

Abstract

Object based segmentation and single tree detection with very high spatial resolution satellite imagery of Tugai Forests along the Tarim River, NW China

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Intensive upstream water regulation and agricultural irrigation of cotton fields of the Tugai river system and the resulting deforestation of flood plains of the last 60 years have drastically altered both the distribution of Tugai forests and the supply of ecosystem services throughout the region. It is important to expand scientific understanding of floodplain forest biomass to establish baseline scientific data for future studies of assessment on environmental impacts associated with land use and climate change.

Therefore this study uses Object-based Image Analysis (OBIA) to identify *P. euphratica* and *Tamarix spp.* plants of riparian Tugai Forests to derive their biomass on a single plant basis. An object based approach takes advantage of all dimensions of remote sensing – objects can be associated with various kinds of properties, such as shape, size, structure and distances.

With the location and the area information of the trees and shrubs from OBIA, missing parameters such as height and DBH were added through linear functions, which were extracted from field samples. Then biomass of *P. euphratica* and *Tamarix spp.* were calculated with regression models of these plants. The forest structure, the density of the plants and the mean biomass estimations were then compared between the field sampling and the OBIA.

Field sampling with the Point-Centered Quarter Method (PCQ-Method) resulted in a density of *P. euphratica* of 140 plants/ha and the density *Tamarix spp.* of 835 plants/ha. Using a hexagon grid (1 ha per cell) – the mean plant frequencies from OBIA, for *P. euphratica* are 71 trees/ha (SD \pm 81) and for *Tamarix spp.* are 67 shrubs/ha (SD \pm 59). According to their frequencies of the PCQ-Method, the biomass of *P. euphratica* is estimated 14.68 t/ha and for *Tamarix spp.* it is 15.6 t/ha. According to the data from OBIA the biomass of *P. euphratica* is estimated 6.19 t/ha and for *Tamarix spp.* it is 1.56 t/ha.

The huge difference of the density of *Tamarix spp.* suggests that the PCQ-Method includes understory vegetation and data from OBIA does not. Broken crowns, a characteristic of older *P. euphratica* trees leads to over-segmentation and differences in biomass estimation. As well

variations of *Tamarix spp.* are not covered in this paper. Therefore stratified sampling could improve the analysis substantially.

Keywords: Tugai Forests, Biomass, Object-based Image Analysis (OBIA)