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AUTOMATED AND MANUAL PLANT PHENOTYPING ACROSS DIFFERENT SCALES

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Our capacity to genotype organisms, now vastly exceeds our ability to phenotype those same individuals. Genotyping can provide molecular resolution at the nucleotide level and can be scaled to deal with whole populations at ever decreasing cost. However, phenotyping of plants is less scalable, is often subjective and measures attributes e.g. yield that are difficult to relate to the underlying genetic variation. This has been termed the phenotyping bottleneck. The National Plant Phenomics Centre represents a major infrastructural development, funded by Aberystwyth University, the Welsh Government and BBSRC, providing state-of-the-art capabilities for objective plant phenotyping using automated imaging systems combined with computing technologies. The facilities are available to scientists via either the BBSRCs National capability grant (UK) or an FP7 grant (collaborative access from Europe), EPPN. The EPPN project supports development of international standards and protocols for phenotyping analogous to those used in other large scale biology.

NPPC facilities: Automated handling of over 800 RFID tagged containers allows plants to be moved on a programmable conveyor system between growth, imaging and sampling areas. Each carriage conveys one large plant (up to 2m tall) or a tray of small plants. Environmental, nutrient and watering controls enable the application of single or combinatorial stresses, allowing the dissection of Genotype x Environmental interactions. Other facilities include a large scale nutrient flow glasshouse, photo-physiological analysis, metabolic and genotyping facilities. Access to remote sensing services (i.e. UAV flights for field phenotyping) can be arranged. Mapping populations can be characterised under defined conditions. The Centre provides a range of imaging techniques and sensors to record plant characteristics non-destructively and dynamically. An early priority will be to develop new high throughput imaging methods to determine key biological parameters. Integration of phenomic data with genomic analyses will be key to exploiting the full value of the NPPC, thus a team of dedicated data analysts assist in this process. This will require coordination with trait ontologies that are widely acceptable for use in both controlled environment and field.

What will the NPPC offer: Different service levels are provided in the NPPC including full service and collaborative projects depending on users' requirements. Academic users will be expected (after a suitable interval) to make their experimental and meta-data available to the community.

Timeline for NPPC operation: We are now in the commissioning phase with the first experiments initiated in March 2013, and we will discuss some of the early results using wheat, oats and Arabidopsis.