APPLICATION OF REMOTE SENSED DATA IN RESEARCH OF SHELTERBELTS EFFECTS AS A PRACTICE OF AGROFORESTRY IN COMBAT WITH WIND EROSION AND DESERTIFICATION

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ABSTRACT
Wind erosion is a widespread phenomenon causing serious soil degradation which leads to the loss of fine particles of soil, organic matter and nutrients. As a major practice of agroforestry systems, shelterbelts (windbreaks) play a significant role in reducing damage caused by wind. Other benefits of shelterbelts are increasingly being recognized as sand drift, protecting crops, livestock and farmstead and providing wildlife habitat, etc. In my PhD thesis I am planning to combine remote sensed data with standard models for wind erosion estimation. I am also expect to find a correlation between remote sensed data about vegetation and land use change with observed data from a filed (with dust samplers). Regarding a shelterbelts (windbreaks) I am going to estimate structural parameters, effects on wind speed reduction and other ecosystem benefits using remote sensed data.

INTRODUCTION
- Wind erosion is a widespread phenomenon causing serious soil degradation.
- According to the EU Thematic Strategy for Soil Protection (EC, 2006), an estimated 42 million hectares are affected by wind erosion in Europe.
- As a major part of agroforestry ecosystem, shelterbelts play a significant role in reducing numerous adverse effects of wind erosion.

Fig 1. Wind Erosion in Vojvodina (Serbia)

Fig 2. Shelterbelts system as agroforestry practice

OBJECTIVE
The main objective of further research will be focused on:
1) How to use remote sensed data:
-with main models for estimating soil loss by wind erosion (WEQ, RWEQ, WEPS).
-with measured and observed data in order to improve generating maps with areas sensitive to wind erosion
2) To use remote sensed data in order to estimate main characteristics, effects of shelterbelts for wind speed reduction and other ecosystem services function.

Fig 3. Vegetation index (NDVI)

Fig 4. Land use change

METHOD
Geographical information systems and remote sensing have been used as a powerful tool for the evaluating of wind erosion. Bing Guo et al. (2017) **combined remote sensed data with combination with multi-criteria decision making, fuzzy logic and wind erosion models to generate maps sensitive to wind erosion.** In terms of shelterbelts research Xiguang et al. (2017) has used **remote sensed data to estimate structural parameters of windbreaks.**

Detection and characterization of hedgerows can be detrmined using by **SAR imagery** (Betbender et al. 2014).

Data collected using synthetic aperture radar (SAR) have the potential to provide information on the geometry of sand dunes and other aeolian features because of the sensor's susceptibility to changes in the structure of surface feature (Francisko Del Valle et al. 2010).

Vegetation indices (e.g. NDVI) and Land use change → Fuzzy logic or multi-criteria decision making (AHP) → Wind erosion models → Maps sensitive to wind erosion

Correlations with observed sand transport rate data

Data obtained by this research will be validate through the further field research.

Vegetation indices (e.g. LAI – Leaf Area Index) → Optical porosity (structural parameter of windbreaks) → Wind speed reduction
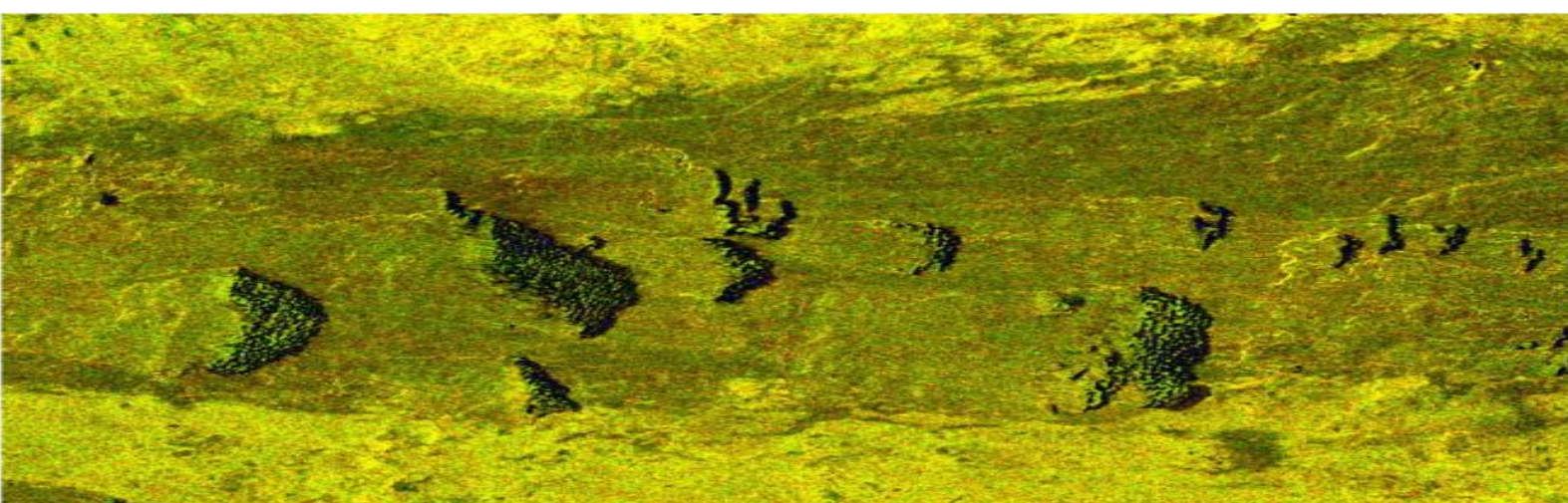

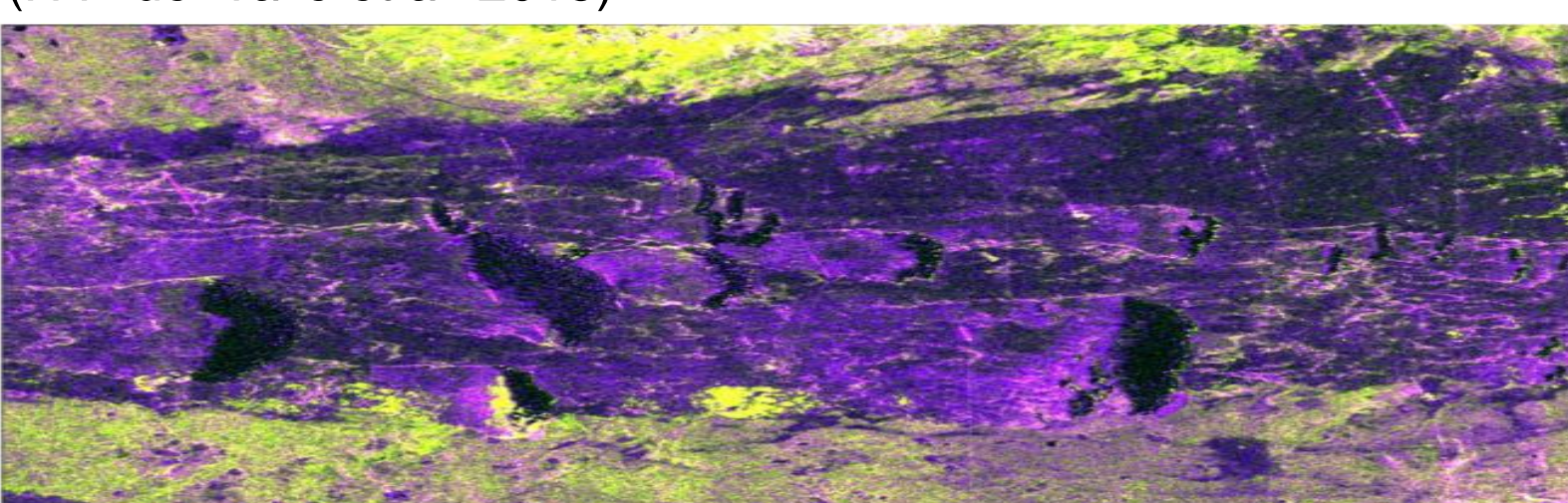Fig 5. COSMO SKYMED subset (X-band), RGB; HH-VV-HH/VV (H.F. del Valle et al. 2015)

Fig 6. ALOS PALSAR subset (L-band), RGB, HH-HV-HH/HV H.F. del Valle et al. 2015)
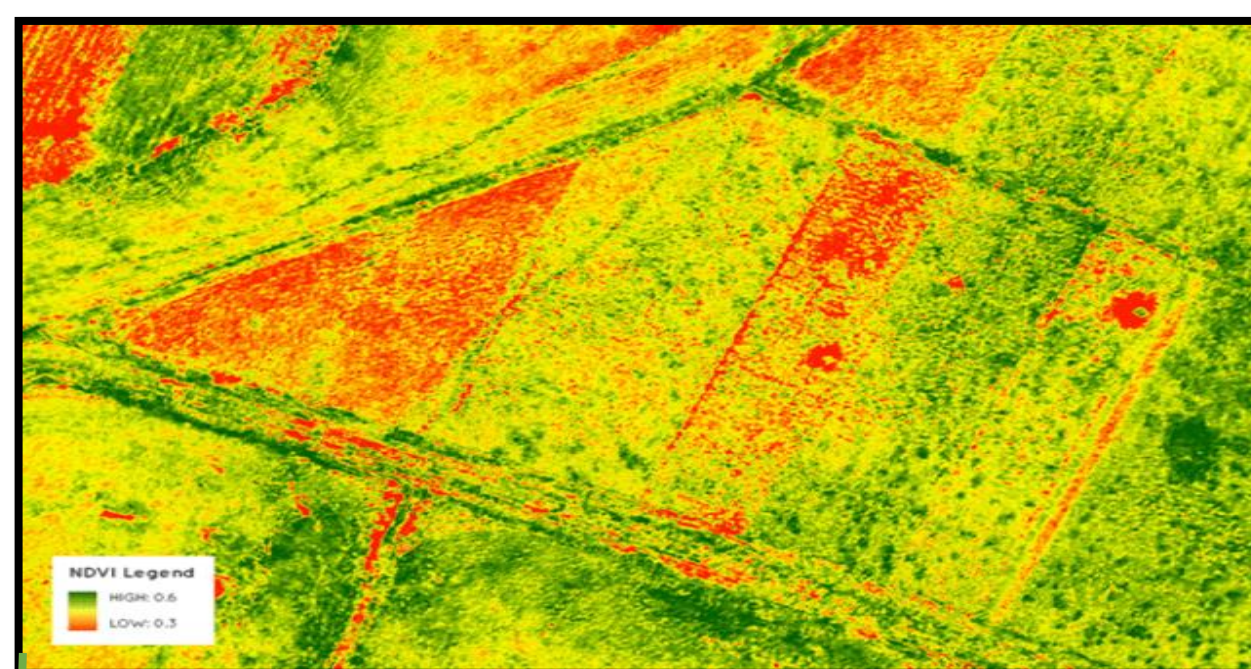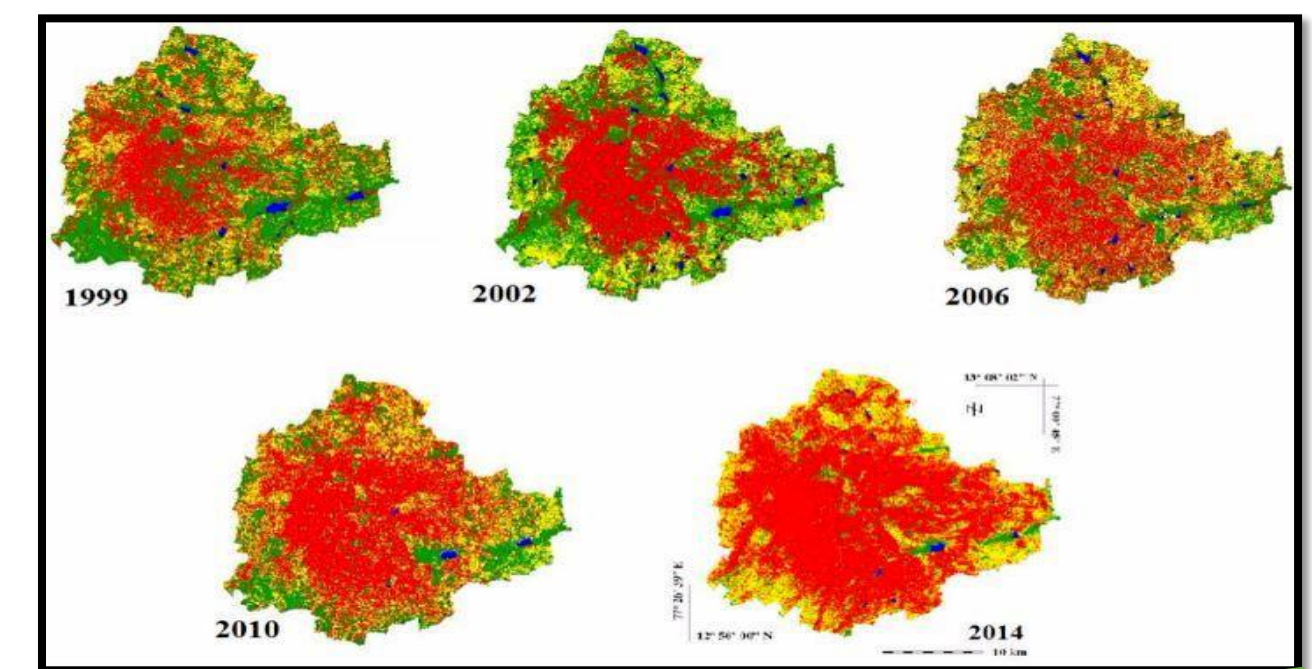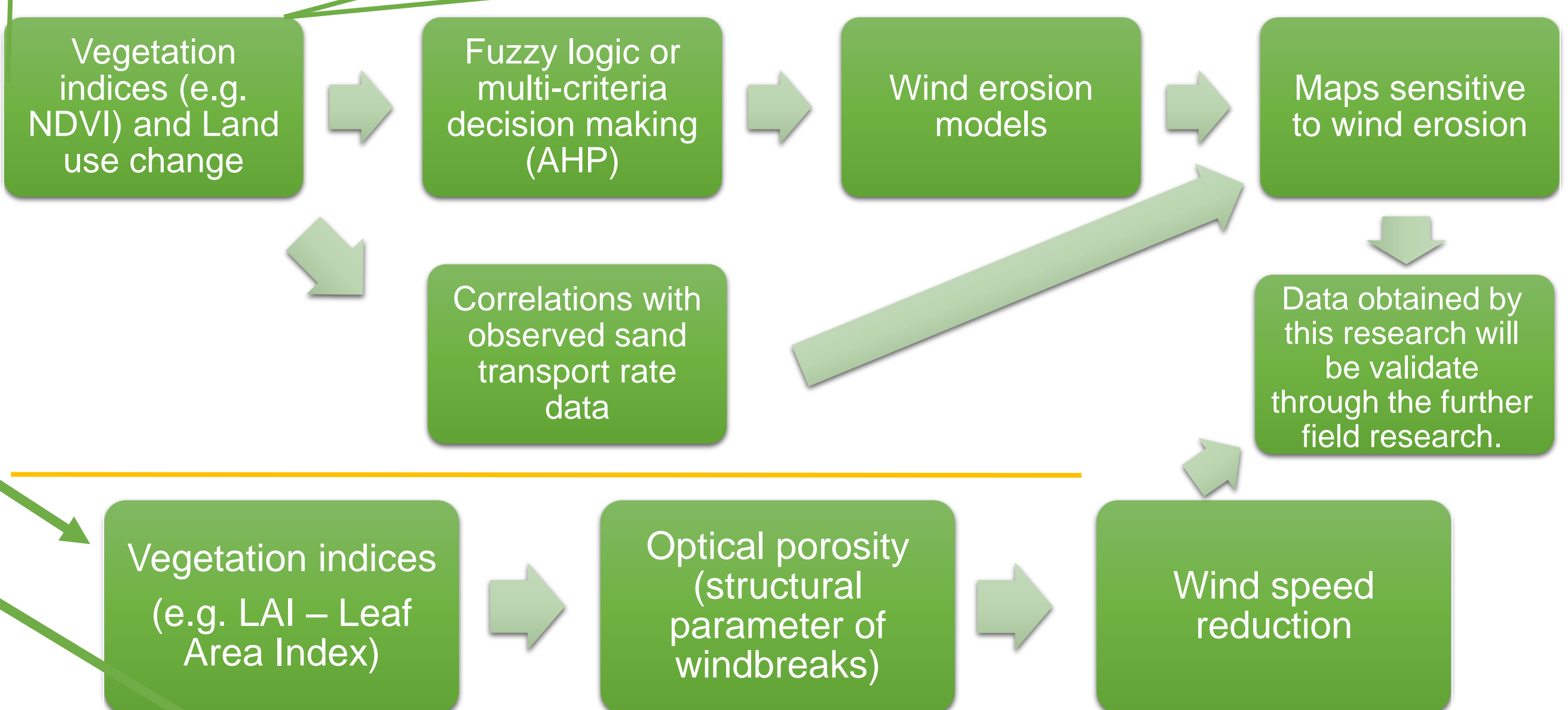
Terrain features caused by wind activity are better discriminated by active microwaves than by sensors operating in the visible and infrared regions of the electromagnetic Spectrum (H.F. dell Valle et al. 2010).
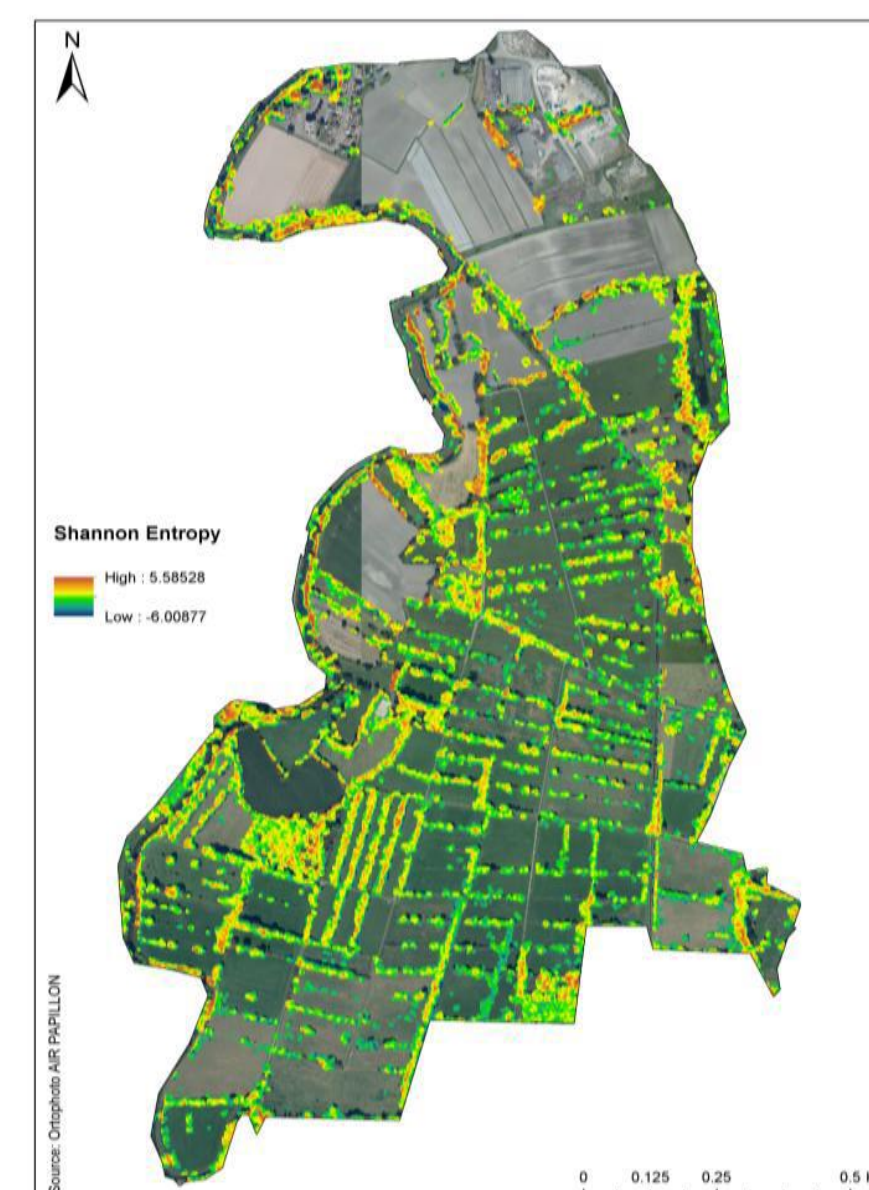

Fig 7. Map of the Shannon entropy index of the hedgerows extracted from the TerraSAR-X image (Betbender et al. 2014)

CONCLUSION
The further research in the filed of wind erosion and shelterbelts (windbreaks) could have positive impact and contribution to the agricultural and forest sector in terms of implementation of agroforestry systems in the Republic of Serbia. New knowledge from Land Training 2018 about land use and land cover; change detection and multitemporal analysis; vegetation status and its disturbance would have great contributions in the future scientific research work through implementation remote sensed data with models for wind erosion estimation and study of shelterbelts.

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