Mapping of mangrove species and communities using UAV photography and high-resolution satellite data to evaluate surface erosion induced by sea-level rise on Pohnpei Island, Micronesia

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In the western Pacific low-latitude region between the Philippines and Micronesia, the sea level has been rising at over 10 mm/yr (IPCC 2013). In the mangrove habitat situated in the low sediment inflow environment, *Rhizophora* pure forest is generally formed as a pioneer community and mangrove peat is created. However, the mangrove peat accumulation rate is considered to decrease with the vegetation succession because of the decline of tree density of *Rhizophora* sp. The mangrove communities decreased mangrove peat accumulation rate is possibly affected by sea-level rise first. In Pohnpei Island, Micronesia, the surface erosion is not recognized in the *Rhizophora stylosa* and *Rhizophora apiculata* communities yet, while it is recognized in the communities dominated by other species.

In this study, we create canopy projections for existed permanent plots using UAV photography and ground data first. Secondly, we examine an auto-detect method for mangrove species using the high-resolution satellite data by reference to the canopy projections. Finally, we zone communities based on Mochida et al. (2006) using the mangrove species distribution maps.

UAV photography enable us to identify mangrove species from the size, shape and color of crown. *R. apiculata* has round and relatively small crown with green and brownish to yellowish green. *R. stylosa* has similar features, though their crown loose shape with more brownish color. The two species can be identified from the distribution pattern, i.e., the former widely distribute to the interior, while the latter develop along the seaward forest edge only. *Sonneratia alba* has large and irregular shape crown with yellowish green. *Bruguiera gymnorrhiza* has relatively roundish crown with blueish green and appear in the space among other species with relatively low tree height. *Xylocarpus granatum* has irregular shape crown with emerald green and appear among other species as with *B. gymnorrhiza*.

Pan sharpening using Panchromatic ortho image (ground resolution: 40 cm) and 8 bands multispectral ortho image (ground resolution: 1.6 m) by WorldView-3 (taken on October 17, 2018) enable us to identify some mangrove species automatically. ArcGIS Pro was used for the Pan sharpening and GIMP 2.10.22 was used for auto-detect of mangrove species. As the result, three groups, i.e., 1) *R. apiculata* or *R. stylos* a, 2) *S. alba* and 3) *B. gymnorrhiza* or *X. granatum* were identified automatically. We can create mangrove community map by considering the distribution pattern for *R. stylosa* and *X. granatum*, i.e., the former distributes along seaward edge only and the latter appears in a climax forest with low tree density. The mangrove community map will enable us to create an evaluation map of surface erosion induced by sea-level rise with consideration for tree density of *Rhizophora* species and distance from the seaward forest edge.

Keywords: Mangrove, Sea-level rise, UAV photography, High-resolution satellite data, Species distribution map, Vegetation community map

