GLOBAL SYMPOSIUM ON
SALT-AFFECTED
SOILS

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Natural resource management and monitoring at salt-affected inter-channel depressions of Amu Darya delta under desertification for the liquorice restoration

Polat Reymov

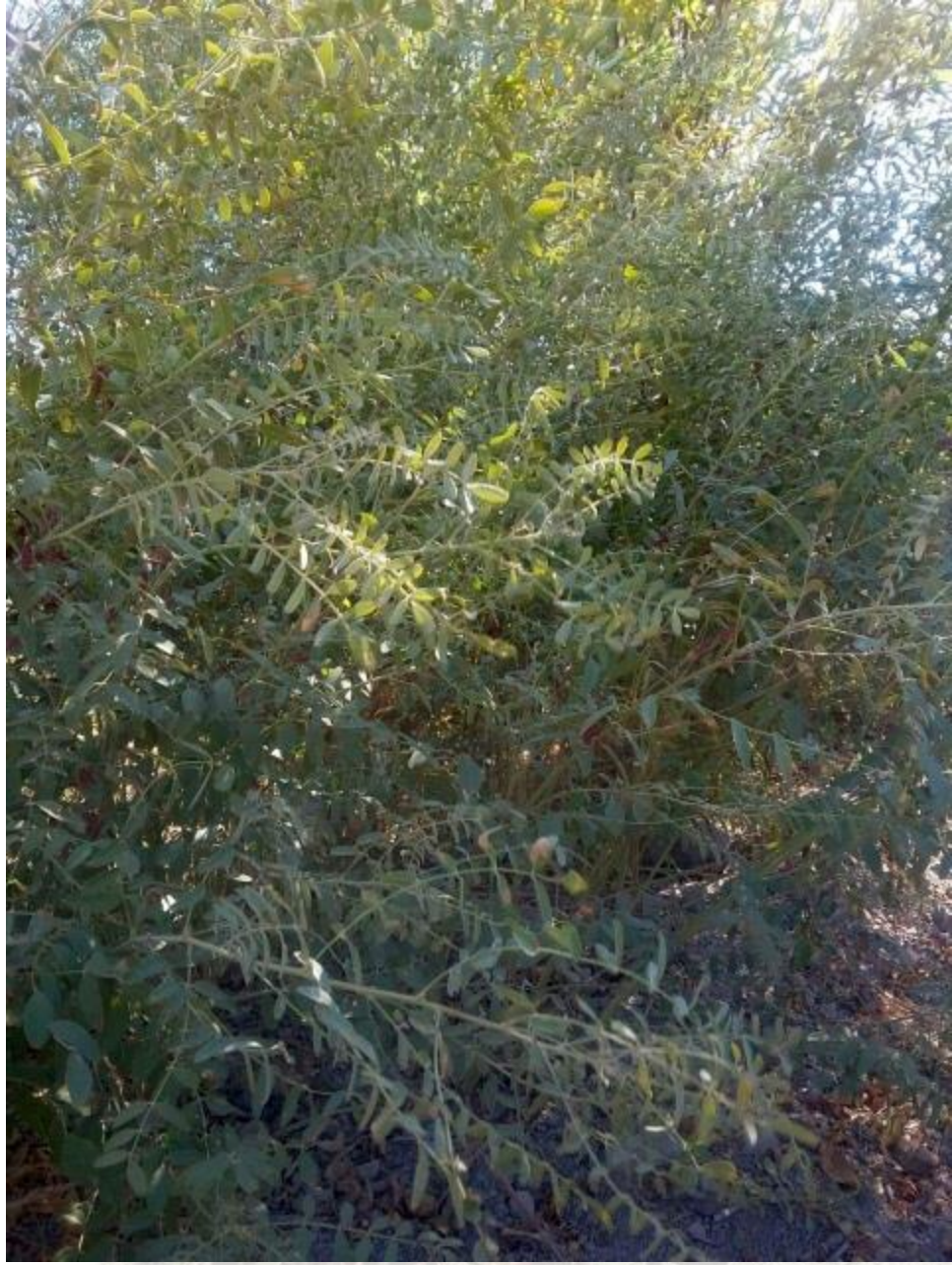
Authors

- Reymov P.R.
- Mamutov N.K.
- Statov V.A.
- Khudaybergenov Ya.G.

Karakalpak State University

Nukus

Uzbekistan

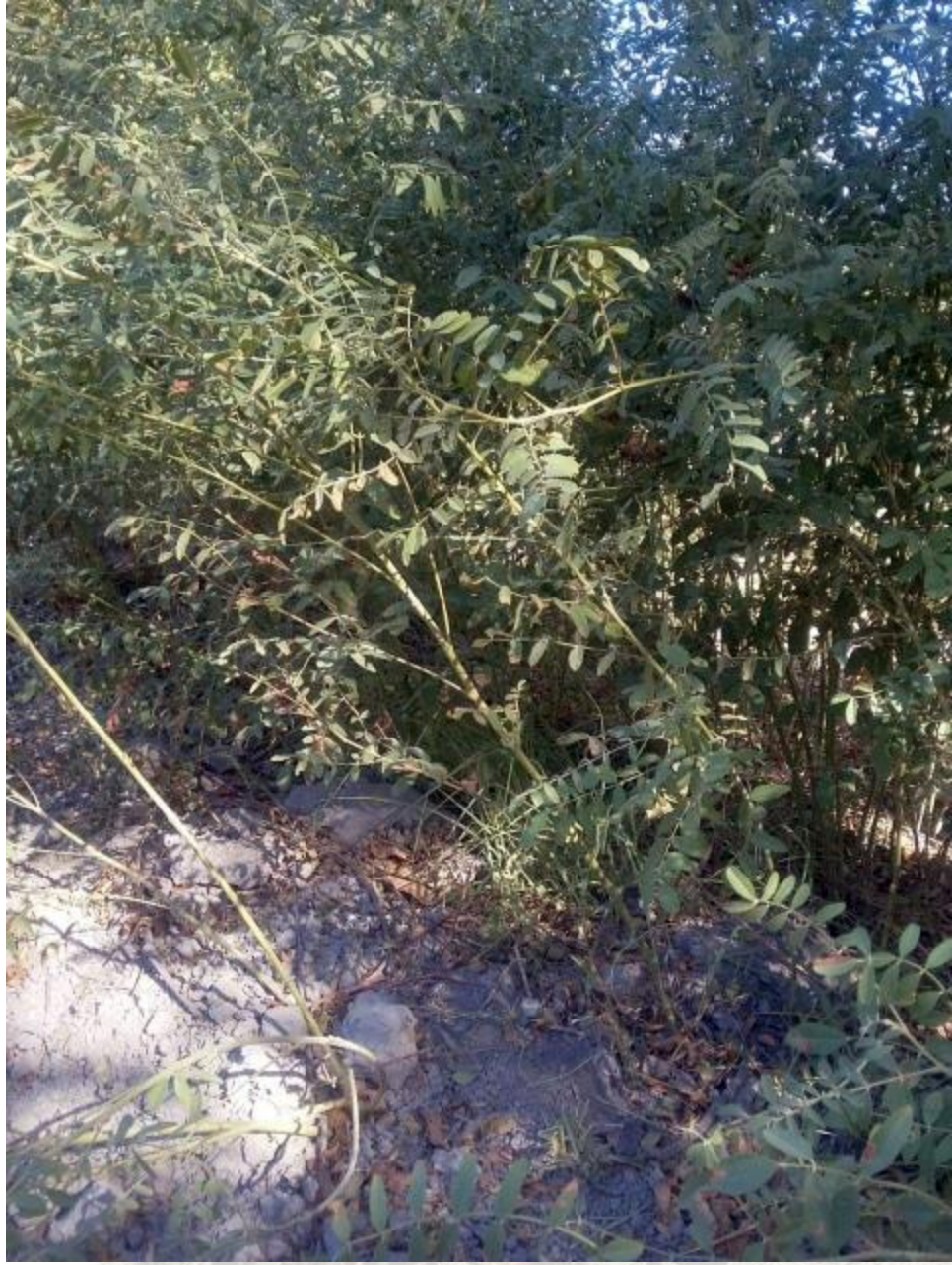


Liquorice and biosaline agriculture

- Licorice, being a halo-tolerant phreatophyte, has considerable ecological resilience and until recently formed licorice-karellinia, licorice-camelthorns and other plant communities that occupied considerable areas in the non-irrigated part of the Amu Darya delta. However, deterioration of edaphic conditions as well as uncontrolled harvesting of plant material led to significant decrease of licorice stocks in the wild.

Liquorices as resource plant

- One of the most vulnerable components of the delta geosystem is inter-channel depressions bounded by levees. These landscape units are important as pastures and a source of wild herbs, especially licorice (*Glycyrrhiza glabra*). Even under unfavorable desertification conditions, the yield of licorice massifs reaches 6 tons per hectare [2].



Ecological stress

- One of the consequences of the Aral ecological crisis is the degradation of the Amu Darya delta. Decrease of natural river flow, termination of floodplain regime, wide use of the drainage water for the lakes and wetlands watering leads to anthropogenic desertification, reduction of biodiversity and deterioration of soil quality

Liquorice restoration – methods and outlooks

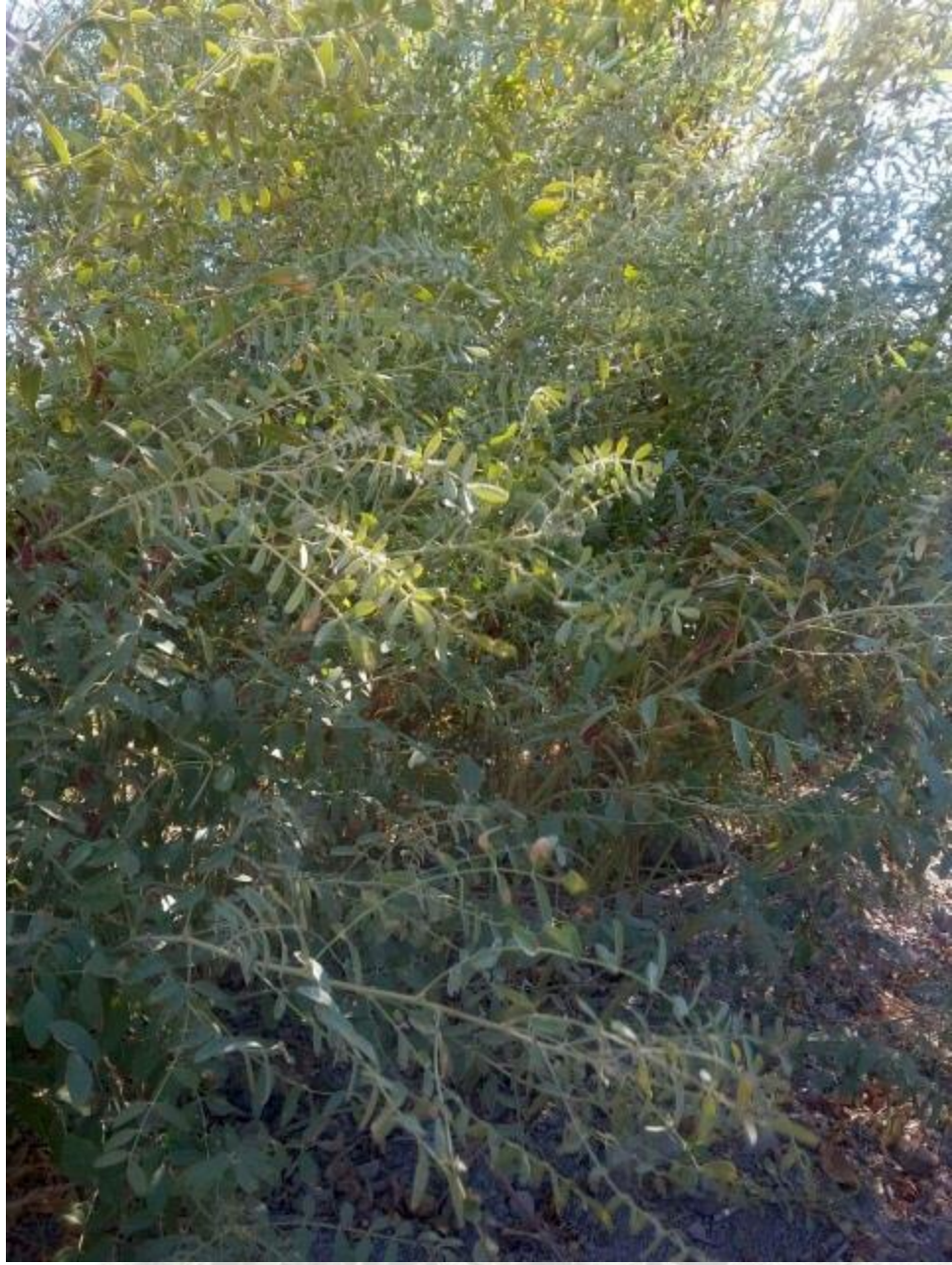
- Restoration of licorice in natural habitats, both independent and combined with measures on pastures phytomelioration after overgrazing, requires considerable efforts and means, therefore it is important to zone the restoration area according to optimal edaphic conditions for the Licorice vegetation, considering dynamics of groundwater level, soil salinity, soil mechanical composition and species composition of phytocenoses that replace economically valuable species.

Landscape analysis

- To solve this important problem of environment engineering, we propose combining geoecological models of landscape transformation with model-oriented recognition of remote sensing data. This geosystem-adapted approach has been developed earlier for the non-stable landscapes of the desertified delta of Amu Darya

Remote sensing data processing

- We used high-resolution space imaging from LANDSAT-7 and SETNTINEL satellites, SRTM-based DEM products and some retrospective information on Amudarya delta landscape transformation, including field data.
- We calculate NDVI, SAVI, BI, COSRI salinity indexes, enhanced built-up and bareness index (EBBI) and ᴍodification of normalized difference water index (MNDWI). Also we used MODIS-derived annual NDVI sequences to discriminate type of flora

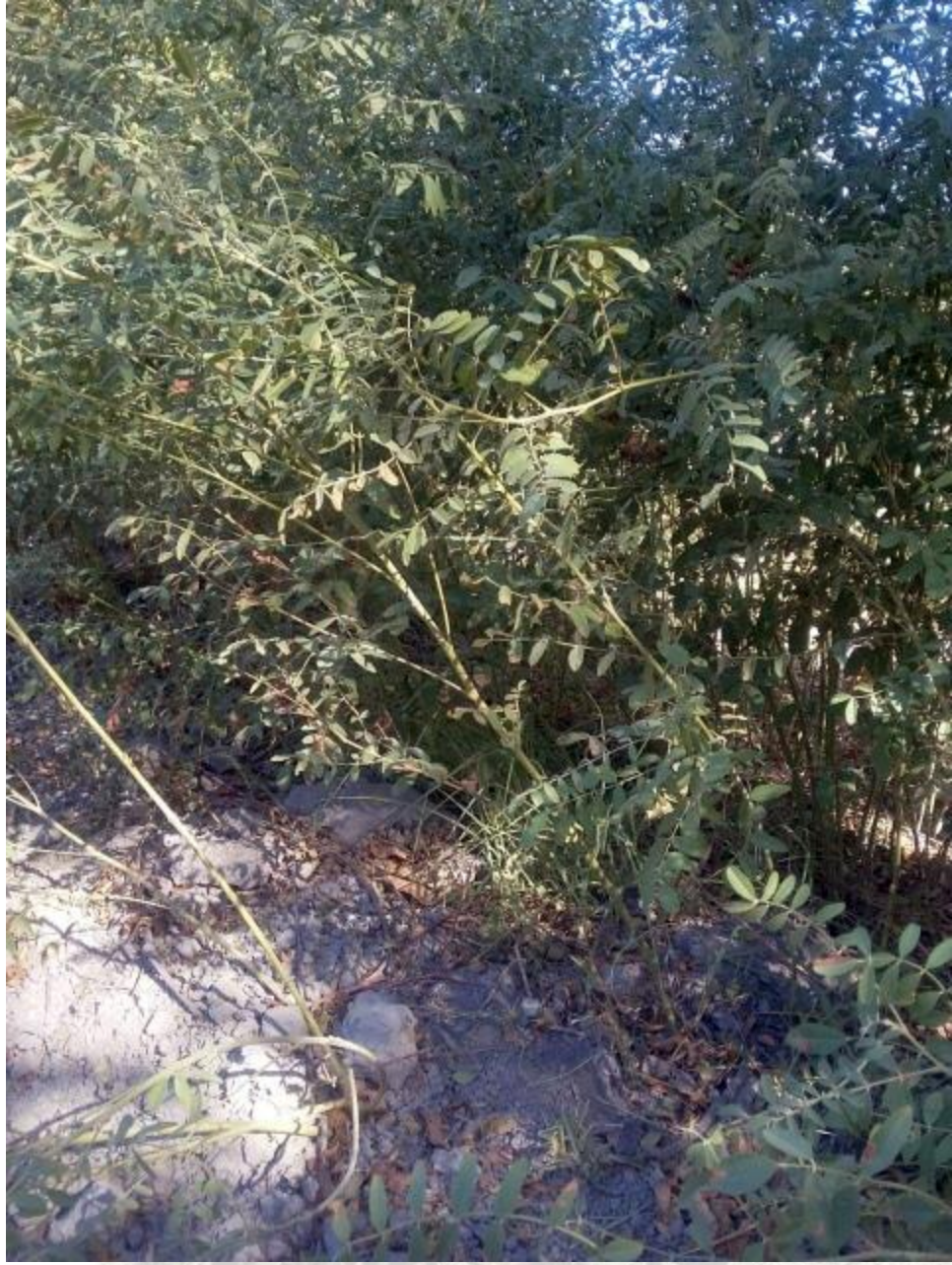


Integrated model for the ecological conditions prediction

- Connection of landscape transformation model with optical change detection based on a spatial distribution and long-term dynamics of vegetation can be effective tool for natural resources mapping and support of phytomelioration measures. Comparison of the obtained results with sparse field data for key points demonstrates good correlation of the predicted environment conditions with licorice occurrence.

Conclusions and recommendations

- Extended landscape mapping based upon both space images interpretation and landscape transformation model demonstrates better prediction powers then common methods of multi-spectral images classification.
- Use of the remote sensing data classification could me more effective being assembled with models of landscape transformation and soil map to predict soil salinity and groundwater level. This approach has a good predictive ability to select most suitable sites for licorice thicket restoration in Amu Darya delta.



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