

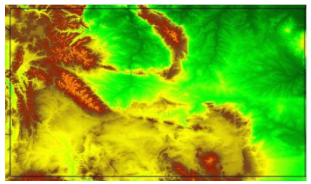

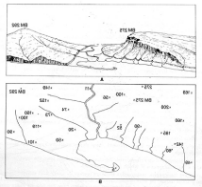
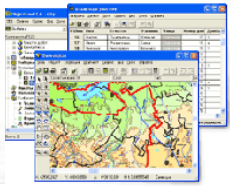

RUSSIAN ACADEMY OF SCIENCES
SIBERIAN BRANCH
BAIKAL INSTITUTE OF NATURE MANAGEMENT

The dynamics of the vegetable cover of Mongolian semiarid zone according to the multi-temporal LANDSAT images (the case of Darkhan city model field)

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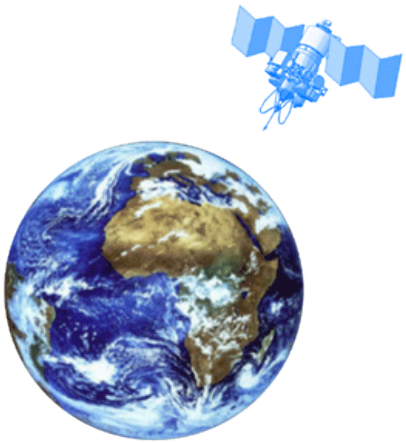
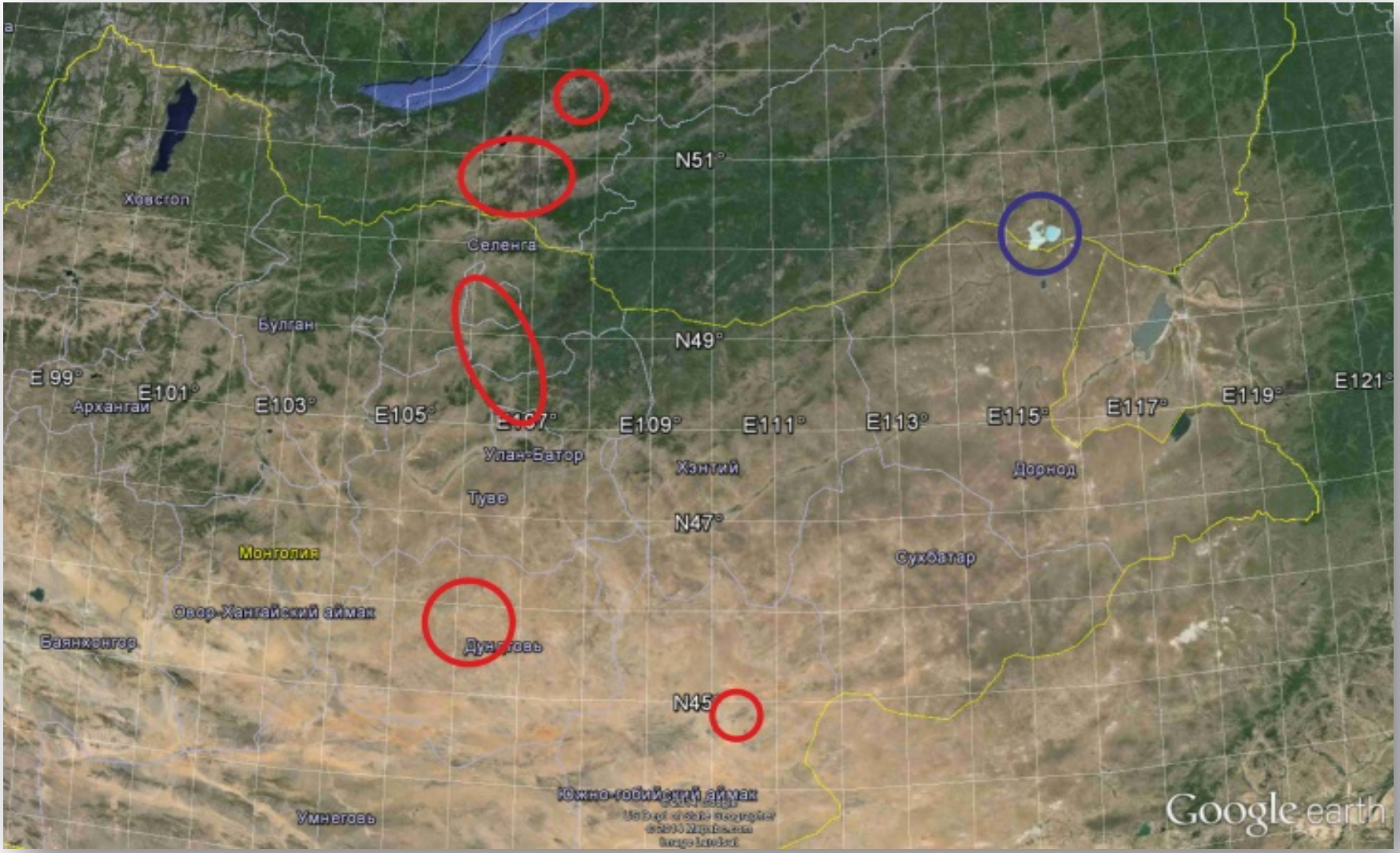


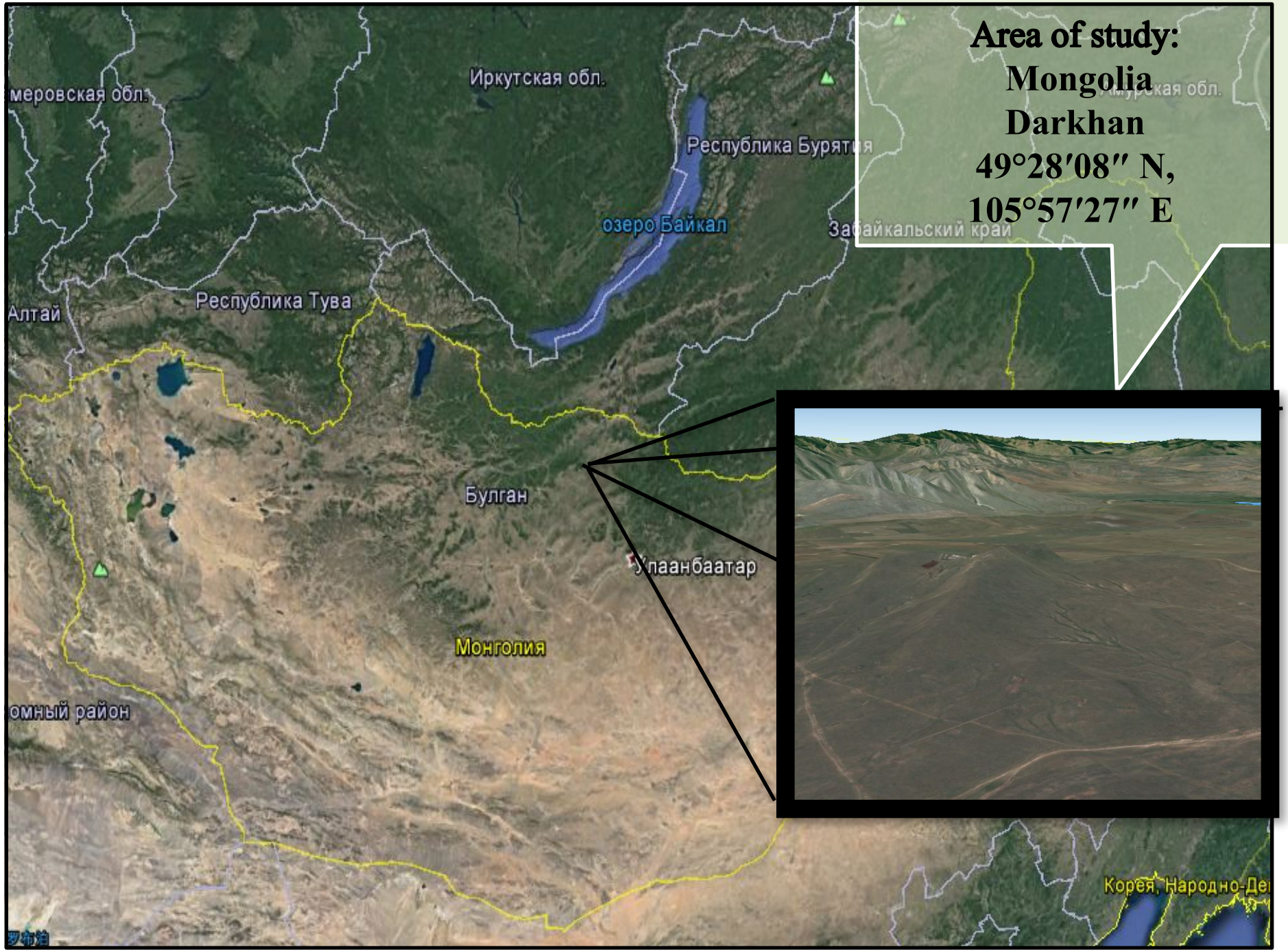
Tomsk – 2016

Climate changes and irrational nature management lead to the transformation of vegetable cover. During the last decades an increased grazing pressure on ecosystems has changed nature balance because of higher vulnerability of semiarid and arid ecosystems, entailing their degradation and desertification.

Today extremely great consideration is given to spatial and temporal dynamics of steppe plant associations in order to estimate their reactions to the present climate changes.

Baikal - Gobi transects between 51° to 44° N from 104° to 108° E




Area of study:
Mongolia
Darkhan
49°28′08″ N,
105°57′27″ E
Иркутская обл.
Республика Бурятия
озеро Байкал
Забайкальский край
Республика Тува
Алтай
Булган
Улаанбаатар
Монголия

Scheme of botanical-geographical zoning

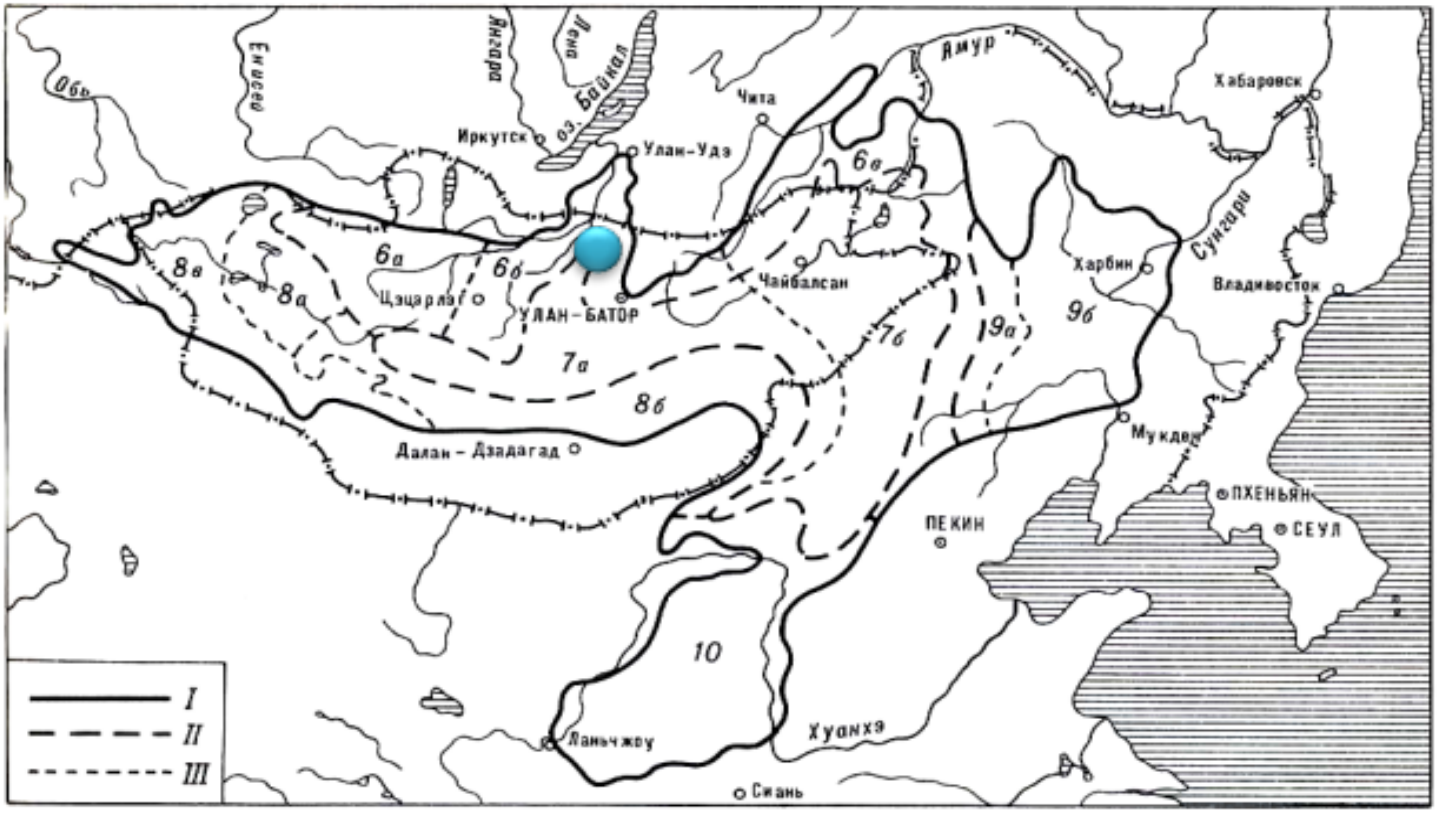
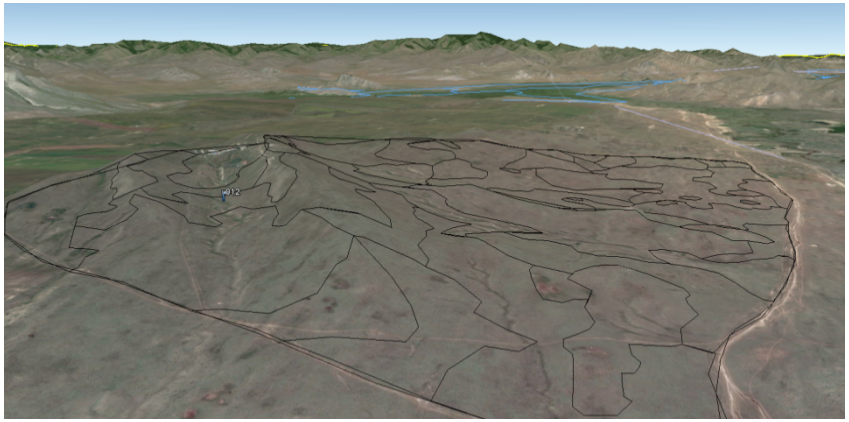


Рис. 2. Схема ботанико-географического районирования Центральноазиатской (Даурско-Монгольской) подобласти степной области Евразии.

Границы: *I* — подобласти, *II* — провинций, *III* — подпровинций.

Провинции: 6 — Хангайско-Даурская горнолесостепная, подпровинции: 6а — Западнохангайская горнолесостепная, 6б — Орхоно-Нижнеселенгинская горнолесостепная, 6в — Нерчинско-Ононская (Даурская в узком смысле) горнолесостепная; 7 — Монгольская степная, подпровинции: 7а — Среднехалхаская степная, 7б — Восточномонгольская степная; 8 — Северогобийская пустынностепная, *подровинции*: 8а — пустынностепная подпровинция котловины Больших Озер, 8б — Северо-восточногобийская пустынностепная, 8в — Монголоалтайская горностепная; 9 — Маньчжурская лесостепная (луговостепная), подпровинции: 9а — Сунгарийская лесостепная, 9б — Южнохинганская горнолесостепная; 10 — Шэнсийско-Ганьсуйская лесостепная и степная.

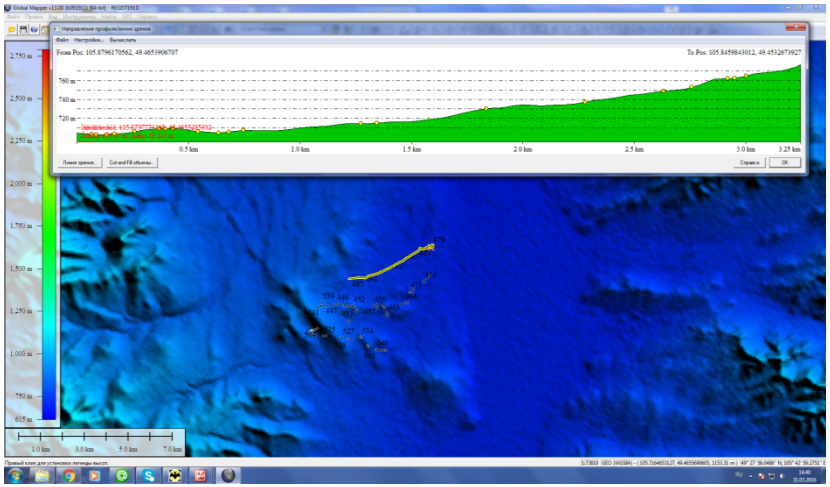
Е.М. Лавренко, З.В. Карамышева, Р.И. Никулина. Степи Евразии. – Л.:Наука, 1991. – 146 с.



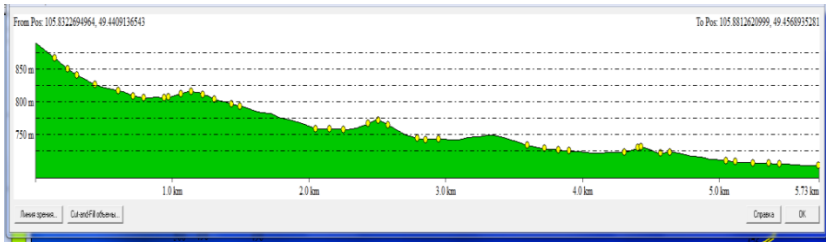
During the field season we performed 85 full geobotanical descriptions. The reliability of the research results was achieved by processing vegetation data directly on the research territory. For each site we identified the geographic coordinates using GPS.

Geobotanical profiles

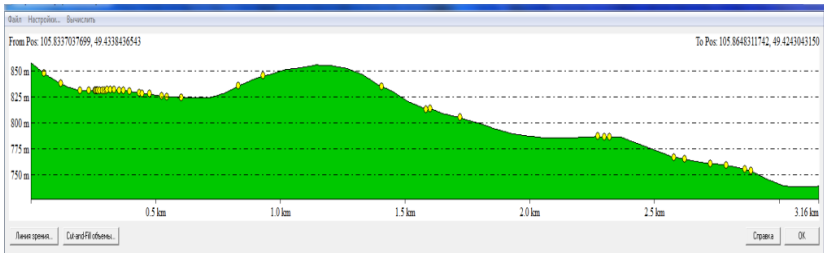
1)



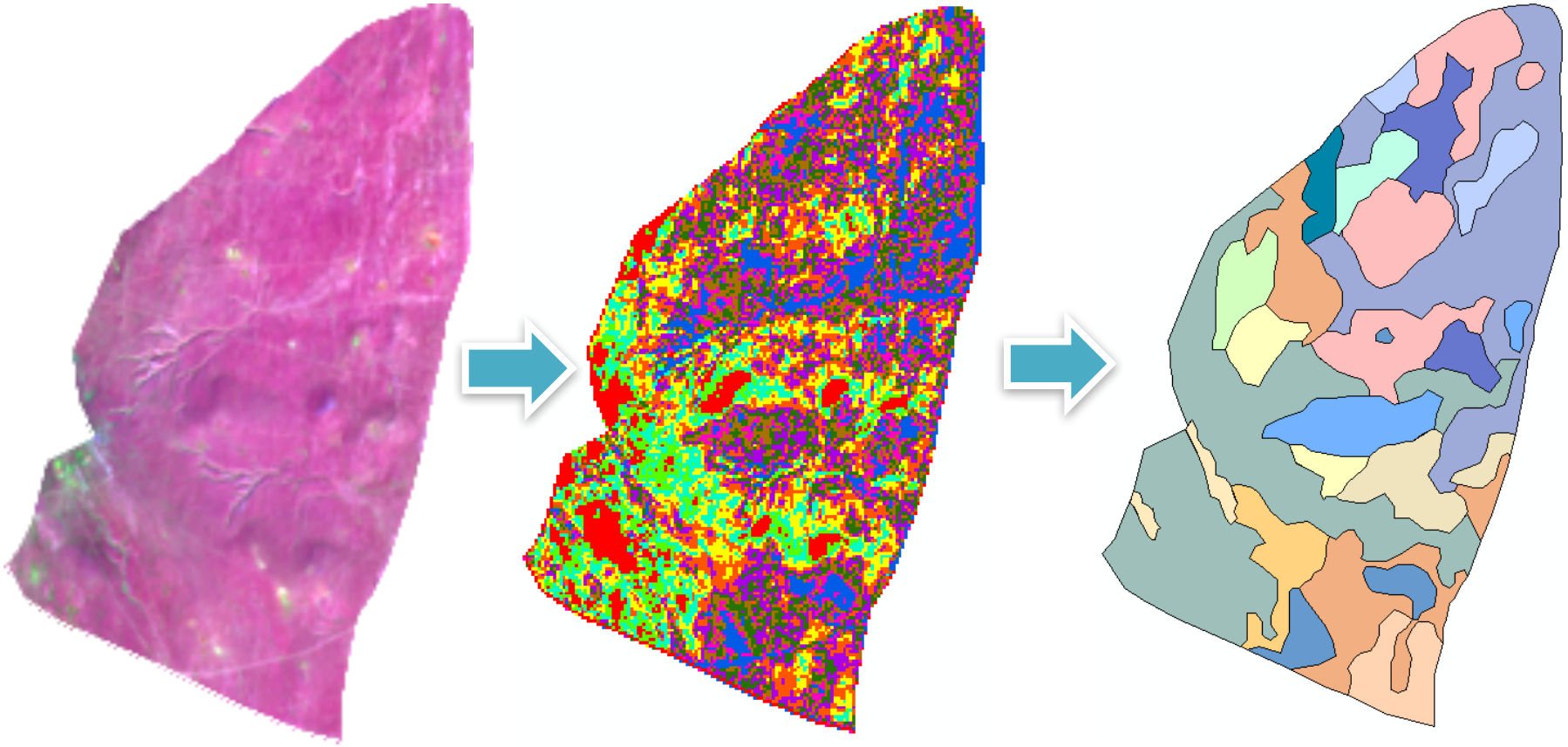
2)



3)



The stages of creating a large-scale geobotanical map:

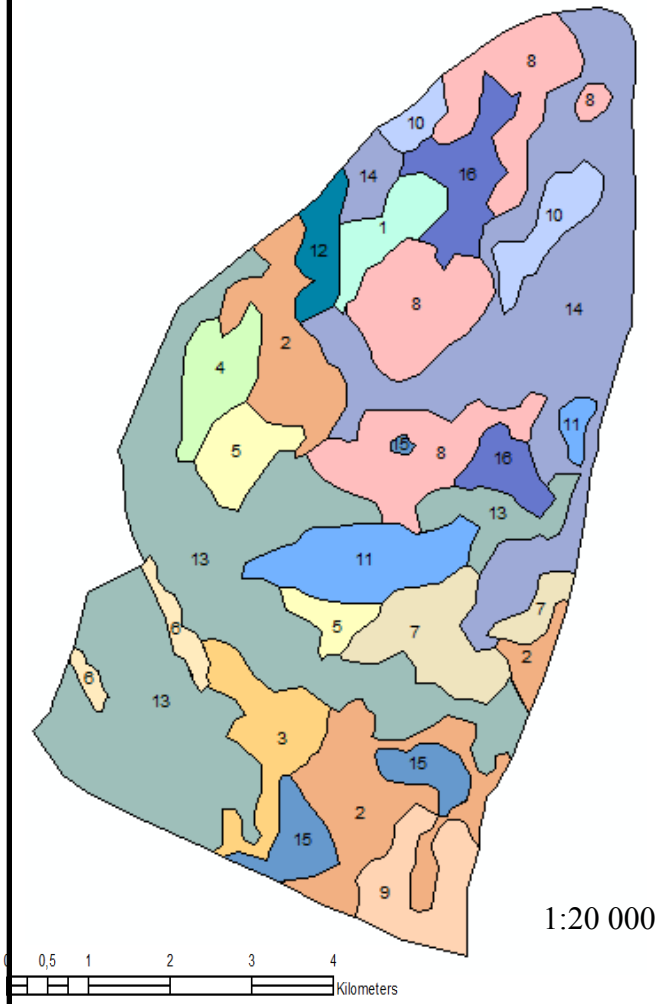


1) The initial satellite image

2) The automated decoding satellite image

3) The large-scale map of vegetation of the research territory

Geobotanical map of vegetation Darkhan polygon model



Гомогенная растительность

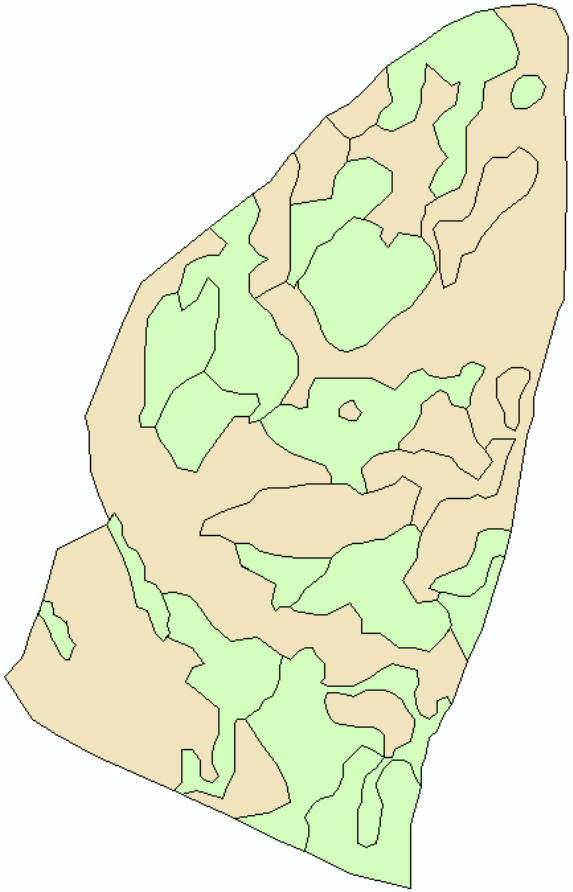
- Растопыреннозмеевковые степи
- Лапчатково-змеевковые степи
- Холоднополынно-змеевковые
- Холоднополынно-караганниковые степи
- Лапчатково--осоковые степи
- Ковыльно-осоковые степи
- Змеевковые степи
- Твердоватоосоковые степи
- Караганниковые степи

Гетерогенная растительность

- Комплекс растопыренно-змеевковых и лапчатково-осоковыхстепей (a:b, 30:70)
- Комплекс холоднополынно-житняковых и ковыльно-осоковых степей (a:b, 40:60)
- Комплекс лапчатково-змеевковых и ковыльно-осоковых степей (a:b, 60:40)
- Комплекс ковыльно-осоковых и холоднополынно-змеевковых степей (a:b, 40:60)
- Комплекс холоднополынно-змеевковых и лапчатково-осоковых степей (f:b, 40:60)
- Сочетание холоднополынно-житняковых с карагано-осоковыми и лапчатково-караганниковыми степями (a:b:c, z 40^30^30)
- Серия ковыльно-осоковых, растопыреннозмеевковых и лапчатково-осоковых степей (a:b:c, 50:30:20)

The chosen model field of the preliminarily deciphered LANDSAT image 2014 shooting was mapped . The map legend is built on the base of ecological and geographic principles, reflecting a connection between steppes and landscape features of the territory, taking into account the phitocoenotic, floral peculiarities of vegetable cover.

While mapping of the key site, both homogeneous and heterogeneous categories were identified. In this particular test site found 9 homogeneous units (feather grass, sedge et al.) and 7 heterogeneous community. Among the elementary chorologic units, microcombinations with a defined set of community, naturally repeating in the space, were found. Among them there are ethers and esters complexes and combinations.



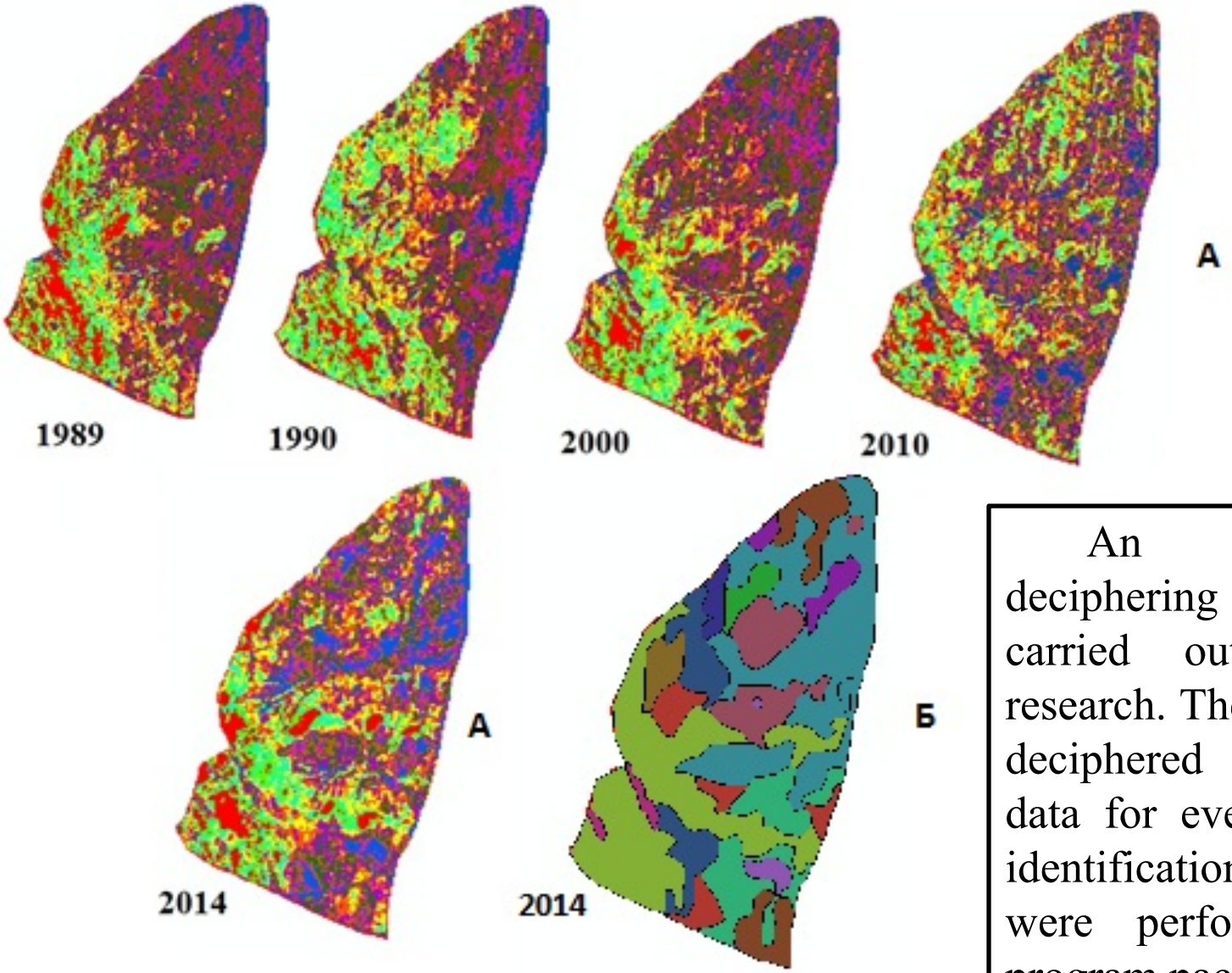
Homogeneous community	Heterogeneous community
76 %	24 %

Characteristics of the experimental set of satellite data

№	Satellite system	The combination of channels, M	Data	The combination of channels
1	Landsat – 8 (OII)	30	2014	7:5:3
2	Landsat – 5 (TM)	30	2010	7:4:2
3	Landsat – 7 (ETM+)	30	2000	7:4:2
4	Landsat – 5 (TM)	30	1990	7:4:2
5	Landsat – 4 (TM)	30	1989	7:4:2

One of the methods permitting to study vegetation state and dynamics is the analysis of multi-temporal satellite images. A precondition for the vegetation dynamics retrospective assessment, stimulated the researches, is the availability of the long-term history data from the LANDSAT satellite, which have a free access via Internet in terms of Global Land Cover Facility Program (http://glovis.usgs.gov). The resolution of the images taken by scanning systems TM, ETM+ from the LANDSAT satellite is 30 m. These scanning systems began working after 1982. In the 1970-ies the system MSS functioned, its spatial resolution was 80 m., but it may not be enough for vegetation cover deciphering in terms of the large-scale mapping.

The results of the automated classification of Landsat images by IsoData (A)
Map of vegetation Darkhan polygon model (B)



An automated deciphering has been carried out during the research. The Linking of the deciphered multi-temporal data for every site and an identification of the changes were performed via the program package ArcGIS

Conclusions

Almost everywhere the current vegetation cover is presented by modified communities, many of them are the stages of degradational successions, formed as a result of constant (seasonal and year-round) cattle grazing. Because of the overgrazing the vegetation of these landscapes is on the stage of middle digression. Vegetable species are in bad vital condition. General projective herbage doesn't grow under 40%, while the average value is 15-20%. Assessment of the species coenotic value was made basing on activity of the species. Comparative analysis of middle projective herbage showed, that 4 species have maximal coenotic value: *Carex duriuscula* (C.A. Meyer), *Caragana microphylla* (Pall.) Lam., *Artemisia frigida* (Willd), *Potentilla acaulis.* Their middle projective herbage is quite big (6-10%). It is established that coenotic value of these species considerably change in the communities of different types of relief. Projective herbage of bushy, feather-grass coldwood sedge steppes reaches 20-35%. Concerning species, there are *Carex duriuscula* C.A. Meyer, occupying 7-10% from the general projective herbage; *Caragana microphylla* (Pall.) Lam. – 8-10%; *Cleistogenes squarrosa* (Trin.) Keng – 3-4 %. In September of 1990 some of these phytocenosis, located in the western part of the area, had the bigger projective herbage, that is why the bigger part of species was presented by sedges, feather grass and forbs.

The received data prove the possibility to use space images to study natural territories. Global long-term LANDSAT data which are accumulated by the present time can be found on the free access via Internet. Moreover, they give a great opportunity to get the retrospective assessment of vegetation cover dynamics.

Thank you for attention!