



American  
University  
of Armenia

**AUA GIS AND REMOTE SENSING LAB**

An initiative of the AUA Acopian Center for the Environment  
and the AUA College of Science and Engineering

<http://ace.aua.am/gis-and-remote-sensing>

# Remote sensing of forest and land cover at the AUA GIS & Remote Sensing Lab

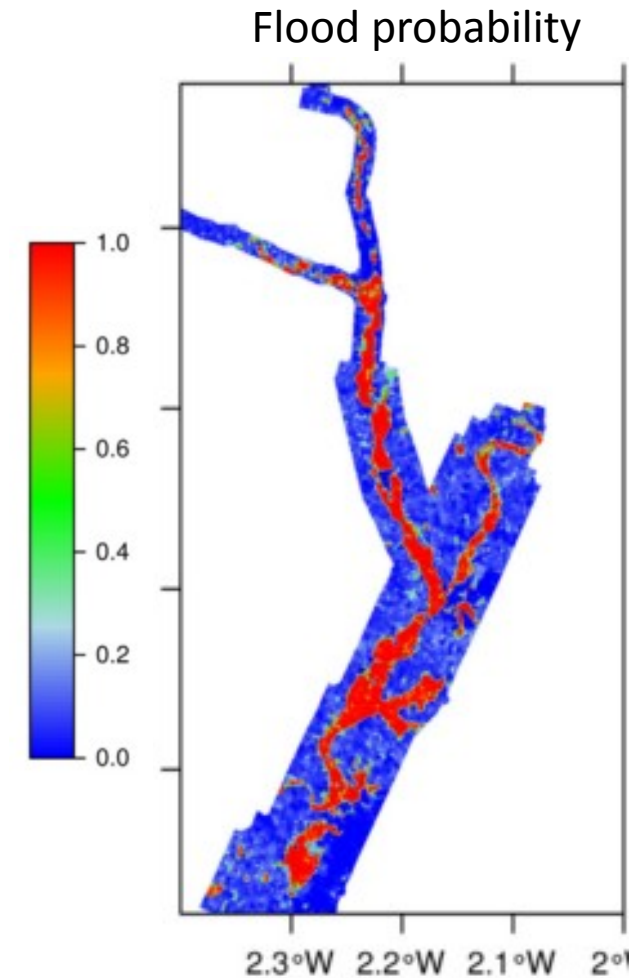
Stefan Schlaffer

Aghavni Harutyunyan

Sean Reynolds

# About myself

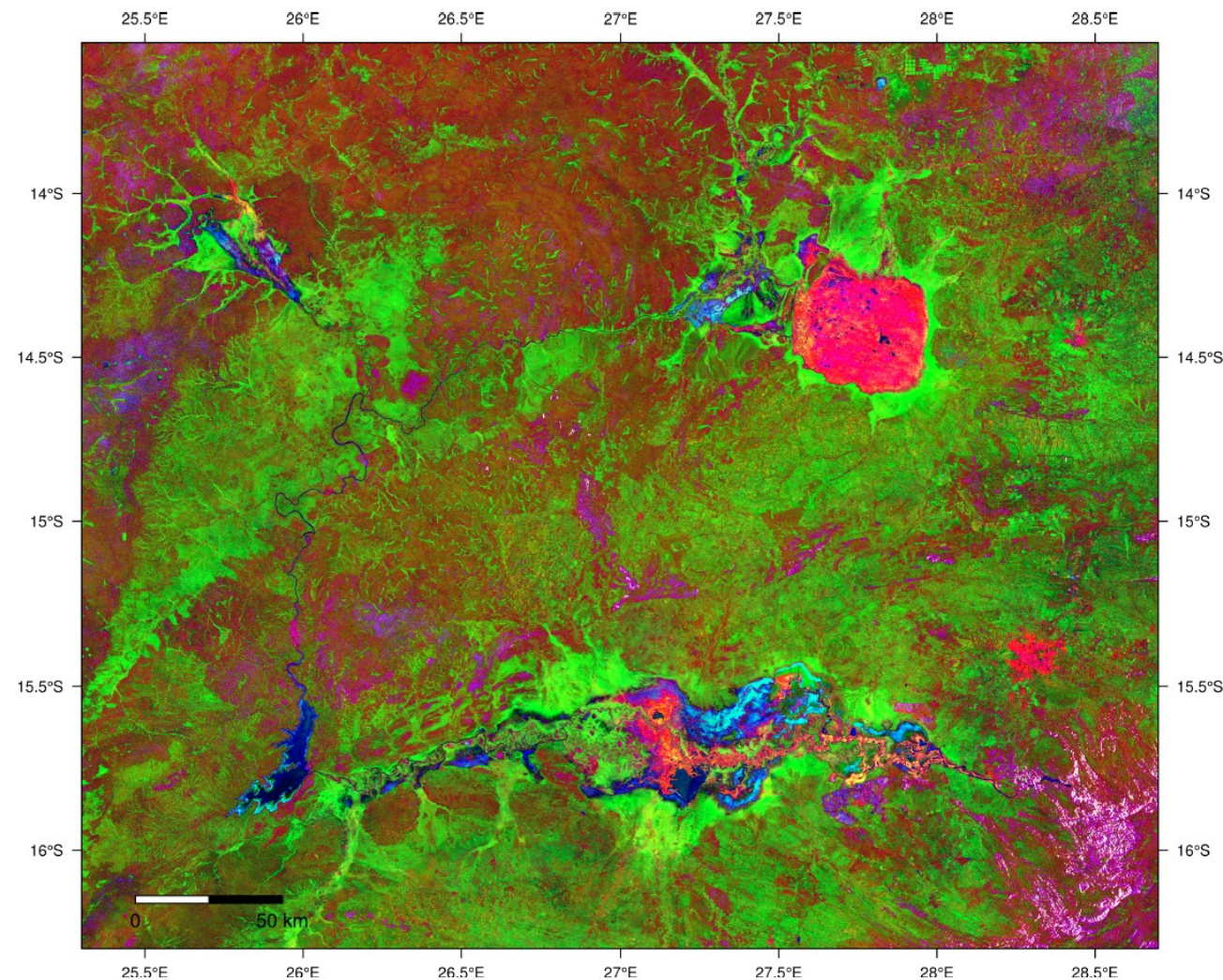
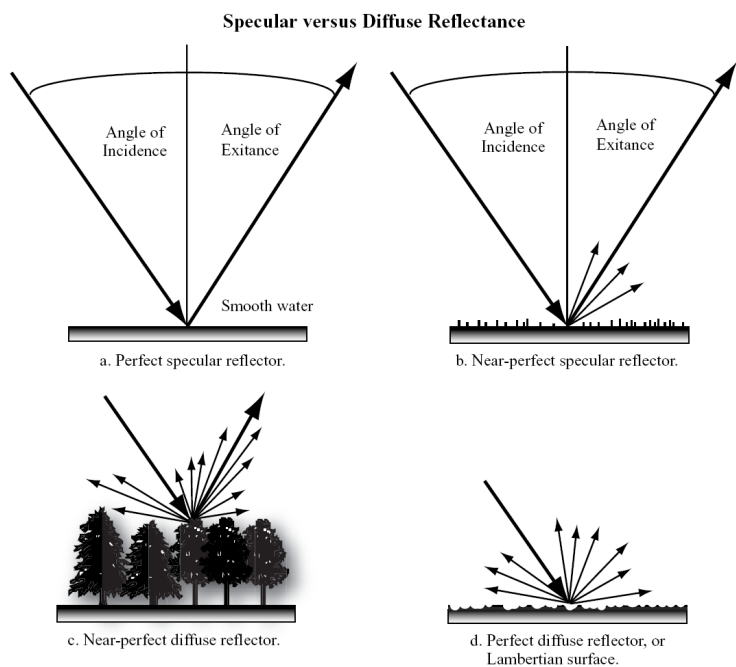
- M.Sc. in Environmental Sciences from University of Bayreuth, Germany
  - Master's thesis in Soil Science on *Tree Species Effects on N Mineralisation in Tropical Plantations*
- Ph.D. in Geoinformation and Remote Sensing from Vienna University of Technology, Austria
  - *Use of SAR time series for flood and wetland mapping*
- Microwave remote sensing at
  - Vienna University of Technology, Austria
  - Luxembourg Institute of Science and Technology



Schlafler et al. (2017)

# Use of SAR for wetland mapping

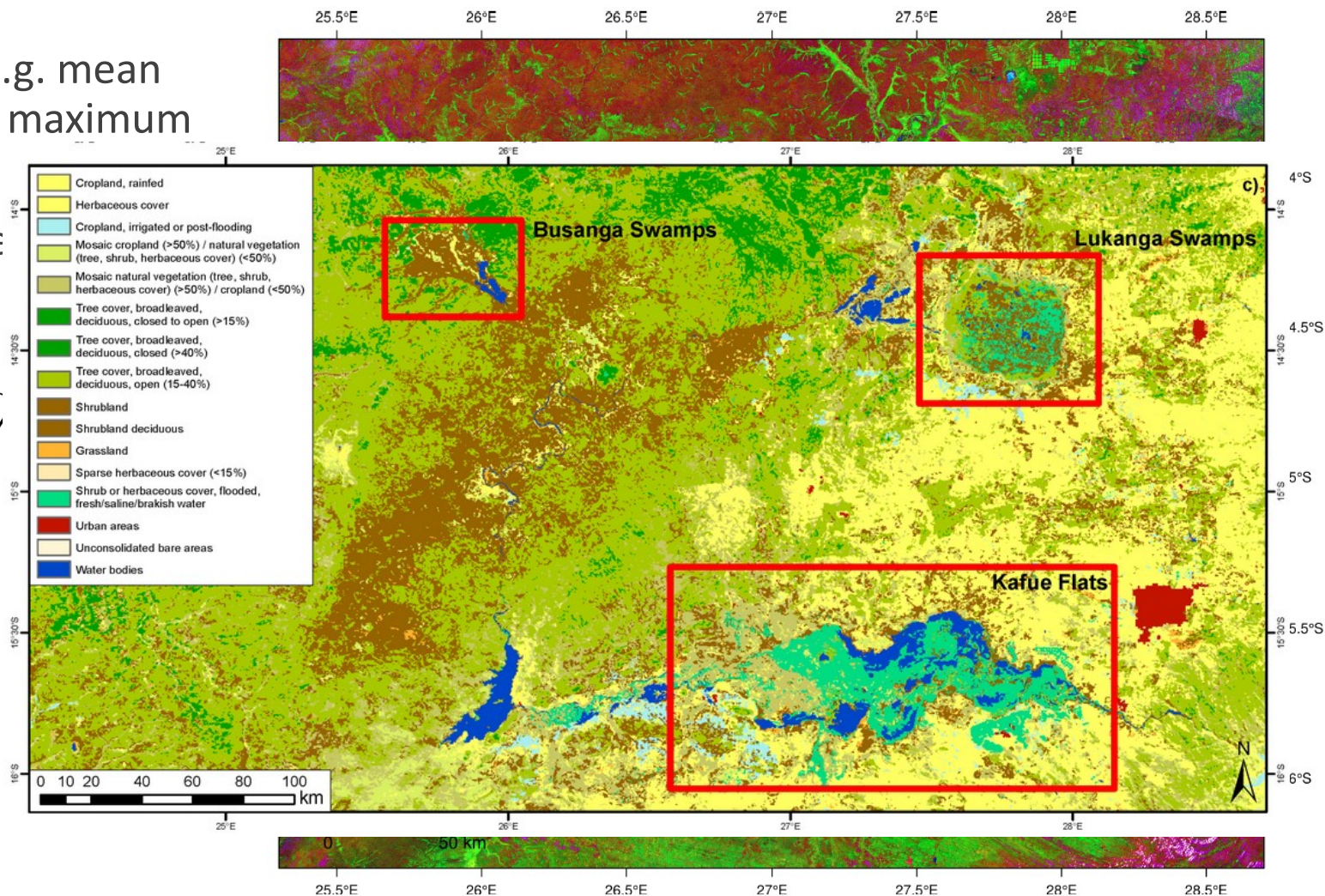
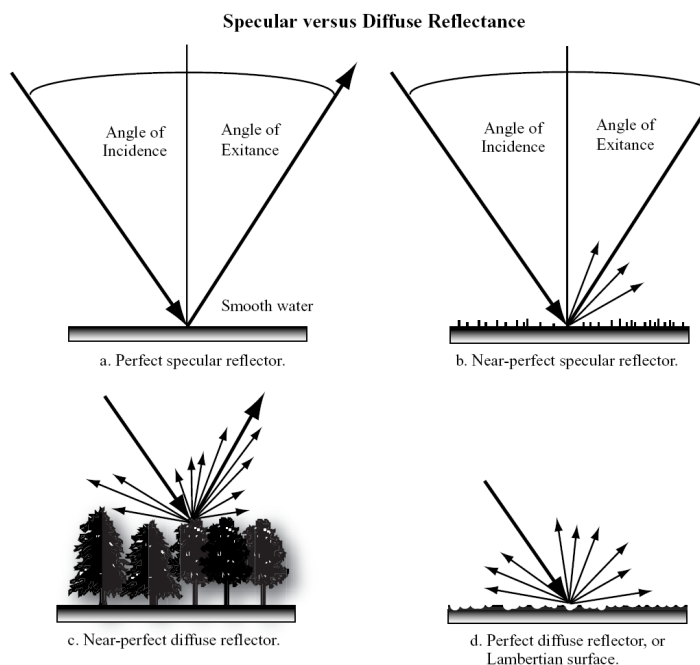
- Extraction of time series parameters, e.g. mean backscatter, annual amplitude, time of maximum backscatter
- Spatial representation of parameters, e.g. as RGB composite





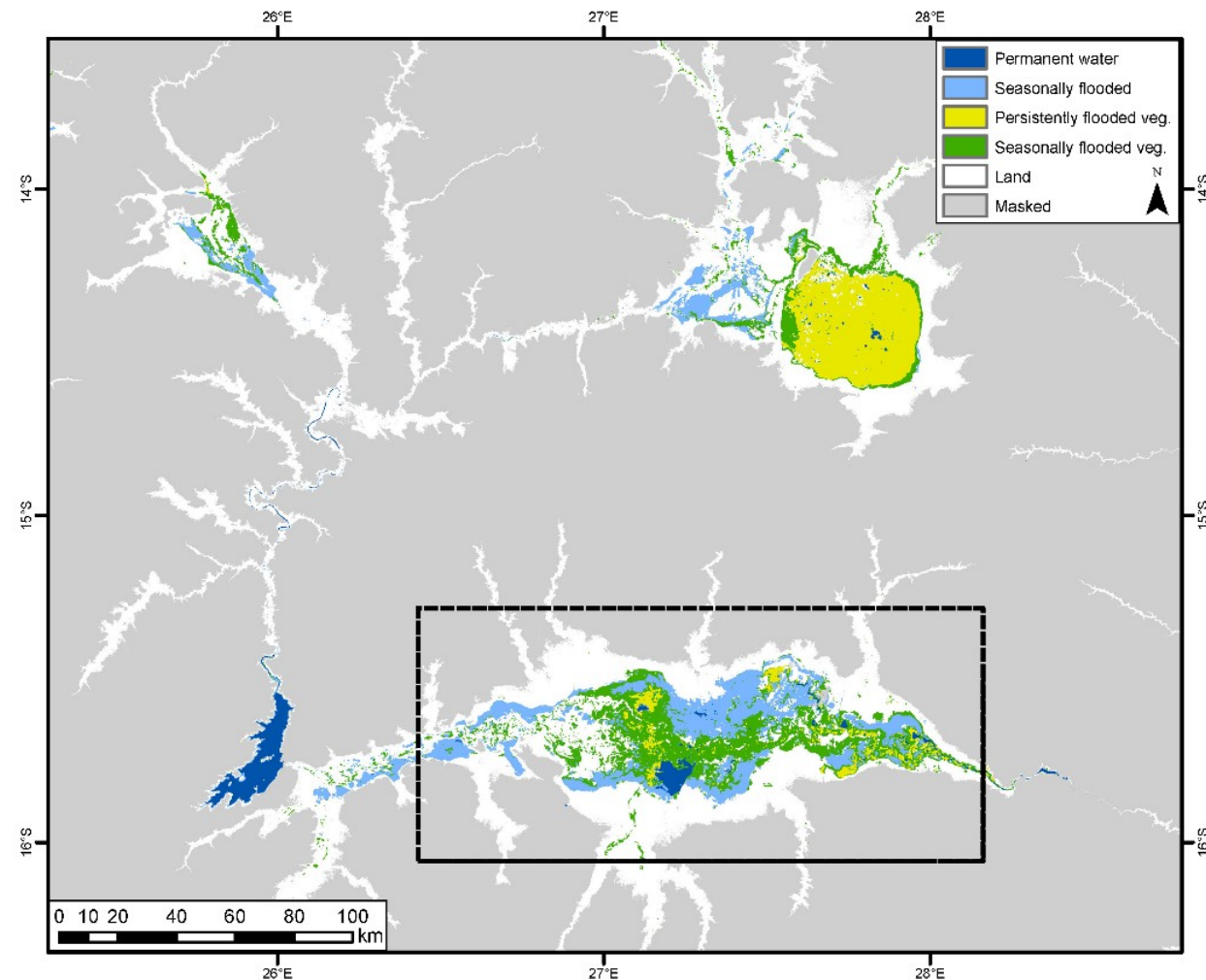
# Use of SAR for wetland mapping

- Extraction of time series parameters, e.g. mean backscatter, annual amplitude, time of maximum backscatter
- Spatial representation of parameters,  $\epsilon$  composite



# Use of SAR for wetland mapping

- Extraction of time series parameters, e.g. mean backscatter, annual amplitude, time of maximum backscatter
- Spatial representation of parameters, e.g. as RGB composite
- Subsequent classification and masking based on topographic data



# American University of Armenia

- Since Feb. 2017: CIM integrated expert at AUA
- Position linked to the GIZ program *Integrated Biodiversity Management in the South Caucasus (IBiS)*
- Involved in the creation of the *AUA GIS and Remote Sensing Lab*
- Training of AUA colleagues and counterparts at ministries (e.g. Ministry of Emergency Situations, Ministry of Nature Protection)
- Building university partnerships with partners in Europe (e.g. Germany, Austria) and Armenia (YSU)





## Integrated Biodiversity Management, South Caucasus (IBiS)

### Overall Goal

Promote better coordination of biodiversity and ecosystem services management across sectors on the basis of solid data.

#### Clients:

- German Federal Ministry for Economic Cooperation and Development (BMZ)
- Austrian Development Cooperation (ADC)

Duration: 12/2015 - 11/2019

Volume (regional): 14,9 Mio. €

- thereof 5 Mio. € ADC

- additional BMZ funding  
foreseen





## Topics addressed in IBiS

**Ecosystem Services** – Demonstrate and safeguard the various benefits people obtain from ecosystems, e.g. water supply, habitat for species, recreation & tourism, raw material, etc.

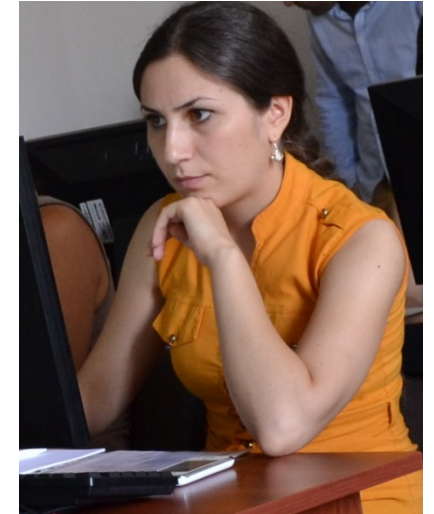
**Integrated Management of Biodiversity** – Bringing different sectors and stakeholders together for a common, sustainable and harmonized management of biodiversity.

**Mainstreaming Biodiversity** – Integrate the conservation and sustainable use of biodiversity into relevant sectoral or cross-sectoral programs and policies and raise the perception and awareness of people on the value of biodiversity.



# The AUA GIS & Remote Sensing Lab

- Aghavni Harutyunyan, M.Sc. and B.Sc. in Geography (Yerevan State University)
- Sean Reynolds, M.Sc. in Geographic Information Systems, B.Sc. in Anthropology (both Florida State University)
- Mapping in support of activities at the *Acopian Center for the Environment*, e.g.
  - Ecotourism
  - Effects of mining, tailings
  - DRM
- Provides training in GIS and remote sensing to professionals at partner organizations



# GIS trainings

In July 2017, the Lab organized trainings for professionals from the Ministry of Emergency Situations (MES) and the Ministry of Nature Protection (MNP)



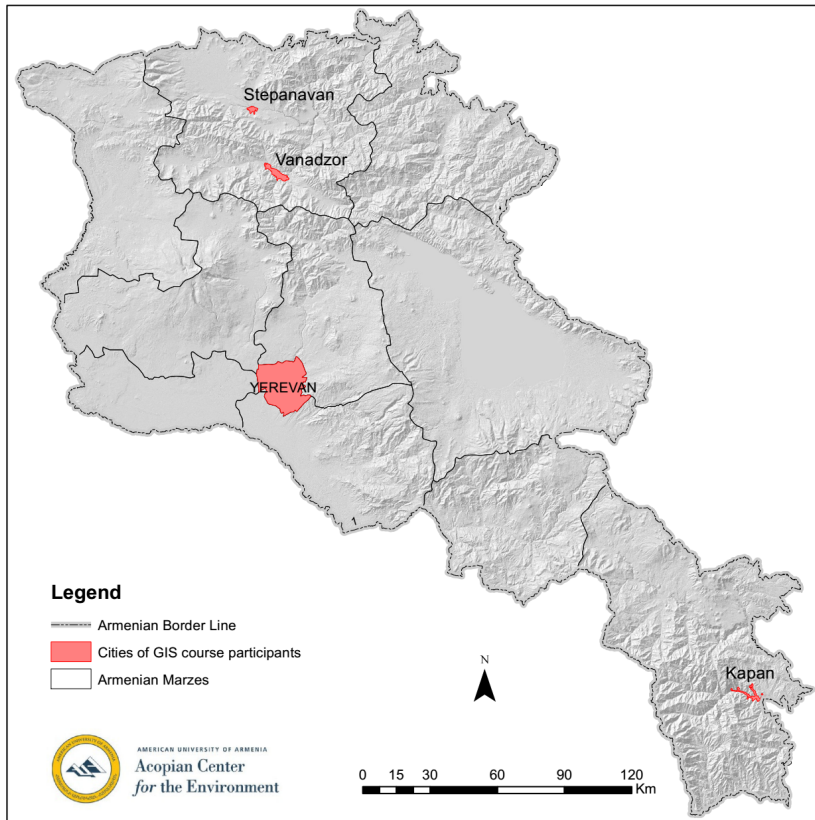
Participants from  
Yerevan and  
different regions  
in Armenia





# GIS trainings

Hoping to contribute to building a national network of GIS & remote sensing professionals in Armenia



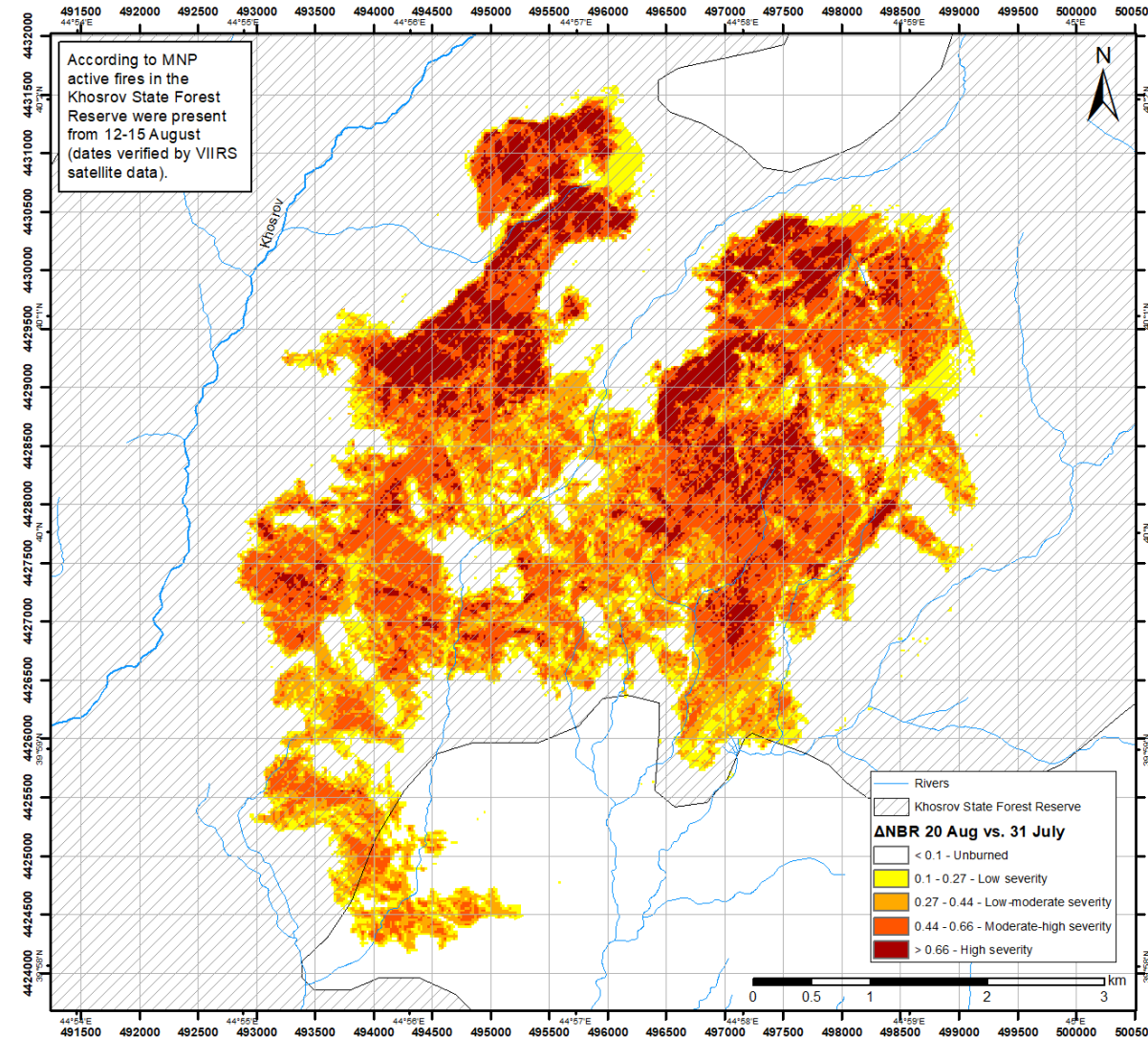
Participants from  
Yerevan and  
different regions  
in Armenia  
=> aiming to build  
network of people  
with experience in  
GIS





# Burned areas mapping

- Wildfires in Khosrov Forest Reserve and Artavan
- Mapping of affected areas using Landsat 8, Sentinel-2 and PlanetScope imagery
- Total affected area ca. 2150 ha (according to S-2)
- Validation using high-res images (Worldview-3 provided by USFS)



According to MNP active fires in the Khosrov State Forest Reserve were present from 12-15 August (dates verified by VIIRS satellite data). The map shows a preliminary estimate of burn severity based on changes in Normalized Burn Ratio (NBR) from multi-spectral satellite data. Based on these preliminary estimates, an area of ca. 1934 ha has been affected by the fires. The severity estimations have to be seen as preliminary and are derived according to guidelines of the USGS FireMon program.

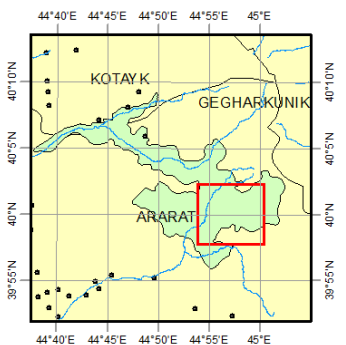
Land cover	Area [ha]
Forest	350
Non-forest	1797
	2147

Left: Difference in Normalized Burn Ratio (ANBR) between pre- and post-fire images; Spatial resolution: 20 m  
Bottom: Overview map showing the location of the Khosrov Forest Reserve (in green).

Post-fire image acquired by Sentinel-2A on 20 August 2017 (7:49:51 UTC), pre-fire image acquired by Sentinel-2A on 31 July 2017 (7:49:51 UTC)

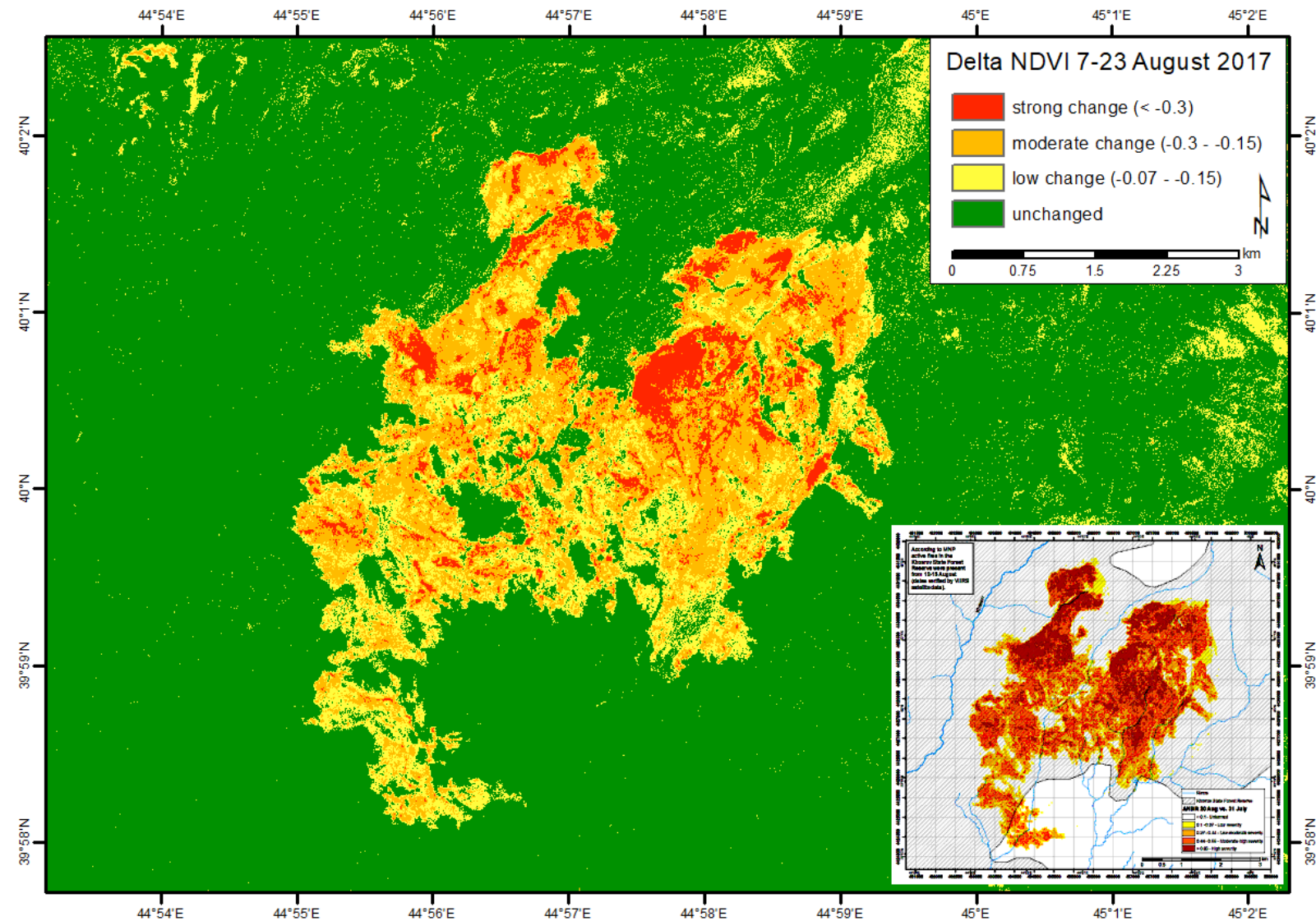
Source: Derived from Sentinel-2 data provided by Copernicus (2017); Vector data taken from the Water Resources Atlas of Armenia.

Grid: WGS 1984 UTM Zone 38 North coordinate system  
Tick marks: WGS 1984 geographic coordinate system



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- Updating of forest cover layers for Armenia (RF based on Landsat 8)

## Khosrov State Forest Reserve Fires, August 2017

In the first half of August 2017, the Khosrov State Forest Reserve was affected by wide-spread forest fire.

Copernicus Sentinel-2A with different spectral bands offers the possibility of mapping burnt areas and active fires in near-real-time.

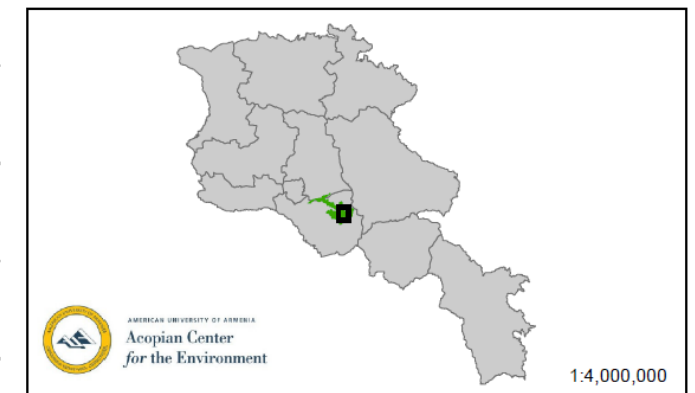
Forest affected areas - 350 ha  
Non Forest affected areas - 1797 ha

### Legend

- Forest affected areas
- Forest



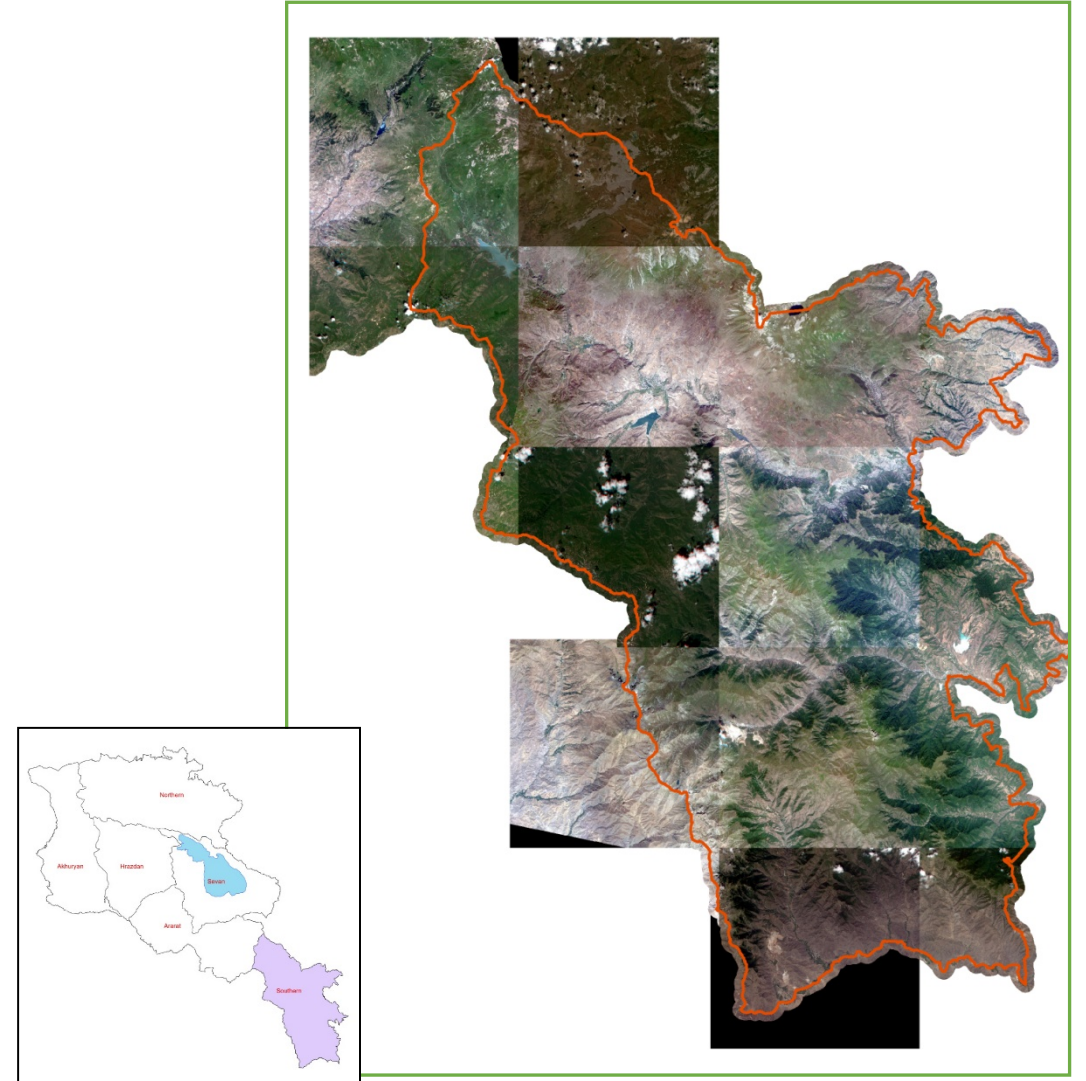
0 0.5 1 2 3 4 Km





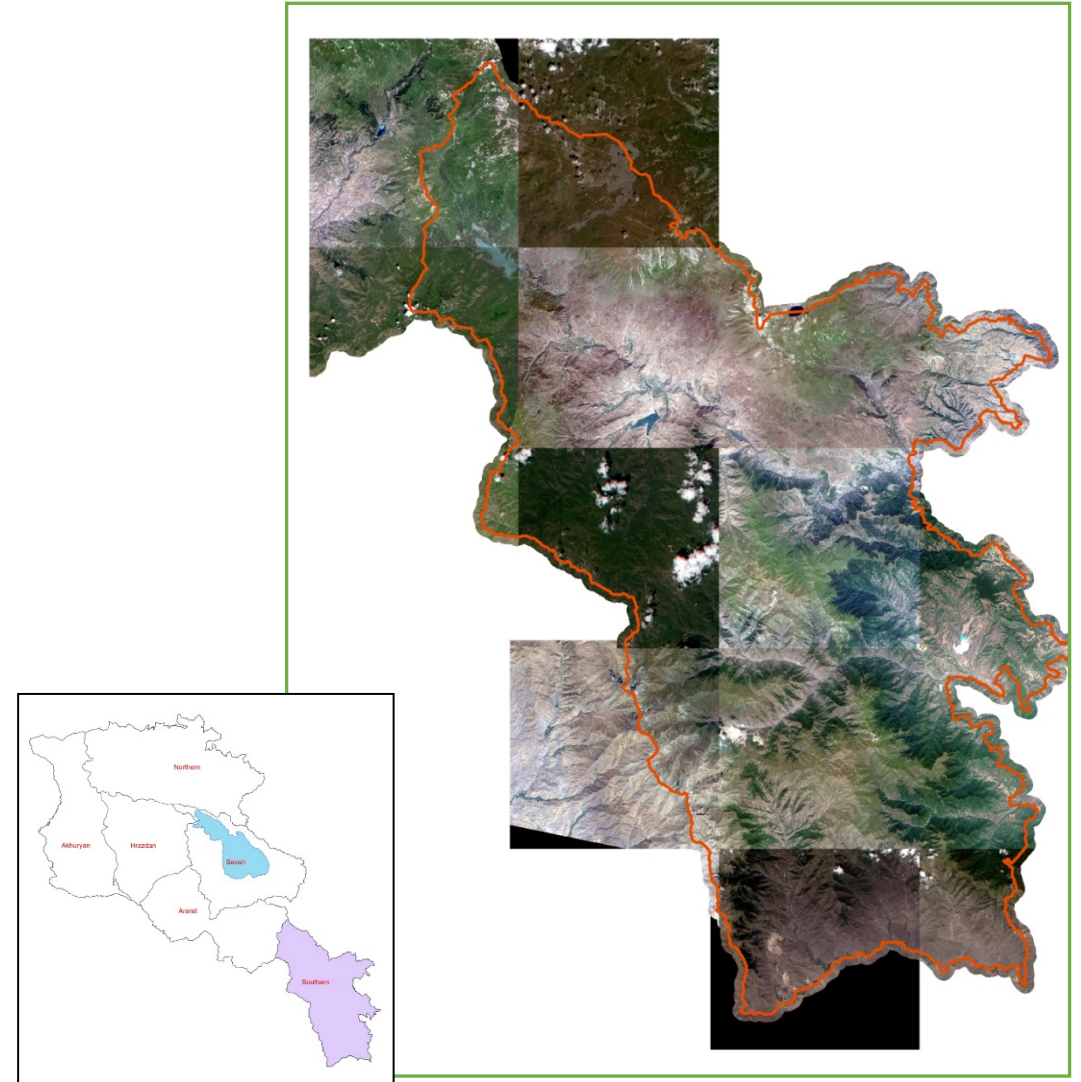
# Land cover mapping in Syuniq

- Artak Piloyan [artakpiloyan@gmail.com](mailto:artakpiloyan@gmail.com) (YSU)
- USAID Clean Energy & Water Program
- CORINE Level 2 land cover classification of Southern BMA
- Based on Rapideye imagery acquired in 2013



# Land cover mapping in Syunig

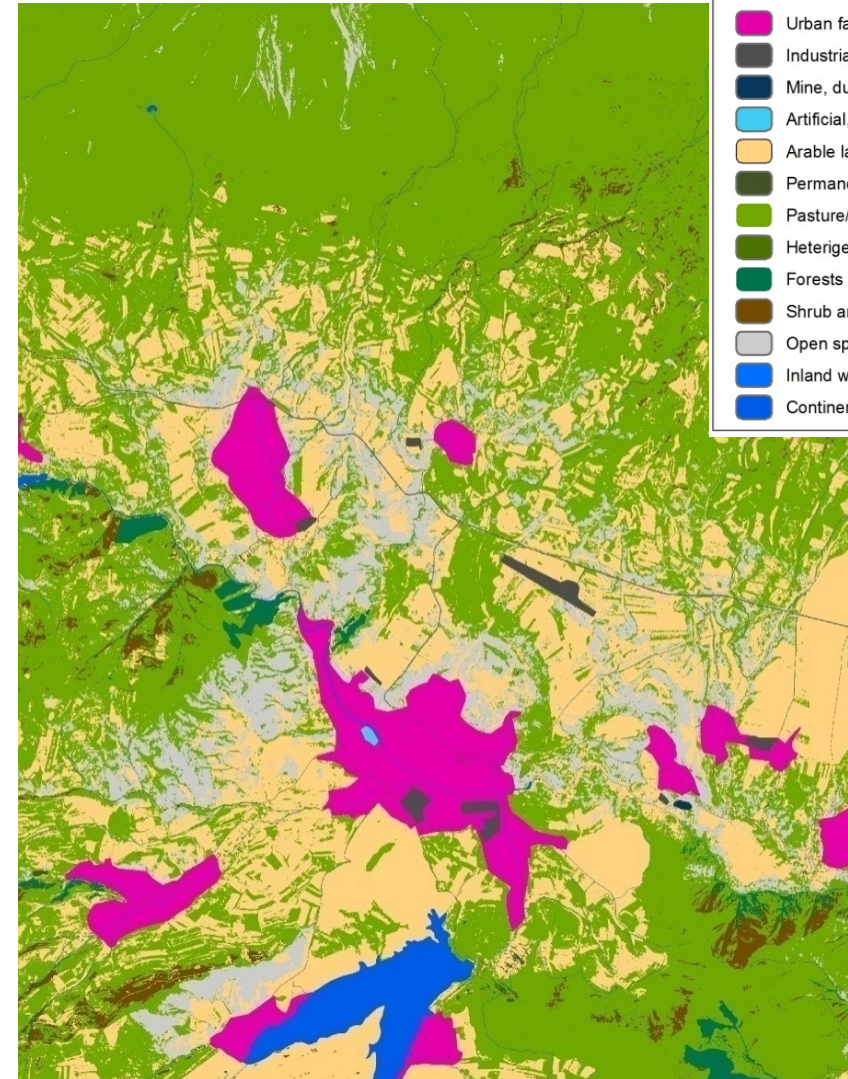
- Artak Piloyan [artakpiloyan@gmail.com](mailto:artakpiloyan@gmail.com) (YSU)
- USAID Clean Energy & Water Program
- Steps:
  - Adaptation of CORINE system for Armenia
  - Unsupervised Classification
  - Field surveys for training supervised classification and validation
  - Maximum Likelihood Classification





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## Legend

- Urban fabric
- Industrial, commercial and transport units
- Mine, dump and construction sites
- Artificial, non-agricultural vegetated areas
- Arable land
- Permanent crops
- Pasture/Grassland
- Heterogeneous agricultural areas
- Forests
- Shrub and/or herbaceous vegetation associations
- Open spaces with little or no vegetation
- Inland wetlands
- Continental waters



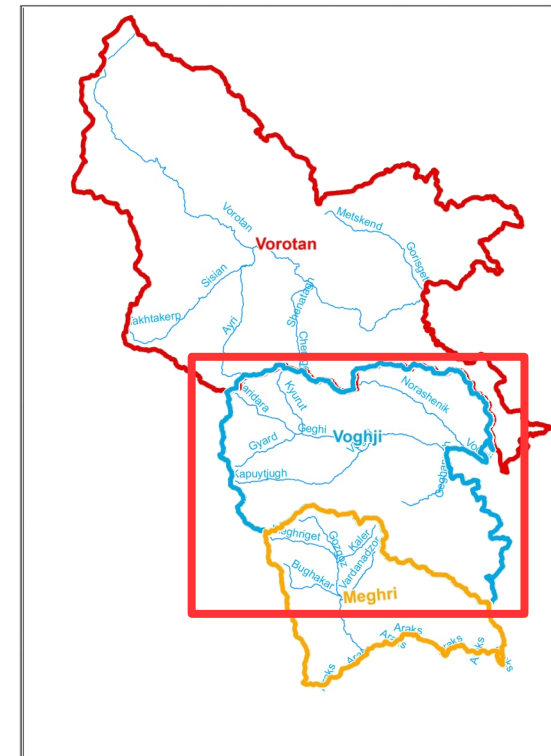
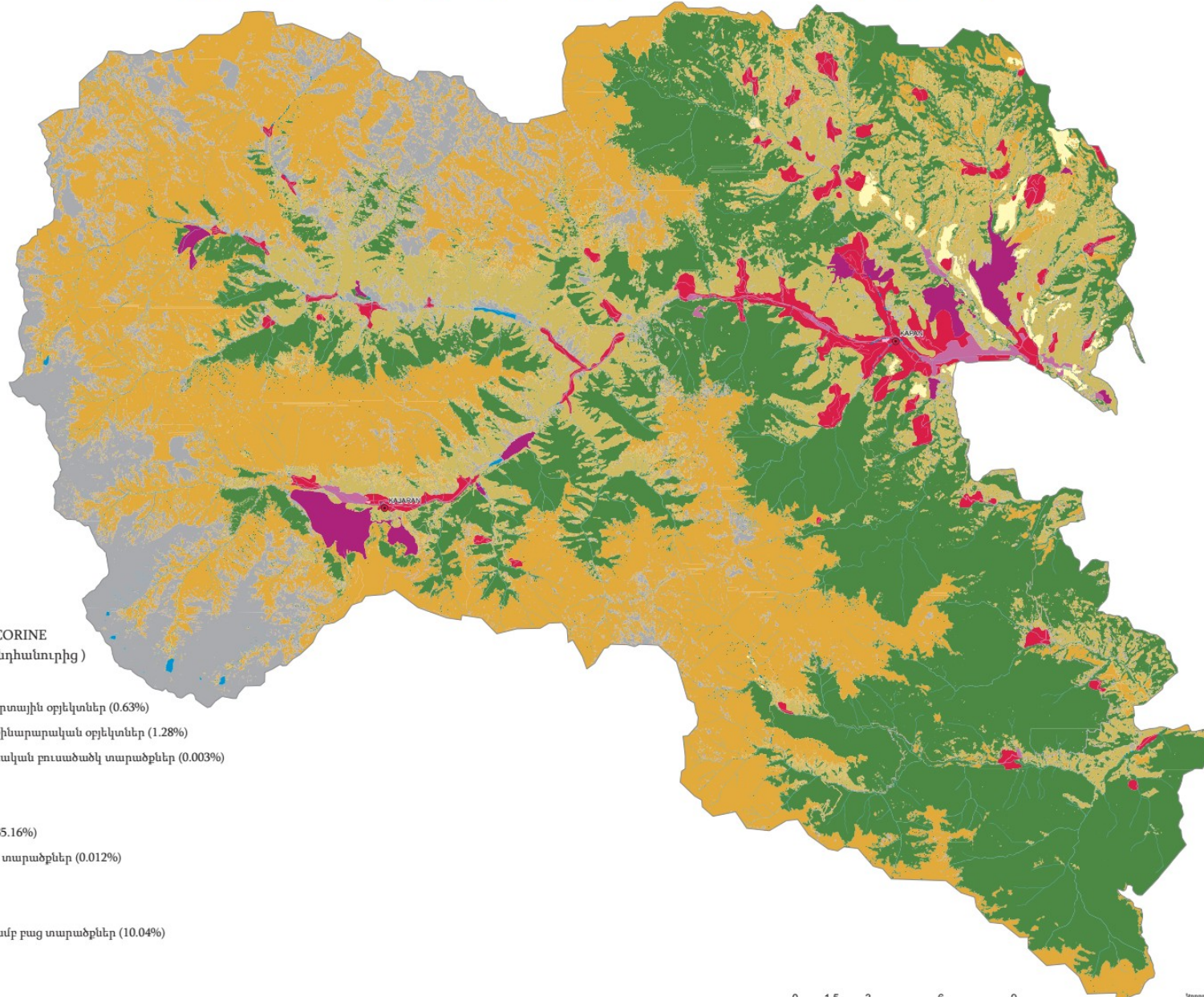


## Ողջիի գետավազանի հողօգտագործման քարտեզ

### Պայմանանշաններ

Հողօգտագործման տեսակը՝ ըստ CORINE  
համակարգի դասակարգման (% ընդհանուրից)

- Քաղաքաշինական (2.77%)
- Արդյունաբերական և տրանսպորտային օբյեկտներ (0.63%)
- Հանքավայրեր, պղծամբարներ, շինարարական օբյեկտներ (1.28%)
- Արհեստական, ոչ գյուղատնտեսական բուսածածկ տարածքներ (0.003%)
- Վարելահողեր (0.58%)
- Բազմամյա տնկիներ (0.003%)
- Արոտավայրեր, խոտհարքներ (35.16%)
- Հետերոգեն գյուղատնտեսական տարածքներ (0.012%)
- Անտառներ (33.85%)
- Թփուտներ (14.97%)
- Քիչ կամ առանց բուսականության բաց տարածքներ (10.04%)
- Ճահճուտներ (0.002%)
- Ջրային մարմիններ (0.7%)



0 1.5 3 6 9

Պատկերաստված համակարգը՝ WGS 84 UTM Zone 38N  
Պրոյեկցիոն՝ Transverse Mercator  
Հիմնականը՝ 2014

# Further activities

- Land cover mapping in Voghji River basin (funded by AUA research grant) focusing on changes (e.g. due to mining activities)
- Collaboration with State Forest Monitoring Center to strengthen capacities in forest monitoring using data from satellite and UAVs
- Building collaborations with universities in Armenia and Europe on topics, such as
  - Monitoring of protected areas in Armenia
  - Mapping of ecosystem services using Participatory GIS
  - Assessment of hazards caused by tailings dam failure
- Organising regular lecture series on GIS & remote sensing



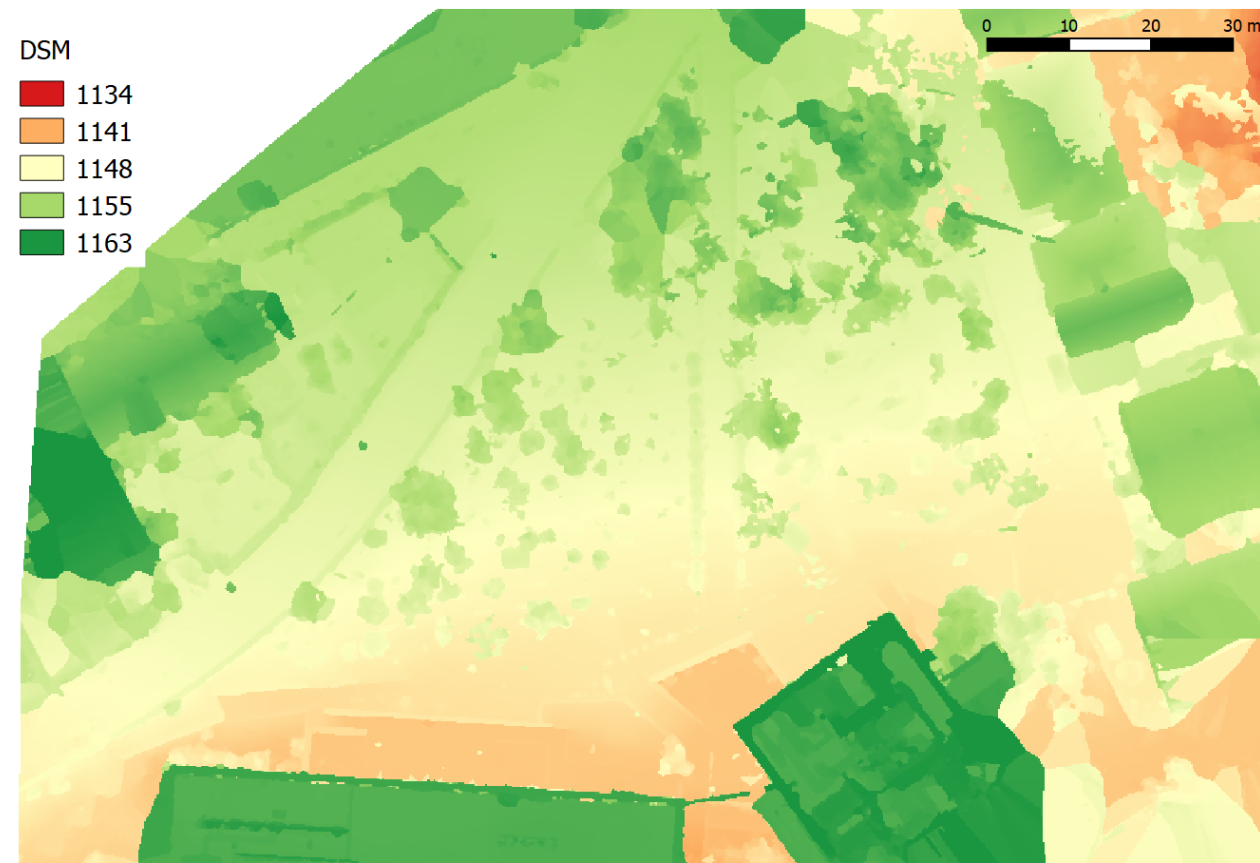
# Conclusions and some lessons learned

- AUA as a link between different research groups
- Importance of
  - High-quality basemap datasets
  - Institutionalisation of knowledge
- Misconceptions about potential and limitations of GIS and Remote Sensing
  - Minute-by-minute updates??
  - Plant species just one click away??
- Promotion of Open Source software



# Drone

- DJI Phantom 3 Pro (quadcopter)
- To be used for DSMs of study areas, orthomosaics of forest areas, urban applications





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Thank you!

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