Cost-effective methods for tracking large scale vegetation physiology: Participatory phase and pilot experiments

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Thirsty? Hungry? Sick? Stressed? Novel optical tools for enhanced vegetation health monitoring.

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WHAT AND WHY?

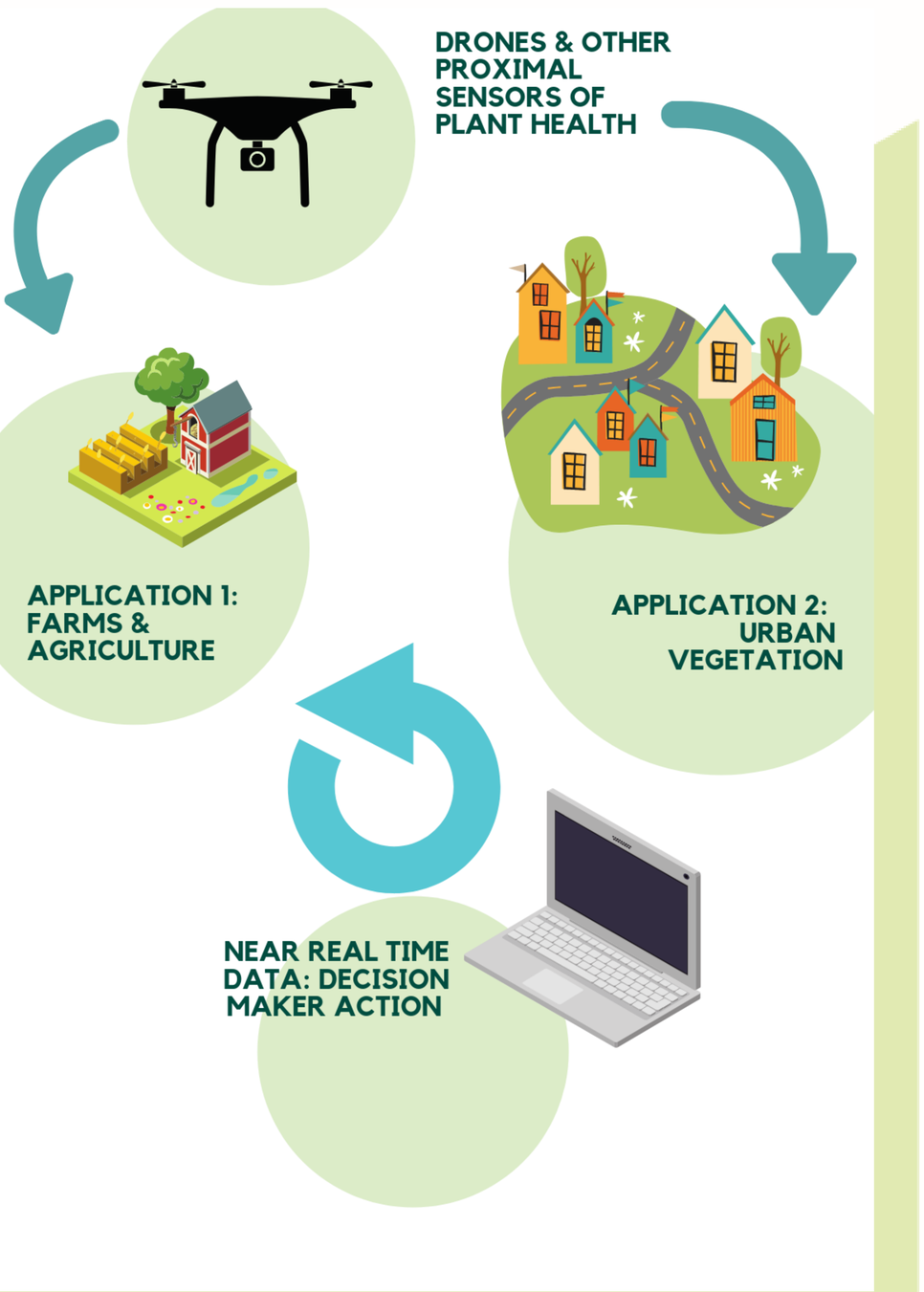
Methods to monitor the status of vegetation are needed in sustainable agriculture (e.g. optimizing fertilizer, pesticide, and water usage), forestry, and urban vegetation management. Traditional remote sensing uses slow changes in vegetation greenness. We test indices with instantaneous response for early alert and near-real time vegetation management.

HOW AND WITH WHOM?

We assess the potential of new optical indices based on reflectance and chlorohyll fluorescence (a dim red light emitted by plants during photosynthesis) for early-stress detection in selected case studies. Multiscale pilots were conducted in experimental farms (LUKE), private farms, street trees (City of Helsinki) and Viikki Campus. We collaborated with FGI, and Edinburgh and Brown Universities. Experiments were co-designed during stakeholder meetings. Stakeholders included: drone and hyperspectral industry, agricultural consulting and city parks departments.

RESULTS, IMPACT AND RECOMMENDATIONS

Fluorescence and reflectance indices showed added potential to monitor leaf nutrient status. Drone-based measurements of hyperspectral reflectance and fluorescence were demonstrated. The project has served to establish key contacts with end-users and industry partners which we plan to exploit further in future applications. The project helped defining possible new sensors, as well as novel applications for drone- (or future satellite-) based vegetation management. New technology should be adopted to ensure sustainable agriculture and vegetation management.



New hyperspectral reflectance and chlorophyll fluorescence indices can be used to obtain **near-real time/online** information on vegetation health and status opening the way to optimization of vegetation management practices.

IMPACTS:

A. **Agriculture: Sustainable use of water, fertilizer and pesticides**
B. **Urban vegetation: Improved care of trees in urban environments**
C. **Cost-effectiveness: targeted action on demand instead of preset management program**

What next?

We are still pending analysis from our large pilot multiscale campaign in summer 2018. Final results will be presented to all stakeholders during the third (and final) stakeholder meeting on 28.11.2018 as well as in the Congres “Drones in Finnish Agriculture and Forestry, Naantali, November 2018. We will also evaluate possible venues for future research, proof-of-concept funding, and additional applications together with stakeholders.

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