Crops for the Future Research Centre

The University of Nottingham

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AgriGIS 2012

Advancing Geospatial Technologies in Agricultural Research

10th May 2012
The University of Nottingham Malaysia Campus
Jalan Broga, 43500 Semenyih
Selangor Darul Ehsan, Malaysia

Organised by:
The University of Nottingham &
Crops for the Future Research Centre

Background

Geospatial information has been playing an important role in agricultural research and practice, especially from Earth Observation systems and data processing. Geospatial analysis and modelling have also proved to be efficient tools for agricultural planning and management. Rapid developments in technologies for the collection and dissemination of information, such as positioning, broadband mobile communications, sensor platforms and sensor-web enablement, spatial search and pervasive computing, are fundamentally changing the access to and use of location-based data in agriculture. In addition to providing more opportunities for expanding the applications, this advancement also creates new avenues for multi-disciplinary research and practices in the use of GIS ('AgriGIS').

The AgriGIS 2012 workshop will focus on state-of-art uses of geo-information, geospatial technologies in agricultural research and practice, and highlight current developments and experiences with an aim to:

- bring together industry, academic and private and public sector researchers with relevant expertise in both geospatial technologies and agriculture to exchange knowledge on strategies for AgriGIS research
- understand current developments in use of geospatial technologies in agricultural research
- demonstrate current work at The University of Nottingham in this theme, in particular the GRASP prototype
- provide a platform to network and develop ideas for future collaborative work in AgriGIS
- act as a focus for AgriGIS research and development and plan proposals and strategies to secure funding for a future road map.

Workshop Chairs

- **Sayed Azam Ali** (CEO, Crops for the Future Research Centre)
- **Tuong-Thuy Vu** (Head of Open-Source Geospatial Lab, UNMC)

Programme Committee

- **Mike Jackson** (Nottingham Geospatial Institute, The University of Nottingham)
- **Sean Mayes** (School of Biosciences, The University of Nottingham)
- **Didier Leibovici** (Leeds University, UK)
- **Charlie Hodgman** (School of Biosciences, The University of Nottingham)
- **Chungui Lu** (School of Biosciences, The University of Nottingham)
- **Jeremy Morley** (Nottingham Geospatial Institute, The University of Nottingham)
- **Kin-Chow Chang** (Veterinary Medicine & Science, The University of Nottingham)
- **Rumiana Ray** (School of Biosciences, The University of Nottingham)
- **Gavin White** (Veterinary Medicine & Science; The University of Nottingham)
- **Christine Dodd** (School of Biosciences, The University of Nottingham)
- **Wyn Morgan** (School of Economics, The University of Nottingham)
- **Sarah Jewitt** (School of Geography, The University of Nottingham)
- **Susanne Seymour** (School of Geography, The University of Nottingham)
- **Amir Pourabdollah** (Nottingham Geospatial Institute, The University of Nottingham)
- **Tim Brailsford** (School of Computer Science, UNMC)
- **Ben Phear** (School of Computer Science, UNMC)
- **Andrew French** (School of Biosciences, The University of Nottingham)
- **Suchith Anand** (Nottingham Geospatial Institute, The University of Nottingham)
- **Doreen Boyd** (School of Geography, The University of Nottingham)
- **Xiaolin Meng** (Nottingham Geospatial Institute, The University of Nottingham)
- **Lei Yang** (Nottingham Geospatial Institute, The University of Nottingham)

Programme

Opening session: 11:00-13:00

Chairperson
Prof. Sayed Azam-Ali, Crop for the Future Research Centre (CFFRC)

Welcome remarks

Overview of CFFRC and Open-Source Geospatial Lab
Prof. Sayed Azam-Ali and Dr. Tuong-Thuy Vu

Speakers:

Prof. Mike Jackson, Nottingham Geospatial Institute, The University of Nottingham, UK
- Crowd-sourced geo-data collection, validation and interoperability for AgriGIS

Dr. Sean Mayes, School of Biosciences, The University of Nottingham, UK
- GeoSpatial anchoring of crop germplasm – identifying new sources of variation for future crop breeding

Dr. Abdul Rashid Bin Mohamed Shariff, Department of Biological and Agricultural Engineering, Faculty of Engineering, Universiti Putra Malaysia (UPM), Malaysia
- AgriGIS Research at Universiti Putra Malaysia

Lunch: 13:00-14:00

Session 1: 14:00-15:30

Chairperson and Lead speaker
Prof. Michael Steven, School of Geography, The University of Nottingham Malaysia Campus
- A Conceptual Framework for Applying Remote Sensing in Precision Agriculture

Speakers:

Dr. Tao Guo, Hitachi, Ltd., Central Research Laboratory, Japan
- Crop information retrieval from a UAV system

Dr. Lam Dao Nguyen, Ho Chi Minh City Institute of Resources Geography, Vietnam
- The use of radar remote sensing data for rice monitoring in the Mekong Delta

Dr. Nisfariza Binti Mohd Noor, Department of Geography, University of Malaya,
- Development of Proximal Hyperspectral Sensing of Ganoderma Basal Stem Rot Identification in Oil Palm

Break: 15:30-16:00

Session 2: 16:00-17:30

Chairperson and Lead Speaker

Dr. Jim Griffiths, Environmental Science, The University of Nottingham, Ningbo China
- Modelling available water capacity for different crop, soil and climate combinations

Speakers:

Dr. Daroonwan Kamthonkiat, Department of Geography, Faculty of Liberal Arts, Thammasat University, Thailand
- Analysis of Climate Change Impact on Rice Production towards Adaptation Strategies

Mr. Tey Seng Heng, Applied Agricultural Resources
- Practical Applications of Geospatial Information Technologies in Oil Palm Plantations

Mr. Ben Phear, Crops for the Future Research Centre
- CropBase

Discussion: 17:30-18:30

Convenors

- **Prof. Sayed Azam-Ali,** Crop for the Future Research Centre
- **Prof. Mike Jackson,** Nottingham Geospatial Institute, The University of Nottingham, UK
- **Dr. Sean Mayes,** School of Biosciences, The University of Nottingham, UK

Dinner: 18:30

Organizers

Crops for the Future Research centre

Crops for the Future Research Centre is a joint venture between the Government of Malaysia and The University of Nottingham. It is the first international research institution dedicated to the study of underutilised plants for food and non-food uses.

Open Source Geospatial Lab

Open Source Geospatial Lab, Malaysia has been established at UNMC with the aim to help create collaboration opportunities for academia, industry and government organisations in open source GIS which will help to create a sustainable environment for open source GIS in Malaysia.

Geospatial Resource for Agriculture Species and Pests (GRASP)

Geospatial Resource for Agriculture Species and Pests (GRASP) is a seed corn funded project by the Food Security Strategy Group of The University of Nottingham. Its objective is to develop a geospatially anchored framework for analysis of genotype-trait variation across any species. It will be integrated with higher levels of knowledge relevant to Food Security objectives. The larger aim of GRASP is to generate a common framework for agricultural species (including major pests and diseases) and for users to shape data handling and integration according to their requirements, before contributing to the population of the prototype database.

Abstract

Crowd-sourced geo-data collection, validation and interoperability for AgriGIS

Mike Jackson

Emeritus Professor for Geospatial Science, Nottingham Geospatial Institute, The University of Nottingham, UK

The presentation discusses how crowd-sourced data collection and validation using mobile phone technology could provide an additional and complementary source of information for use within an AgriGIS environment. The presentation will examine the current and imminent capabilities of smart-phone technology for spatial data collection purposes, examine some of the quality issues associated with crowd-sourcing and consider approaches that may be adopted to enable such data to be validated and modelled within the context of spatial data infrastructures (SDI's). Current research projects at the Nottingham Geospatial Institute which address these topics will be summarised to illustrate the research progress being made as well as to high-light remaining challenges.

GeoSpatial anchoring of crop germplasm – identifying new sources of variation for future crop breeding

Sean Mayes

Associate Professor, School of Biosciences, The University of Nottingham, UK

The presentation discusses the potential value of taking a geospatially-orientated view of crop germplasm. By making the object 'genotype' (whether defined by variety, molecular genetics or other fixed characteristic) and associating trait, processing, product, end-user, market and farmer information to that object we have developed a package of information that can cross the academic disciplines. The different levels within this package will be context-dependent to differing extents. For example, the genotype will be fixed, the traits could depend upon agro-ecological zones and soils and the products could be cultural dependent, whether at a country or continent level. Such an approach potentially allows us five levels of analysis: 1) an analysis of trait dependency across environmental zones 2) the identification of matching zones where the basic adaptive traits of the genotype match 3) The identification of cultural and market acceptability between zones for genotypes or crops. 4) Developing integrated datasets will also allow us to examine the effects of predicted climate change and focus on future agricultural systems 5) As more species are added, we can begin to develop a more Systems-based approaches to future agriculture. How this might apply to one underutilised crop, Bambara groundnut, will be illustrated.

AgriGIS Research at Universiti Putra Malaysia

Abdul Rashid Bin Mohamed Shariff

Associate Professor, Department of Biological and Agricultural Engineering, Faculty of Engineering, Universiti Putra Malaysia (UPM), Malaysia

This talk will address the focus areas of agricultural engineering research at Universiti Putra Malaysia that involve spatial technologies, particularly GIS. It traces the roots of the involvement of spatial sciences and technologies into agriculture at the end of the previous century, particularly on the introduction of the Precision Agriculture research. The changes to the undergraduate curriculum of the agricultural engineering program in assimilating spatial sciences is delved upon. The resulting interest in the postgraduate research in spatial science is reflected through the research agenda that ensued. This presentation will touch on the 1st National Paddy Precision Farming project at Kuala Selangor, the use of Remote Sensing in monitoring tree health and management in agriculture, variable rate application of fertizers, the use of image analysis in maturity determination, the agricultural land suitability evaluator and a host of AgriGIS applications developed at UPM. This talk will be of interest to practitioners, academics, researchers, growers and individuals involved in the agricultural sector who have an interest in the application of GIS and spatial technologies to agricultural issues.

A Conceptual Framework for Applying Remote Sensing in Precision Agriculture

Michael Steven

Professor, Director of Studies, School of Geography, The University of Nottingham Malaysia Campus

The management of crops on fine spatial scales – Precision Agriculture – requires the integration of four technologies: GPS, GIS, crop monitoring techniques and targeted treatment systems. While the first two are now routine and the last is a matter of applying conventional engineering, the monitoring component often involves interpretation of ambiguous data according to context. The use of a vegetation index derived by remote sensing can provide information on photosynthetic light capture and potential growth rates, but its interpretation depends critically on growth stage. The alternative approach of modelling crop growth from climatic inputs provides such information but offers no information on spatial variability. The combination of remote sensing with a crop modelling approach allows temporal variation to be determined from climate variables and spatial variability to be assessed by remote sensing. When tested on farms in the UK, it was found that the timing of remote sensing inputs had a large bearing on their interpretation and that the history of crops over several years provided a further layer of information that distinguished soil factors from other sources of variation. The generalisation of this approach to wider environments, such as the humid tropics, is explored.

Abstract

Crop information retrieval from a UAV system

Dr. Tao Guo

Hitachi, Ltd., Central Research Laboratory, Japan

Retrieval of spatial and spectral variability within crop field is of great importance for identifying crop stress that is one of the major factors influencing farming management decisions making. Satellite imagery has been widely utilized to address this problem due to its capacity to provide the large spatial and temporal scales. But there are some basic limitations in this perspective. The first is the lack of timely imagery during the critical time of crop actively growing season when cloudy weather makes little chance of image acquisition window available. The second is the difficulties to reach a favourable trade-off among spatial and spectral resolution and data cost.

We consider the low-cost remote sensing system mounted on unmanned aerial vehicle (UAV) could provide a complementary means to the conventional satellite/aerial remote sensing solutions especially for the applications of precision agriculture. UAV remote sensing offers a great flexibility to quickly acquire field data in sufficient spatial and spectral resolution at low cost. However a major problem of UAV is the high instability due to the low-end equipment and difficult environment situation, and this leads to image sensor being mostly operated with a highly uncertain configuration. Thus UAV images exhibit considerable derivation in spatial orientation, large geometric and spectral distortion, and low signal-to-noise ratio (SNR). Accordingly it still remains a challenge to generate quantitative mapping products by means of a UAV remote sensing platform.

To achieve the objectives of agricultural mapping from UAV, we present a micro-helicopter UAV with a multiple spectral camera mounted and develop a framework to process UAV images, which mainly consists of geometric and spectral modules. The purpose of our geometric processing is to generate a mosaic image which can be aligned with maps for later GIS integration.

With appropriate geometric calibration applied, we first decompose a homography of consecutive image pairs into a rotational component and a simple perspective component, and apply a linear interpolation to the angle of the rotational component, followed by a linear matrix interpolation operator to the perspective component, and this results in an equivalent transformation but ensure a smooth evolution between two images. By suppressing the angular transformation on the mosaic plane, the drastic changes of intermediate image frame shapes, such as flipping affect can be effectively avoided, and a coarsely aligned mosaic strip is generated. Provided an image map is available, a fine adjustment is further done by applying mutual information to match the coarse mosaic with the image map so as to generate geo-referenced mosaics. To demonstrate the potential of UAV images to precision agriculture application, we perform the spectral analysis to derive some vegetation indices (VIs) maps of crop, such as normalized difference vegetation index (NDVI) etc. Meanwhile the corresponding VIs are also derived from both high resolution satellite images and field spectrometer measurement. A comparison shows that they are highly correlated and well suitable for deriving crop growth status.

Through this paper, we demonstrate that UAV remote sensing is a very complementary means to satellite remote sensing. And we develop a framework to process UAV images in context of geometric and spectral processing. Further we show that it is highly feasible to generate quantitative mapping products such as crop stress maps from UAV images, and suggest that UAV remote sensing is very valuable for the applications of precision agriculture.

The use of radar remote sensing data for rice monitoring in the Mekong Delta

Nguyen Lam-Dao(1), Phung Hoang-Phi(1), Juliane Huth(2)

(1) GIS and Remote Sensing Research Center, HoChiMinh City Institute of Resources Geography

(2) German Remote Sensing Data Center, German Aerospace Center, 82234 Wessling, Germany

Food security has become a key global issue due to rapid population growth in many parts of Asia, as well as the effect of climate change. For this reason, there is a need to develop a spatio-temporal monitoring system using remote sensing methods that can accurately assess rice area planted and rice production. Vietnam is a country located in the tropics it is often clouded to affect the image quality obtained from optical remote sensors. Radar remote sensing overcomes this drawback and can acquire images at any time of year.

Changes in rice cultivation systems have been observed in various countries of the world, especially in the Mekong Delta, Vietnam. The changes in cultural practices have impacts on remote sensing methods developed for rice monitoring, in particular, methods using radar data. The objective of the study was to develop a rice crop inventory system using time-series radar imagery.

Field data collection and in situ measurement of rice crop parameters were conducted in Cho Moi district of An Giang province, Mekong Delta during Autumn-Winter crop 2010, and Winter-Spring and Summer-Autumn crops 2011. The average values of the radar backscattering coefficients that corresponded to the sampling fields were extracted from the Envisat-ASAR APP and TerraSAR-X SM images. The temporal rice backscatter behaviour during crop seasons were analysed for HH and VV and polarisation ratio data. The relationships between rice parameters and backscattering coefficient of HH, VV, and polarisation ratio were established.

This study showed that the polarisation ratio HH&VV of rice fields at a single date during a long period of the rice season could be used to derive the rice/non-rice mapping algorithm. The predictive model based on multiple regression analysis between in situ measured yield and polarisation ratios at 3 dates or more during the crop season attained good results and thus proved to be a potential tool for estimating rice production in the study area.

Development of Proximal Hyperspectral Sensing of Ganoderma Basal Stem Rot Identification in Oil Palm

Nisfariza(1), M.N. Maris(1), Steven M. (2), Boyd D.S. (2), Idris, A.S(3), Helmi Zulhaidi M. Shafri(4)

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(3) Ganoderma and Diseases Research for Oil Palm (GANOCROP) Unit, Biological Research Division, Malaysian Palm Oil Board, 43000, Kajang, Selangor, Malaysia

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Malaysia's palm oil industry is one of the important industries of the nation and it is the fourth largest contributor to the national economy and currently accounts for RM53 billion in 2010 GNI (Gross National Income). Identified more than 50 years ago, Basal Stem Rot (BSR) is caused by a type of shelf or bracket fungus (Ganoderma) and is lethal and incurable. Diseases caused by Ganoderma species caused major losses of palms and other perennial crops throughout the world and particularly significant in Asia. The detection and assessment of the disease symptoms, especially early detection of the disease is vital for profitable agriculture business. In view of plantation management, early identification of stress and diseases are decisive and could ameliorate on plan and strategy to overcome the problem in a cost effective manner. This study focus on development of a foundation to facilitate the proximal sensing-collecting spectral reflectance data close to crop using hyperspectral remote sensing techniques in early identification of Ganoderma Basal Stem Rot (BSR) disease in Malaysia. Hyperspectral remote sensing can be exploited to determine the stress of a plant by examination of features observed in several regions of the electromagnetic spectrum. This paper summarises new advances and technical aspects of hyperspectral remote sensing in early detection of Ganoderma BSR in different age stages of oil palms with two different hyperspectral sensors.

Abstract

Modelling available water capacity for different crop, soil and climate combinations.

Jim Griffiths

Environmental Science Engineering Division (SEB437), The University of Nottingham Ningbo China 199 Taikang East Road, University Park, Ningbo, China 315100.

The need for accurate prediction of soil moisture variation in response to plant use, soil type and climate is a complicit part of planning for future crops. This presentation will describe the potential use of GIS for integration of land-cover, soil and climate data at both a national scale and local scale based on experiences of the author in predicting soil water variation in un-gauged catchments in the UK (Young et al, 2006).
A 1km resolution database of 'hydrological response units' (HRUs) characterised by soil type and land-cover across the UK was developed using ARCGIS. Each HRU was then used as a basis from which to simulate evapotranspiration and drainage loss from different soil and land-use combinations. Each HRU was defined using available national datasets including:

- Digital Terrain Model (DTM) - a hydrologically referenced 50m resolution DTM (Morris and Heerdegen, 1988)
- Hydrology of Soil Types (HOST) - 29 class hydrological response classification of soils (Boorman et al., 1995)
- CEH Land-cover Map 2000 (LCM2000) - 50m resolution classification system (Smith et al., 2001) from which five broad vegetation classes.

Each HRU was defined by combining twenty-eight HOST classes and the five derived LCM2000 vegetation classes (potential 140 different combinations). Grid cells for each HRU type were amalgamated at the catchment scale to form representative fractional extents of each HRU within any catchment.

The above model represented evapotranspiration from vegetation cover as a function of the maximum rooting depth of the vegetation, and soil moisture deficit (after Allen et al., 1998). Vegetation (land-cover) was allowed to freely transpire until soil moisture deficit exceeded the threshold defined by its root depth, after which it decreased in proportion to the moisture deficit. The maximum available water capacity was calculated from the field capacity and wilting point of each soil, which were based on characteristic sand/silt/clay content of each HOST soil type. Soil drainage was generated only when the soil moisture deficit was zero.

It is proposed that the above modelling framework can be adapted for use in modelling soil moisture variation for different plant and climate scenarios and for a range of different soil types, at both the national scale and the local scale. The feasibility and advantages of such an approach are discussed.

References

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Analysis of Climate Change Impact on Rice Production towards Adaptation Strategies

Daroonwan Kamthonkiat

Department of Geography, Faculty of Liberal Arts, Thammasat University. Thailand

The growing population coupled with increasing climatic disasters, threaten the global food security. Rice production is extremely vulnerable to climate change; accelerating the earth's temperature is causing yield declines while encouraging weed and pest proliferation. In warmer climates, altered wind patterns may change the spread of both wind-borne pests and of the bacteria and fungi that are the agents of crop disease. Proper understanding of the effects of climate change is therefore necessary, it will help scientists to guide farmers to make crop management decisions such as selection of crops cultivars, sowing dates and irrigation scheduling to minimize the risks. This information will also be a good guidance for policy makers to quantify the damage to both market and non-market sectors, evaluate the consequences for food security and estimate the investments that would offset the negative consequences for human well-being. However these kinds of researches are still limited in Thailand and thus a framework for investigation on the impact of climate change on rainfed rice production, the most staple food in Thailand and East Asian region are setting.

Crop growth simulation models are important tools for agronomic management strategy, which assists in developing site-specific recommendations to optimize yield. Number of researches implied that crop simulation models provide a means to quantify the effects of climate, soil and management on crop growth, yield and sustainability of agricultural production in one season or one location to other seasons, locations or management. These models are one of the interesting tools which reduce the need for expensive and time-consuming field experimentations; however the models should be evaluated after the calibration and validation under local condition. In addition, state-of-the-art technologies like geographic information system (GIS) and remote sensing (RS) can also help identify and map vulnerable areas of climate change impacts such as drought-prone or flood-prone areas in the province/country. The use of information and communications technology can also play a critical role to bridge the knowledge gap between farmers and scientists to explore climate change adaptation strategies.

In this study, three parts consist of field sensor observation node in the rice field, modeling and rapid response system as presented in Figure 1 are proposing for an analysis of climate change impact on rice production towards adaptation strategies. The first part refers to field observations from satellite, a crucial source of data time series data used for model analysis and spatial data from GIS, sensors (weather and soil moisture) and field measurements (LAI, water level, plant's height and so on). The second part is to utilize our developed and calibrated crop model called SWAP model in the study area in Northeastern Thailand. The information from our observation and model simulation are served to the rapid response system for supporting the information of the yield estimation and risky of rice disease.

Abstract

Practical Applications of Geospatial Information Technologies in Oil Palm Plantations

Tey Sheng Heng

Applied Agricultural Resources, Selangor, Malaysia.

Spectral responses of oil palms were first investigated in early 1990s but the interest in remote sensing has grown rather slowly particularly for tropical crops due to chiefly the absence of clear advantage and difficulties in acquiring timely cloud-free images. With the advent of low-cost desktop GIS software, affordable hand-held GPS receivers and improvement in the accuracy of GPS, more interests have grown towards utilizing these geospatial information tools for general mapping, field navigation, land feasibility studies and more recently planning of planting terraces and drainage system.

Our initial intention of getting estate maps digitized and accurately updated for printing at various desirable scales and shades of colors has formed the basic application of GIS and GPS in plantations today. There are about 5 millions hectares (ha) of oil palms in Malaysia today while the cultivated area in Indonesia has swelled to more than 8 million hectares in recent years. With each basic management unit or estate of 2000 to 3000 ha in size (can be slightly larger in Indonesia) requiring an accurate map for reference, essentially there are thousands of maps to be updated and reproduced from time to time. This has made the GPS a useful basic management tool in plantations. Other practical applications include quick land parcel mapping, area verification and the production of pest and disease census maps.

As city dwellers roam through cities with the help of a GPS navigator, planters in large plantation complexes too can maneuver through their fields effortlessly with geo-referenced digital estate maps. At the density of over 150 m per ha, a 2500 ha hilly estate can have more than 350 km of roads constructed across the field. Maneuvering through the estate on this massive road network can be perplexing for visitors and staff members who are new to the estate without using a digital field navigator.

In Malaysia, remnant areas that can still be developed for oil palm cultivation are generally patchy. Stringent selection based on terrain features and soil properties is required to safeguard the environment. With the availability of free global SRTM elevation data, ASTER global DEM data and more recently the affordable IFSAR data in Malaysia, terrain conditions of forested lands can now be conveniently yet meticulously assessed with a desktop computer. Terrain is examined to avoid lands with steep slopes above permitted limits while regional watershed studies are performed to identify flood-prone areas. Decisions can then be made to determine if the land of interest is worth investing before making a ground visit, saving a great deal of time, cost and efforts.

As we expand into marginal lands and have our old fields replanted from time to time, constraints associated with sedimentation of rivers and drains can become a serious problem. Total losses due to extended harvesting intervals, sub-optimal palm growth and other drainage related drawbacks can amount to more than 5 tons/ha/yr of fresh fruit bunches valued at RM 3000/ha/yr. For young immature palms, a single flood event that causes the shoot (meristem) to be submerged in water for even a day can result in severe casualties. In new developments, terrain data have been utilized to demarcate watersheds, define flow-paths and delineate un-drainable flood-prone areas for omission. For drainage planning in fertile low-lying fields, geospatial information technologies have been utilized to determine the location of outlets, position and effective height of bunds and alignment of artificial drains. In areas where excess water has to be removed quickly via pumping, watershed sizes and runoff volumes can be accurate estimated from a good digital terrain model.

Other potential applications include mapping of palm points at planting to produce a point map for planters to assess the quality of their planting. Vacancies of gaps can then be filled while crowded areas may be identified for adjustment wherever possible or earmarked for thinning in future. Techniques are also being developed to utilize highly accurate digital terrain data from LIDAR for instance and survey-grade GPS receivers for the planning of planting terraces and lining of planting points to optimize the planting density and pattern of oil palms on hills. Rapid expansion and shortage of manpower can often cause underperforming areas to be overlooked and hence continue to perform poorly. Improvement in the availability of high-resolution satellite sensors like Ikonos, Quickbird, GeoEye, Worldview etc., and the advent of robust and advanced unmanned-aerial-vehicles (UAV) may hopefully allow timely satellite images and aerial photographs to be captured for agronomists and planters to efficiently and effectively locate underperforming palms for correction.

At current high commodity prices, losses due to thefts can amount to hundreds of thousands of Ringgit. Robust and reliable GPS tracking system should be developed for planters to arrest this emerging problem.

CropBase

Ben Phear

Crops for the Future Research Centre and Faculty of Engineering, The University of Nottingham Malaysia Campus

There are many hundreds of under-utilised agricultural species that are grown and consumed locally but for which a wider value chain and knowledge-base has not been established. For example South East Asia has a rich supply of many such plants that have been used for centuries by local communities for food, medicines, energy and biomaterials. However, few of these plants have been developed into value-added products that serve the wider economic requirements of the region or beyond. A major challenge is to identify which currently under-utilised crops can become potentially important crops of the future both economically and in response to changes in climate. CropBase aims to provide an objective and verifiable process through which CFFRC and its partners can select Exemplar Crops for further research and development, and host an up-to-date and unabridged knowledge-base on said crops. CropBase will also help establish a `Research Value Chain' approach for selected exemplar crops that links breeding and crop improvement programmes through to end users and markets. It will provide all parties across the Research-Value-Chain with an ever-evolving and up-to-date knowledge-base allowing efficient uptake of under-utilised crops and serve to fast-track value-added schemes to said crops at all points along the Research-Value-Chain.

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