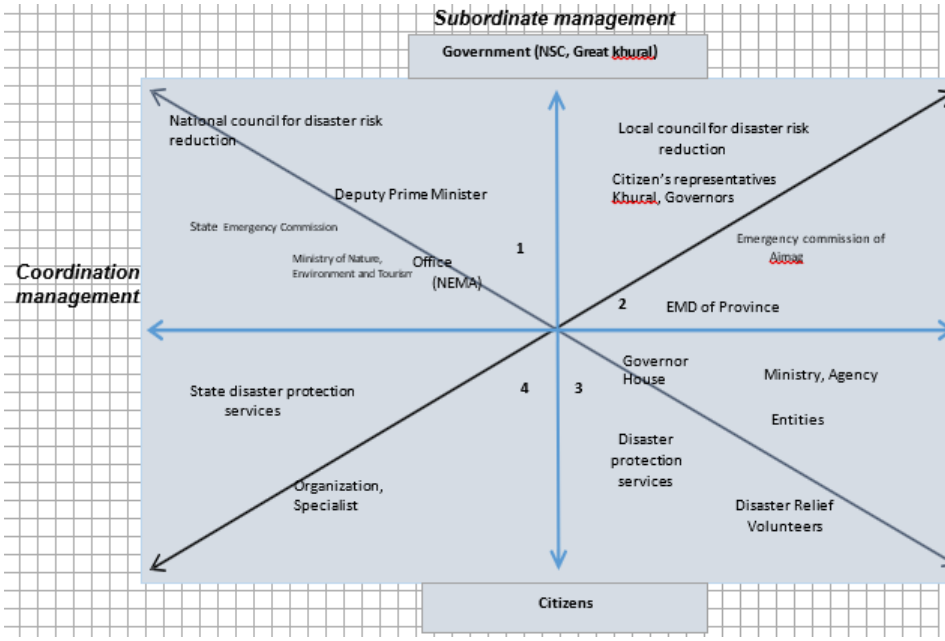
Figure 5. Disaster Protection Services

FUNCTIONS OF THE DISASTER PROTECTION SERVICE
• To plan sectoral disaster protection activities, to get approval for the required budget and to organize the implementation of the activities; • To incorporate and implement disaster risk reduction measures in the sector development policy and strategic planning; • To implement and report legislations and decisions of higher level organizations; • To determine the composition of the disaster protection service in accordance with the specifics of the sector, to establish a professional unit and to ensure their training, preparedness and readiness; • To ensure the operational stability of the sector during disasters and accidents; • To ensure the constant readiness of the sector warning system; • To develop relevant rules, regulations, guidelines, instructions and standards within the area of responsibility and to get them approved.

Table-3. Implementation functions

In the past three years, the state disaster protection office of Selenge province has undertaken various measures to address disaster risks, including analyzing forest fire statistics and enhancing coordination between the state administrative center and local organizations.

The implementation of regulatory legal guidelines was assessed using the six tools identified by van der Volt and du Toit, which are categorized into vertical (subordination), vertical coordination, and horizontal coordination.



Definition: 1, 4-Inter-sectoral relations 2, 3-Relations between Aimag and soum management. 1,2-Relations at the branch and aimag level 3,4-Branch and soum level relations

The analysis of relevant laws and regulations indicates that the legal

framework governing the coordination of activities between state and local administrative bodies is inadequate. The existing provisions are unclear, which appears to stem from a lack of theoretical understanding and methodological knowledge regarding coordination and operational alignment.

The National Agency for Meteorology and Environmental Monitoring is responsible for issuing alerts in the short, medium, and long term. This includes informing the public and providing warnings during natural disasters. The NAMHEM, an organization involved in disaster management, will issue disaster warnings in collaboration with its provincial offices and report any potential disasters to the provincial governors.

According to Government Resolution No. 286 of 2015, the disaster warning information provided by the National Agency for Meteorology, Hydrology and Environment Monitoring to the National Emergency Management Agency (NEMA) will also be shared with the public. The NAMHEM uses a radar system for early disaster detection. However, this radar system has limited coverage; it can only provide preliminary information about phenomena occurring within 200 km of Ulaanbaatar city.

The Institute of Water, Meteorology, Environmental Research, and Information, which operates under the National Agency for Meteorology, Hydrology, and Environment Monitoring, focuses on research development. It is responsible for processing satellite data on weather, which is essential for NEMA and other organizations. The institute also provides information on natural disasters, including droughts, forest fires, and wildfires.

A database containing information about natural disasters and forest fires is available on the website of the Environmental Information Center. This page is now under the jurisdiction of the institute's environmental database.

Conclusion

The risk of forest and field fires in border areas of Mongolia is determined by the drought index as of September 24, 2024 using MODIS satellite data.

If we identify and evaluate the points that determine the degree of risk of forest and forest fires:

- the dryness index of Kherlen and Khalkh sums in Dornod province is the highest (3259 and 3238), which means that the fire risk is “dangerous”;

- The drought index of Sukhbaatar, Selenga and Ub provinces ranges from 2941 to 2723 and is classified as "dangerous". However, the results of some central provinces (Ugtaaltsaydam, Silver Horse) are included in the "medium" and "low" ratings.

In order to reduce and prevent the risk of forest and forest fires, coordinate activities between the state administrative center and local administrative organizations, as well as implement regulatory legal norms, the work and activities of the State Administration for Protection from

Natural Disasters of the Selenginsk Velayat in the city have been carried out over the past 3 years, as well as an analysis of the subordination of management in forest fire statistics.

When analyzing using the method, the lack of legal regulation and professional management in terms of coordination and coordination of activities between the central state administration and local authorities was established. administrative organizations.

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