Use of SPOT 5 Take 5 data supported with Landsat 8 imagery for monitoring forest areas in a temperate zone as a precursor of Sentinel-2 applications

Zbigniew Bochenek[1], Dariusz Ziółkowski[1], Maciej Bartold[2,1], Bogdan Zagajewski[2], Andrzej Kłos[3]

[1] Institute of Geodesy and Cartography, Remote Sensing Centre, Warsaw, Poland
[2] Department of Geoinformatics, Cartography and Remote Sensing, Faculty of Geography and Regional Studies, University of Warsaw, Poland
[3] Independent Department of Biotechnology and Molecular Biology, Faculty of Natural and Technical Sciences, Opole University, Poland

STUDY AREA AND DATA USED

Bialowieska Forest located in northeastern Poland, characterized by diversified forest structure due to tree species, forest sites and stand mixture, has been selected as a study area.

Seven non-cloudy SPOT 5 images were collected for this area within SPOT 5 Take 5 experiment, starting from early April till end of August 2015. In addition, seven Landsat 8 OLI images covering vegetation period were acquired for the same study area. All satellite images were atmospherically corrected prior to further data analysis.
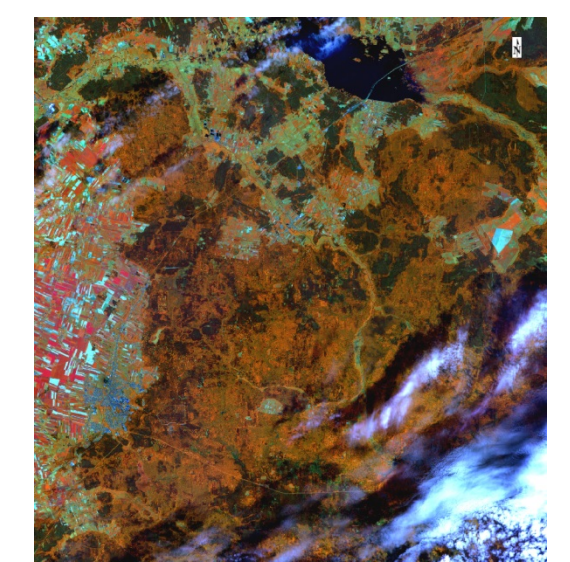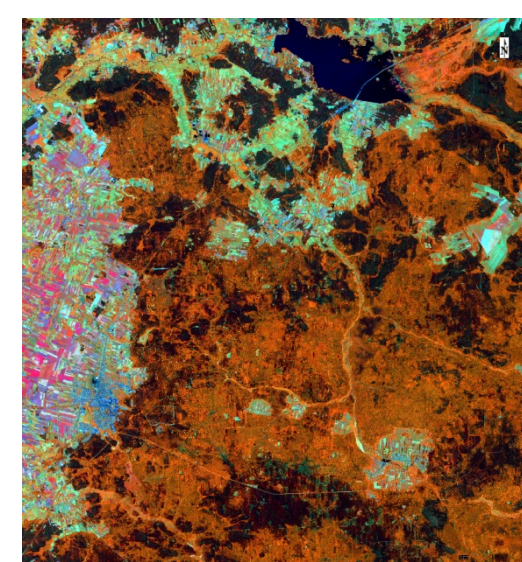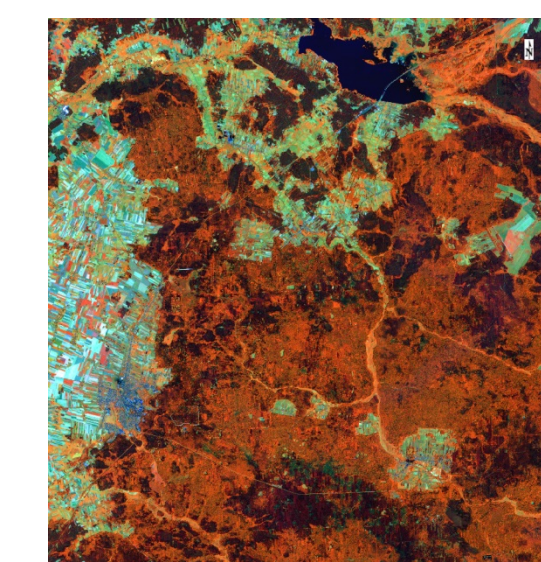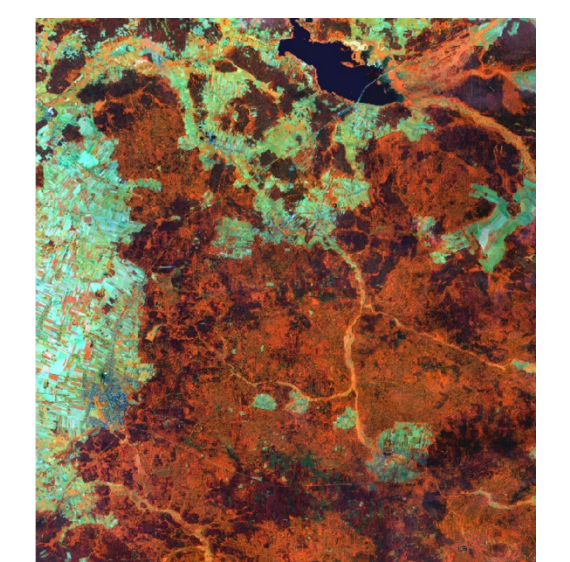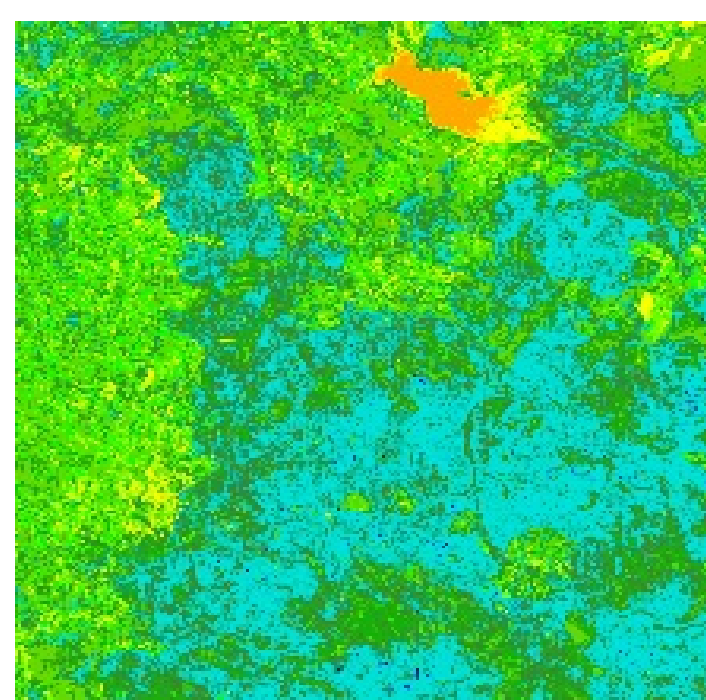
SPOT 5 IMAGES
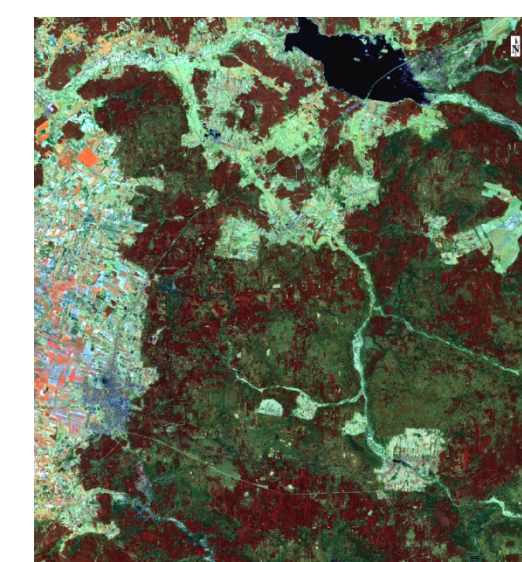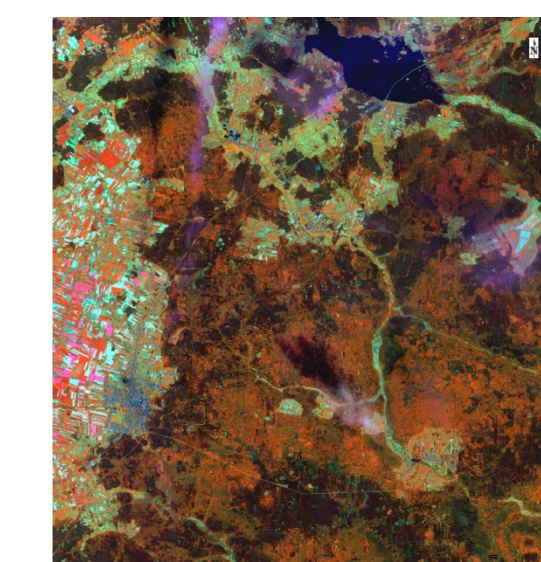
APRIL 09   MAY 19   JUNE 08
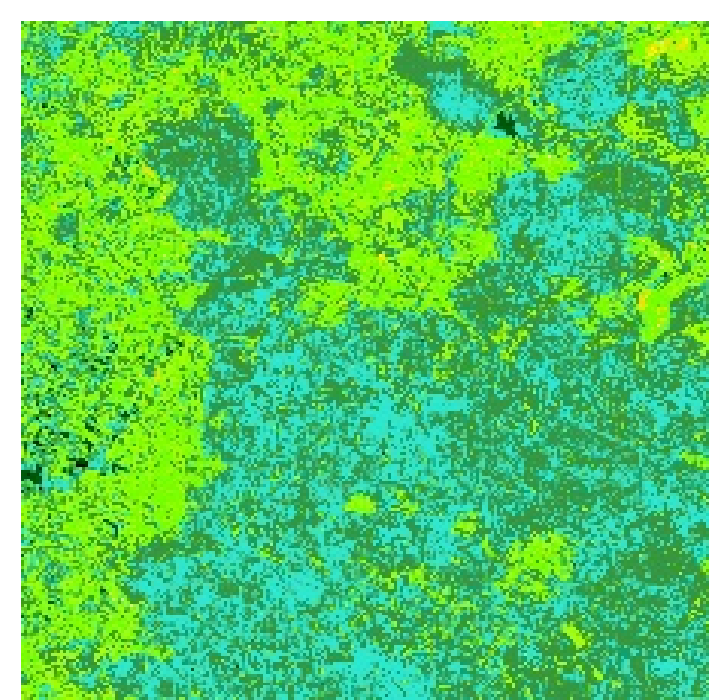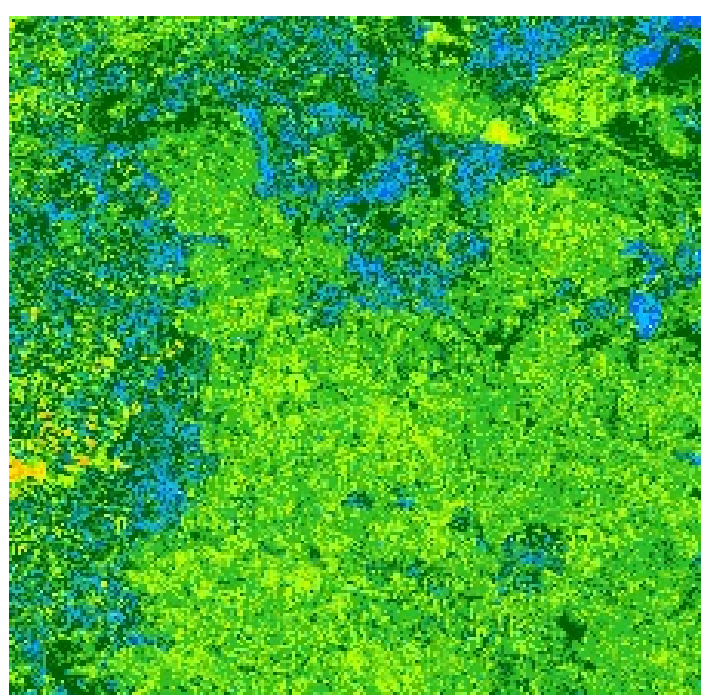JULY 03   AUGUST 07   AUGUST 27

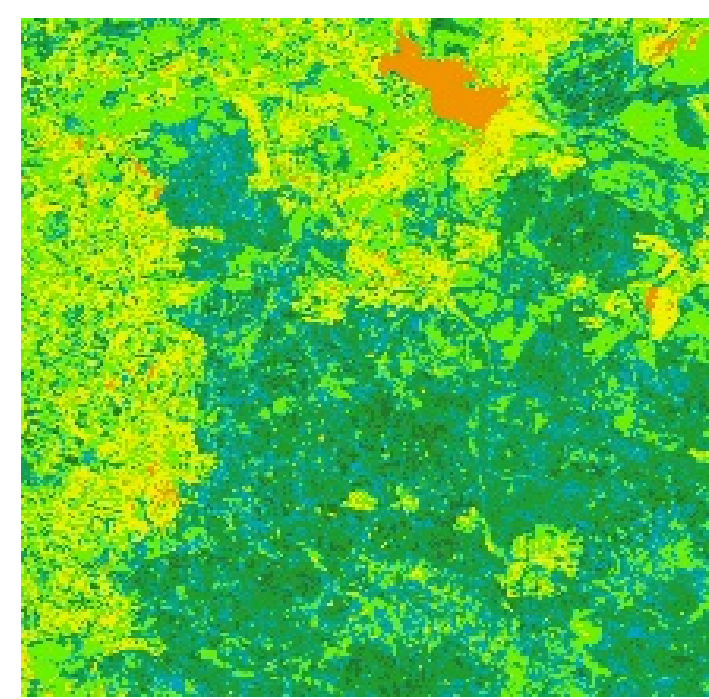## VEGETATION INDICES DERIVED FROM SATELLITE DATA

NDVI   NDII
RDI   DSWI

Four vegetation indices have been derived from SPOT 5 and Landsat 8 images. They characterize different aspects of vegetation development:

- Normalized Difference Vegetation Index – NDVI
    $$NDVI = (NIR - RED) / (NIR + RED)$$
    characterizing general vegetation condition
- Normalized Difference Infrared Index - NDII
    $$NDII = (NIR - SWIR1) / (NIR + SWIR1)$$
    sensitive to water content in plants
- Ratio Drought Index – RDI
    $$RDI = SWIR1 / NIR$$
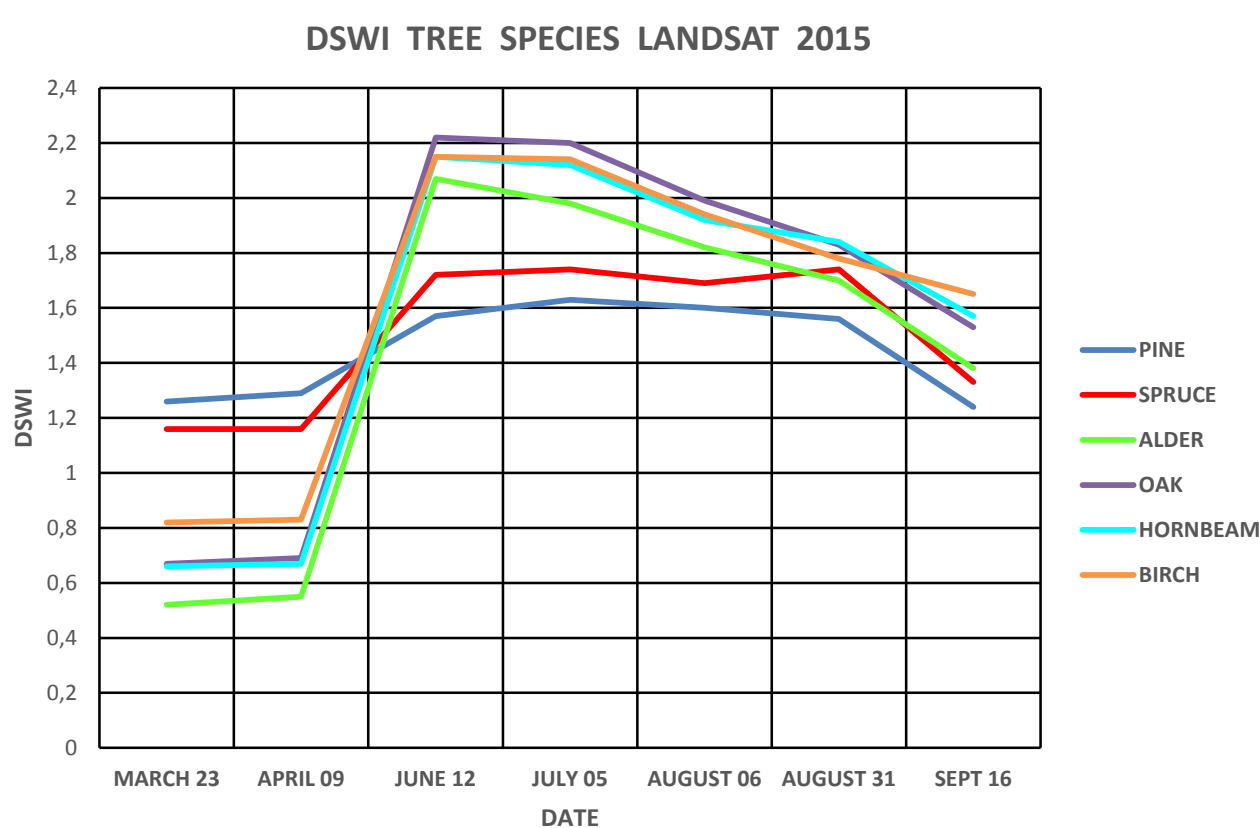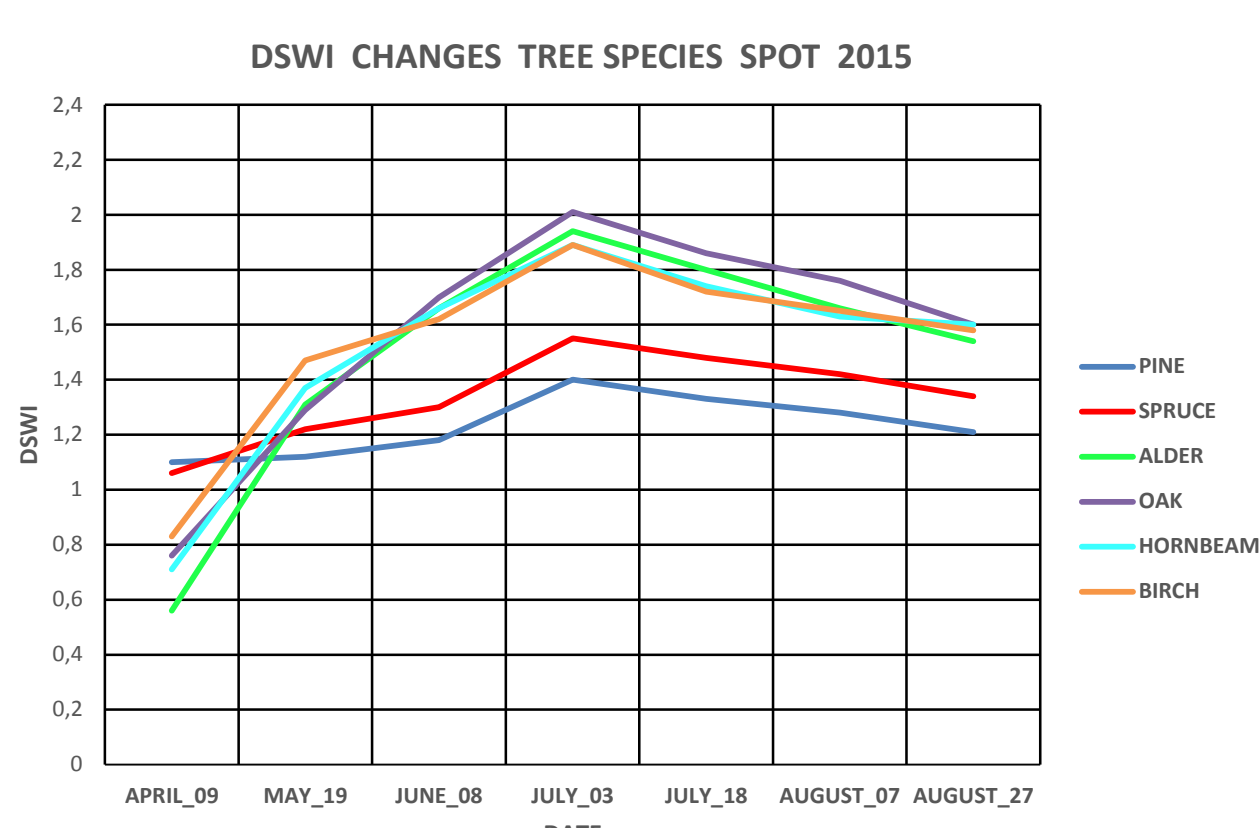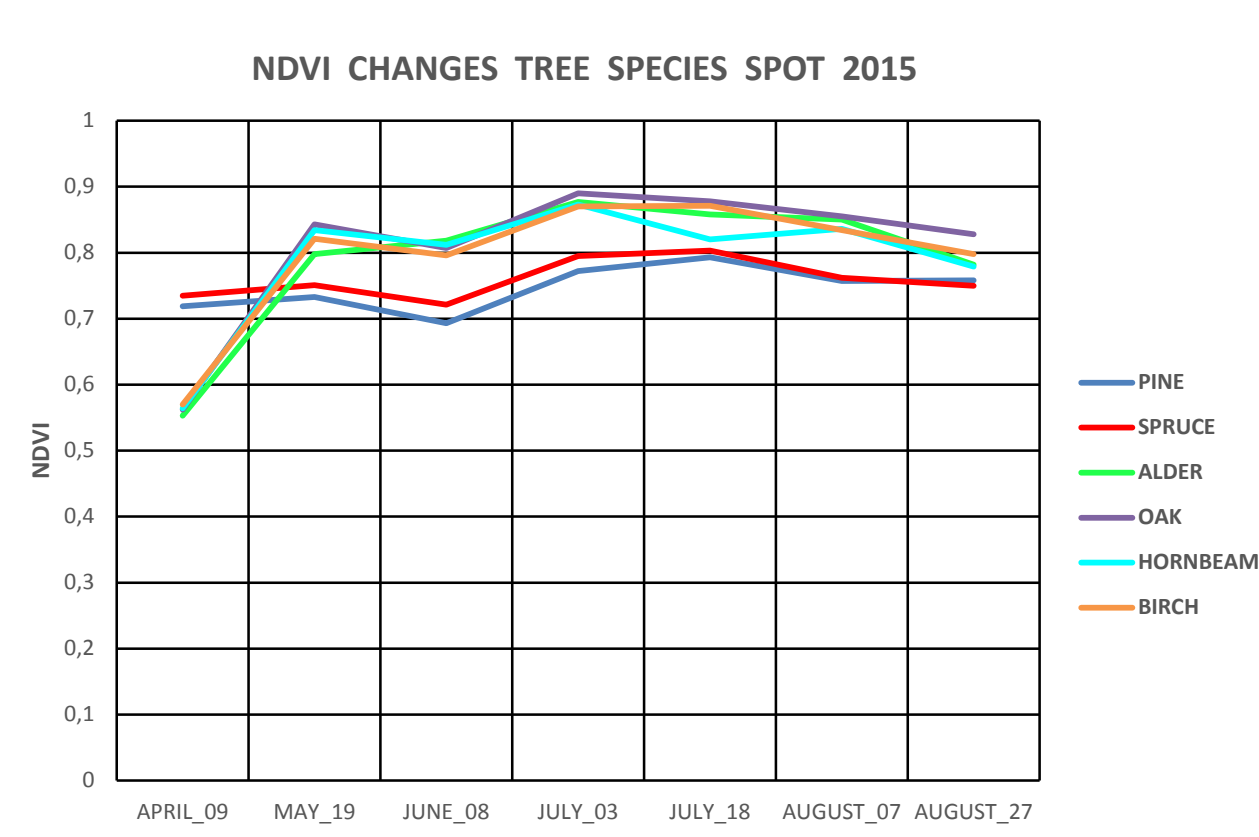   characterizing drought impact
- Disease Water Stress Index – DSWI
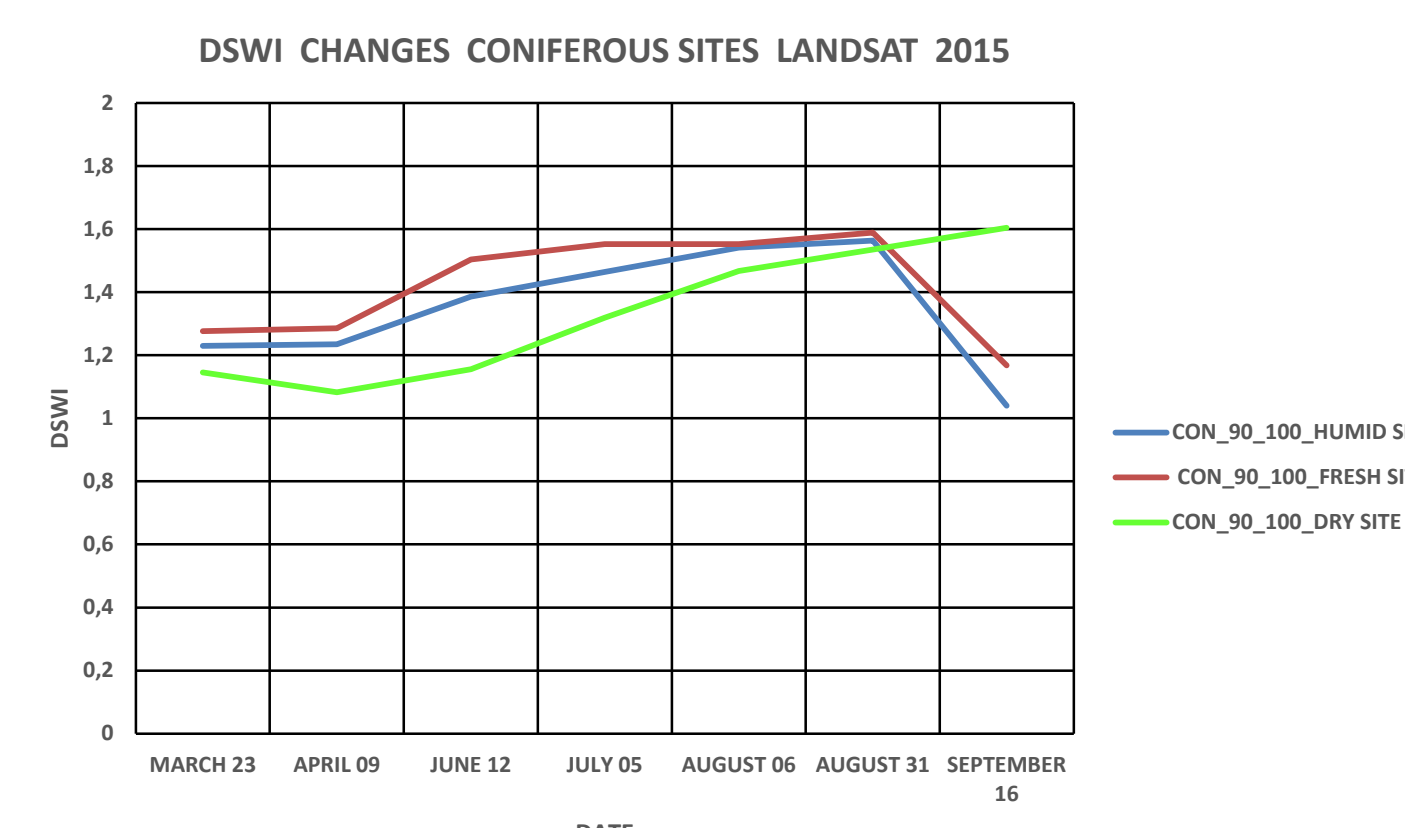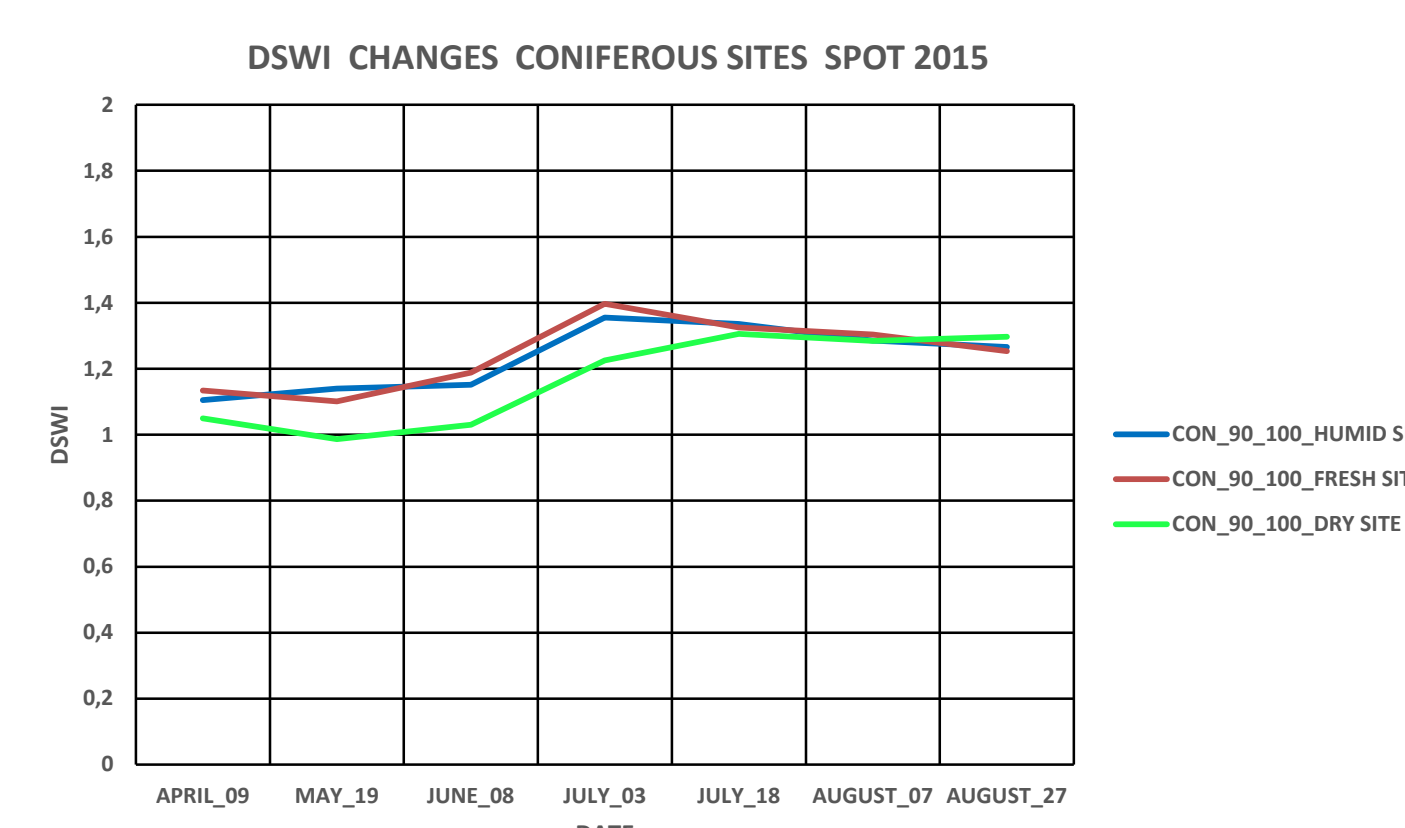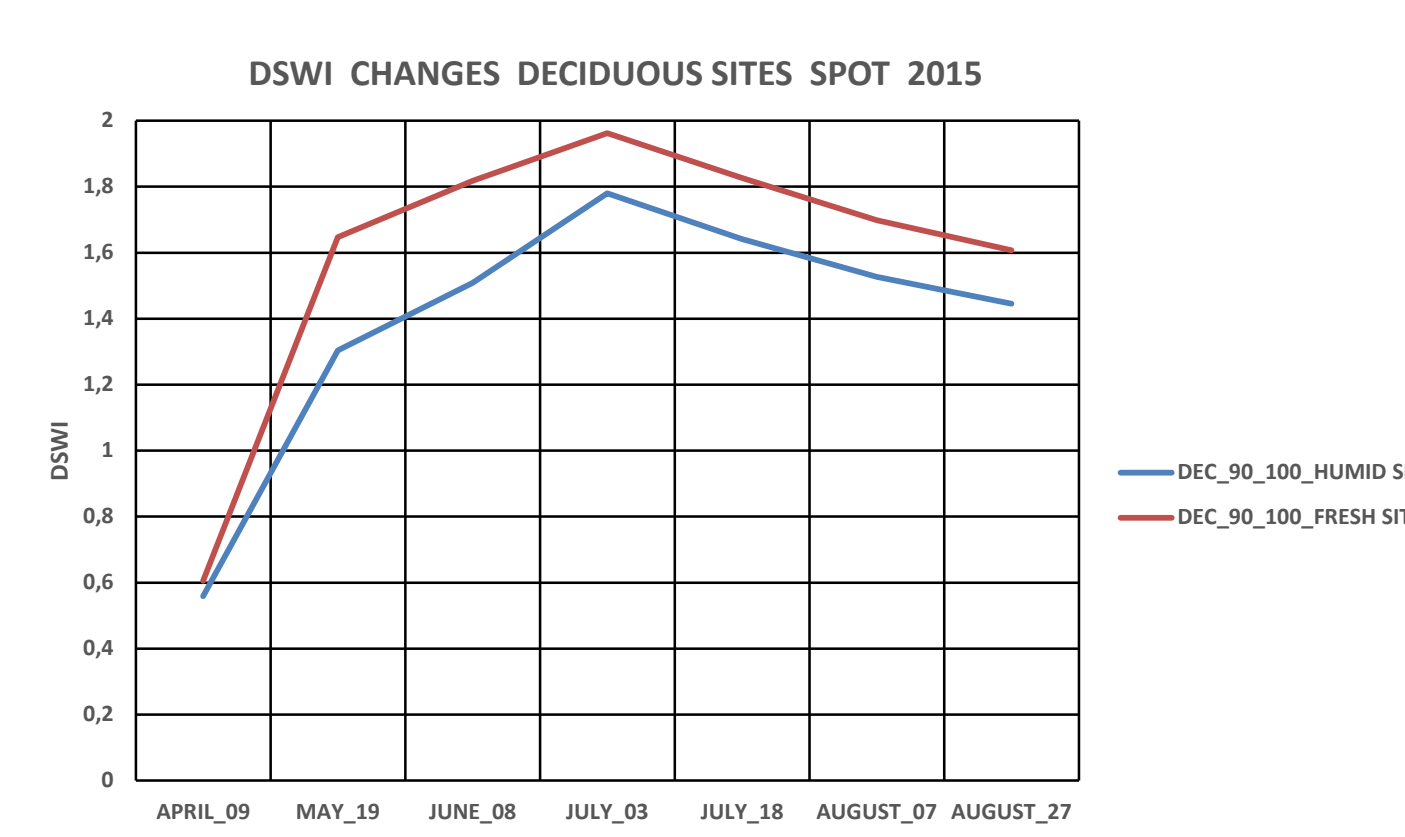 $$DSWI = (NIR - GREEN) / (SWIR1 + RED)$$
    sensitive to stress due to water shortage and plant damage

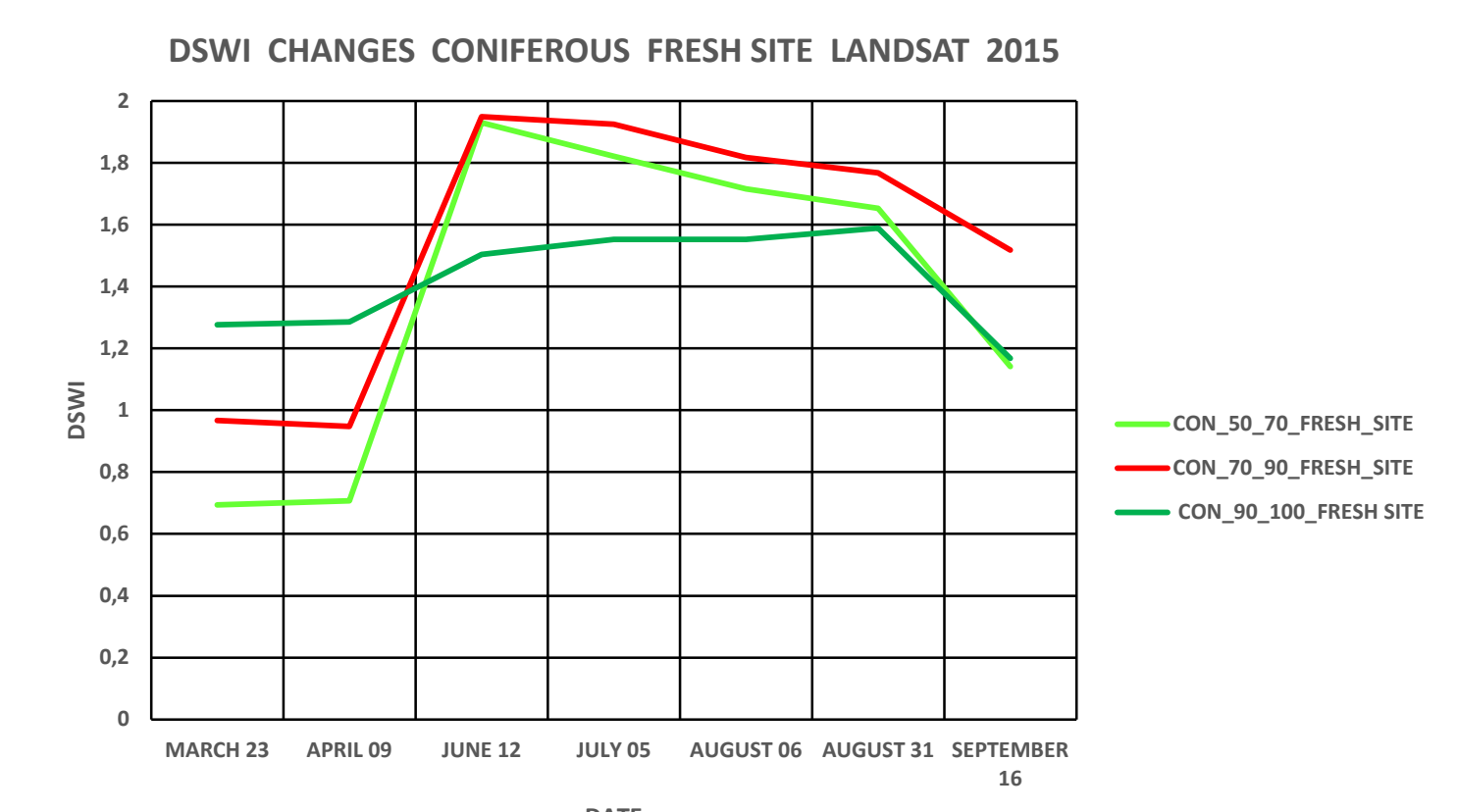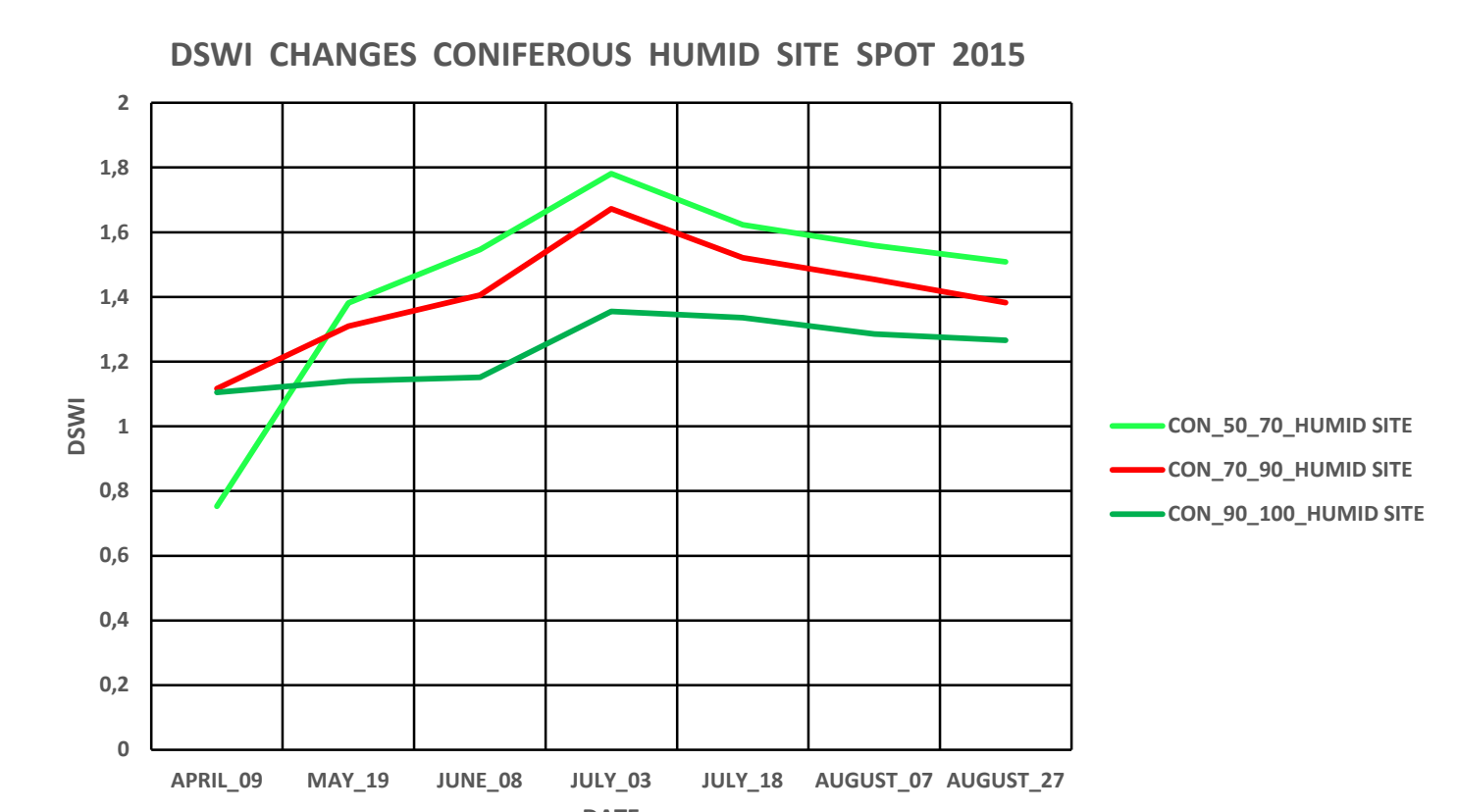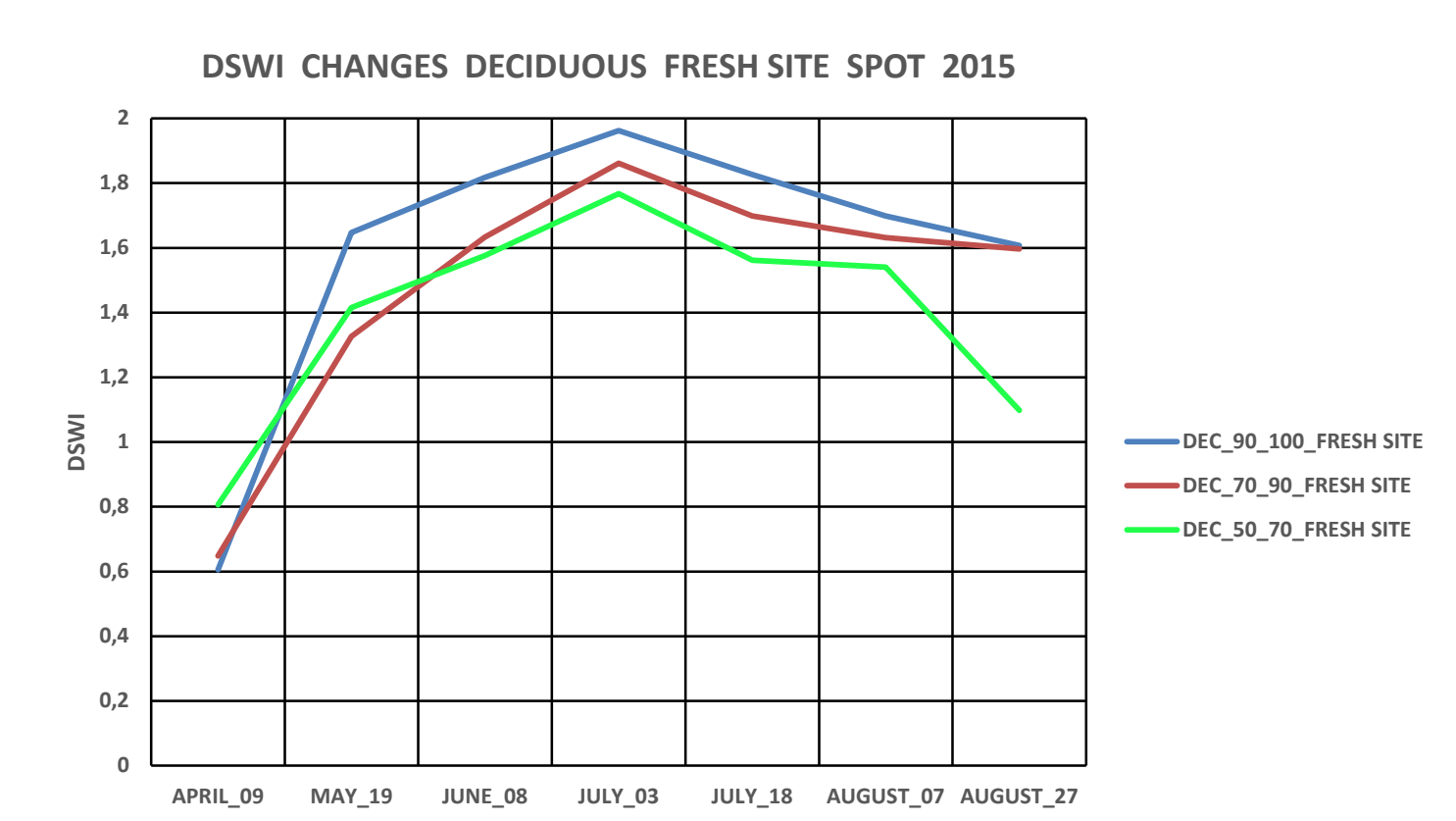## STUDY OF VARIOUS ENVIRONMENTAL FEATURES OF FOREST AREA

TREE SPECIES

FOREST SITE TYPE

FOREST COMPOSITION

CONCLUSIONS

- Inter-comparison of various vegetation indices – NDVI, NDII, RDI and DSWI revealed superiority of Disease Water Stress Index – DSWI for characterizing environmental conditions within forest areas
- DSWI index allows to differentiate two types of forest stands – coniferous and deciduous forests in a better way than the remaining vegetation indices
- Coniferous forests located on dry forest sites appear to have lower DSWI values than those situated on fresh and humid sites
- Deciduous forests located on fresh forest sites have higher DSWI values than those situated on humid sites throughout the whole growing season
- In case of mixed coniferous forests DSWI index increases depending on degree of mixing with hardwoods; in case of deciduous forests DSWI decreases while mixing with conifers is observed
- Decrease of values of vegetation indices – DSWI, NDII, NDVI – at the second part of vegetation season 2015 is correlated with the drought period, which appeared in June, July and August
- Forest stands situated on dry forest sites are more resistant to drought impact than those located on humid and fresh sites

ACKNOWLEDGMENTS