ZUD: EARLY WARNING

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ZUD

Zud is the phenomena that occur in winter-spring time due to harsh climatic events and as a result die high number of animals because of hunger /no ability to go for grazing/. /Natsardorj.l 2009/

Zud is a major natural disaster in Mongolia which can cause serious damage to the livestock sector. Zud occurs when the winter condition particularly heavy snow cover and/or low temperature prevents livestock from accessing pasture or receiving adequate hay and fodder. It can continue for several months and reflect a shortage of pasture and water and lead to livestock exhaustion. So zud is important issue to study because 30% of Mongolians depend on herding and animal husbandry for their livelihood.

ZUD: SPECIFIC CHARACTERISTICS

- Zud occurs in regions with pastoral animal husbandry such as Mongolia .

- Zud is a seasonal phenomena.

- Unfavorable pastoral and meteorological conditions are the main causes of zud.

- High density of livestock and overgrazing may cause zud.

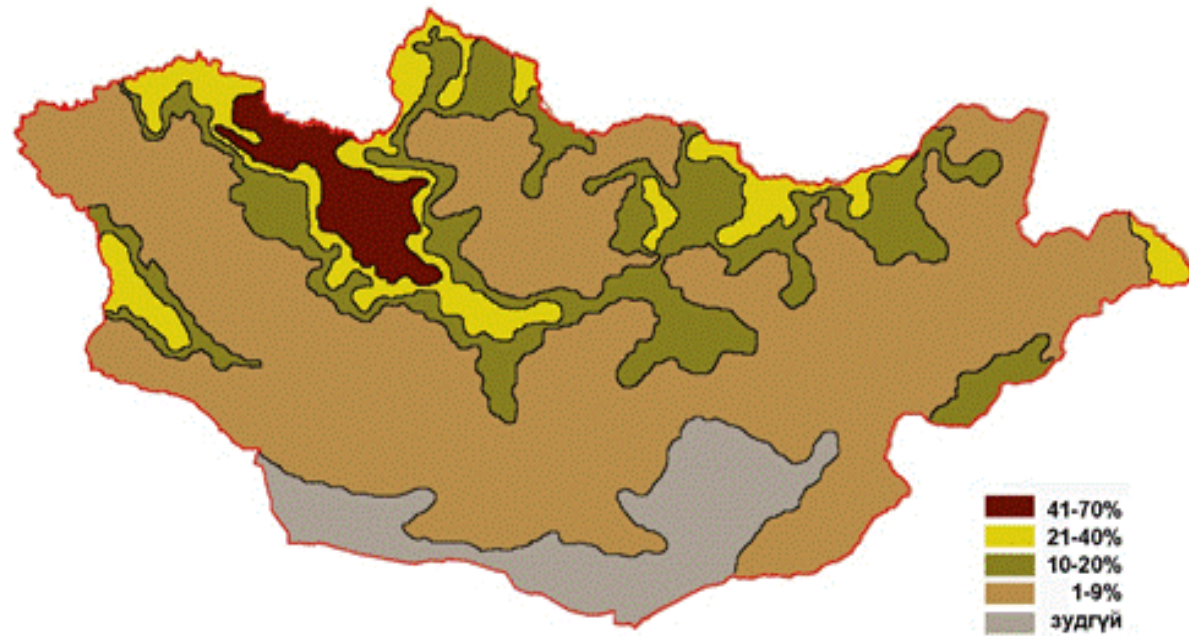- Geographical condition is an important factor for zud.

ZUD: CLASSIFICATIONS

Zud Form	Description	Climate Criteria
Tsagaan (white) *zud*	Results from high snowfall that prevents livestock from reaching the grass. Herders used to leave the *zud* area if the area was small. Can cause a very serious disaster if it covers a large area. *Tsagaan* is the most common and disastrous form of *zud*.	Long lasting: large amount of snowfall in the beginning of winter. Short at the end of winter
Khar (black) *zud*	Occurs when lack of snow in grazing areas leaves livestock without any unfrozen water supplies where wells are not accessible. Both human and animals suffer from lack od water to drink. This form usually happens in the Gobi Desert region.	Very little or no snowfall in winter. No water forage on pasture because of drought in summer. No winter forage on pasture due to overgrowth in number of voles (*Microtus brandtii*) and grasshoppers or increasing incidence of forest and steppe fire.
Tumer (iron) *zud*	occurs when snow cover melts and refreezes to create an impenetrable ice-cover that prevents livestock from grazing	short rapid warming in wintertime (3-7 C higher than monthly mean temperature) followed by return to sub-freezing temperatures
Khuiten (cold) *zud*	Occurs when air temperature drops to very low levels for several consecutive days. Extreme cold temperatures and strong freezing wind prevent animals form grazing. The animals expend most of their energy in maintaining their body heat.	air temperature falls by 5-10 C lower than the monthly mean.
khavsarsan (combined) *zud*	a combination of at least two of the above phenomena occurring at the same time	Geographically widespread *zud*

Source: Vulnerability of Mongolia's Pastoralists to Climate Extremes and Changes, P.Batima, L.Natsagdorj et al, AIACC project, UNEP, 2008

ZUD: WHITE ZUD

White zud frequency (1973-2009)

|	
■ 41-70%	
■ 21-40%	
■ 10-20%	
■ 1-9%	
■ зудгүй	

Tsagaan zud /1973-2099 on/

Natsagdorj.L ,Dulamsuren.J

The map shows white zud frequency based on the ground observational data 1973-2009. White dzud is regularly 4-7 times in 10 years in the west-northern part of the country /some areas of Zavkhan and Uvs aimags), which is the highest frequency of total territory.

ZUD: LIVESTOCK LOSS

Livestock loss, sheep unit in millions, 1981-2010
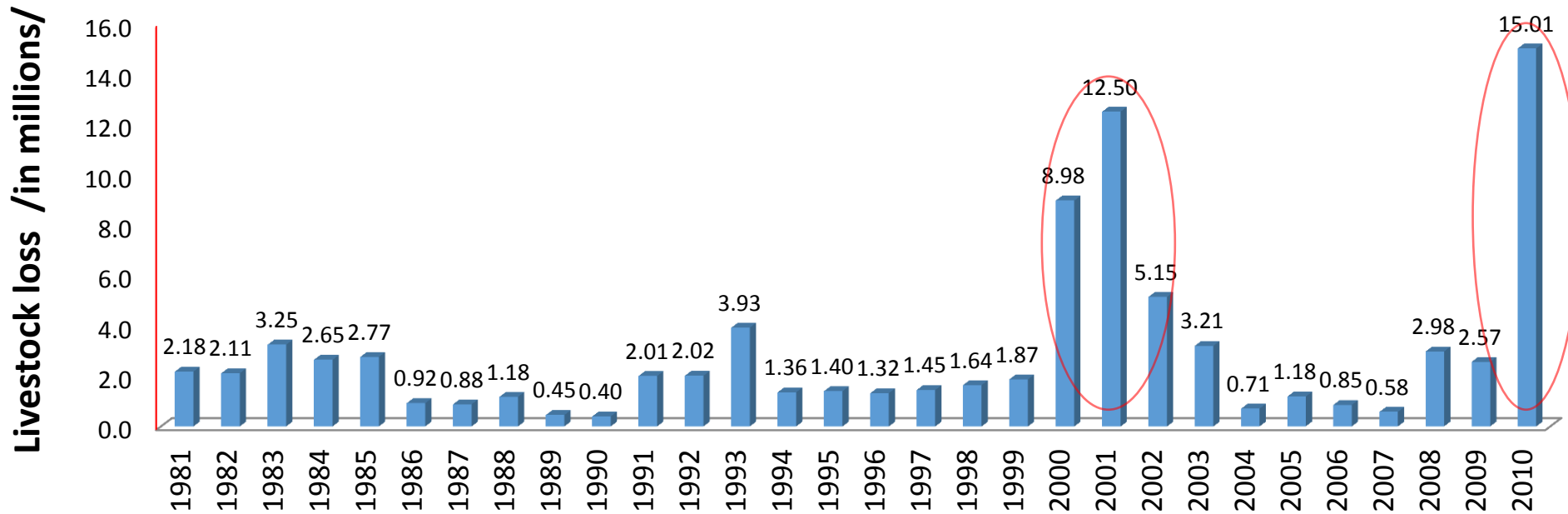
The highest livestock loss occurred in 2010, which was 15.01 million in sheep unit.

Source: NSO

ZUD: NEEDS TO EARLY WARNING

- A high frequency of drought and zud causes high economic crisis often. Therefore it is necessary to predict zud and warning it's risk, based on scientific approach and technology to decision makers and public.

- The main mission of zud risk assessment is to prevent from damage in high risky areas.

- The main consumers of the product will be government and decision-making organizations. The product will be used directly and/or by public communication channels.

White zud:
-Pasture snow density is >0.25 g/sm3 in all natural zones
-10 days and monthly air tem is below more than norm >3.0 C …. Snow average depth >25 sm in high mountain and forest steppe, >22sm in steppe, and >12 sm in the gobi region.

"White zud"

White semi-zud:
-Pasture snow density is 0.20-0.24 g/sm3 in all natural zones
-Snow average depth >16 sm in high mountain and forest steppe, >11 sm in steppe, and >5 sm in the gobi region.

"White semi-zud"

Гурав. Зудыг үнэлэх шалгуур үзүүлэлт

3.1. "Зуд" гэж өвөл, хаврын улиралд цаг агаар хүндэрснээс мал сүрэг бэлчээр, усаар нэн гачигдан, турж зутран олноор хорогдох нөхцөл бүрдэхийг ойлгоно.

3.2. Зудыг эрчимшлээр нь "зудтай", "зударахуу" гэж ангилна.

3.3. Мал бэлчээрт өл залгаж чадахгүй болох шалтгаанаар нь зудыг цагаан, хар, туурайн, шуурган, төмөр буюу мөсөн зуд гэж ялгах бөгөөд тэдгээрт дор дурдсан нөхцөлийг хамруулна;

3.3.1. "цагаан зуд" гэж өвөл бэлчээрийн цасны нягт нь аль ч бүс нутагт 0.25 г/см³ буюу түүнээс их, арав хоног, сарын дундаж агаарын температур олон жилийн дунджаас 3.0⁰С болон түүнээс хүйтэн буюу дундаж квадрат хазайцаас давсан байх, цасны дундаж зузаан өндөр уулын болон ойт хээрийн бүсэд 25 см-ээс, хээрийн бүсэд 22 см-ээс, говь цөлийн бүсэд 12 см-ээс их байх нөхцөлийг;

3.3.2. "цагаанаар зударахуу" гэж бэлчээрийн цасны нягт нь аль ч бүсэд 0.20-0.24 г/см³, цасны дундаж зузаан өндөр уулын болон ойт хээрийн бүсэд 16 см-ээс, хээрийн бүсэд 11 см-ээс, говь, цөлийн бүсэд 5 см-ээс их байх нөхцөлийг;

3.3.3. "хар зуд" гэж зун нь гантай, гандуу байсан нутагт өвөл цас ороогүй, арав хоног, сарын дундаж агаарын температур олон жилийн дунджаас

ZUD RISK MAP: METHODOLOGY

Chosen parameters

ID	Data group	Parameters	Period /Monthly and 10 days/
1	Past summer condition	Temperature anomaly	Jul-15
		Precipitation anomaly	Jul-15
		Summer condition	Current 10 days, 2015
		Pasture biomass (1500 sites)	3rd decade of August 2015
		Pasture carrying capacity	3rd decade of August 2015
		Livestock number	3rd decade of August 2015
		Drought map (MODIS)	Current 10 days, 2015
2	Current situation	Snow depth	Current 10 days, 2015
		Snow density	Current 10 days, 2015
		Snow cover (TERRA/MODIS)	Current 10 days, 2015
3	Weather prediction	Air temperature	Next month
		Precipitation	Next month

## Flowchart for Zud risk mapping
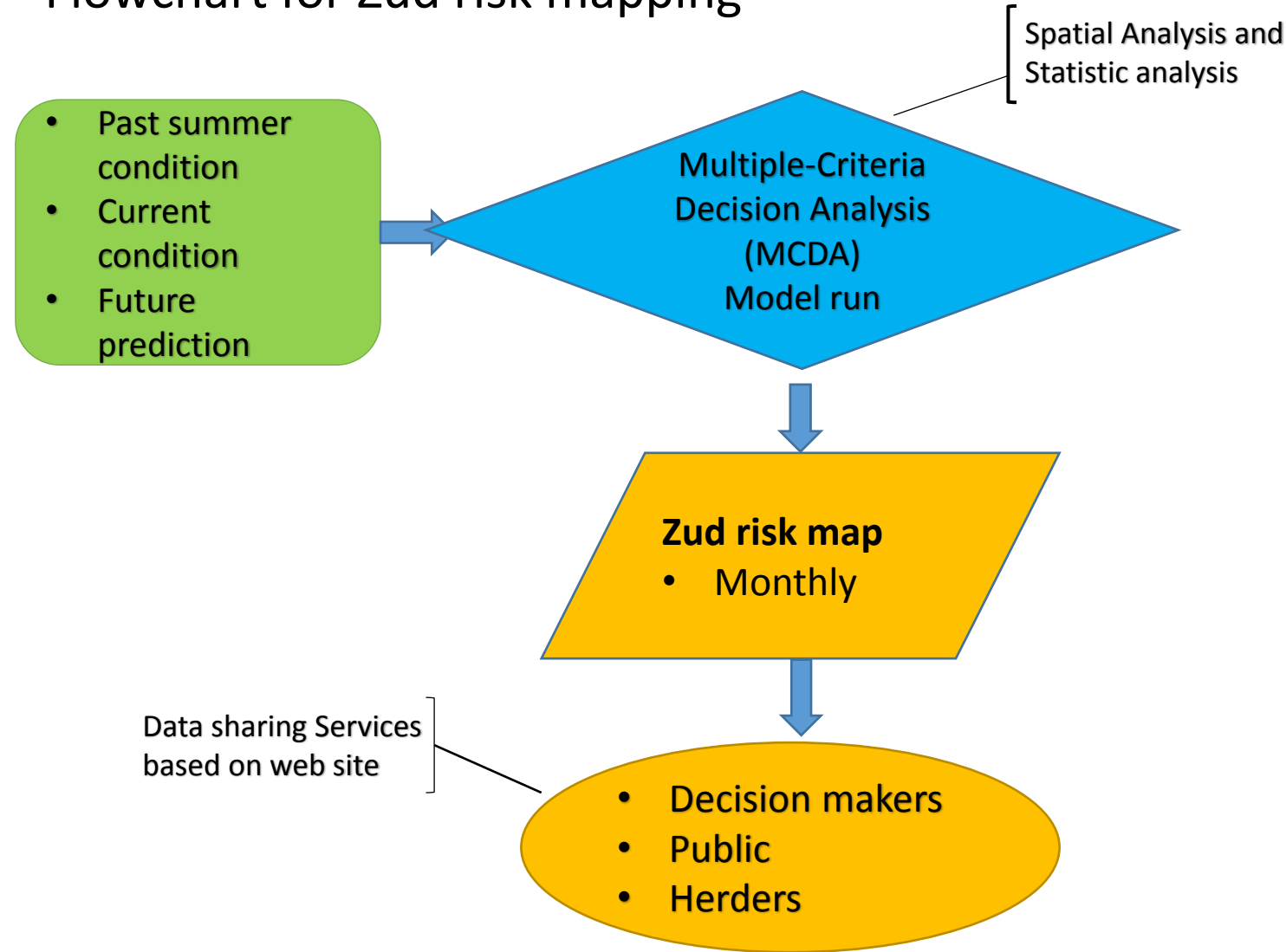
ZUD RISK MAP: METHODOLOGY

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

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

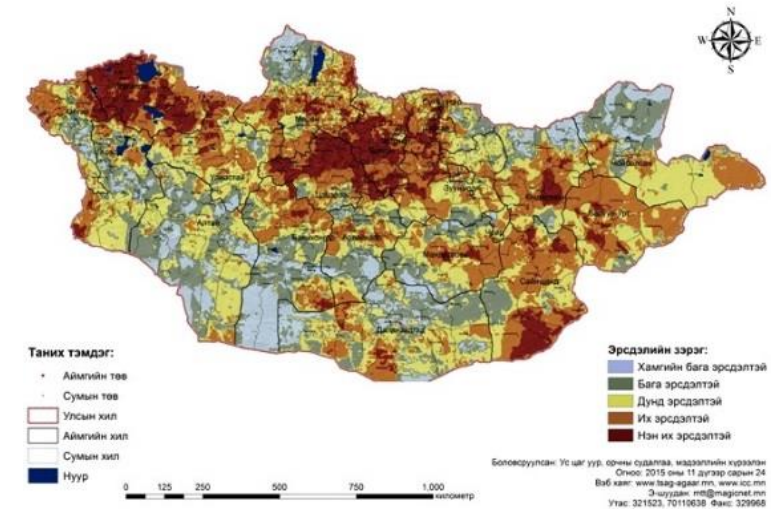$$W_i \frac{(n - r_k + 1)}{\sum_{k=1}^{n}(n - r_k + 1)} \qquad W_i = 1$$

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/
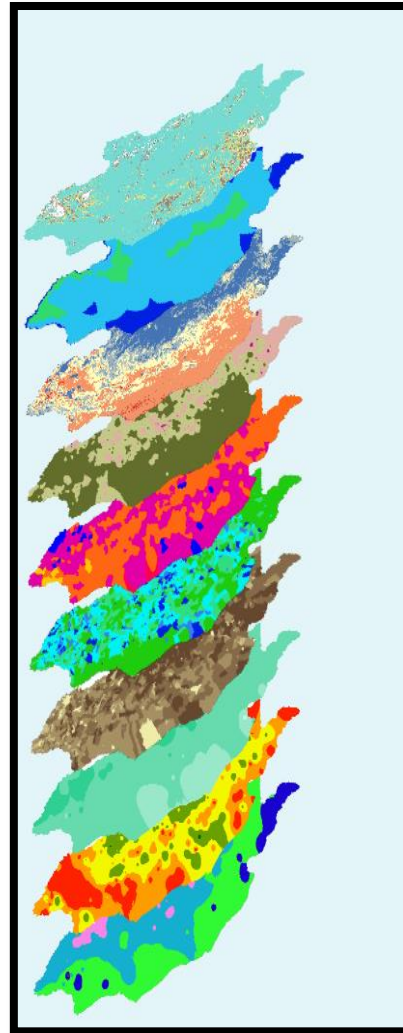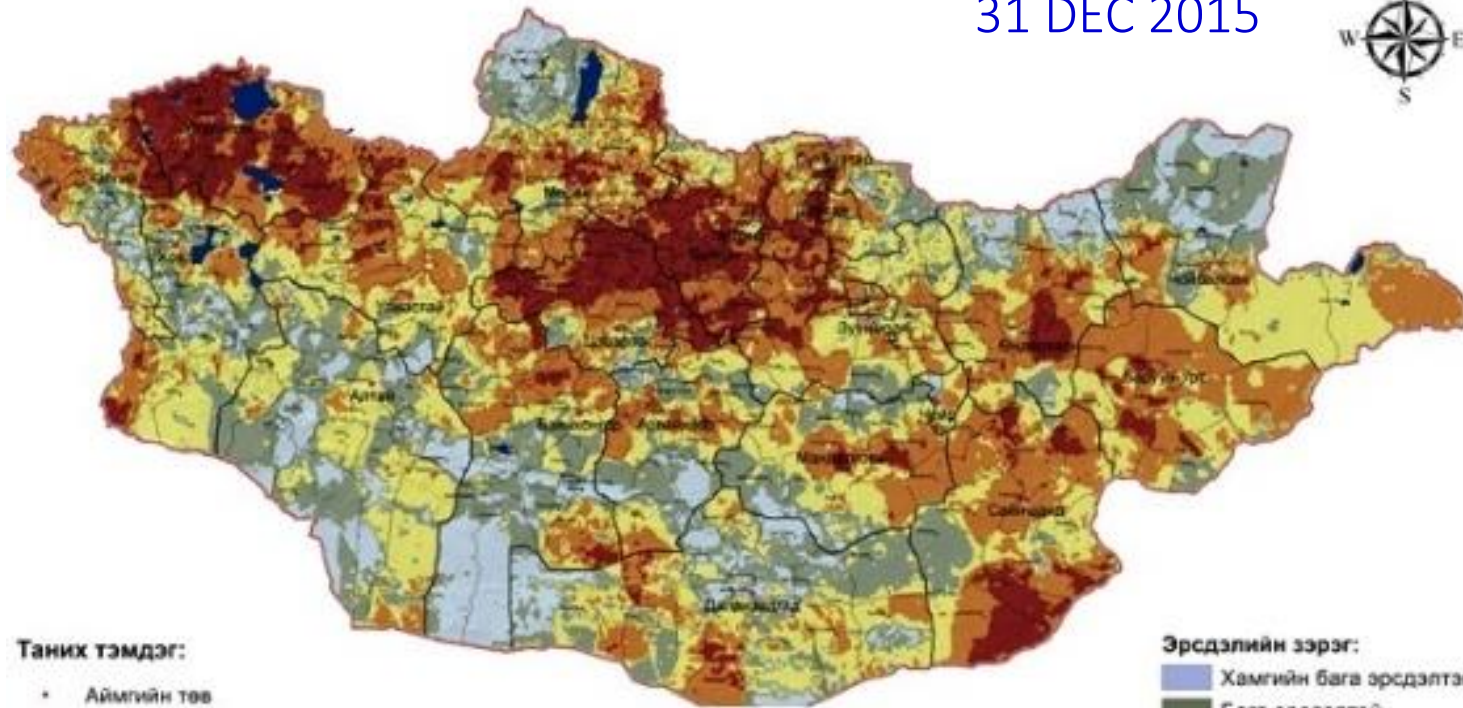

Overlay

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.

ZUD RISK MAP:RESULT AND APPLICATION

31 DEC 2015

Zud risk map informed to:
-Mongolian Government Meeting, 23 Nov 2015
-Special committee meeting on Emergency Management (25 Nov 2015 and 7 Dec 2015)
-Parliament Standing Committee meeting on Food and Agriculture, 1 Dec 2015
-Interview for Mongol HD TV, 4 Dec 2015
-Interview for Mongolian Radio, 16 Dec 2015
-UNDP meeting in Mongolia (some donor organizations), 4 Nov 2015
-Ministry Road and Transition (Their requested)
-National Workshop for managers of local Red Cross branches, 21 Jan 2016
-Interview for Mongolian National TV, 26 Jan 2016
-Special committee meeting for Emergency Management, 28 Jan 2016

Таних тэмдэг:
- Аймгийн төв
- Сумын төв
- Улсын хил
- Аймгийн хил
- Сумын хил
- Нуур

0   125   250   500   750   1,000 километр

Эрсдэлийн зэрэг:
- Хамгийн бага эрсдэлтэй
- Бага эрсдэлтэй
- Дунд эрсдэлтэй
- Их эрсдэлтэй
- Нэн их эрсдэлтэй

Боловсруулсан: Ус цаг уур, орчны судалгаа, мэдээллийн хүрээлэн
Огноо: 2015 оны 11 дугаар сарын 24
Вэб хаяг: www.tsag-agaar.mn, www.icc.mn
Э-шуудан: mti@magicnet.mn
Утас: 321523, 70110638 Факс: 329968

- As a zud risk map, more than 40 percent of total territory had under the very high and high risk at the end of December 2015.
- The highly risk aimags was the most area of Bulgan, Sukhbaatar, the northern part of Arkhangai, the eastern part of Khuvsgul, the west area of Tuv, some part of Zavkhan, Khentii, Dornogobi, Dundgobi, Dornod and entire Uvs aimag.

ZUD RISK MAP:SPATIAL COMPARISON

Livestock loss number and percentage loss by soum /2015-2016 winter-spring/
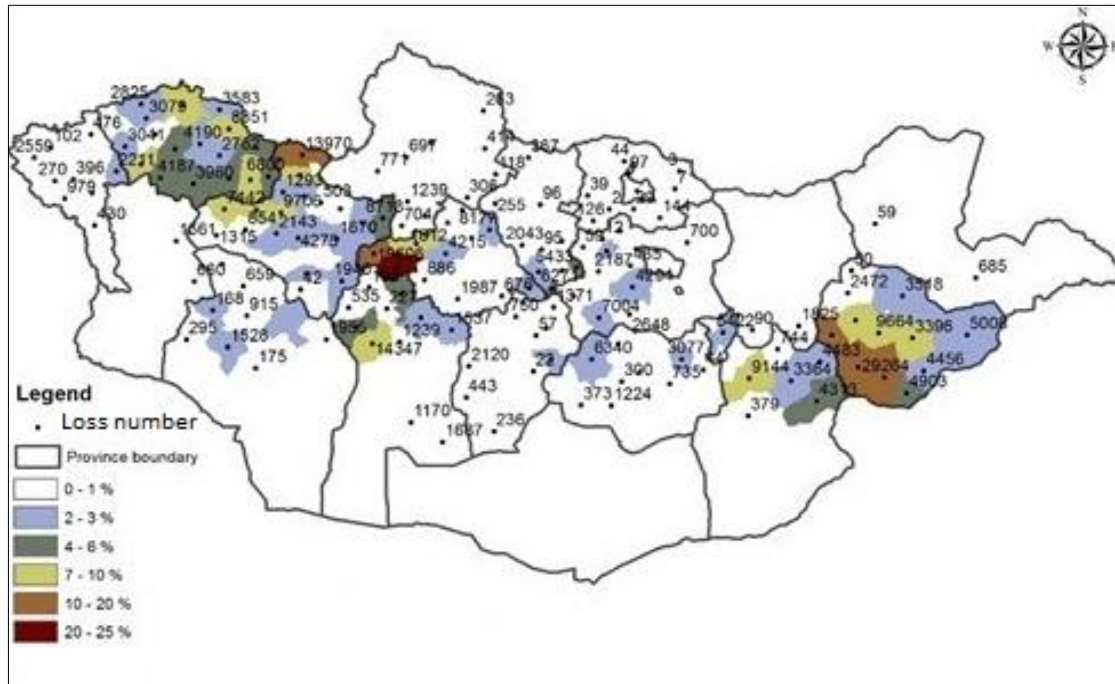
Livestock loss number on March 2016
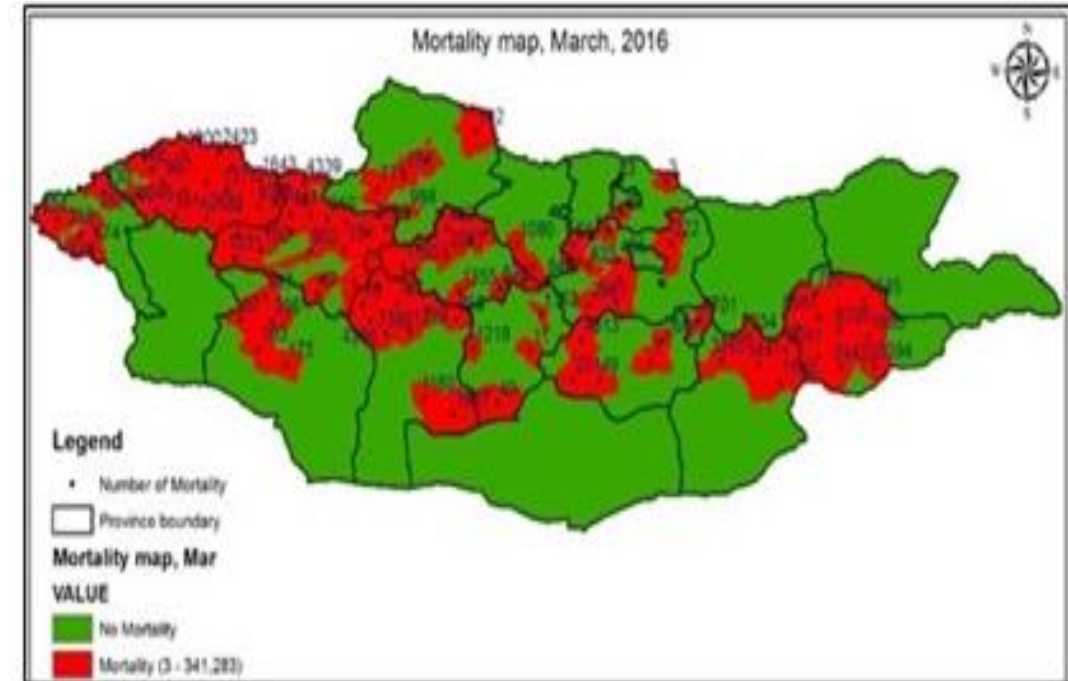
The aimags that lost the largest percentage of their livestock were Uvs (5.8%), Sukhbaatar (5.5%), Zavkhan (3.5%), and Arkhangai, Dornogovi, and Govisumber with 2.6 percent.

CURRENT APPROACHES OF ZUD EARLY WARNING

- Drought (summer condition) is mapped by IRIMHE every 10 days during warm seasons.

- Pasture carrying capacity (PCC) is calculated by IRIMHE at the end of August each year.

- Winter outlook is also provided by IRIMHE.

- Based on these data, wintering management plan is developed.

- Bigger areas (several aimags) are handled by government.

- Smaller areas (one aimag or several soums) are managed by aimag.

CURRENT APPROACHES OF ZUD EARLY WARNING

Flowchart of disseminating information
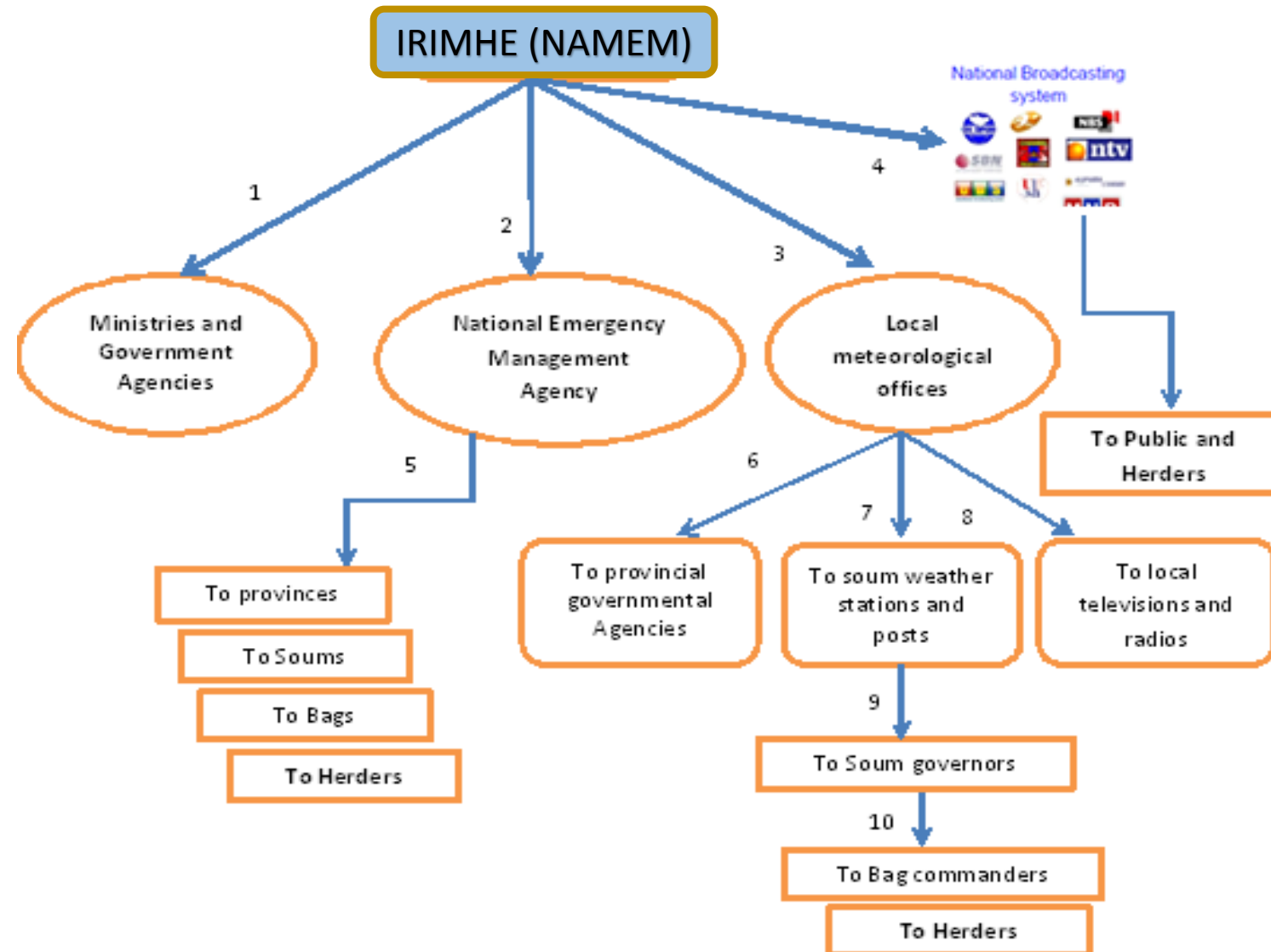
CONCLUSION

- Zud early warning is very important for better wintering management and reducing loss of livestock.
- There is need to improve the current zud early warning approach
- The current approach needs to be systemized
- The zud early warning related awareness needs to be raised and information/data needs to be utilized in a better, more efficient way.
- For early warning and reducing zud damage we started to produce zud risk map and accuracy of weather forecast is important.

THANK YOU