

## NNX15AD42G Annual Progress Report – Year 1

### Management of social-ecological grazing systems in the Altai Mountain transboundary zone

PI: Giorgos Mountrakis (gmountrakis@esf.edu – 315.470-4824)

Co-PI: James Gibbs (jpgibbs@esf.edu - 315.470-6764)

NASA Program Manager: Garik Gutman (NASA LCLUC Program)

#### Progress Summary

Our first year was successful both in terms of completed tasks but also via promising initial results. The most challenging component of the grant (in terms of execution, not time or cost) is finished as we managed to obtain herders' interviews from Russia and Mongolia. Within the allocated budget we also obtained comparable interviews from Kazakhstan, which was not identified in the original proposal but it is expected to significantly improve our analysis. We have largely completed the four country comparison of change in NDVI over time and find a clear signal of disintegration of the Soviet system on grassland productivity albeit with many country-specific nuances. We have started incorporating remotely sensed data with herder data to understand how this socio-economic system work and began to apply Ostrom's framework for doing so. We also expect to integrate the remoted sensed data with UAV-derived or Quickbird data next year. We are looking into a promising machine learning method, Deep Neural Networks, as a technique that would allow us to integrate data from multiple spatial and temporal resolutions. We are also working on establishing per-pixel accuracy metrics for classification purposes that would support error propagation in our models.

#### Itemized Progress

The proposed grant duration is three years. The following annual milestones were submitted in the proposal:

1. Secure research permits from Russia and Mongolia as well as human subjects research approval from home institution.
2. Structured Interviews with 50 herders in Sailyugem Range along Russia-Mongolia border during summer.

Interviews have been conducted with 53 herders in Mongolia, 51 in Russia and 34 in Kazakhstan. We are in the process now of analyzing the data.

3. Landsat/MODIS data acquisition and multi-temporal stack creation, integrated with teaching activities.

Multi-temporal MODIS data have been collected, synthesized by country and year, and linked to herders' perception of pasture quality. A manuscript is currently under review [1]. These data will be incorporated into teaching activities in year 2.

4. Mongolia-based high resolution reference data acquisition through UAV-based imaging of 100 1 km<sup>2</sup> plots spatially coincident with Landsat/MODIS cells in low and high elevation grasslands in western Mongolia.

Due to export controls and FAA strict regulations we have not acquired UAV-based data yet. We performed an in depth investigation of available platforms and sensors and we expect to collect data in year 2.

We are also considering using Quickbird high spatial resolution imagery through the NGA-NASA cooperative agreement that we were made aware of in the April LCLUC meeting. We have submitted the necessary paperwork and now we are waiting for approval to download data.

5. Initial investigation on the spatio-spectral evolution profile creation.

We are currently working on using Deep Neural Networks (DNNs) to study the relationship between datasets of various resolutions for classification purposes. We are also developing a new methodology for pixel-based accuracy metrics that is expected to assist with error propagation in our models.

6. Develop a project website and disseminate information about the project broadly.

The website will be finalized by year 2, when we will report our first findings.

### **Publications**

[1] Paltsyn, M. Y., J. P. Gibbs, L.V. Iegorova, G. Mountrakis (in review). Estimation and Prediction of Grassland Cover in Western Mongolia using MODIS-derived Vegetation Indices. Remote Sensing Letters.