Information and Research Institute of Meteorology, Hydrology and Environment, NAMEM, MONGOLIA

Dzud early warning system over Mongolia

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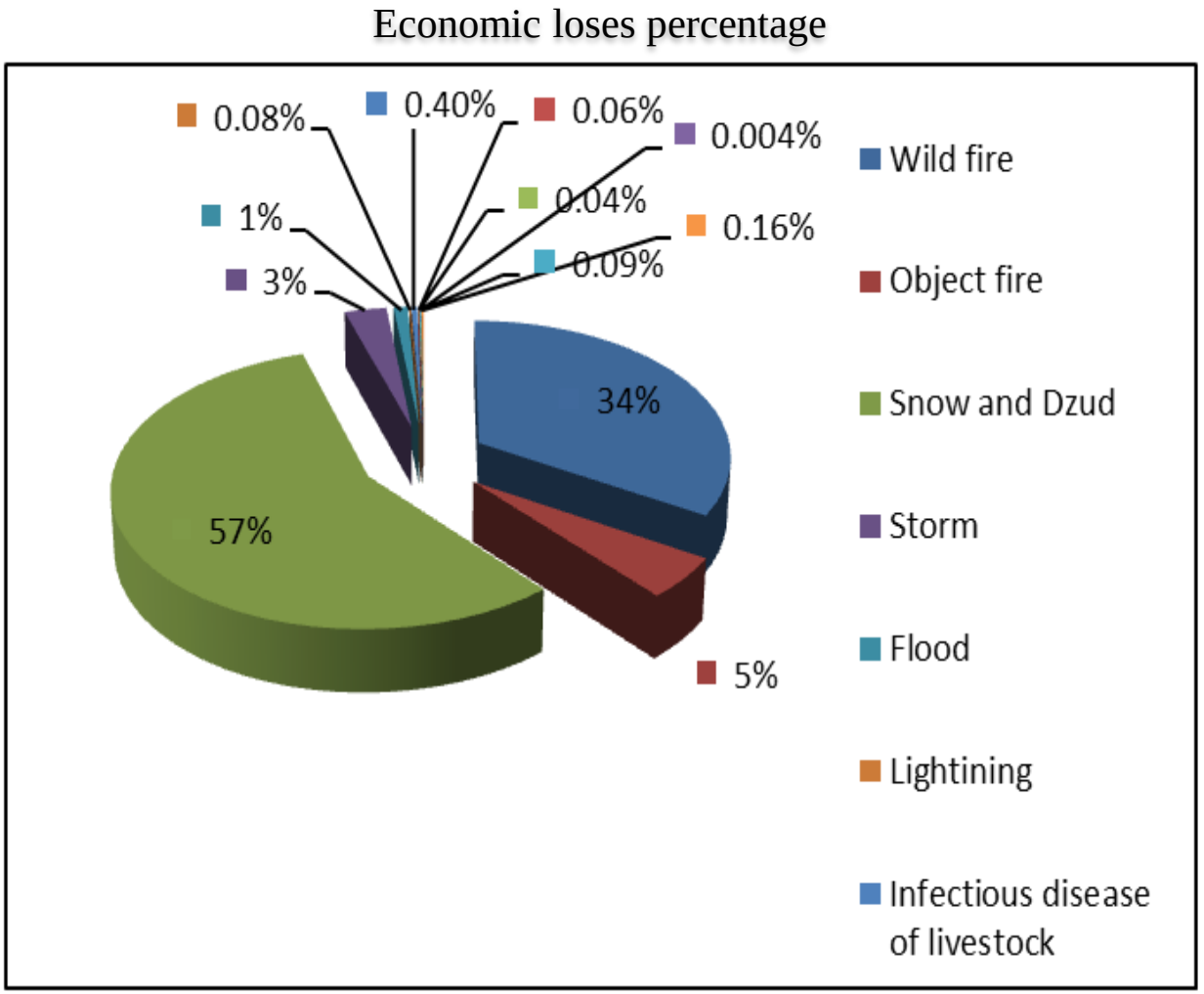
A.Davaadorj, B.Erdenetsetseg, N.Elbegjargal and L.Oyunjargal

davaadorj@namem.gov.mn

Weather and Environmental, Numerical Modeling Research Division, IRIMHE,NAMEM

Major disaster types:

- **Drought =>WildFire**
- **Dzud** (Heavy snow and extreme cold temperature)
- **Geological hazards**
- **Flood**
- **Storm…etc**



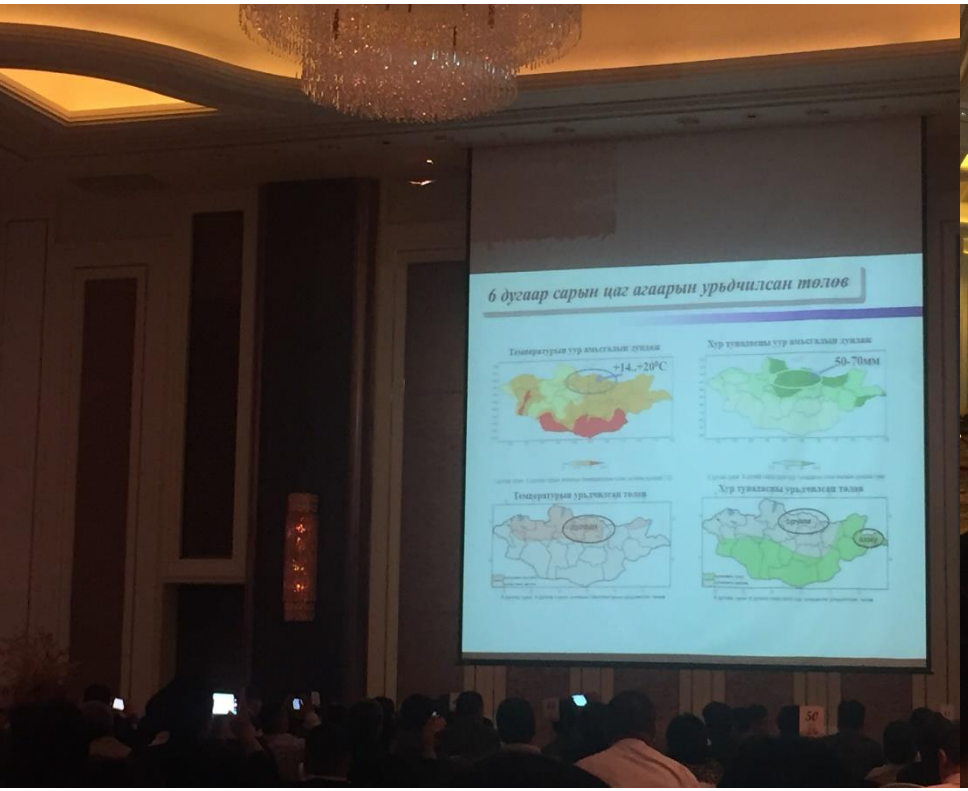
From National Emergency Management Agency (NEMA)

Main seasonal outlook users:

Summer Outlook /Drought/

Winter Outlook /Dzud/

Summer outlook users:



Summer outlook issued end of march and updated every months. We present National Farmers forum for the end of April.

Based on summer outlook they were decide what kind of seeds to plan and what kind of technology to use.

Dzud definition

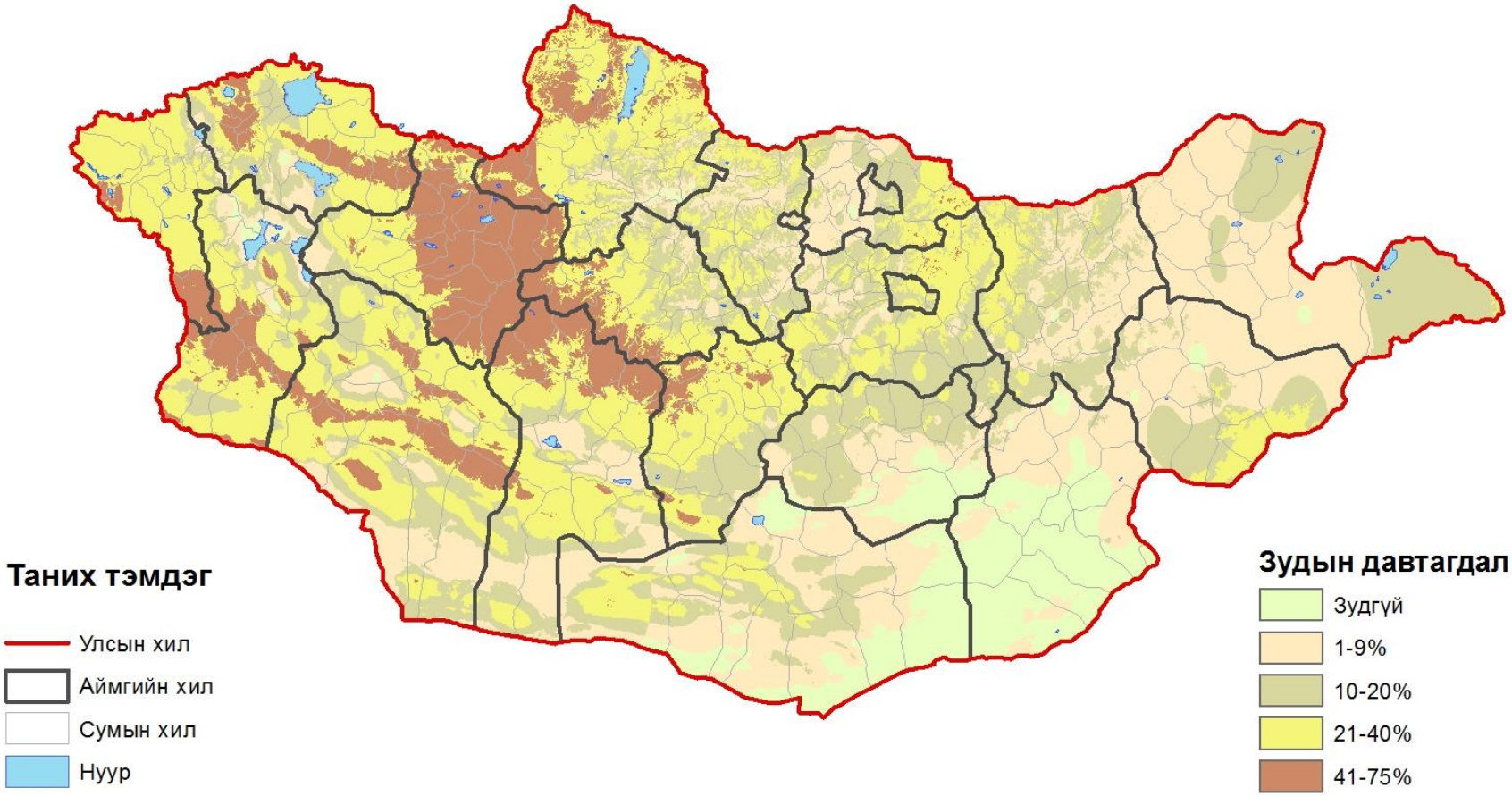
- Dzud
  - Dzud (sometimes spelled zud) is a winter disaster in which deep snow, severe cold, or other conditions that render forage unavailable or inaccessible lead to high livestock mortality.
  - At least five types of dzud
    - **White dzud** happens when deep snow covers grass.
    - **Black dzud** refers to freezing temperatures and lack of snow (essential for livestock and human water in the winter) and forage.
    - **A combined dzud** occurs when there are both deep snow and cold temperatures.
    - **A storm dzud** is indicated by high wind and blizzard conditions.
    - **Iron dzud** happens when a layer of ice makes forage inaccessible. Finally, a hoofed dzud occurs when many livestock converge in a location, and the combination of trampling and heavy grazing eliminates forage.

  Many herders believe that “dzud follows drought” and severe winters are likely to occur following a poor summer.

Dzud: Defining parameters

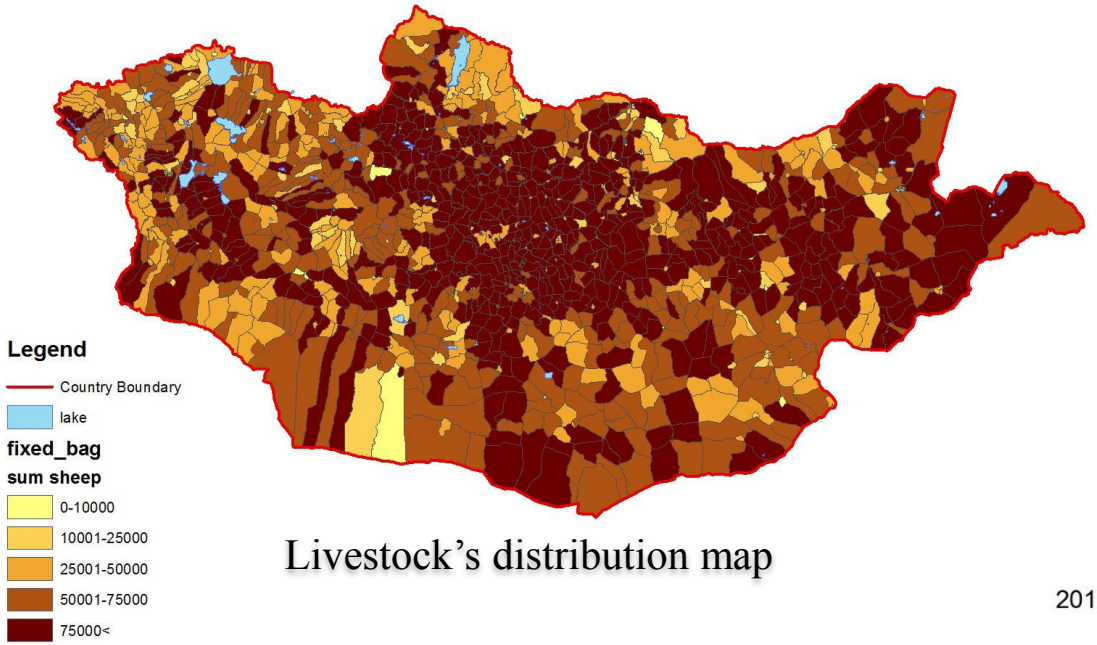
- Previous summer condition
- Pasture carrying capacity (PCC)
- Time of snow cover formation
- Depth of snow cover
- Snow density
- Number of days with snow cover
- Air temperature

Dzud frequency map



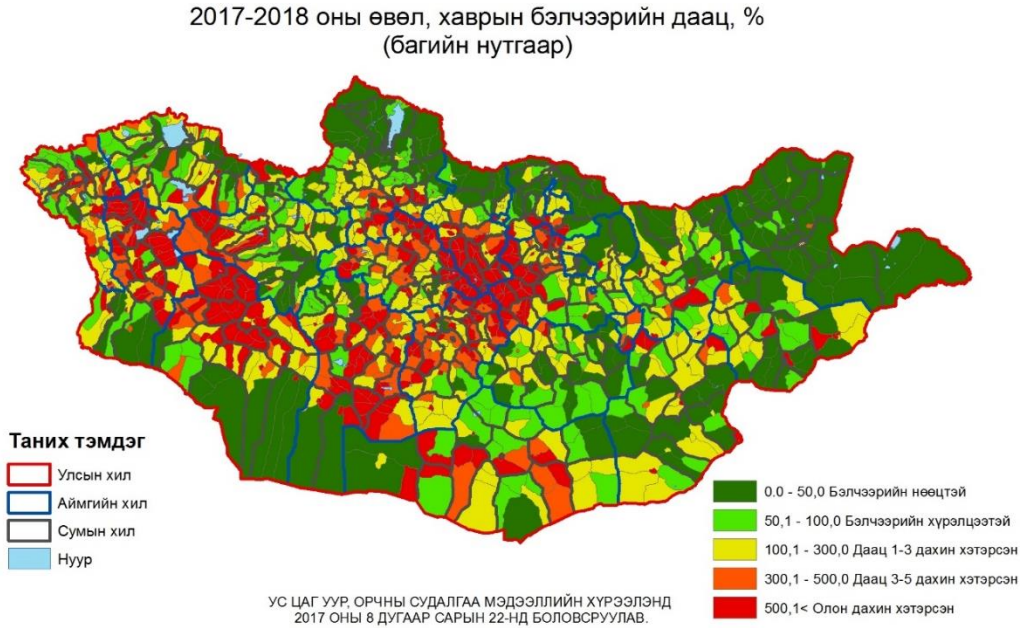
Dzud frequency map /1980-2016/

Livestock distribution and pasture carrying capacity /2017/



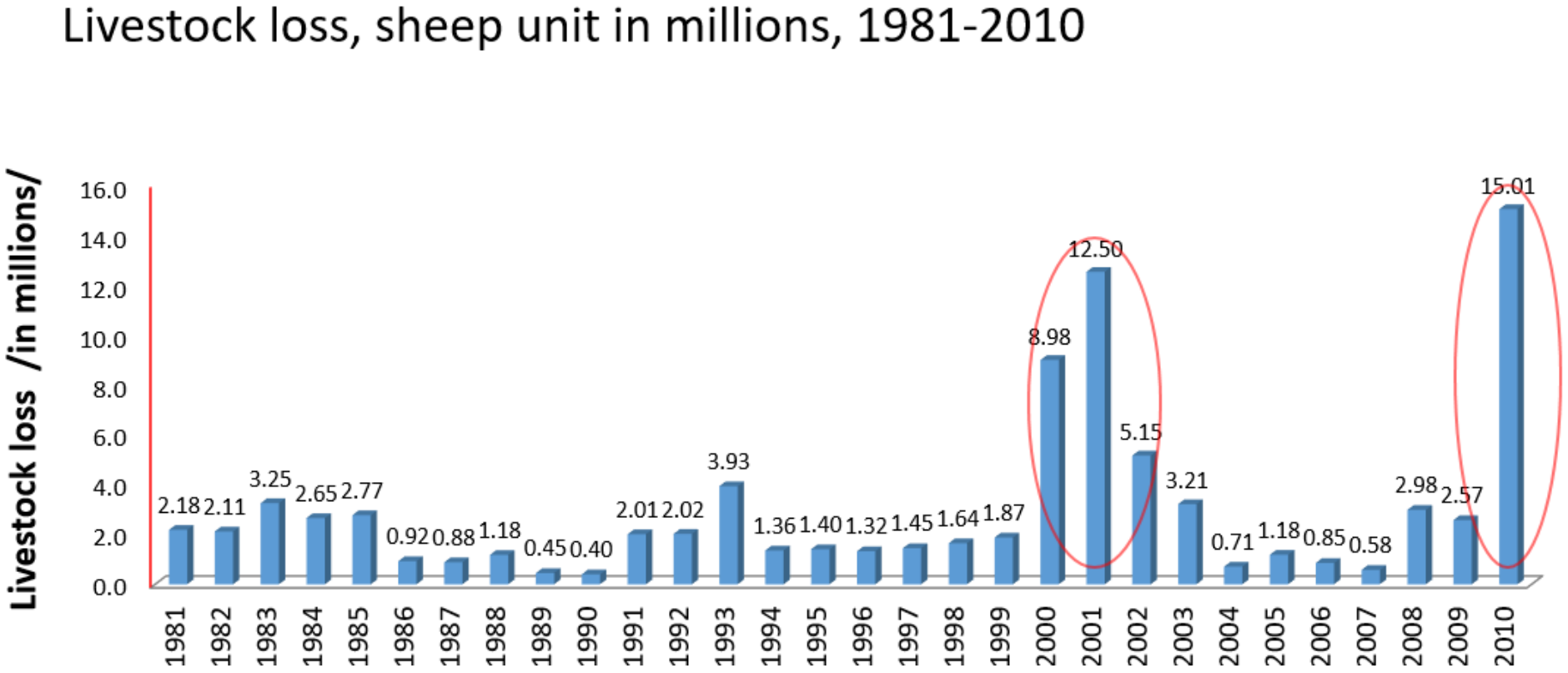
Livestock's distribution map

Mongolia have more than 70 million head of livestock's at the end of 2017. Agriculture is responsible for 14% Mongolia's total GDP and accounts for 12.5% of export, according to the Ministry of Food and Agriculture of Mongolia.



Pasture carrying capacity map

Livestock loses

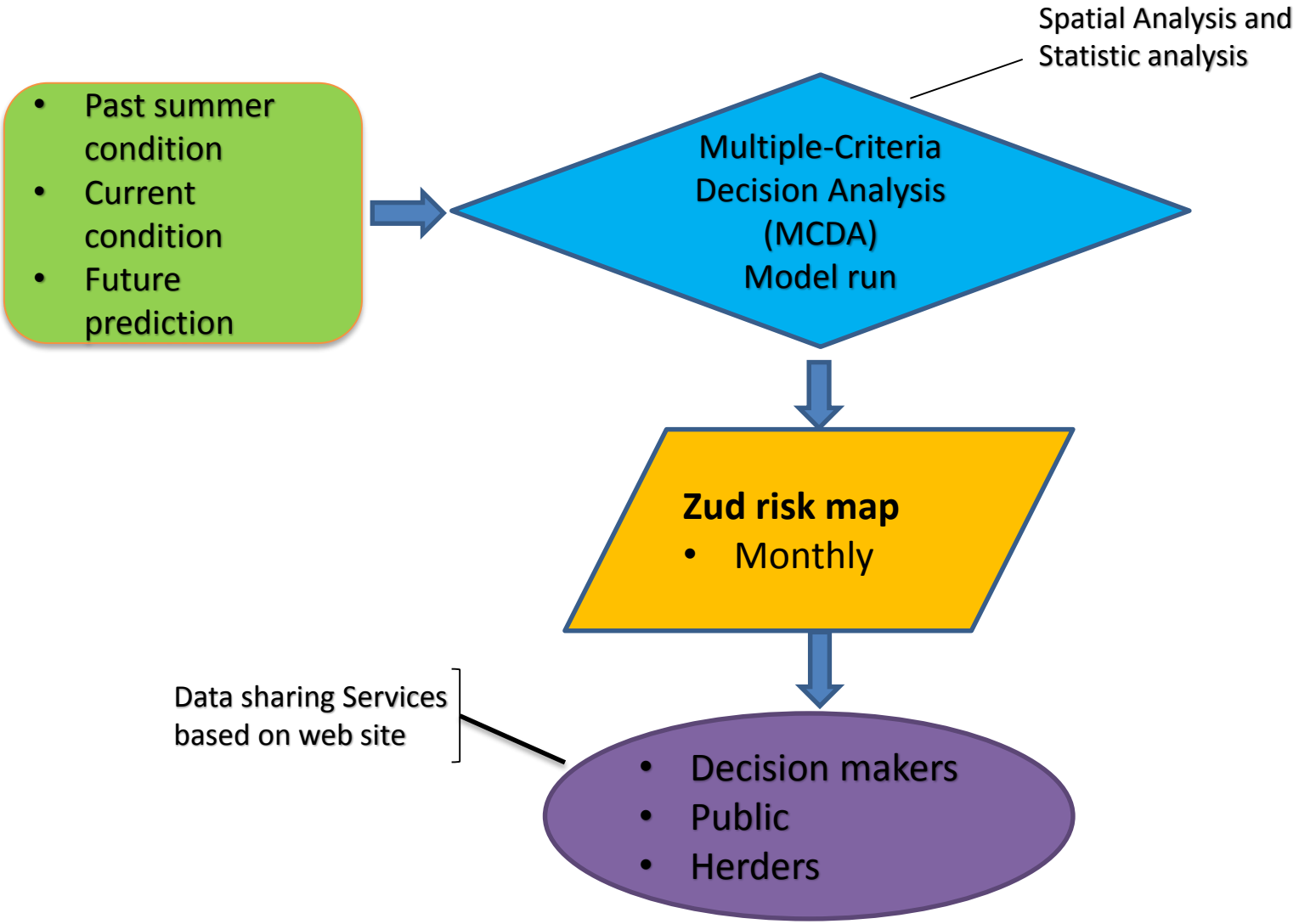


Over 50,000 people are estimated to have moved to Ulaanbaatar directly after the 1999-2001 dzuds, and another 70,000 people two to three years after as herder families struggled to rebuild their livelihoods. Mongolia was again impacted by harsh dzud in 2009/2010, in which more than 15 million head of livestock died, and around 20,000 herders were forced to migrate to towards Ulaanbaatar.

Mass migration from the rural areas into Ulaanbaatar has risen over the last two decades, resulting in an increase in population and population density. Migrated people built ger, the traditional nomadic dwelling of Mongolians, in the perimeter of the urban area. The ger district is heavily dependent on solid fuels such as coal and wood as household fuel for heating and cooking. This causes air pollution that spans a considerably long duration in Mongolia, especially in the cold season.

Dzud early warning information system.

Methodology



Methodology

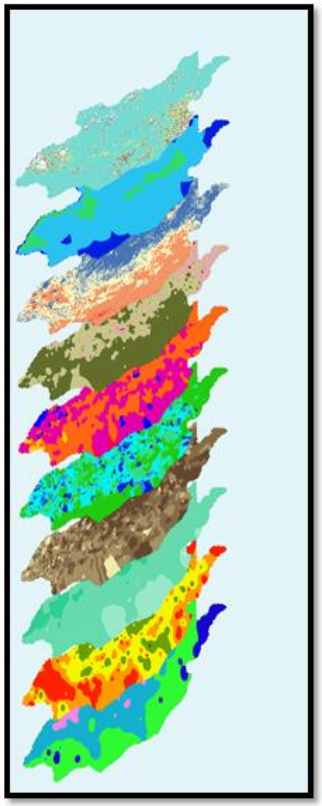
id	layer name	Rank	Numerator	Weights	0-100 scale
1	Summer condition	3	9	0.09	9
2	Pasture carrying capacity	2	10	0.10	10
3	Livestock number	3	9	0.09	9
4	biomass/1500 site	2	10	0.10	10
5	Anomal precipitaion	5	7	0.07	7
6	Anomal temperature	5	7	0.07	7
7	Drought index/MODIS	4	8	0.08	8
8	Snow depth	1	11	0.11	11
9	Snow cover/MODIS	3	9	0.09	9
10	Air temperature forecast	2	10	0.10	10
11	Precipitation forecast	1	11	0.11	11
			101	1.00	100

$$Numerator = \sum_{k=1}^{n} (\mathrm{n} - r_k + 1)$$

$$W_i \frac{(\mathrm{n} - r_k + 1)}{\sum_{k=1}^{n} (\mathrm{n} - r_k + 1)} \quad W_i = 1$$

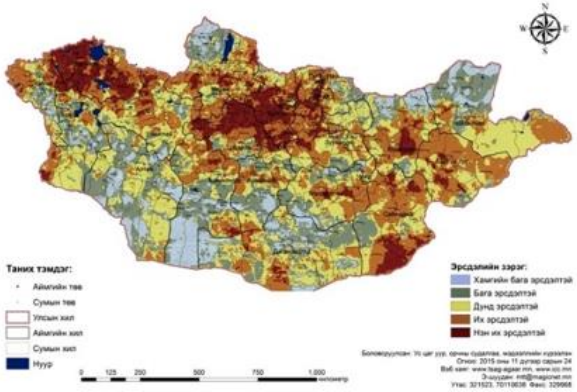
Using GIS based Multi-Criteria Decision Analysis

- Determine the criteria /
- Standardize the parameters /ranking/numerating method/
- Determine the weight of each parameter
- Weighted combination /overlay based on GIS technique/



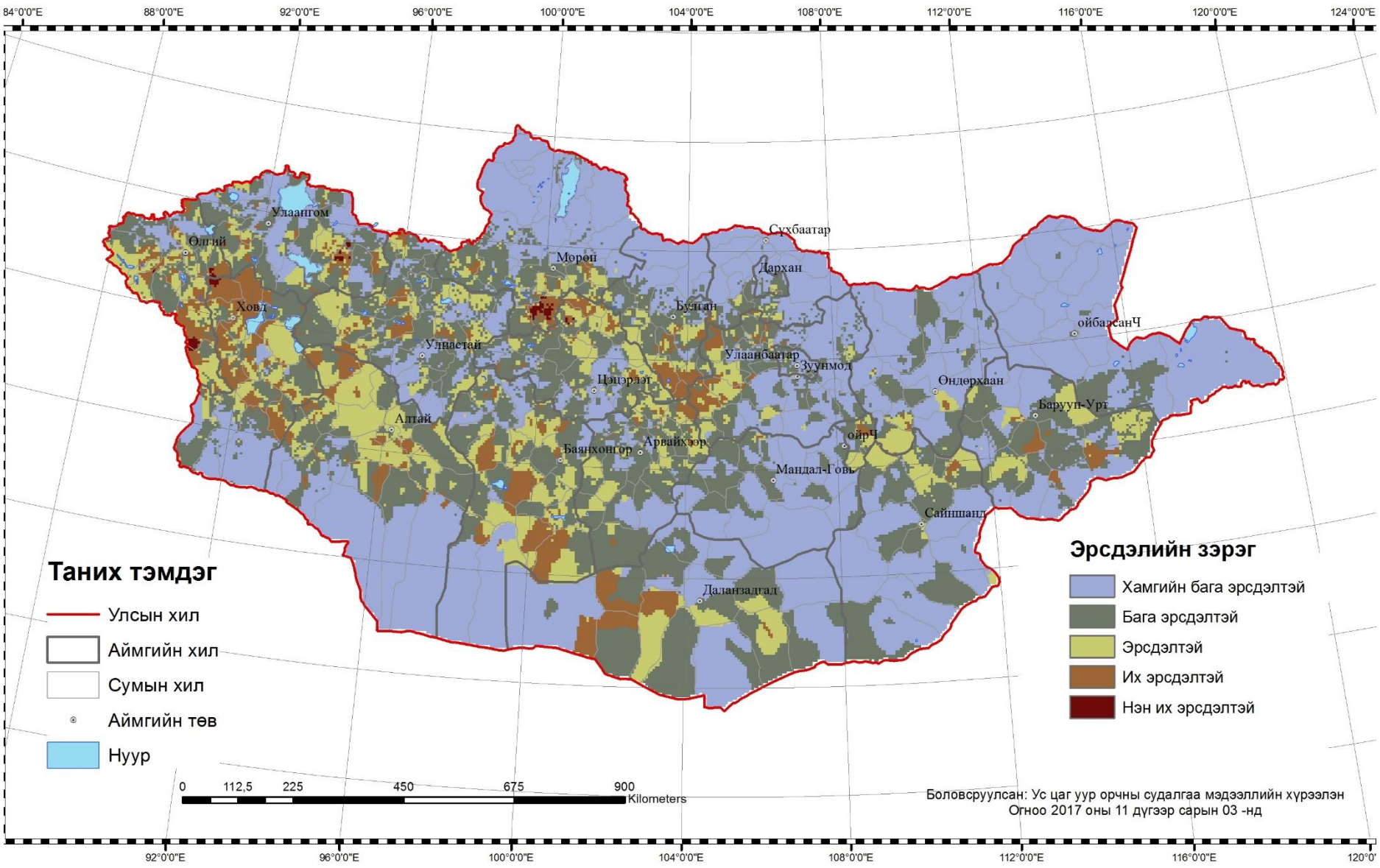
Overlay

Weighted Overlay

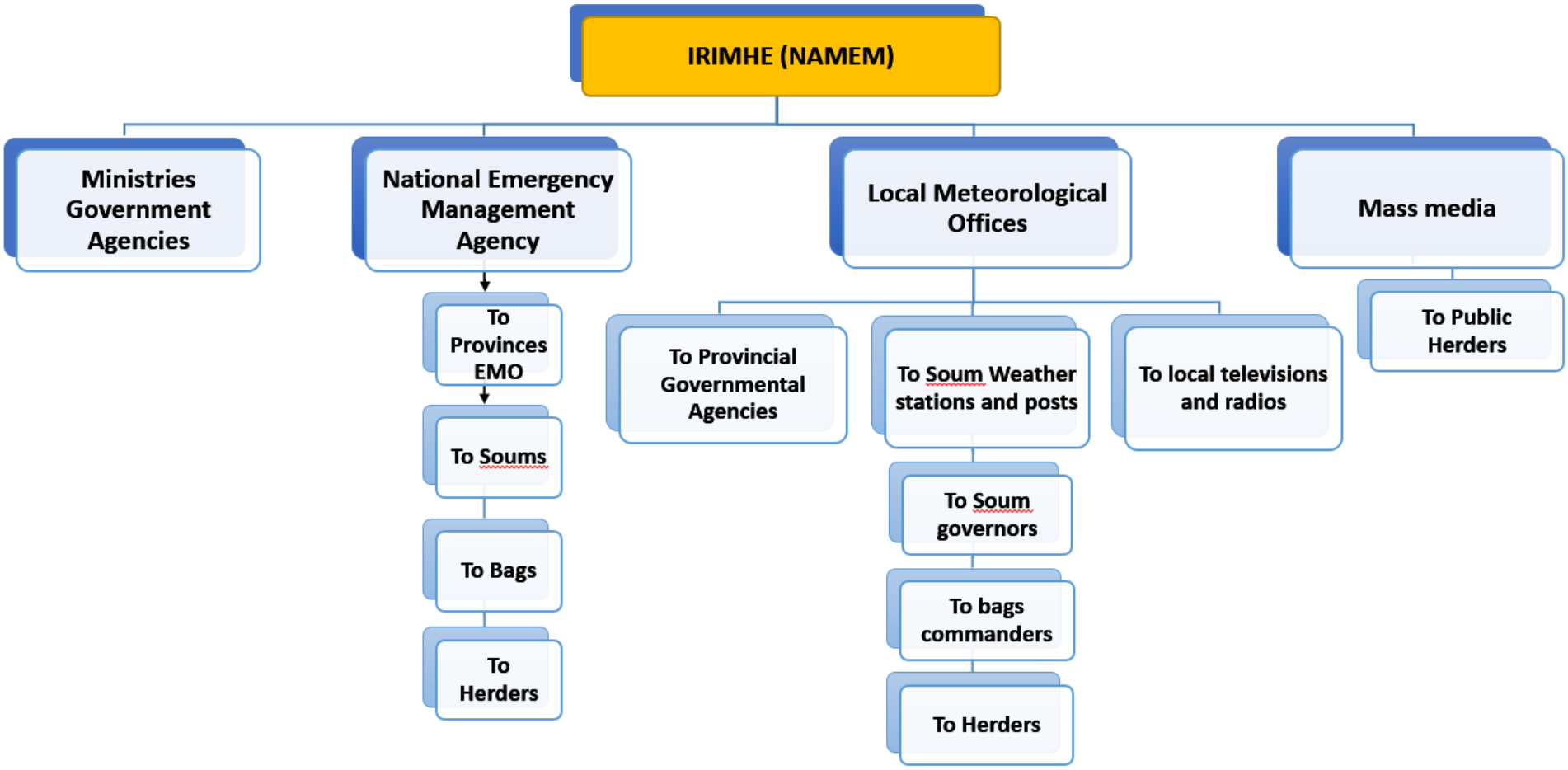


- The risk map was produced on 20 Oct, 20 Nov and 31 Dec. in 2015 using ground observation data and remote sensing data
- Risk classification: very high, high, medium, low, and very low.

Dzud risk map for Winter 2017/2018



Dzud Flowchart of disseminating information



Winter preperation

Summary

Main users' sectors of our long range weather forecast are agriculture and livestock husbandry. Warm seasonal outlook is important for agriculture and cold seasonal outlook – for livestock husbandry. Actually users of these sectors want to know whether there would be drought and Dzud.

Warm seasonal outlook is introduced in Farmers' Forum in the end of April and they decide what kind of seeds to plan and what kind of technology to use.

Cold season outlook is essential for herders whose livelihood highly depend on upcoming winter condition especially Dzud condition. Dzud is a major natural disaster in Mongolia which can cause serious damage to the livestock sector, community well-being and the national economy.

Even though, we issue cold season outlook, it is not easy to predict Dzud possibility. However, our met service produce "Dzud risk map" – which is impact based product. One of factors of Dzud risk map is winter climate outlook.

Dzud risk map is produced by end of Nov and presented to the Mongolian Government Meeting, Parliament Standing Committee meeting on Food and Agriculture, and Special Committee meeting on Emergency Management.

This information became the basis of winter preparation works and dzud early warning management measures that have been implemented countrywide.

Thank you for your attention