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Annual and seasonal agriculture land-use mapping using remote sensing in case of arid region

Zeineb Kassouk (1,2), Raja Mabrouki (1,2), Bernard Mougenot (2,3), Zohra Lili Chabaane (1,2)

(1) LR17AGR01 (GREEN-TEAM-TEAM), National Agronomic Institute of Tunisia (INAT), Carthage University, Tunis, Tunisia, (2) LMI Naila LMI NAILA « Gestion des ressources en eau dans les milieux ruraux tunisiens », (3) Centre d'Etudes Spatiales de la Biosphère, UPS, CNRS, CNES, IRD – UMR5126, Toulouse, France

Spatial land use information is important input parameters for semiarid agro-ecosystem and water management. Advancement in satellite technology in terms of spatial, temporal and spectral resolutions and treatment methods leads, successfully, to more identification of land use components. Automatic assessment of spatio-temporal crop and tree pattern and extent at multi-scale (community level, regional level and global level) has been a challenge to researchers.

The aim of this project is to develop a semi-automated approach to extract seasonal and annual crop and trees patterns in the case of Merguellil plain in Tunisia. The method is based on remote sensing data and associated spectral indexes calculated and field-training samples.

At first, a methodology for the enhanced differentiation of the major annual Agriculture landuse patterns is developed by using the decision tree (DT) approach and time series of Normalized Vegetation Index (NDVI) and the first Independent component (IAC) calculated on 14 SPOT5 images acquired in 2012-2013 and based on 125 field training data. The method identify six class (Cereals, arboriculture, winter vegetables, summer vegetable, olives, and bare soil) with a global precision of 79 % with a Kappa index of 0.72. The method is most favorable for the differentiation of seasonal crop and tree patterns: In winter, the method allows identification of five classes (Cereals, arboriculture, winter vegetables, olives and bare soil) with a global precision of 90% with a Kappa index of 0.85. In summer, four classes are identified (cereals, arboriculture, summer vegetables, olives and bare soil) with a global precision of 87 % with a Kappa index of 0.85.

- the combination of the decision approach using multitemporal NDVI time series calculated from 19 Sentinel 2A imagery (for 2016-2017), 180 training field data and by using object oriented classification process of the IAC and ACP first components results on best mapping of annual patterns with a global precision of 92% and kappa index of 0.90. Winter crop paterns are identified with a global precision of 89.5 % and summer ones are identified with a global precision of 85%.

- Random Forest classifier (RF) applied to NDVI time series calculated from SENTINEL2A (2016-2017) allows the identification of eight classes in winter (cereals, bare soil, alfalfa, parsley, olive trees, citrus trees, winter vegetables and deciduous trees) with a global precision of 91 %. In summer, we identified twelve classes (bare soil, pepper, tomato, alfalfa, melon, parsley, olive trees, olive with tomato, olive with peach, olive with melon, chili with melon, and deciduous trees) with a global precision of 83%.

The resulting dataset reveals seasonal crop maps is extremely heterogeneous. Consequently, the integration of remote sensing-based crop rotation data can considerably reduce uncertainties regarding agriculture land-use.