Use of Crowdsourced Information to Validate the Accuracy of a Japanese Knotweed Distribution Map Derived from Earth Observation Data

COBWEB
Citizen Observatory Web

Summary

This brief highlights the preliminary findings of an exercise to test the use of environmental observations recorded by citizens to validate a distribution map of Japanese Knotweed (Jkn) which has been created using freely available Earth Observation (EO) data in Wales.

Background

Both the crowdsourcing of environmental intelligence and the application of EO imagery in support of environmental monitoring are of significant interest to decision making and policy formation and evaluation (Chapman & Hodges 2015). Seven of the current twenty six UK headline biodiversity indicators are measured against data collected via citizen science (Pocock et al 2012, DEFRA 2013) making the application of crowdsourced data for environmental monitoring particularly relevant. The increasing interest in citizen science type activities harnessing the advances in internet and mobile phone technology suggest this trend is set to continue. There is an awareness within Government that consistent and repeatable measurement of our environment, made possible through the use of EO technologies, is required to provide a comprehensive source of evidence to support the increasingly sophisticated models and regimes needed to monitor and manage our natural resources (The Royal Society 2015). Significant European investment in the Copernicus programme (approx €4.3 Billion over the next 6 years) is indicative of the value placed in EO technologies by the EC.

The cost-effectiveness and increased availability and quality of data, both from citizen science/crowdsourced activities and from EO technology (particularly with the freely available data and services available under the Copernicus programme) bring the potential of these approaches into sharp focus, especially when compared against expensive and resource intensive traditional environmental data collection methods (e.g. field survey).

Both sources of data are often challenged in their suitability as robust forms of environmental evidence. Crowdsourced data is often perceived as being of variable (usually low) quality and accuracy. Uptake of EO for policy development and decision making in Wales, and the wider UK, has been gradual, with historic high costs and a lack of skills and knowledge acting as barriers.

Purpose

As a partner in the EC funded project Citizen Observatory Web (COBWEB), officials from Welsh Government: Land Nature and Forestry Division set out to test a practical application of how far these two technologies could be mutually supportive to provide an accurate distribution map of Jkn within the Snowdonia National Park.

Working in partnership with Snowdonia National Park Authority (SNPA), a mobile phone app was developed which uses the digital infrastructure and technologies developed within COBWEB. The app, which was co-designed with SNPA, provided an intuitive and accessible means for citizens to easily record the location of Jkn within the park, producing standardised, high quality digital data.

This data, once quality assured, was used to test the accuracy of a rule-based classification of EO data which sought to identify stands of Jkn from

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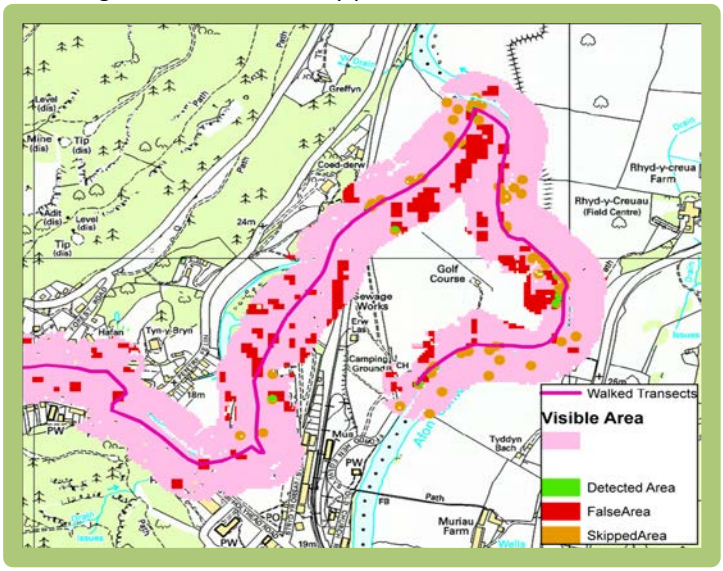
other vegetation based on its height, unique spectral signature and proximity to environmental and man-made features known to be the primary means for spreading this particularly invasive plant. The EO derived Jkn classification was based on promising small scales tests commissioned by the then Environment Agency Wales in 2011.

This exercise had to two main objectives:

- To test the extent to which crowdsourced environmental data recorded by non-expert volunteers can be used to 'ground truth' EO models.
- To test the suitability of an established method of identifying Jkn from freely available EO (CIR & LiDAR) data over a large and diverse study area. This takes into account the variability in availability and quality of the required datasets.

Results and Conclusion

The use of the crowdsourced Jkn observations were incredibly helpful in the assessment of the accuracy of the EO classification. The use of the COBWEB technology to support the co-design of the Jkn app and the survey protocol produced standardised data sets that were accessible to non-experts but of sufficient content and quality to support expert validation exercises. Inclusion of presence and absence data recording within the Jkn survey protocol allowed the collection of meaningful datasets that are well suited to assess the distribution estimates of Jkn stands proposed. Experimental use of a tool within the COBWEB app to describe polygons of Jkn infestation showed considerable promise in standardising how to record the area of knotweed without relying on subjective estimation of extent. This tool proved difficult to operate in the field particularly in describing smaller stands of knotweed and may turn out to be of more use in describing larger scale phenomena.



Variability in data quality across the National Park proved to be a significant hurdle for the distribution map. Low resolution data and inconsistencies between the acquisition dates of the different data types feeding the model resulted in confusion between Jkn and other shrubby vegetation of similar characteristics. Jkn stands under overhanging foliage are also effectively masked from the classification. Appropriate use of this approach to effectively estimate the distribution of Jkn and other invasive plant species that manifest at a similar scale will require greater harmonisation of data capture periods. Existing EO data capture regimes are being examined to see how they might be rationalised to obtain maximum value from the data.

It is clear that the two methods of describing Jkn distribution are most effective when used in conjunction with each other. Fit for purpose, robust, crowdsourced data can provide useful intelligence on the distribution of Jkn on its own merit. This data has proven to be a useful data source to allow the ground-truthing of the Jkn classification. The data also provides a useful means to train future classification exercises to filter out the 'noise' of vegetation with similar characteristics and allow the creation of more informed rulesets.

"Fit for purpose, robust, crowdsourced data can provide useful intelligence on the distribution of Japanese Knotweed on its own merit"

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