Laboratory and image spectroscopy for mapping of selected rocks in peak areas of the Krkonoše Mountains

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HyMountEcos - Hyperspectral Remote Sensing for Mountain Ecosystems

- EUFAR TA - European Facility For Airborne Research,Transnational Access
- Warsaw University, Department of Geoinformatics and Remote Sensing (Bogdan Zagajewski and his team)
- Charles University in Prague, Faculty of Science, Department of Applied Geoinformatics and Cartography
- Project goals
  - Mountain ecosystems mapping and inventarization
  - Analyses of ecosystems species composition and invasive species introduction.
  - Analyses and evaluation of forest ecosystems conditions/health (biophysical parameters like chlorophyll content, LAI, water content)
  - Proposal of the processing chain for mountain ecosystems monitoring using hyperspectral technologies and potential/feasibility assessment of hyperspectral data/technologies for the mountain ecosystems analysis and monitoring.
- … one of the research topics (master thesis – Jana Kubečková):

Mapping of selected rocks of the Krkonoše mountains peak area using laboratory and image spectroscopy

Goals

- To classify selected rocks, block fields and outcrops in peak areas of the Krkonoše Mountains using four classification methods: SAM (Spectral Angle Mapper), SID (Spectral Information Divergence), MESMA (Multiple Endmember Spectral Mixture Analysis) and LSU (Linear Spectral Unmixing)

- To compare the used methods (evaluation of classification results based on expertise of geologist – dr. Karel Martínek – Geology Dpt. CUNI)

- To evaluate the influence of lichens covering the rocks in different density on the classification result

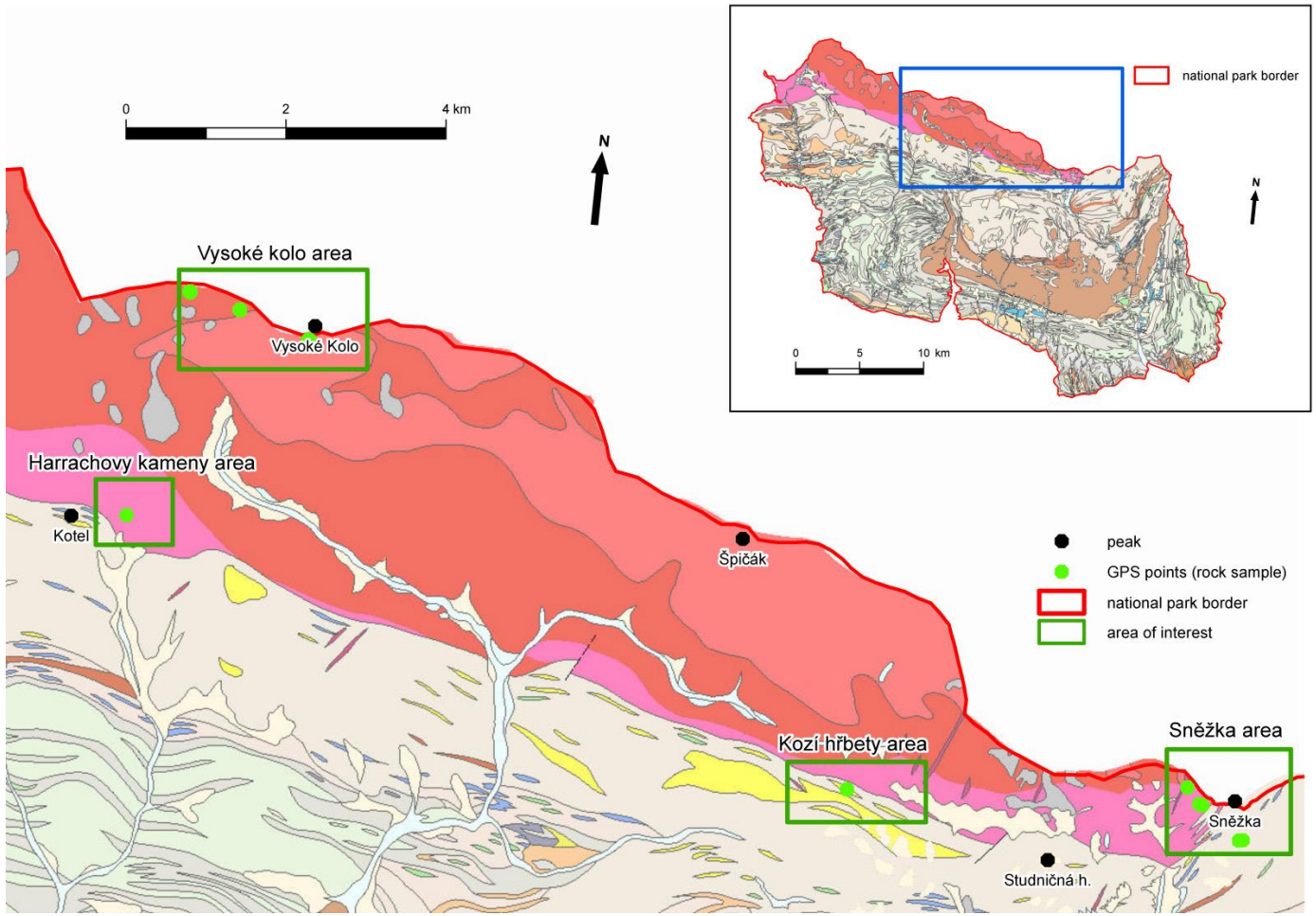
Study area

4 peak areas of the Krkonoše Mountains on the Czech – Polish border:

- Vysoké kolo
- Harrachovy kameny
- Sněžka Mts.
- Kozí hřbety

Geology

Mainly granite, schist, quartzite

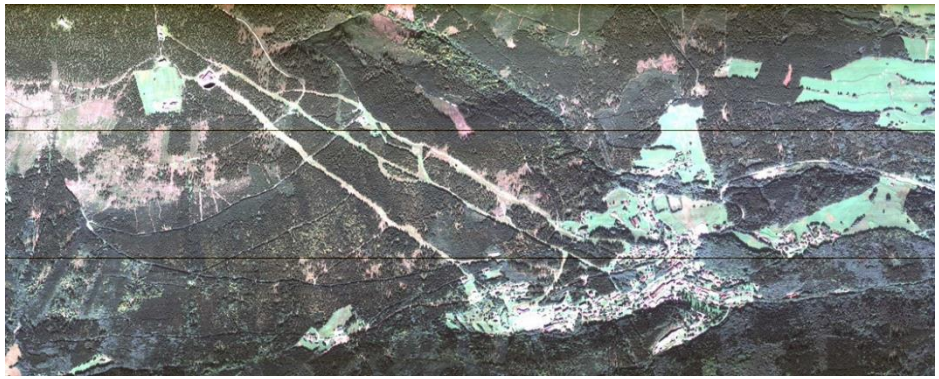


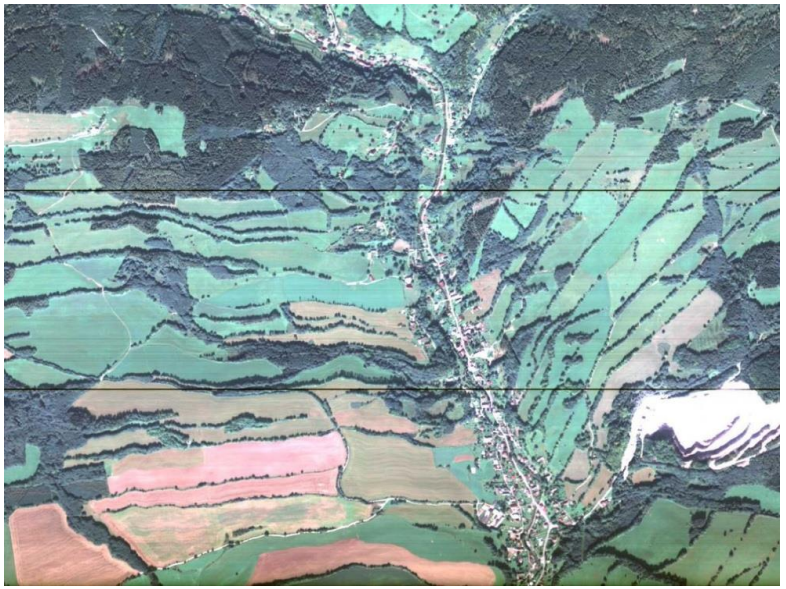
Study area

Image data

APEX sensor (Airborne Prism Experiment)

- Spectral coverage: 380 – 2500 nm
- Number of bands: 288
- Spatial resolution: 2.4 m

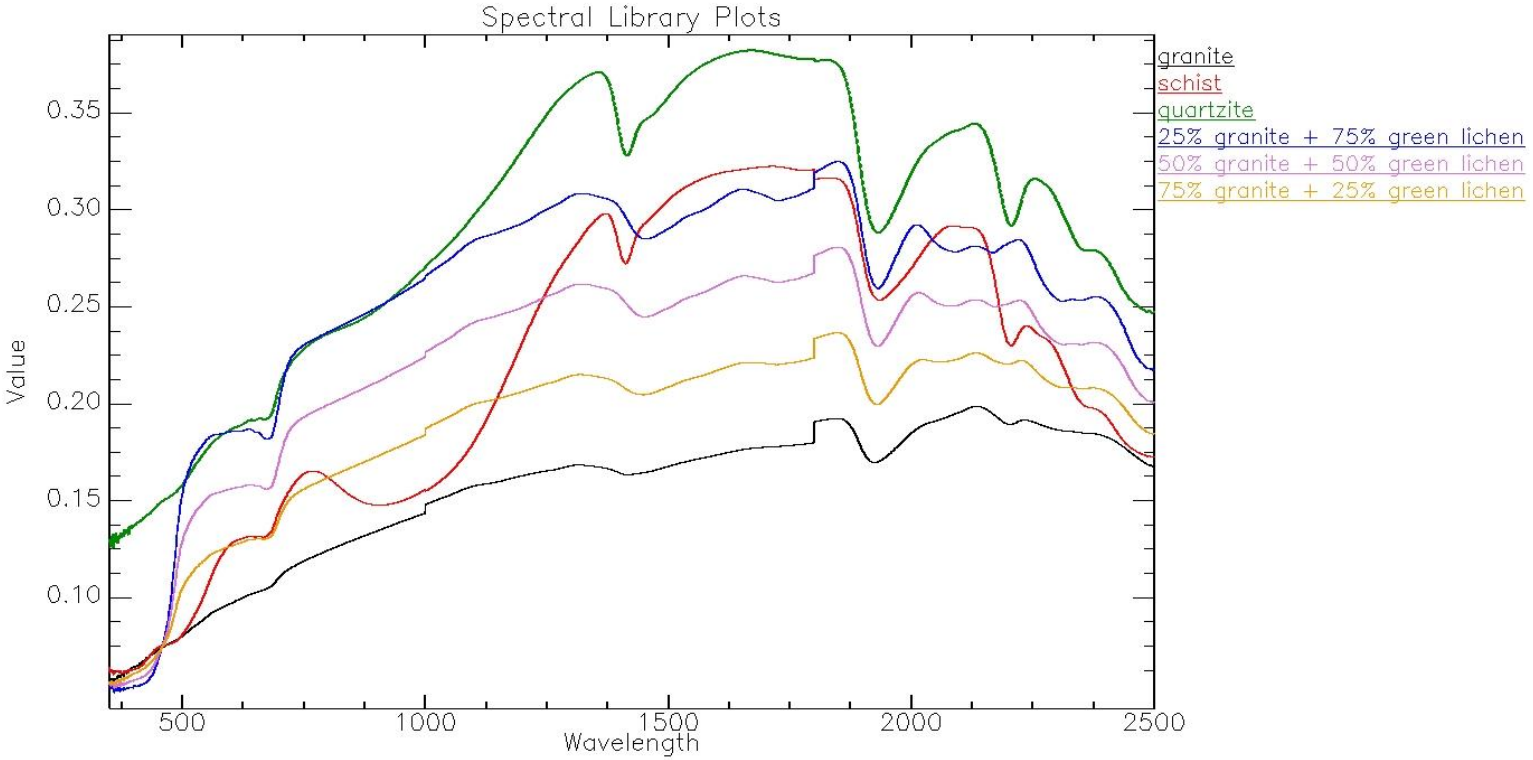




Field/laboratory data

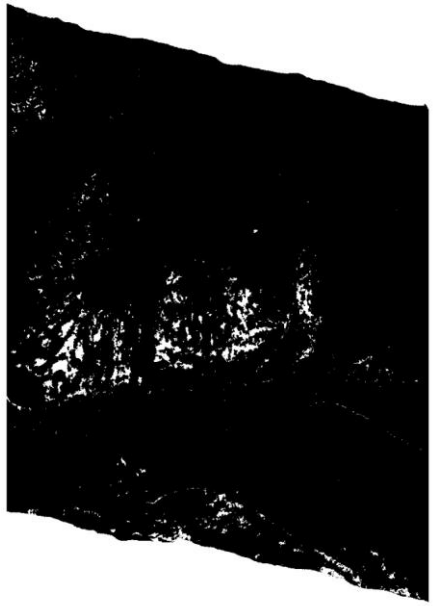
- Field spectral measurements of selected rocks, block fields and outcrops
- Laboratory spectral measurements of geological samples and lichens (green, yellow and black)
- ASD FieldSpec 4 WR spectroradiometer

- Created spectral library contains spectra of rocks and lichens and mixtured spectra of rocks and lichens (25%, 50% and 75% share of green, yellow and black lichens)



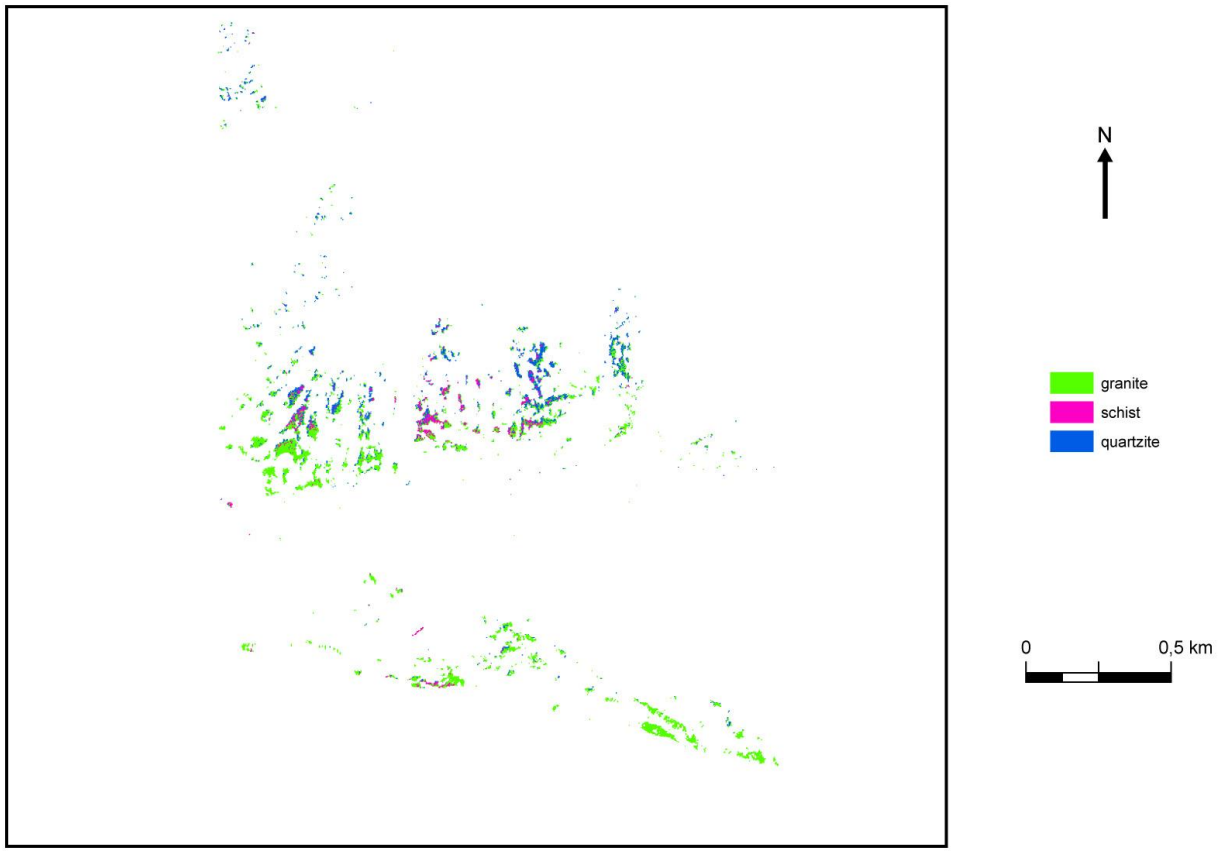
Methods

- Mask of rocks (based on NDVI threshold)
- Endmembers selection from library and from image
- Classification
    - SAM (Spectral Angle Mapper)
    - SID (Spectral Information Divergence), MESMA (Multiple Endmember Spectral Mixture Analysis)
    - LSU (Linear Spectral Unmixing)
    - Evaluation of classification results based on expertise of geologist



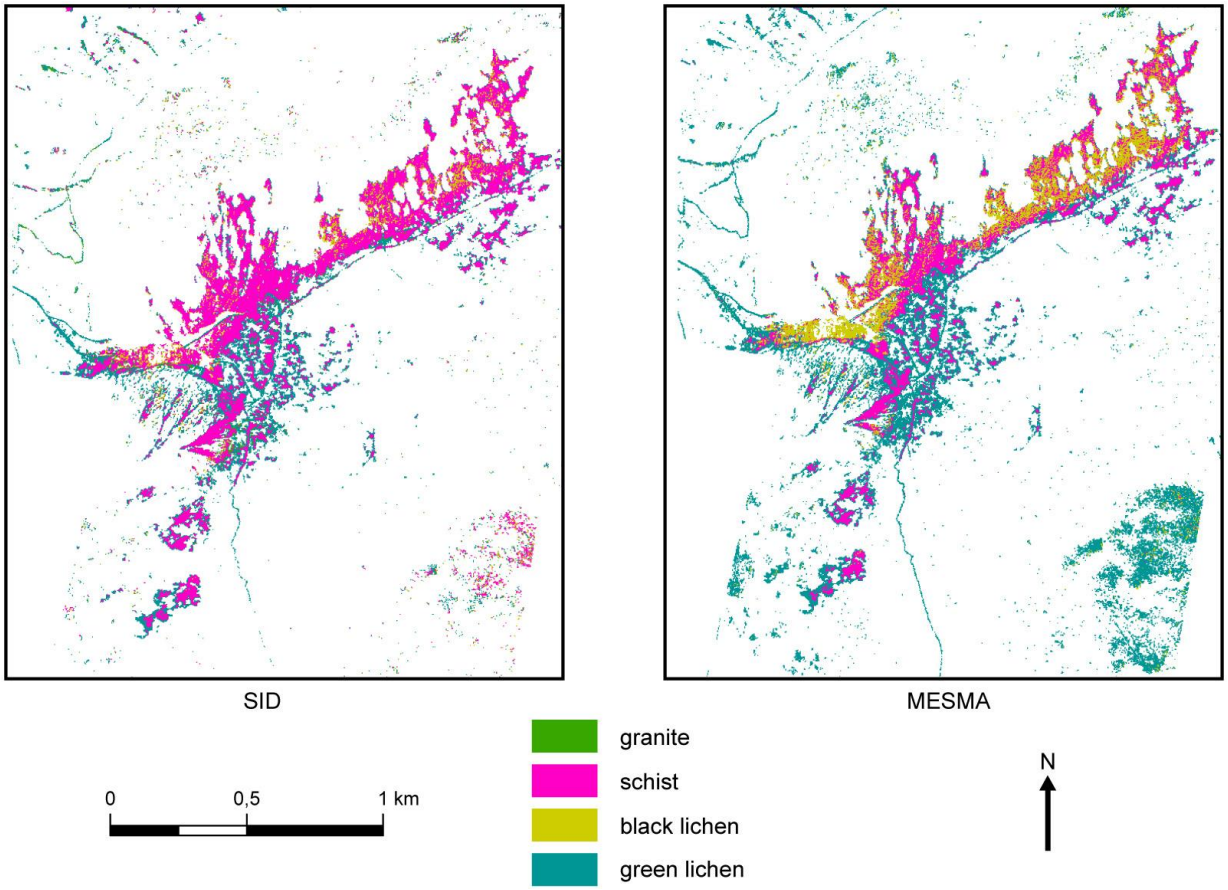
Results

- Kozí hřbety classification output
- Steep slope – all types of rocks mixture
- Good results MESMA, note very good results SID



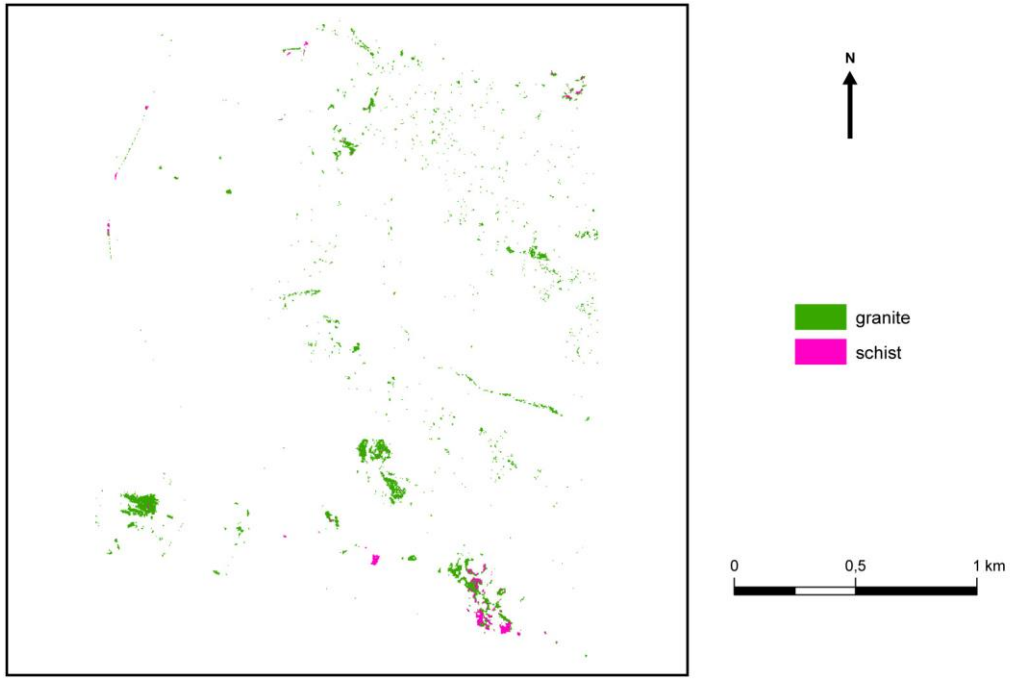
Results

- SID and MESMA classification for Sněžka based on laboratory spectra of rocks and lichens
- Detects geological border between granite and schist and different types of lichens
- Other methods classify more extensive area but the results are not accurate



Results

- Harrachovy kameny - MESMA
- Best results MESMA, good results SAM
- Good border detection between granite and schist



Results

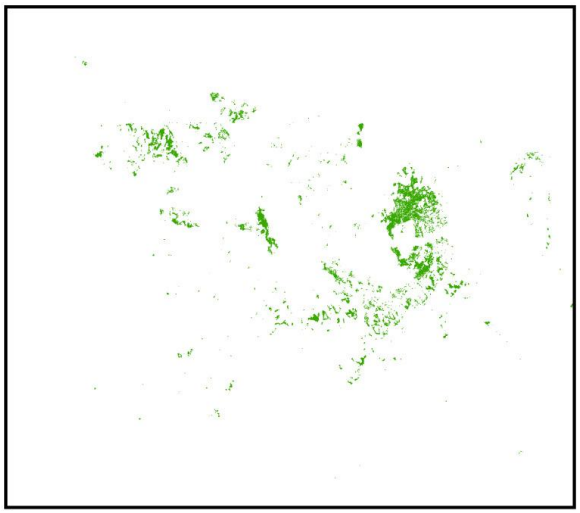
- Vysoké kolo area – MESMA classification results

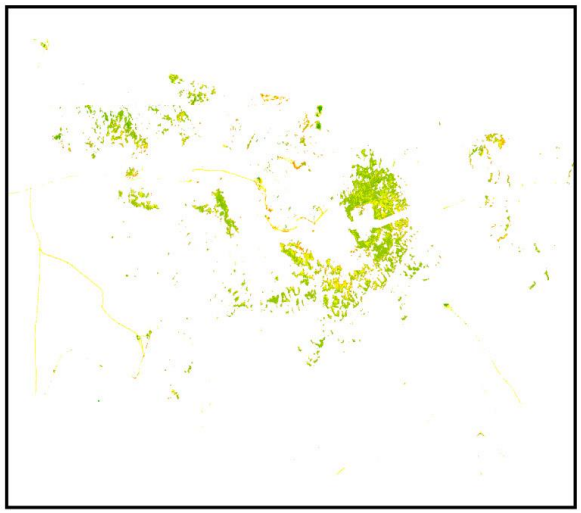
Endmembers

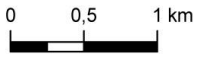
Only granite

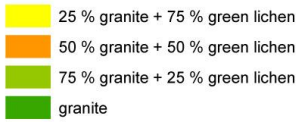
granit + green lichens

better spatial classification according to mask









Conclusions

- As for classification methods based on expertise of geologist the best results were achieved using MESMA and SID classifiers
- MESMA produced the best spatial accuracy and also the best classification accuracy of particular rocks types
- The worst results provided for most of the sites SAM classifier
- Similar accuracy for image and laboratory spectra
- Better accuracy for rock spectra and lichen spectra than for spectra of only rocks
- Recommended approach – MESMA using laboratory spectra of rocks or combination of laboratory and image spectra and pure spectra of all lichens

Thank you for your attention!

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