

BIOMASS ESTIMATION OF OIL PALM USING AIRSAR DATA

LAILI NORDIN

Malaysian Centre For Remote Sensing (MACRES)

No. 13 Tun Ismail Rd.

Kuala Lumpur

Malaysia

E-mail: laili@macres.gov.my

ABSTRACT

The utilities of multi-polarization and multi-frequencies of Synthetic Aperture Radar (SAR) data for oil palm biomass inventory and mapping are investigated. The study is on oil palm plantations in Tapah, Malaysia. The work focuses on two main applications. First, retrieval of oil palm biomass by establishing empirical relationships between backscatter coefficient and conventional estimation of biomass based on model as well as ground data. Second, mapping oil palm plantation based on age using segmentation algorithms and classification.

The results of estimation oil palm biomass from radar backscattering coefficient using multi-frequencies and multi-polarization are encouraging. The backscattering coefficient from both L- and P-bands of horizontally transmitted and horizontally received (hh), vertically transmitted and vertically received, and horizontally transmitted and vertically received (hv) are linearly correlated ($r=0.75$) with oil palm biomass and age. This is in agreement with other studies using JERS-1 SAR on oil palm where backscattering coefficient of L-hh is linearly correlated with oil palm height.

The results also show good degree of agreement between the output of a region growing segmentation algorithm applied to de-speckling SAR images (using 5 x 5, 7 x 7, 9 x 9, and 11 x 11 windows of Frost, Lee and Gamma filters), and conventional classification using optical Landsat Thematic Mapper data and field checking. However, the results are very complex, variable and highly dispersed. Oil palm of ages 6, 7, 15 and 20 years can be discriminated in L-hh polarization and 25 years old in P-hh polarization, respectively, after de-speckling with the Gamma filter of 5 x 5 window. The oil palm of one and two years old are highly discriminated in L-hh polarization with the Frost Filter of 5 x 5 and 7 x 7 windows, respectively. Oil palm with an age of 25 years can be discriminated in P-hh polarization with the Lee filter of 5 x 5 window and the five years old oil palm can be discriminated in L-hv polarization with the Lee filter of 9 x 9 windows. Overall, the Gamma filter of 11 x 11 window discriminates oil palm age classes more effectively than the rest.

The main conclusion of this work is that the biomass and age of oil palm can be estimated, discriminated and mapped using AIRSAR images. Thus, the multi-polarization and multi-frequencies AIRSAR data can be useful in monitoring oil palm biomass production and distribution in Malaysia based on their ages.

