Environmental Changes, Migration, and Remittances Affect Pastoralist Communities in Montane Central Asia

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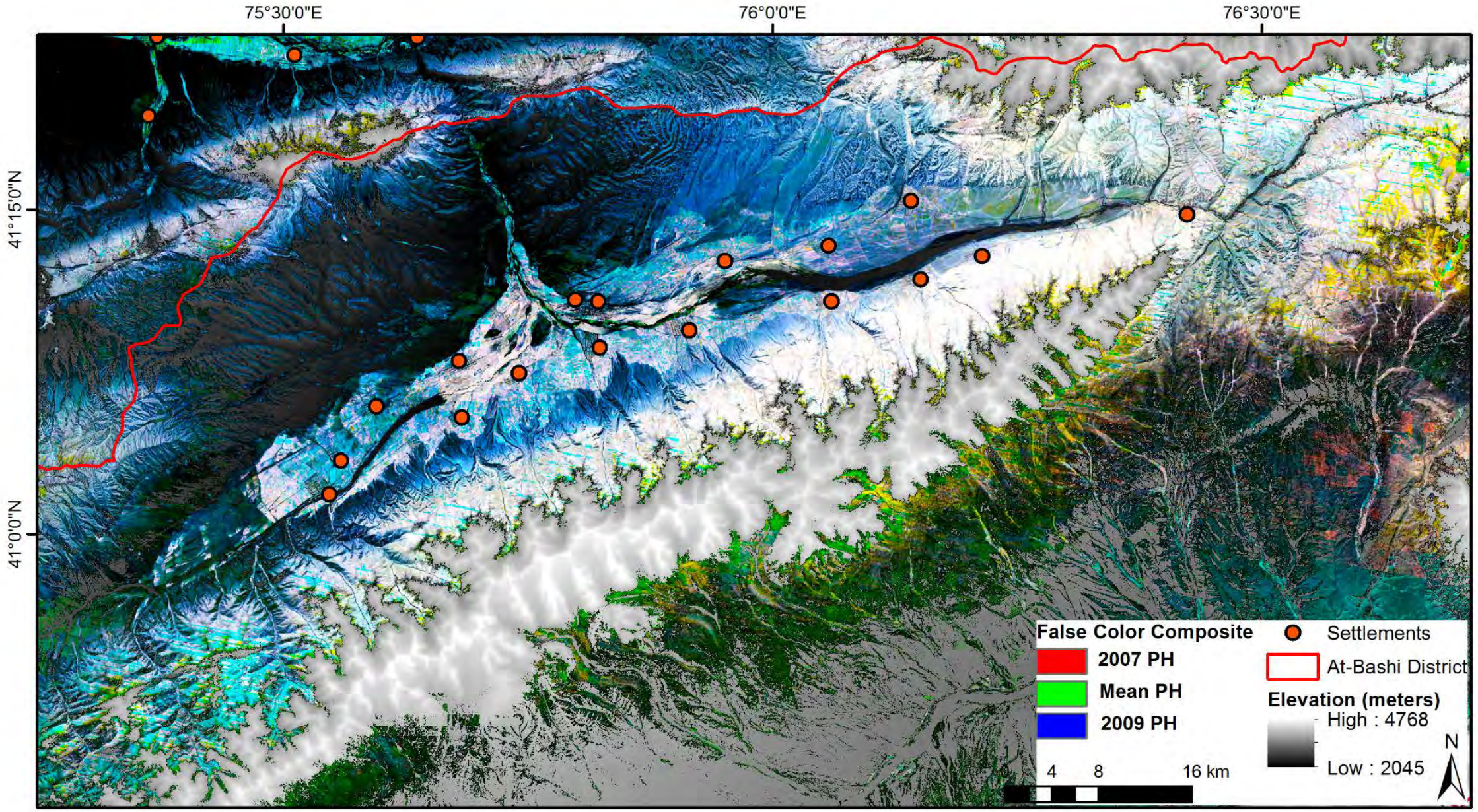
Naryn and At-Bashy rayons in Naryn oblast in central Kyrgyzstan

Phenometrics in At-Bashy rayon: NDVI ***Peak Heights*** from CxQ model displayed in false color composite: dry year (2007) & mean (2000-2015) & wet year (2009)




Explaining phenometric maps to local pasture committee members in At-Bashy rayon
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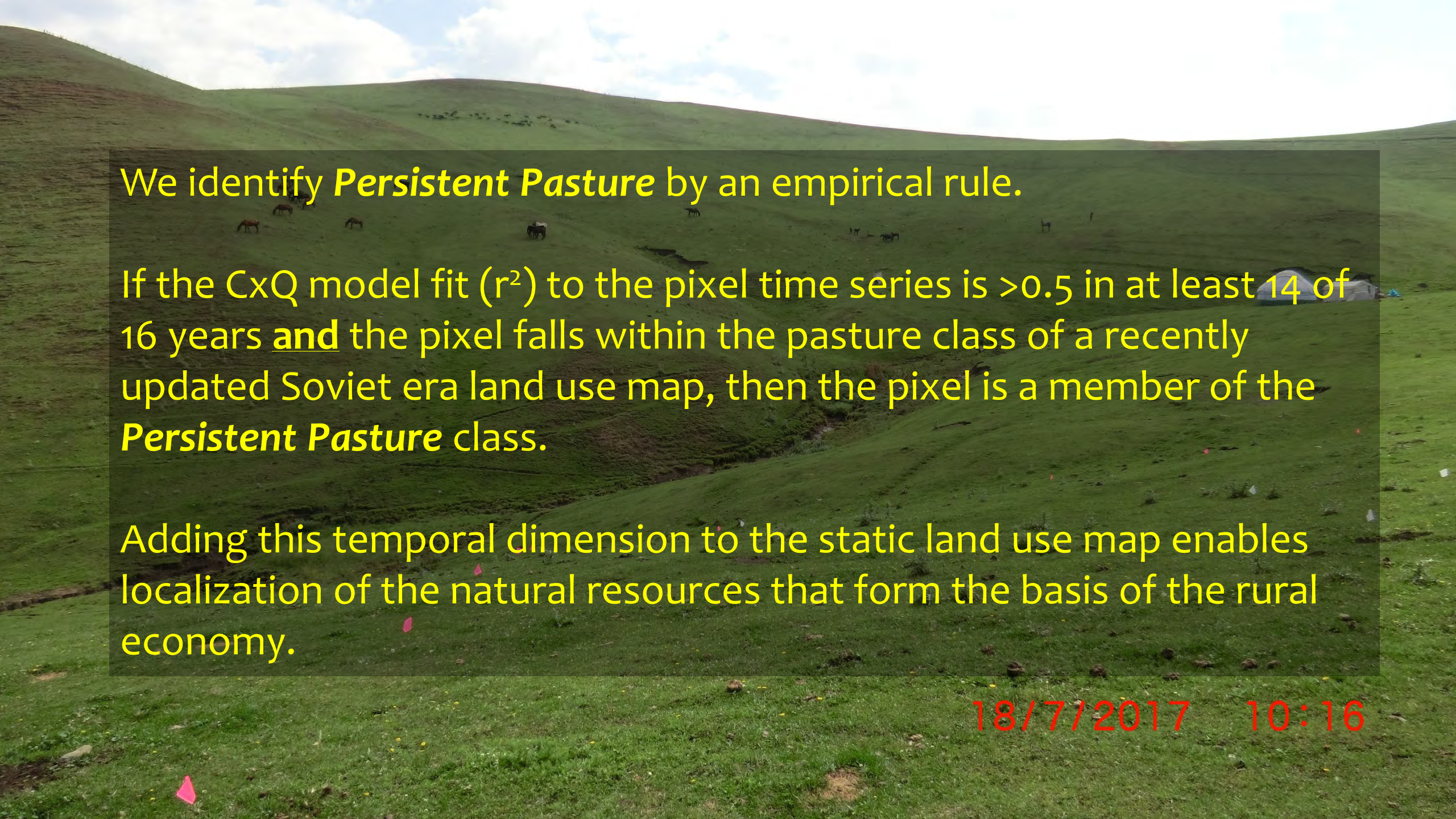
We identify ***Persistent Pasture*** by an empirical rule.
If the CxQ model fit (r^2) to the pixel time series is >0.5 in at least 14 of 16 years **and** the pixel falls within the pasture class of a recently updated Soviet era land use map, then the pixel is a member of the ***Persistent Pasture*** class.
Adding this temporal dimension to the static land use map enables localization of the natural resources that form the basis of the rural economy.
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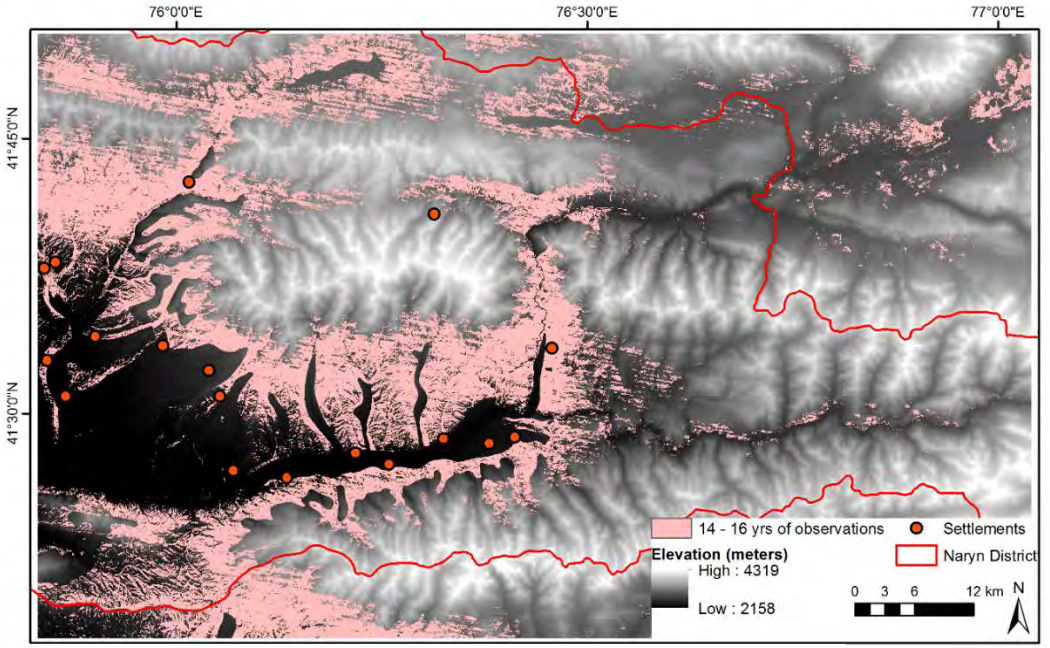
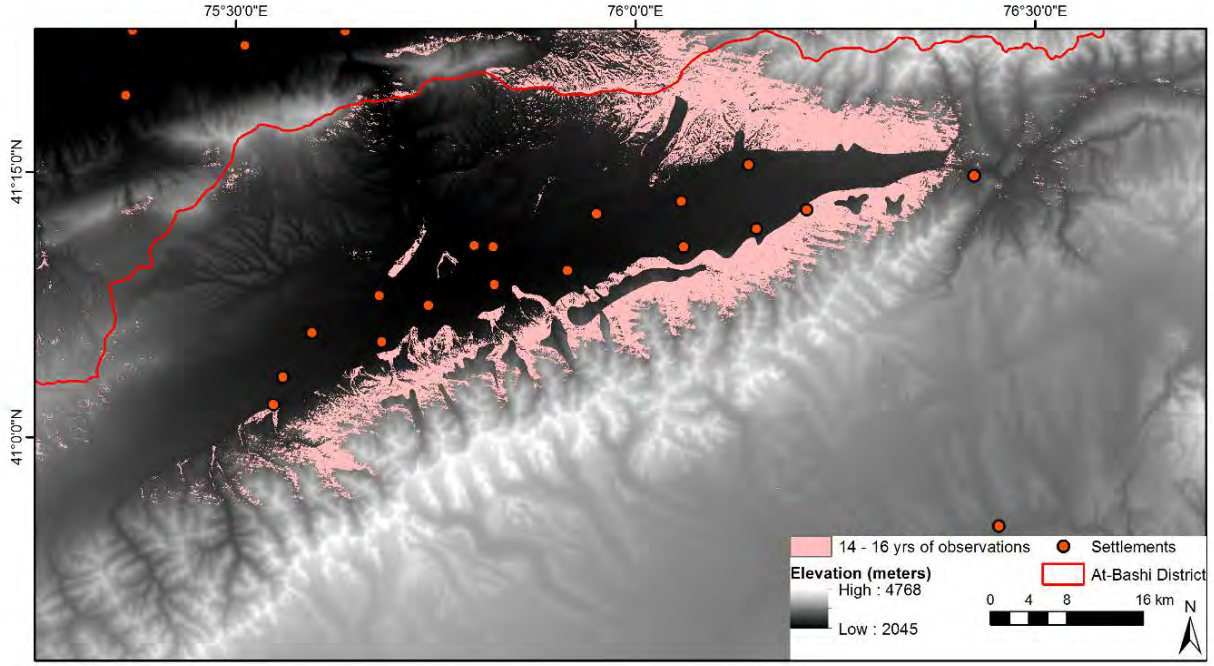
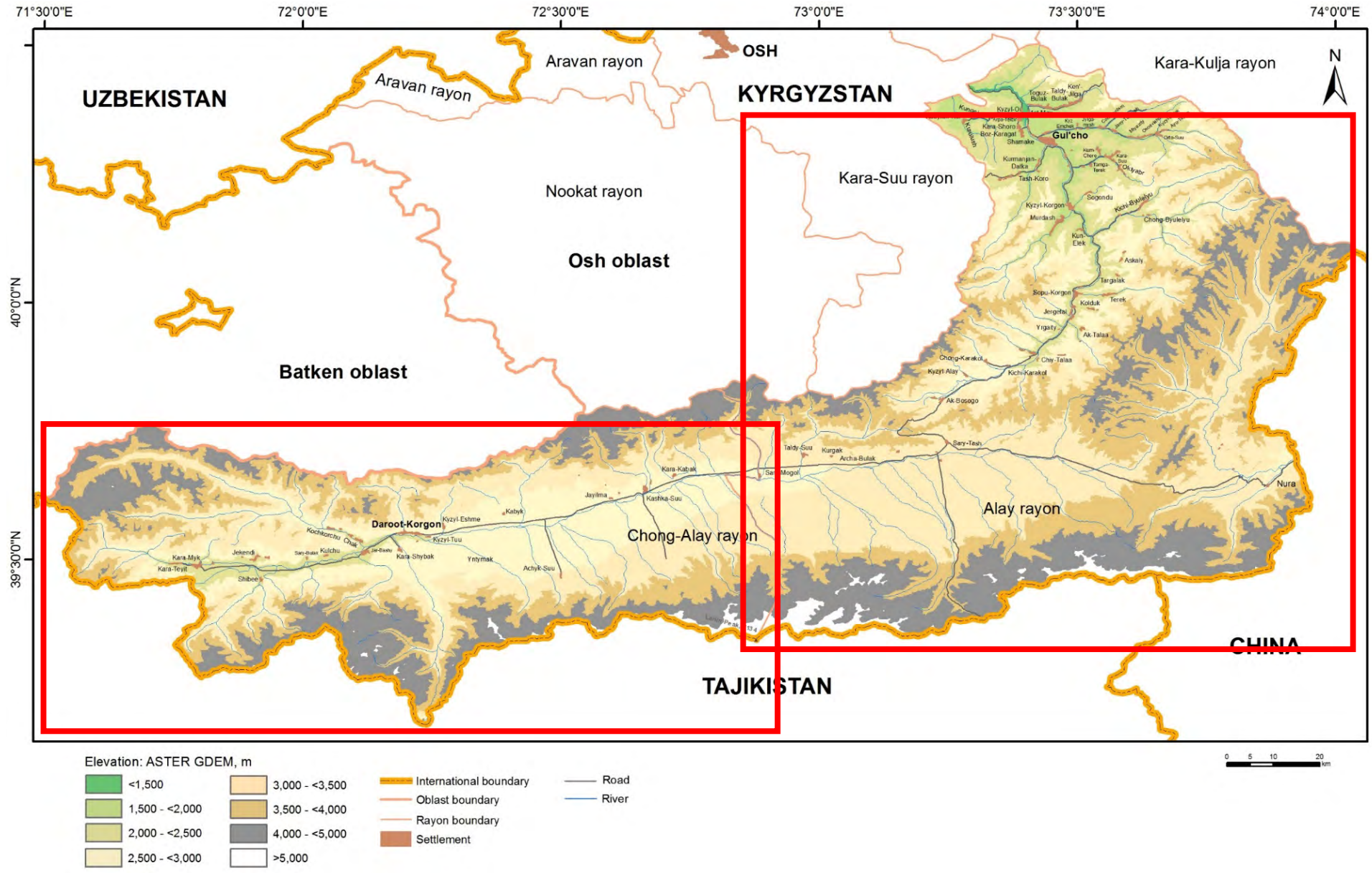
Persistent Pasture Resources in Naryn and At-Bashy Rayons were identified as those locations successfully modeled with Landsat 30 m & MODIS 1 km data in 14 of 16 years.

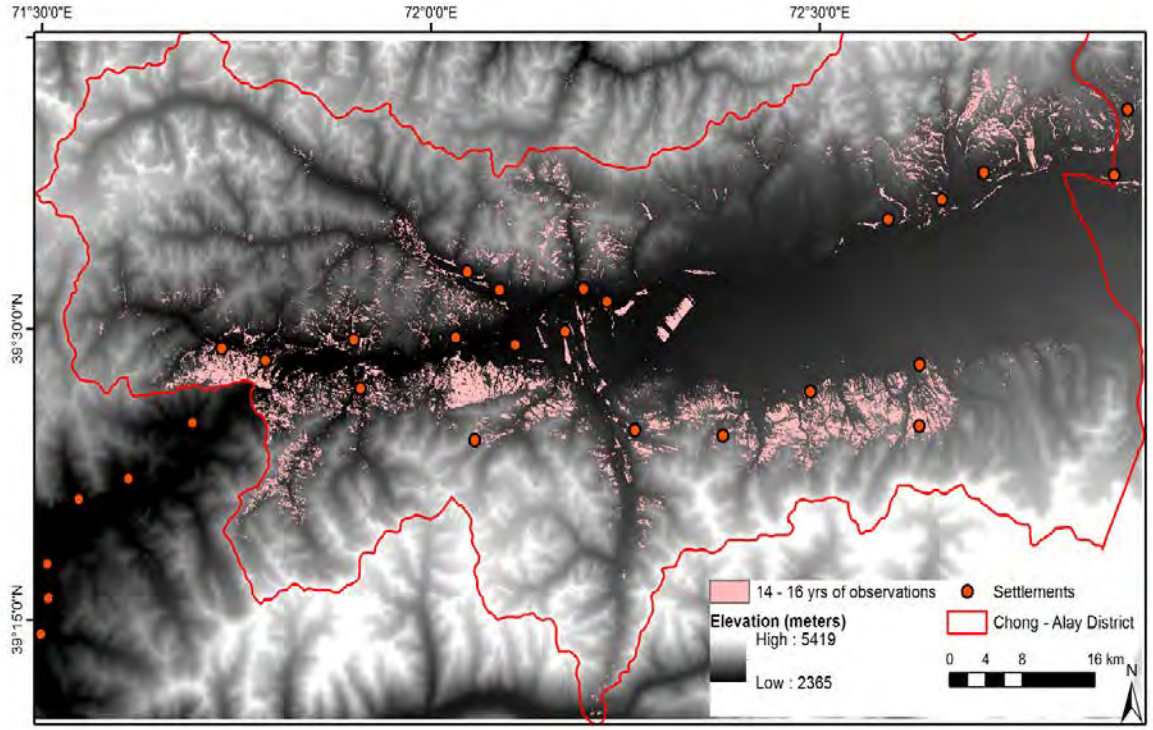


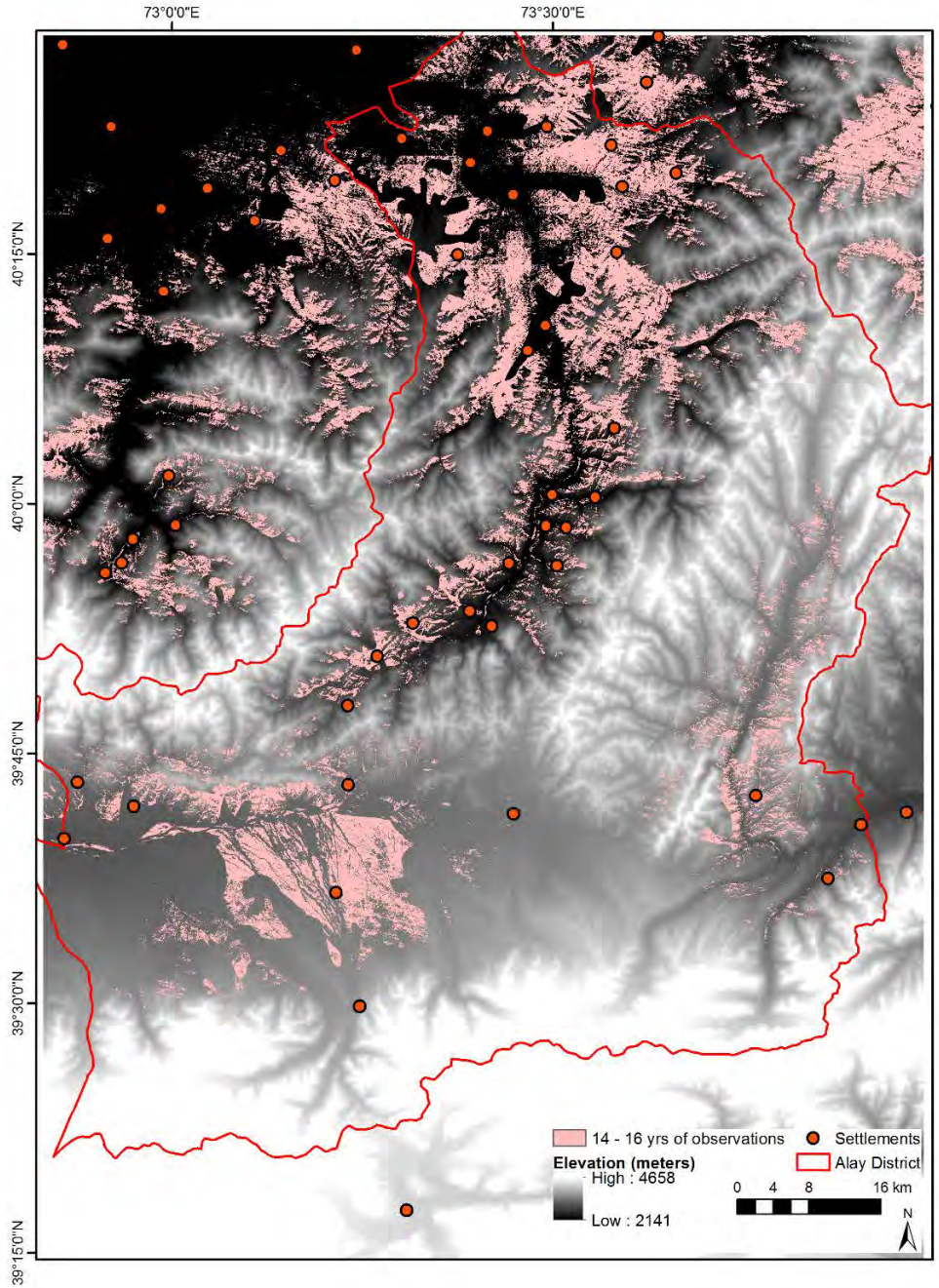


Alay and Chong-Alay rayons in Osh oblast in southern Kyrgyzstan



Persistent Pasture Resources in Chong-Alay and Alay Rayons



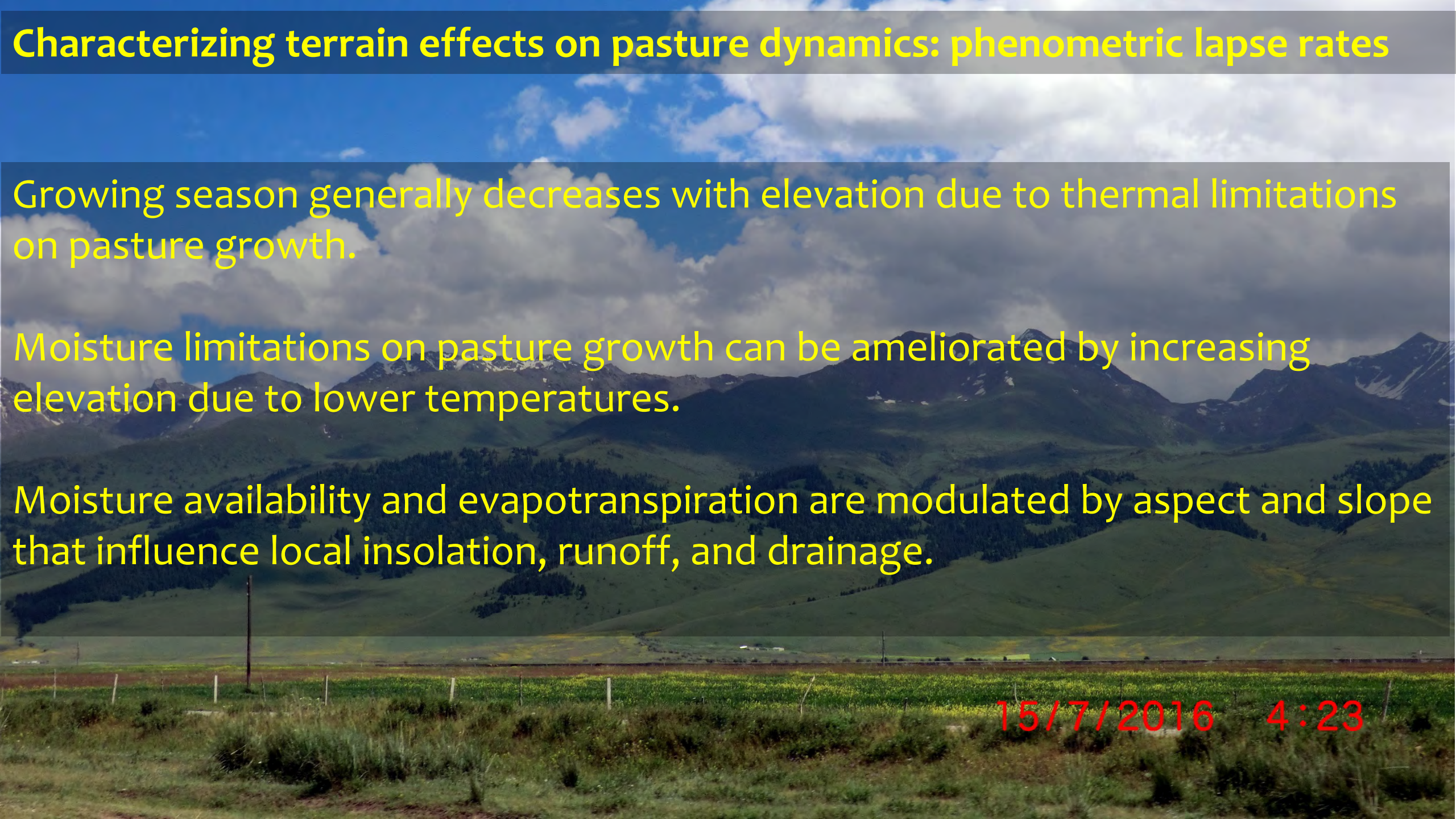


Characterizing terrain effects on pasture dynamics: phenometric lapse rates

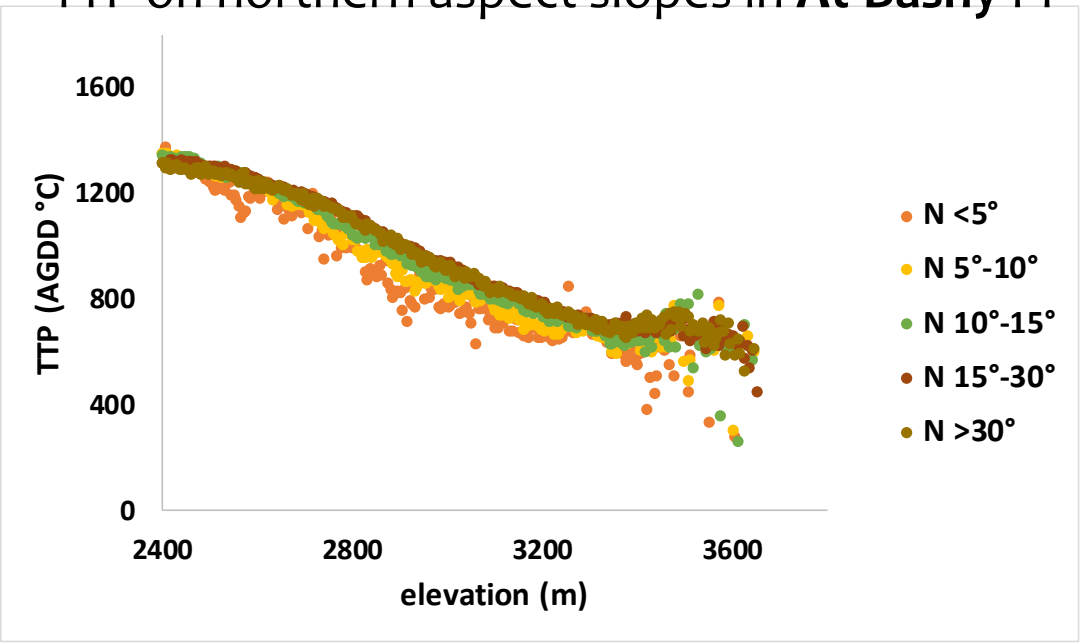
Growing season generally decreases with elevation due to thermal limitations on pasture growth.

Moisture limitations on pasture growth can be ameliorated by increasing elevation due to lower temperatures.

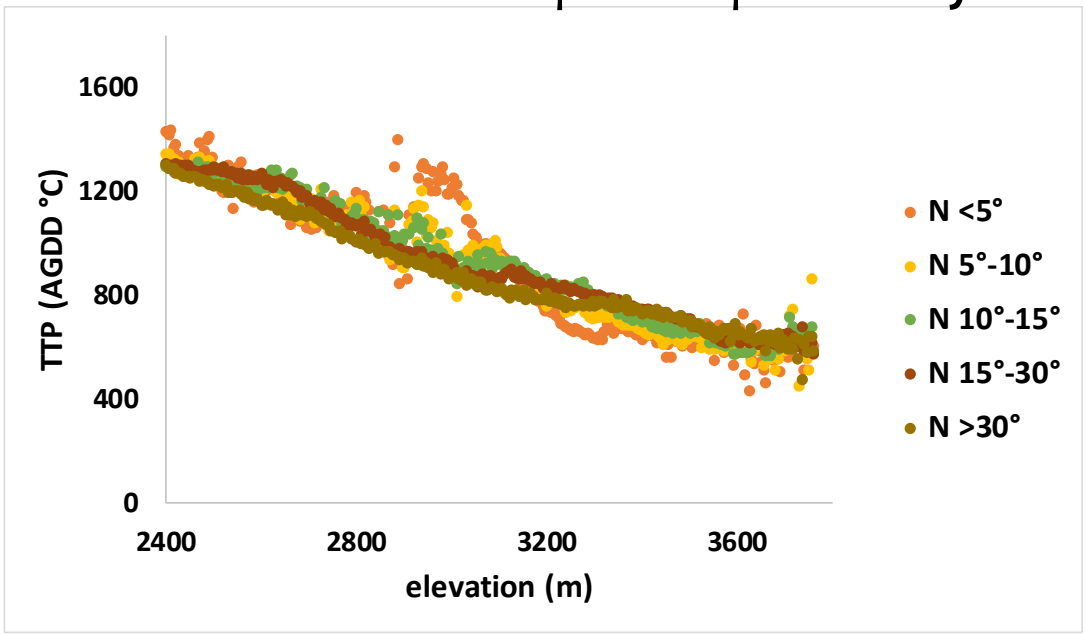
Moisture availability and evapotranspiration are modulated by aspect and slope that influence local insolation, runoff, and drainage.



TTP on northern aspect slopes in **At-Bashy** PP

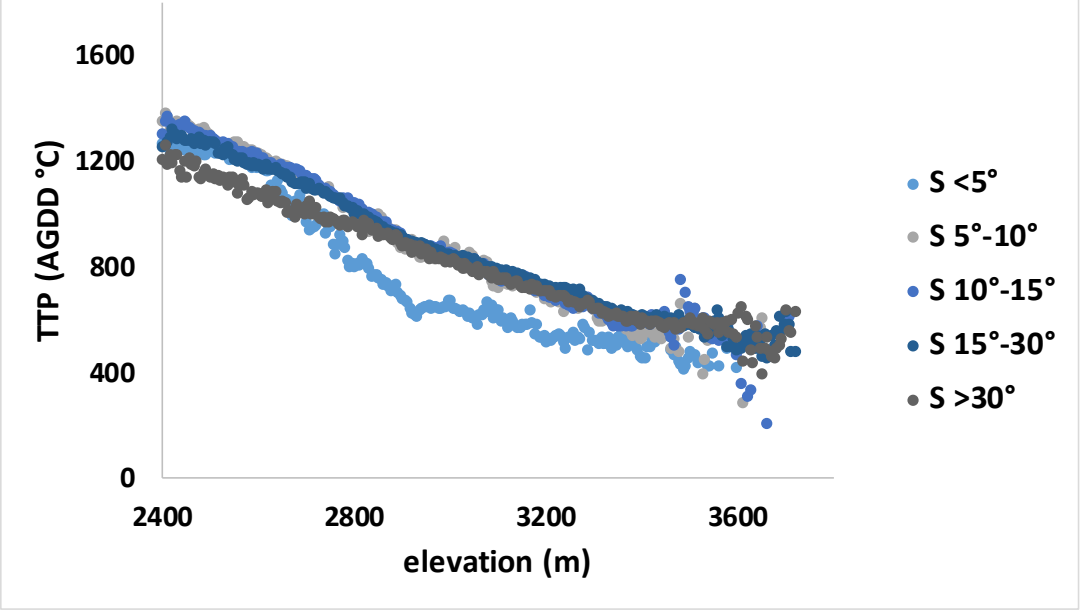


TTP on northern aspect slopes in **Alay** PP

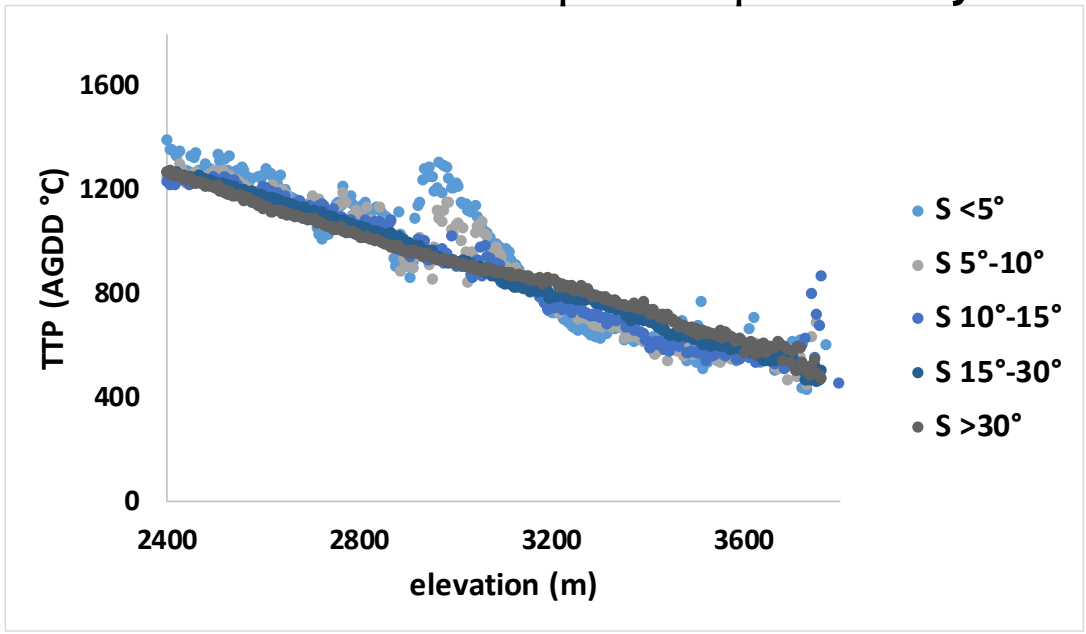


Terrain Modulates Phenometric Lapse Rates of **Thermal Time to Peak** (TTP)

TTP on southern aspect slopes in **At-Bashy** PP



TTP on southern aspect slopes in **Alay** PP

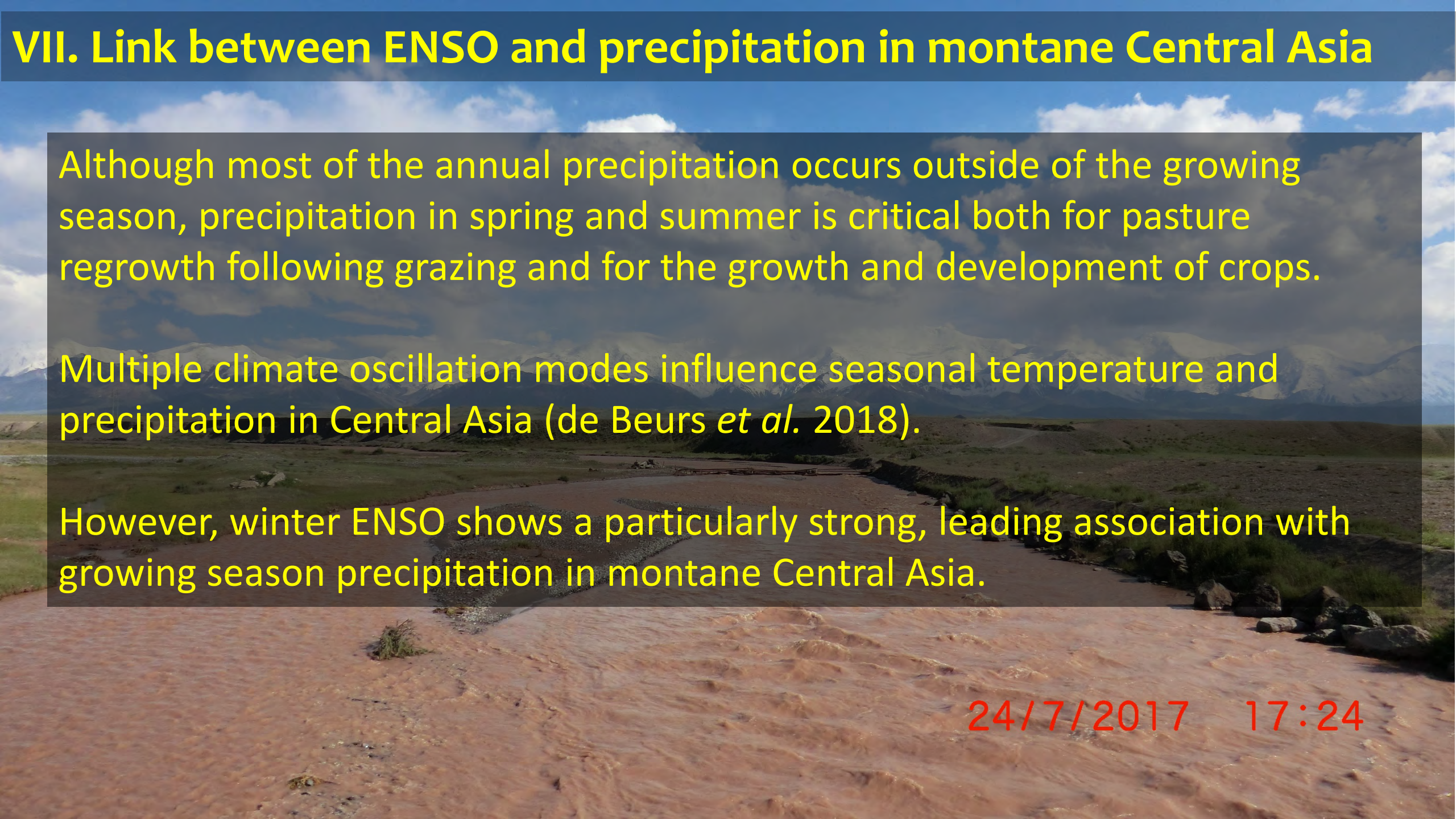


VII. Link between ENSO and precipitation in montane Central Asia

Although most of the annual precipitation occurs outside of the growing season, precipitation in spring and summer is critical both for pasture regrowth following grazing and for the growth and development of crops.

Multiple climate oscillation modes influence seasonal temperature and precipitation in Central Asia (de Beurs *et al.* 2018).

However, winter ENSO shows a particularly strong, leading association with growing season precipitation in montane Central Asia.

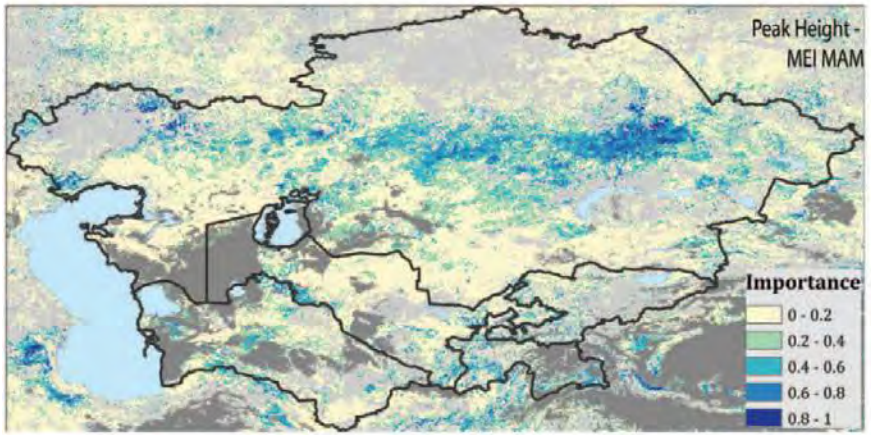


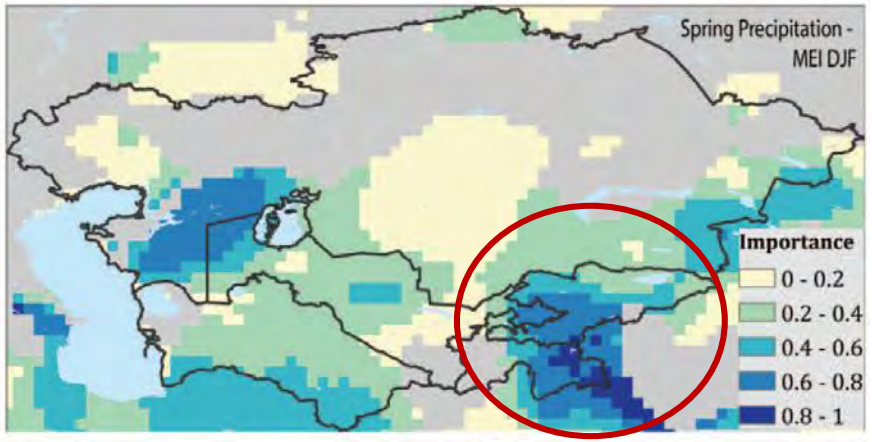
VI. Link between ENSO and precipitation in montane Central Asia

ENSO: El Niño/Southern Oscillation
DJF: December-January-February

MEI: Multivariate ENSO Index
MAM: March-April May

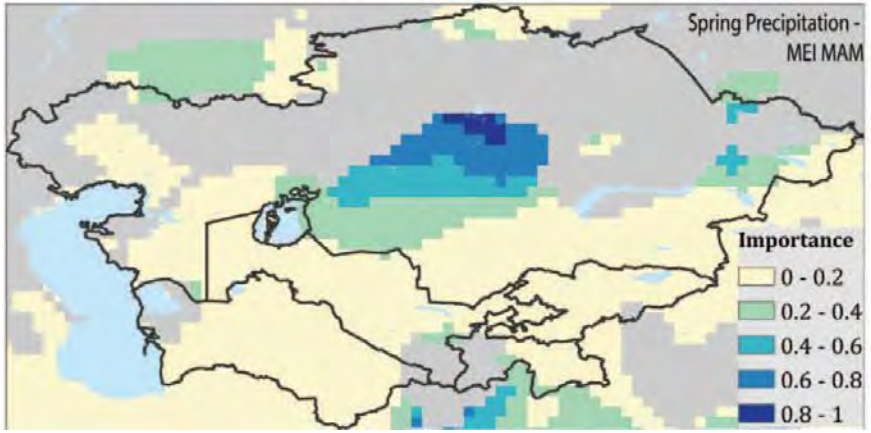
Peak Height & MEI MAM ➔

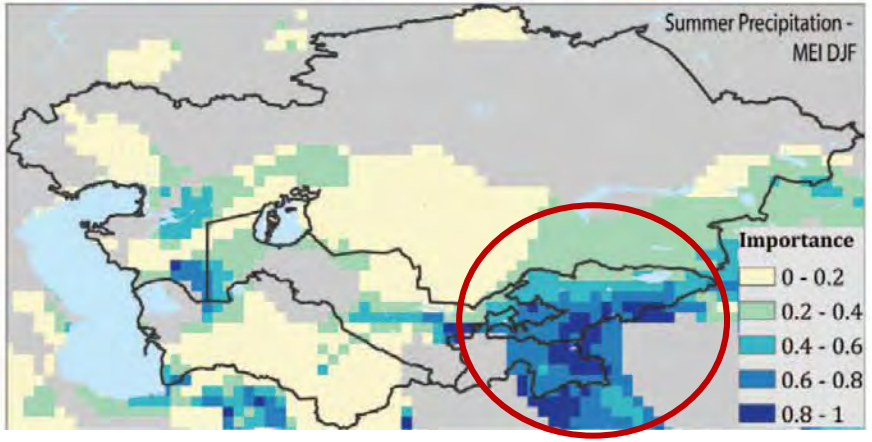




➔ Spring Precipitation & MEI DJF

Spring Precipitation & MEI MAM ➔





➔ Summer Precipitation & MEI DJF

de Beurs KM, GM Henebry, B Owsley, I Sokolik. 2018. Large scale climate oscillation impacts on temperature, precipitation, and land surface phenology in Central Asia. ***Environmental Research Letters*** 13:065018

VIII. Labor migration and remittance networks

Remittances are typically transfers of money between family members across national borders.

Remittances are a significant source of income in many developing economies and can exceed international foreign aid.

Most remittances are sent by workers who have emigrated to locations with stronger economies, remitting a portion of their earnings to their families back home.

Remittances are a form of telecoupling that is highly distributed and personal.

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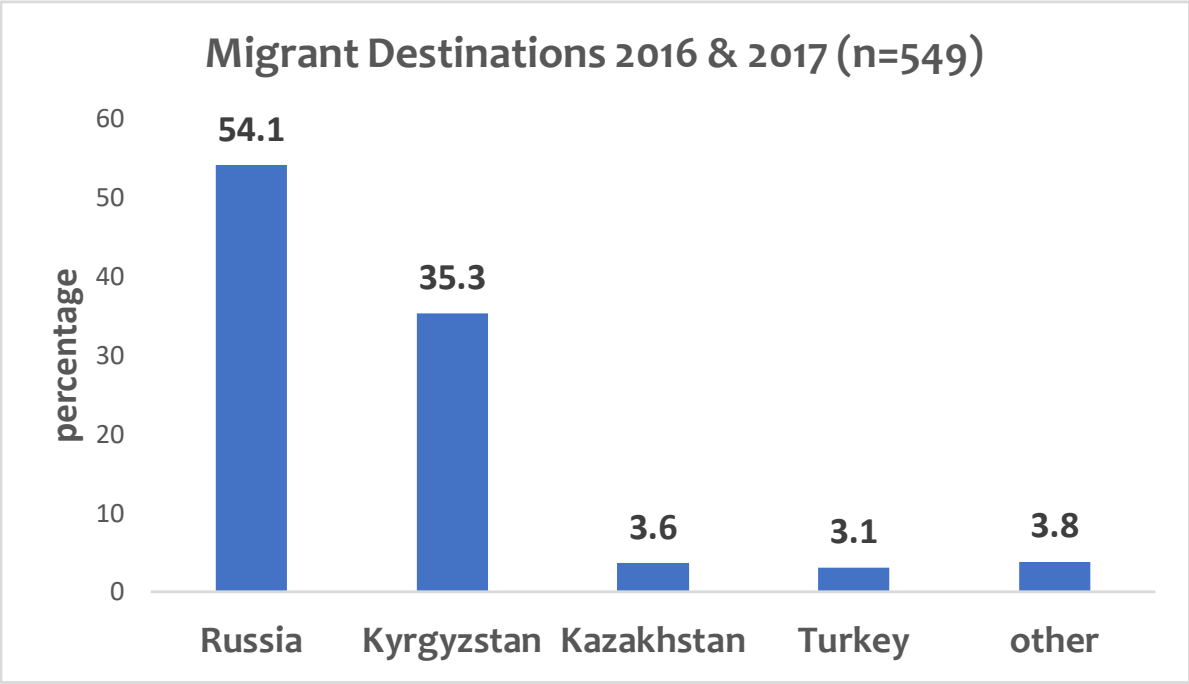
Top 15 recipients of global remittances in 2015

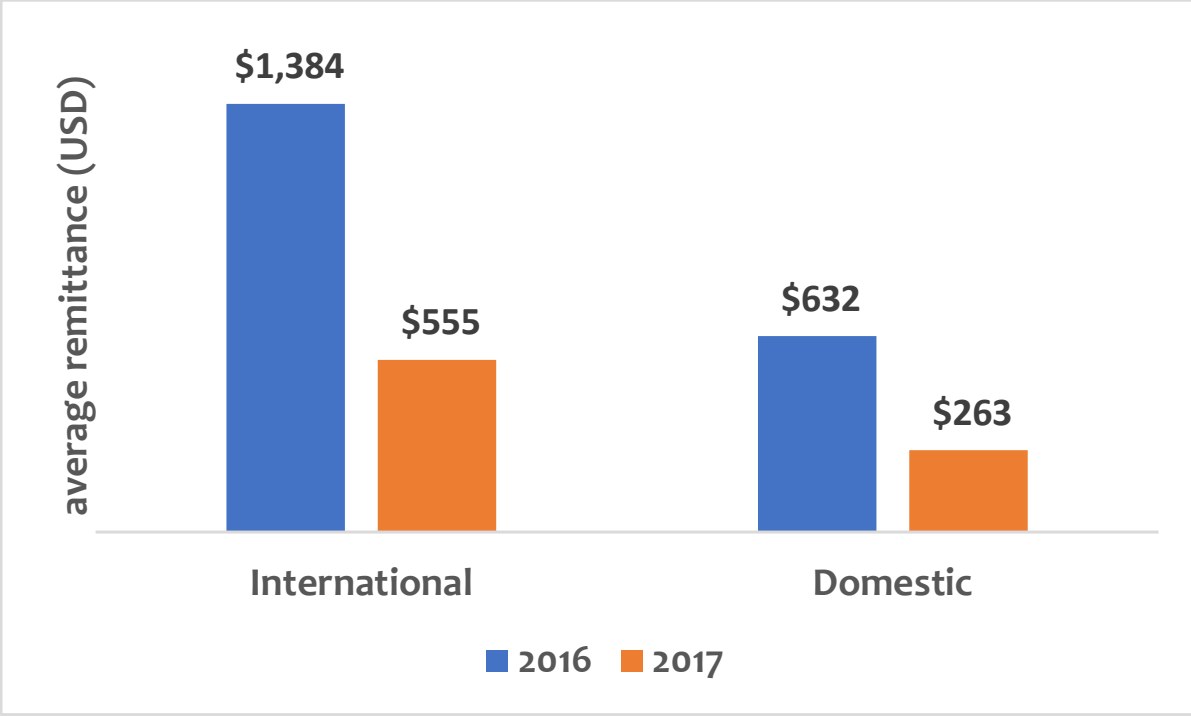
[in terms of % GDP of recipient country]

Rank	Country	2015 $B	% world	% GDP recipient
1	Nepal	6.7	1.16	32.2%
2	Liberia	0.6	0.11	31.2%
3	Tajikistan	2.3	0.39	28.8%
4	Kyrgyz Republic	1.7	0.29	25.7%
5	Bermuda	1.4	0.24	25.0%
6	Haiti	2.2	0.38	24.7%
9	Samoa	0.2	0.03	20.3%
10	Comoros	0.1	0.02	19.9%
11	Honduras	3.7	0.63	18.2%
12	Lesotho	0.4	0.06	17.5%
13	Jamaica	2.4	0.41	16.9%
14	Kosovo	1.1	0.18	16.7%
15	El Salvador	4.3	0.74	16.6%

Top 15 most dependent nations total <5% of global remittance $$

Source: World Bank

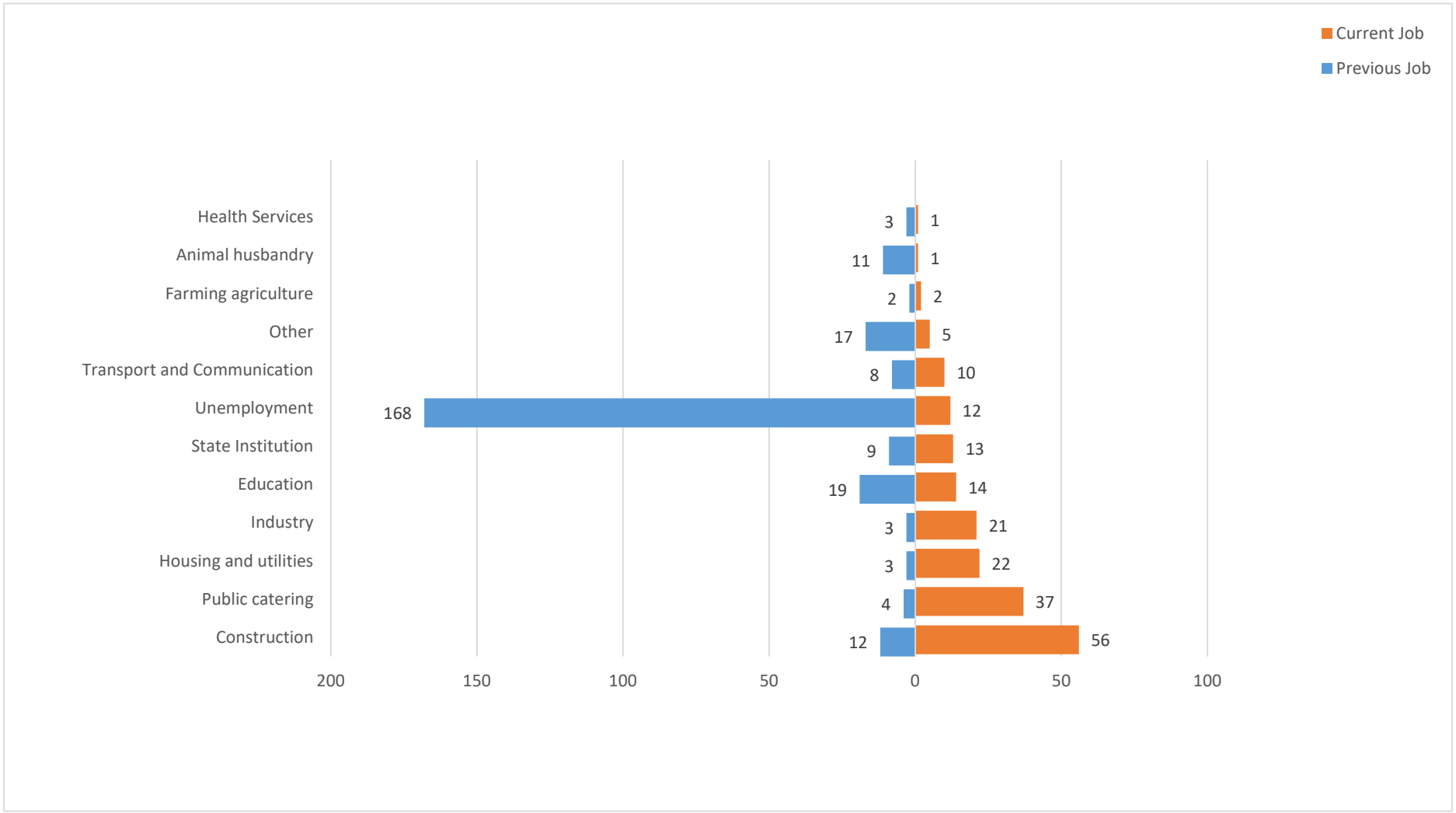




Data gathered from surveys in Naryn oblast (2016) and Osh oblast (2017), KYR

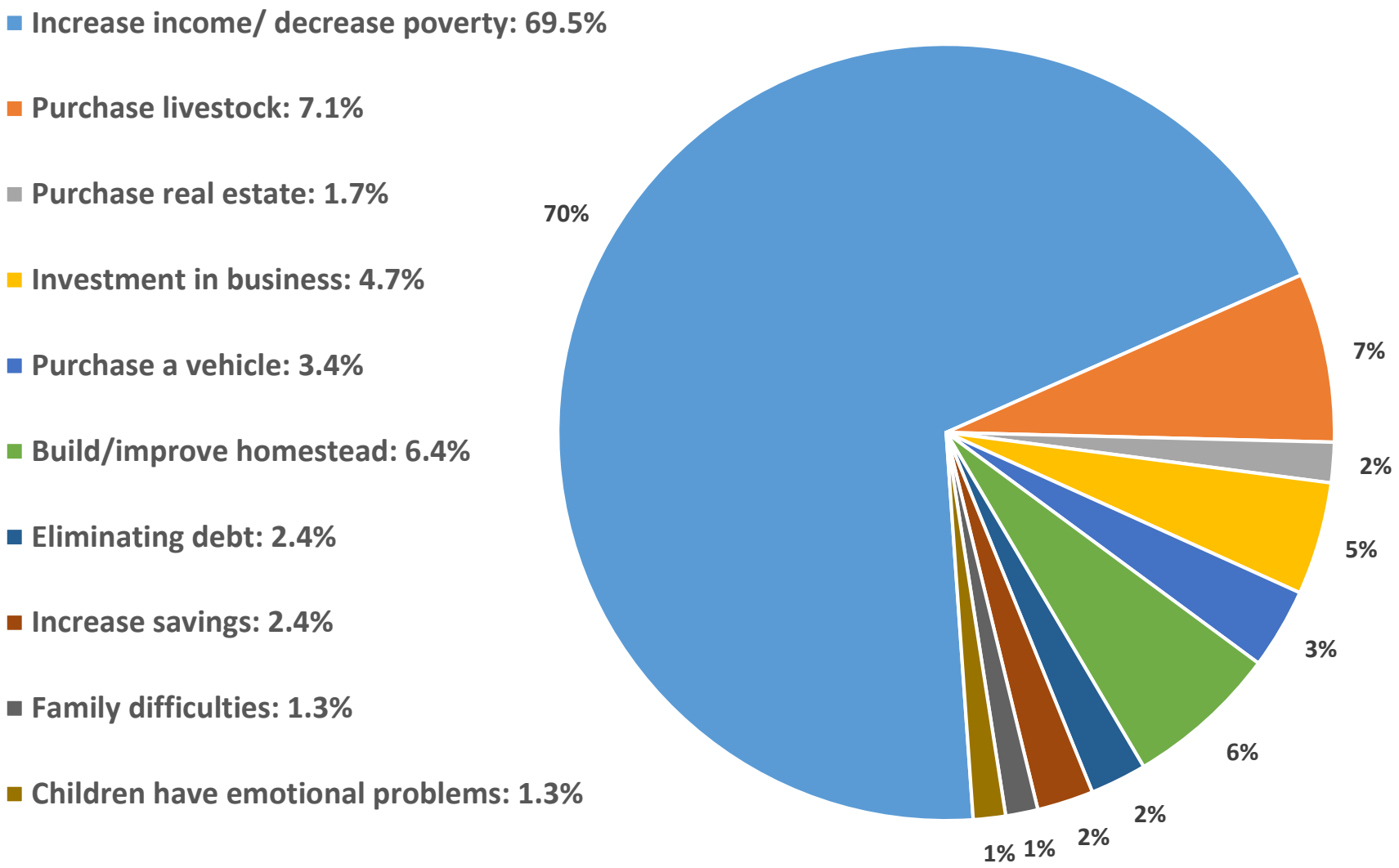
- About 63% more males were labor migrants than females.
- Most labor migrants travel to Russia, but more than one-third are domestic migrants.
- Average remittance from international migrants was larger than domestic.
- Construction was the primary use of remittances, although purchase of livestock was prevalent, particularly in Osh oblast.
- Use of remittances for celebrations or social events was common in both Osh and Naryn oblasts.

2017 Migrant Jobs – Alay rayon, Osh oblast



Slide courtesy of G. Chi, Penn State gchi@psu.edu

2017 Overall Impact of Migration



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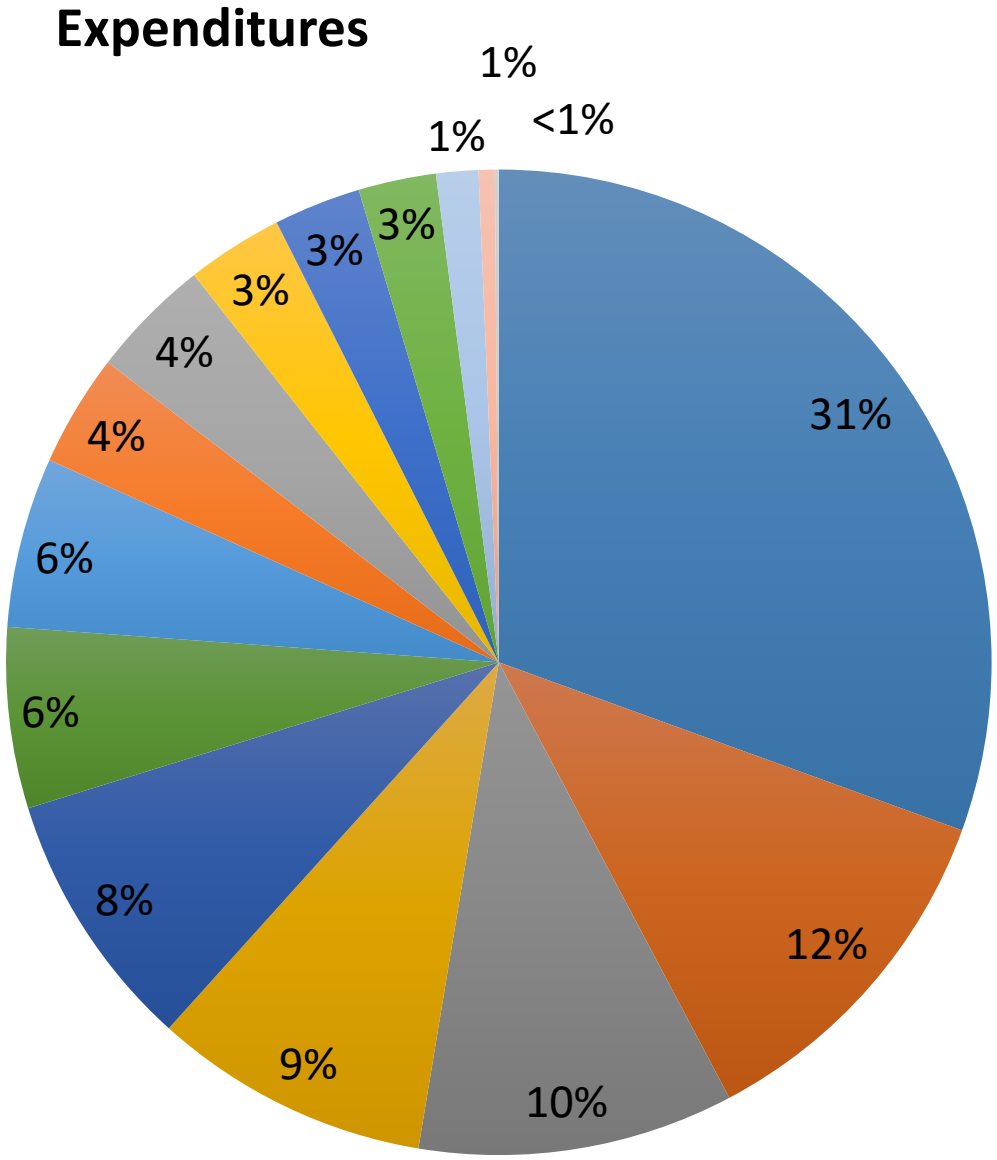
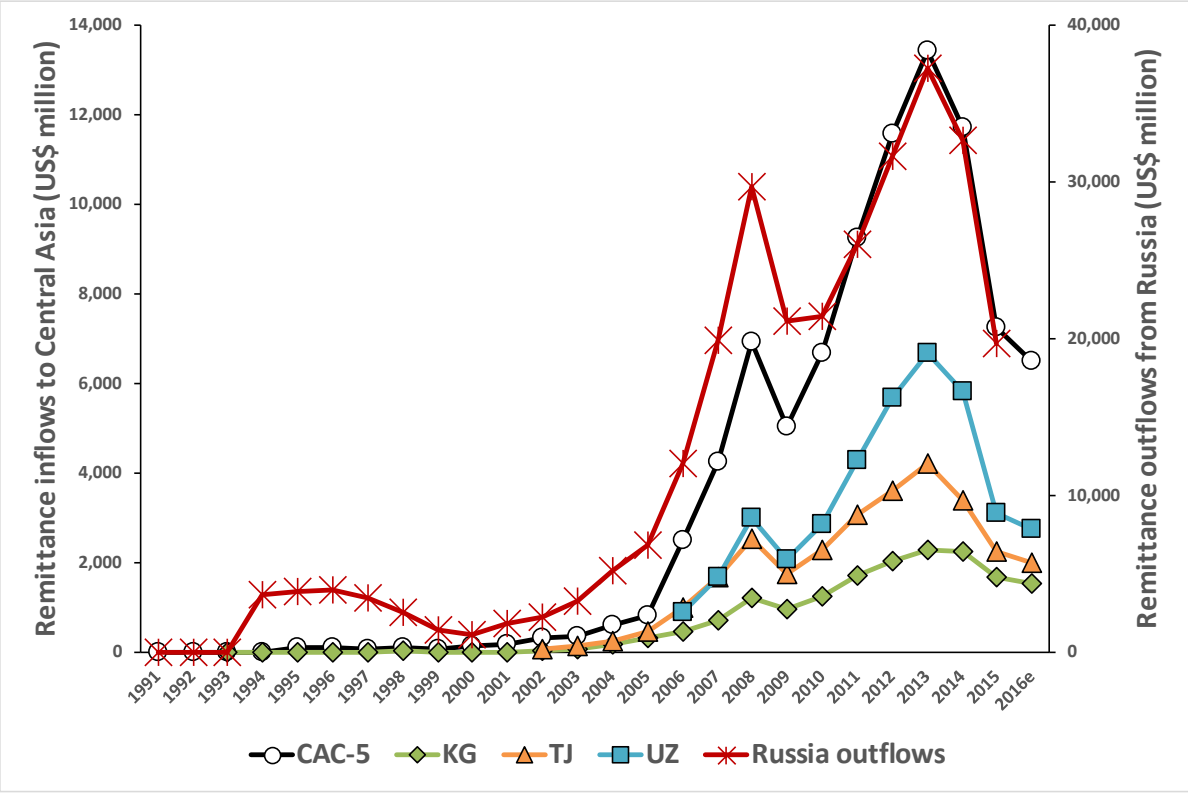
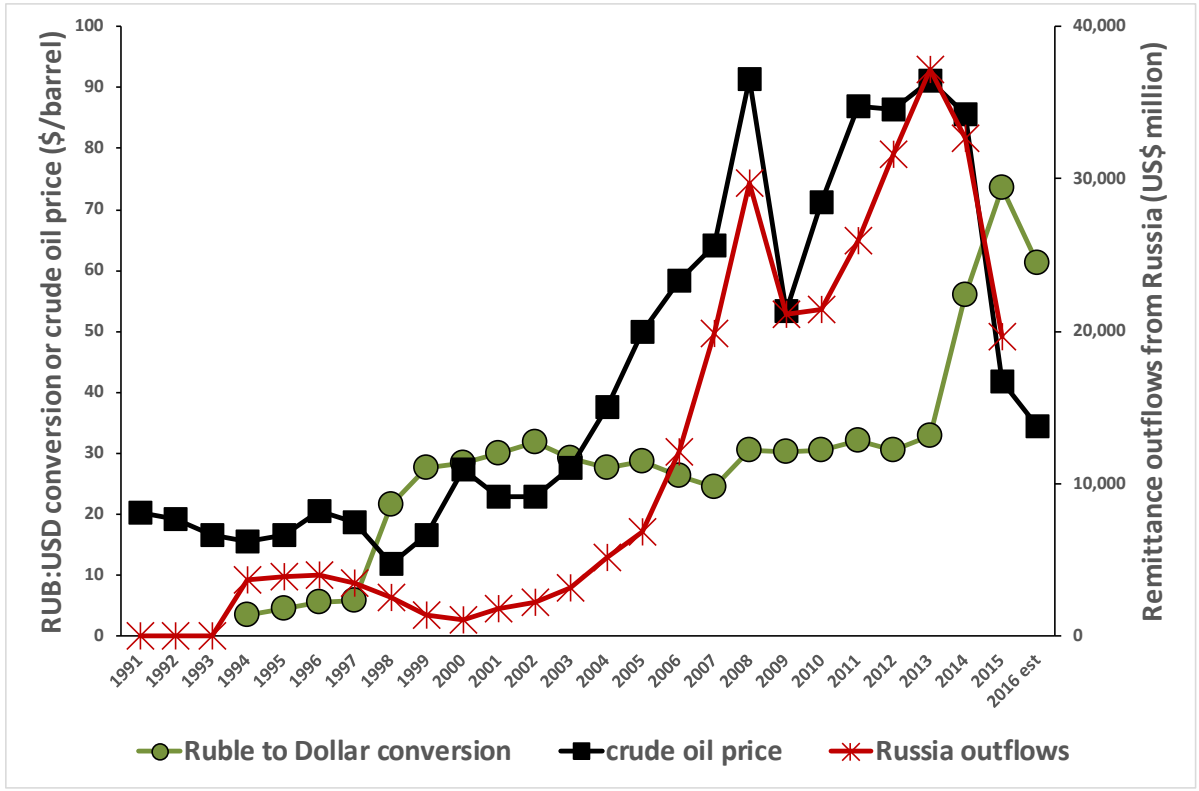
2017 How remittances are spent

- Construction: 30.5%
- Livestock: 11.7%
- Social events: 10.4%
- Loan repayment: 9.1%
- Food: 8.5%
- Farming: 5.9%
- Education: 5.6%
- Consumable goods: 3.7%
- Medical: 4.0%
- Transportation: 3.2%
- Savings: 2.9%







Issues & Challenges

- Needing national & regional insights into migration & remittance dynamics
- Lack of subnational and subannual resolution; uncertainties and missing data
- World Bank data relies on international banking system, but informal value transfer systems (***hawala*** in the Middle East & ***hundi*** in South Asia), are not captured so global remittances are seriously underestimated.

IX. Left behind children

Socio-demographic surveys in villages and yurt camps were led by Prof. Guangqing Chi of Pennsylvania State University.

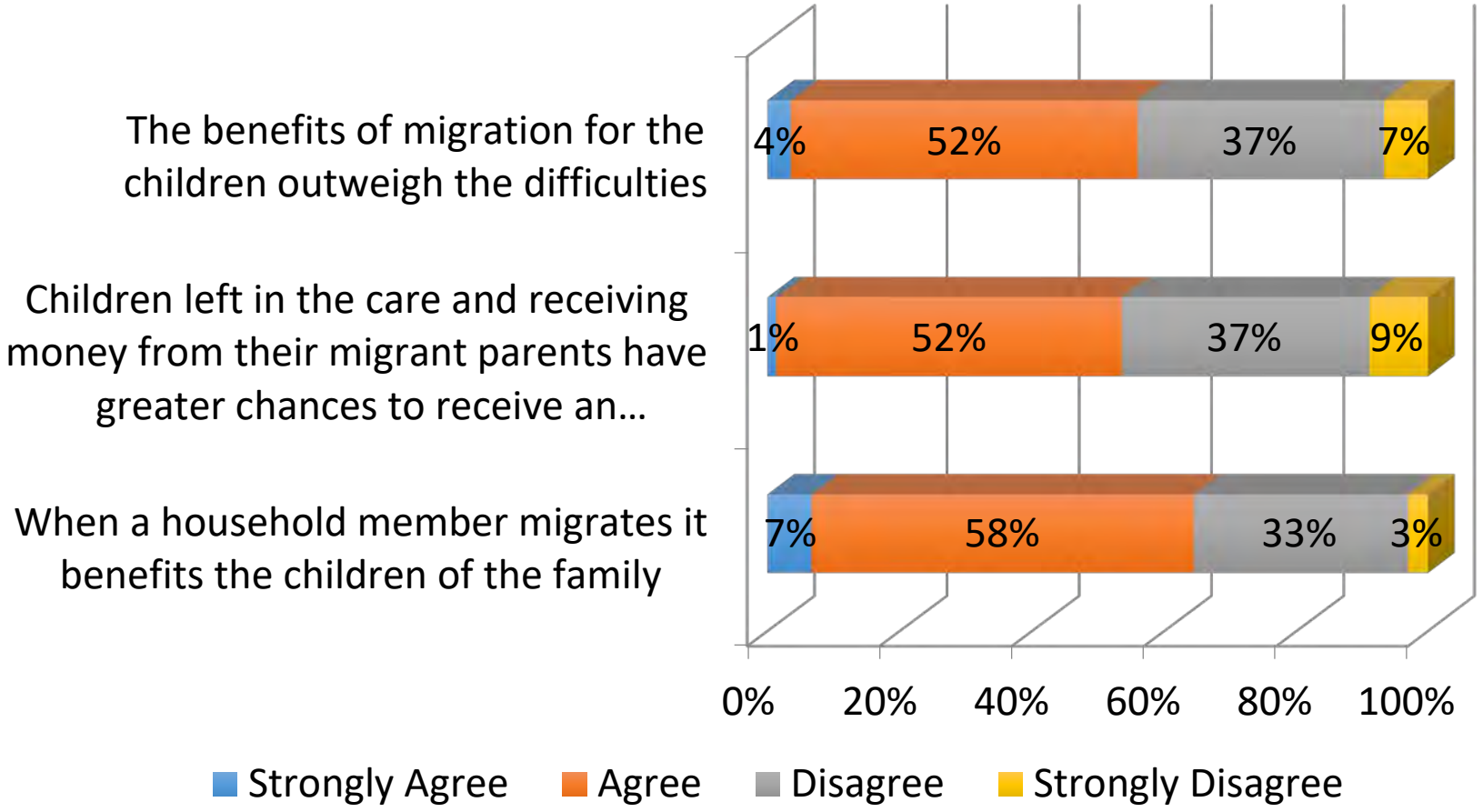
Local teachers were recruited and trained to conduct the surveys.

In 2016, the questionnaires were paper-based, which made transport cumbersome and ingestion of the data slow. The team collected 587 surveys in 2016.

In 2017, the surveys were conducted using tablet computers, which enabled more consistent data collection and easier data handling. The team collected 1234 surveys in 2017.

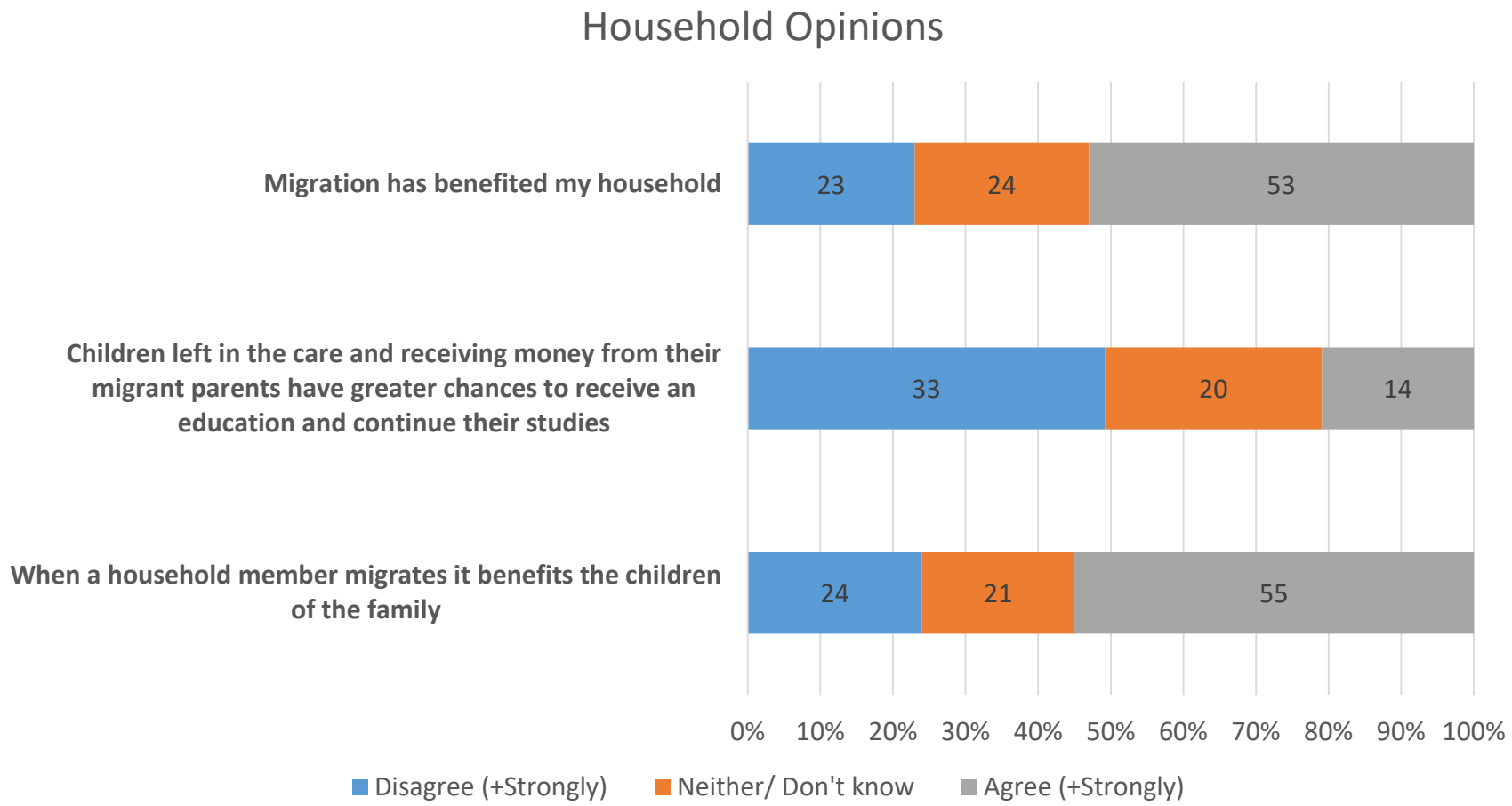
Children in the 2016 Survey

1,122 children (ages 0-17)



Children in the 2017 survey

2,063 children (ages 0-17)



Slide courtesy of G. Chi, Penn State gchi@psu.edu

Migration impacts on children

Migrants
- Short vs long term
- Destinations
- Current vs seasonal vs return
- Age/gender
- Remittance spending

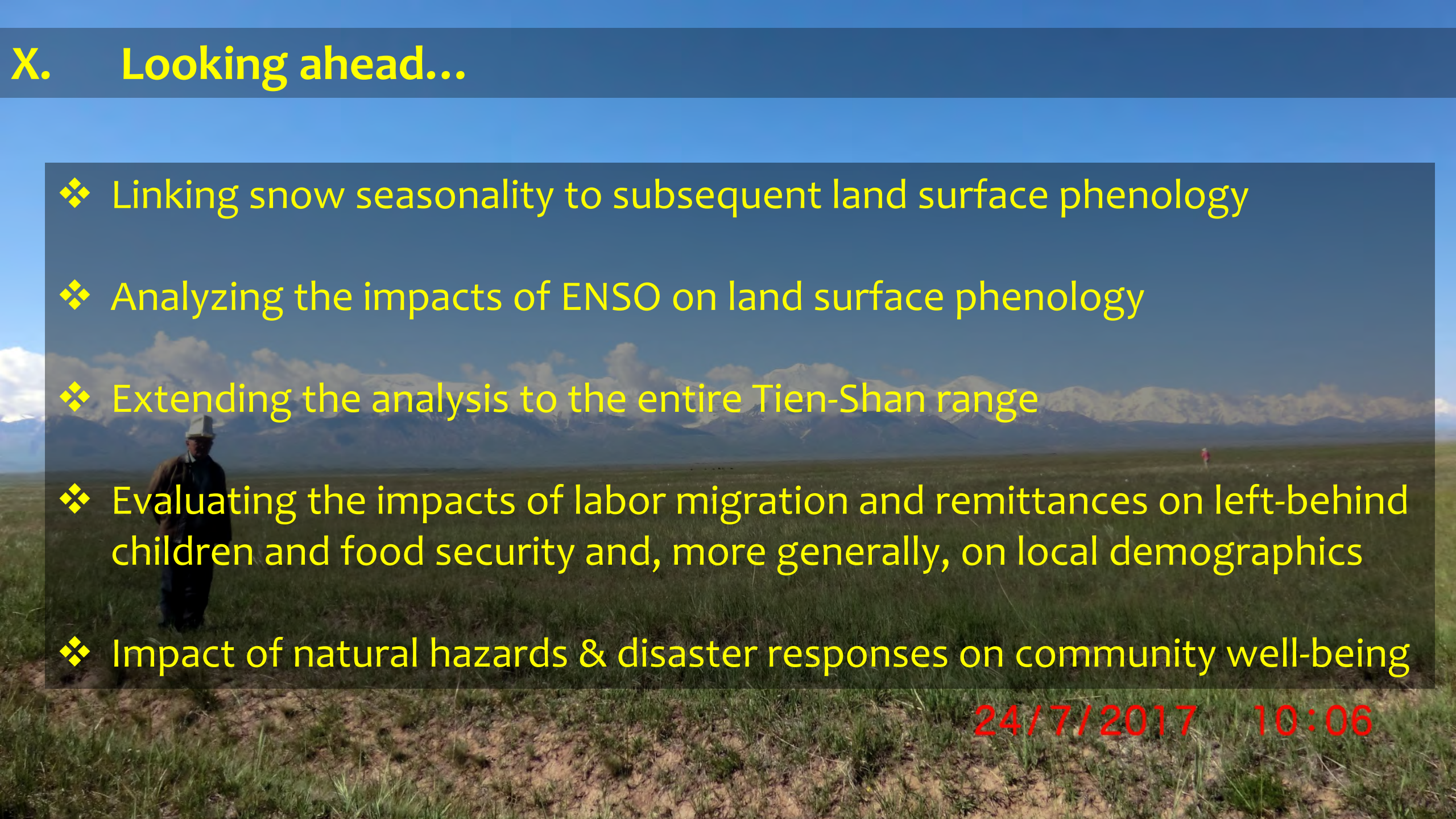
Potential Mediators & Moderators
- Family structure
- Child's gender
- Child's age
- Community characteristics

Children's well-being
- Food nutrition
- Education
- Social & emotional
- Aspiration

Slide courtesy of G. Chi, Penn State gchi@psu.edu

X. Looking ahead…

- Linking snow seasonality to subsequent land surface phenology
- Analyzing the impacts of ENSO on land surface phenology
- Extending the analysis to the entire Tien-Shan range
- Evaluating the impacts of labor migration and remittances on left-behind children and food security and, more generally, on local demographics
- Impact of natural hazards & disaster responses on community well-being




Thanks for your attention!
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