Effects of Land Use Change on Fire, Vegetation and Wildlife Dynamics in Arid Grasslands of Southern Russia

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Big Picture

Scheffer et al., 2001
Background – land use change

Breakdown of Soviet Union

KALMSTAT, 2009
MODIS-based classification, number of times area burned

1980s – 1990s

2000 – 2008

Dubinin et al., 2010. Aridnye Ecosystem (in review)
Question 1

How did the burning regime change before and after Soviet Union breakdown?
Methods – burned area mapping

Decision trees classification, AVHRR, 1.1km, 1985-2007
Results – burned area change

Breakdown of Soviet Union

- estimated trend (AVHRR)
- validation (MODIS, RESURS, TM/ETM+)
- official data

Dubinin et al., 2010. RSE
Question 2

What are the driving forces for the change in burning?
Explanation – burned area change

- Burned area
- Maximum summer temperature
- Livestock numbers
- Spring NDVI

*Graphs showing box plots for burned area, maximum summer temperature, livestock numbers, and spring NDVI before and after with p-values and change in means.*
Explanation – burned area change

pl-sum – previous year summarized precipitation
pre4 – precipitation in April
tmx8 – maximum T in August
NDVI4,5 – NDVI in April, May
LNDVI9 – previous year NDVI in September
Livestock – annual livestock numbers
Question 3

What is the effect of the increase in burning on vegetation?
Vegetation change

MOD13Q1 NDVI, Field data

Shrub cover

2001
2006
2007
burned
Question 4

What is the effect of ecosystem changes on habitat selection?
Saiga antelope habitat selection

Daily MOD09GQK NDVI, Calving timing data
Saiga antelope habitat selection

September, 2004

September, 2005
Conclusions/Summary

- Institutional change was followed by the increase in burning
- It took 5-6 years after the breakdown for vegetation to restore
- Livestock was strong determinant of burning, but not alone
- Fire facilitated the transition from shrub to grass-dominated vegetation communities, but was not exclusive reason for that.
Acknowledgements

NESSF!

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Committee: Monica Turner, Randy Jackson, Phil Townsend, Tim van Deelen

Colleagues: Peter Potapov, Anna Lushchekina

Field helpers: Alexey Zakharov, Svetlana Goryunova, Igor Glushkov, staff of Center for Wild Animals and Stepnoy Zakaznik

Labmates: Alexander Prishchepov, Tobias Kuemmerle, Camilo Alcantara, Shawn Serbin, Avi Bar Mossada and SILVIS Lab