Low Hanging Fruit? An Assessment Of Low-Cost Drone Technology And Imaging Systems In Support Of Sustainable Oil Palm Estate Management.

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Abstract: The average yield per hectare in oil palm plantations varies greatly depending on a wide variety of biotic and abiotic conditions. A fundamental concept of sustainable palm oil production is maximizing the yield per hectare. GIS and remote sensing are widely used for precision agriculture in perennial crops but have not been broadly implemented as tools for identifying and reducing yield gaps in oil palm plantations. Perceived costs, shortage of in-house capacity, and "business as usual" practices are often cited as impediments to embracing technology as a core management tool. Awareness of unmanned aerial vehicles (UAV's) has become widespread but they are still commonly perceived as very "high-tech". However, hobbyists are routinely flying remote controlled aircraft fitted with high-definition cameras and sharing their experience on the internet. So, has "drone technology" become common and "low tech" enough to be easily implemented by oil palm plantations while still providing useful data and management information? We designed and built a low-cost drone capable of autonomous flight and high-resolution, real-time imaging using widely available commercially components to assess the practical application of "hobby grade" technology in an oil palm plantation. Multiple data acquisition missions were conducted against increasingly complex objectives:

1) Record a comprehensive aerial perspective of the estates and infrastructure with 1080 HD video.
2) Detection and mapping the location of oil palm "vacancies" in the estates.
3) Acquire high-resolution color aerial imagery suitable to create an orthomosaic with 25 cm GSD.
4) Use of a modified pocket camera to acquire near-infrared imagery for field scouting and identification of agronomy concerns.
5) Detection and mapping of oil palm stress using NDVI.

The results of the data acquisition flights and mission objectives are presented with an equipment and capability assessment, human resource capacity requirements, potential return on investment, and suggestions for adopting these low-cost tools in support of sustainable palm oil production.

Keywords: Oil Palm, Sustainability, Precision Agriculture, UAV, Remote Sensing