

# Spatial Heterogeneity in Grazing Pasture from Small Unmanned Aerial Vehicle (sUAV) with Structure from Motion (SfM) Photogrammetry

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**3-1. Spatial Heterogeneity in Grazing Pasture from Small Unmanned Aerial Vehicle (sUAV) with Structure from Motion (SfM) Photogrammetry**

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Site-specific management strategies in grazing ecosystem increase management efficiency. Due to complex interrelationship among soil-plant-animal-environment in grazing ecosystem, site-specific grazing management needs high measurement density to reflect their spatial patterns within the field. Recently, small unmanned aerial vehicles (sUAV) have been introduced into agricultural research. Images captured by sUAV are shown to be a potential alternative given their low cost of operation in pasture monitoring with high spatial and temporal resolution, and their high flexibility in image acquisition programming. Moreover, current developments in photogrammetric algorithms are specifically adapted to the needs of UAV imagery. Our goal is to clarify the interrelationship between plant-animal in grazed pasture for making precision grazing management. In this paper, we reviewed current developments of sUAV and photogrammetric algorithms, and their applications for pasture managements using our results mainly obtained at Hiroshima University farm in two grazing season of 2014-2015. The results include; (1) seasonal changes in floristic composition and nutritive status for dominant species, (2) spatial distribution of beef cattle with GPS collar attached, (3) application of sUAV to estimate vegetation coverage, herbage biomass and cow's dung detection, and (4) spatial relationship between plant and grazing behavior.