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The land management tool: Developing a climate service in Southwest UK

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ABSTRACT

Seasonal climate forecasts (SCFs) have significant potential to support shorter-term agricultural decisions and longer-term climate adaptation plans, but uptake in Europe has to date been low. Under the European Union funded project, European Provision Of Regional Impacts Assessments on Seasonal and Decadal Timescales (EUPORIAS) we have developed the Land Management Tool (LMTool), a prototype seasonal climate service for land managers, working closely in collaboration with two stakeholder organizations, Clinton Devon Estates (CDE) and the National Farmers Union (NFU). LMTool was one of several prototype climate services selected for development within EUPORIAS, including those for the UK transport network, food security in Ethiopia, renewable energy production, hydroelectric energy production in Sweden, and river management in two French basins. The LMTool provides SCFs (1–3 months ahead) to farmers in the Southwest UK, alongside 14-day site specific weather forecasts during the winter months when the skill of seasonal forecasts is greatest.

We describe the processes through which the LMTool was co-designed and developed with the farmers, its technical development and key features; critically examine the lessons learned and their implications for providing future climate services for land managers; and finally assess the feasibility of delivering an operational winter seasonal climate service for UK land managers.

A number of key learning points from developing the prototype may benefit future work in climate services for the land management and agriculture sector; many of these points are also valid for climate services in other sectors. Prototype development strongly benefitted from; working with intermediaries to identify representative, engaged land managers; an iterative and flexible process of co-design with the farmer group; and from an interdisciplinary project team. Further work is needed to develop a better understanding of the role of forecast skill in land management decision making, the potential benefits of downscaling and how seasonal forecasts can help support land managers decision-making processes. The prototype would require considerable work to implement a robust operational forecast system, and a longer period to demonstrate the value of the services provided. Finally, the potential for such services to be applied more widely in Europe is not well understood and would require further stakeholder engagement and forecast development.

Practical implications

As part of the EU project EUPORIAS (Buontempo and Hewitt, 2017), the UK Met Office, University of Leeds, Predictia and KNMI—in close collaboration with Clinton Devon Estates (CDE) and the National Farmers Union (NFU)—have developed the Land Management Tool (LMTool), a prototype

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climate service providing seasonal climate forecasts (1–3 months ahead) to support land management-related decision making for Southwest UK. This service focuses on the winter months since recent advances in the prediction of the North Atlantic Oscillation (NAO) allows for better seasonal forecasts of the Northern Europe winter climate (see Scaife et al., 2014, for further details). The choice to focus on winter seasonal forecasts was a deliberate, a priori decision of the development team, given that forecast skill was a requirement during the EUPORIAS prototype selection process (Buontempo et al. 2017).

The LMTool was iteratively developed between January 2014 and May 2016, building strongly on a range of stakeholder engagement activities (workshops, interviews, surveys and feedback gathering) carried out with land managers. During the first winter (2014/2015), the project worked closely with a small, representative subset of farmers to blueprint the prototype service, providing 3-month outlooks of temperature and precipitation for the county of Devon in hardcopy and email. Insights gained from the several stakeholder engagement activities during the first winter were then taken forward, alongside engaging a wider farmer group, in developing forecast products for the following winter (2015/2016): 3-month outlooks of temperature and rainfall for the whole UK (delivered at the end of each month from September to February), and also 14-day forecasts of rain, temperature and winds for a set of weather stations across South West UK (updated every 6-h). This time, these products were delivered via an interactive password-protected website (which forms part of a more general micro site describing the whole prototype: http://lmtool.euporias.eu/) and a mobile app. These user-friendly e-platforms have been found to be very useful to carry the prototype to the public.

A number of key learning points from developing the prototype may benefit future work in climate services, particularly those in the land management and agriculture sectors. Working closely with stakeholders is an important element of climate service development including developing the initial research proposal, and we found significant value in involving intermediaries (CDE and NFU) to both set initial scope, and help identify engaged, representative farmers to work with throughout the project. For instance, working initially with a small, representative user group allowed us to rapidly test and develop products which could then be rolled out to a larger group in the following steps. Prototype development strongly benefitted from an iterative process of co-design with the farmer group, and from an interdisciplinary project team (e.g. weather/climate science, social science, technology).

Remaining flexible about project scope also helped us to deliver a prototype that was more relevant to, and usable by the farmers. For example, although the initial scope was around seasonal forecasts for cover-crop decisions, the farmers found additional value in the provision of shorter-term (14-day) weather information and the outlooks were relevant to a much wider range of land management decisions (e.g. forestry, grassland and livestock management). The farmers asked for seasonal forecast information to be made available to them in a tiered approach, starting with headline messages and gradually increasing in depth and complexity to reveal full background information depending on their level of interest.

Driven by farmer feedback, clear and simplified presentation of probabilistic forecasts increased their uptake and comprehension. The users noted that even relatively complex probabilistic forecast information that was new to them could be understood given time to become familiar with it. Finally, although it was often difficult to identify a particular decision or action which directly depended on a forecast provided by the prototype, making it challenging to attach a monetary value, farmer feedback suggested a much broader definition of value (e.g. increased knowledge of climatology, forecast uncertainty, useful background information alongside shorter-term forecasts, etc.).

There are several areas for further development of our prototype. Firstly, especially given the low skill of current seasonal forecast systems in Europe outside the winter period, further work is needed to understand the role of forecast skill in land management decision making, and the potential benefits of techniques such as downscaling to provide more locally-relevant forecasts. Secondly, our prototype was developed as a research tool, and considerable work would be required to implement a robust operational forecast system. Although we gained considerable insights from the two seasons of prototype development, a much longer period would be required to demonstrate the value of the services provided given the seasonal nature of decision making, and the skill levels of the underlying forecast systems. Finally, the potential for such services to be applied more widely (e.g. across the UK or Europe) is not well understood and would require more stakeholder engagement work and forecast development. This requires not only gathering and coordination of appropriate impact data (Buontempo et al. 2017) but also the development of new methods for understanding the value of climate services in land management decision making (Bruno Soares, 2017). It is also recommended to focus on areas where the forecast models have considerable skill. In particular, provision of seasonal forecasts for key world crop growing regions could be of benefit to farmers in anticipating changes in grain prices and market changes, whilst acting as an entry point to more local application of similar climate services in the longer-term.

1. Introduction

Climate variability and extreme weather events can have wide-ranging impacts on agriculture including, but not limited to, crop stress due to high temperatures, impacts on crops due to high rainfall (lodging, water logging), and reduced water availability due to drought (Falloon and Betts, 2010; GFS, 2014; Falloon et al., 2015). For example, the summer of 2012 was a remarkably wet season which impacted wheat yields in the UK with an overall yield reduction of 14% (Defra, 2012). In contrast, the 2003 heat wave in Europe was one of the hottest summers on record, reducing maize yields in France and Italy by 30–35% as a result of the increased heat and drought stress (Ciais et al., 2005). In this context, availability and access to climate information such as seasonal climate forecasts (SCFs) which provide probabilistic outlooks for a month to a year ahead, can have a significant potential to support and inform both shorter-term agricultural decisions as well as longer-term climate adaptation plans (Van der Linden and Mitchell, 2009).

SCFs have been applied in agriculture and land management contexts in some regions of the world, notably Africa, Brazil, the US and Australia (Dessai and Bruno Soares, 2013; Hansen et al., 2011). For example, the Brazilian state of Ceará adopted SCFs in 1989 to manage drought conditions. In 1992, the government used forecasts to warn local farmers of an imminent El Niño and provide them with drought-tolerant seeds, substantially increasing farmers' yields compared to what was expected. Since then, the Ceará's weather forecasting agency (FUNCEME, http://www.funceme.br/) has been continuously developing SCFs to inform government sectors involved in agricultural