P4-543

[WG11] Soil Information Exchange Standards and Systems

Making Apsim Open Data Driven

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Sustainable agriculture information is on high demand for farmers to make informed decisions in the crop management process. There are some tools available for predicting the crop yield and agricultural business profitability, among which is the Agriculture Production System Simulator (APSIM) [1-2]. The APSIM is a modelling framework which is developed by the Australian Commonwealth Scientific Research Organization (CSIRO) and the Queensland Government Agency. This modelling framework is used for simulating the biophysical process in a farming system for crop system management or risk prediction with environmental inputs such as rainfall, humidity, temperature, solar radiation, and wind speed. It follows the "plug-in/pull-out" approach in which users can configure the model with crop, soil and utility modules for the crop management. The model can simulate more than 20 crops and forests, e.g. alfalfa, eucalyptus, cowpea, pigeonpea, peanuts, cotton, lupin, maize, wheat, barley, sunflower, sugarcane, chickpea, and tomato. All simulation processes of the APSIM model are based on the data from the BOM-SILO database [3] which is maintained by the Queensland Climate Excellence within the Department of Science, Information Technology, Innovation and the Arts (DSITTA). The data was collected from 4760 BOM weather stations from 1889 until today. Most of the data used in the model are historical data.

Being a closed system, APSIM is not suitable for dynamic information integration. As there is no external plug-in available for accessing the model, it is hard to run the model for prediction within external applications. Furthermore, while recent trends in dynamic decision support systems are very much inclined to the use of mobile applications, there is no web based services around APSIM for that purpose.

To solve this issue, we propose to develop an open data driven model which extends the existing APSIM model with domain knowledge by following the Linked Data principles [4]. Domain knowledge is often represented as ontologies, which provide a common understanding of the concepts and their relationships within a domain of interest (in our case, the agricultural domain). We plan to express ontologies based on Semantic Web technologies, e.g. Web Ontology Language (OWL) [5] and Resource description framework Schema (RDFS) [6], which are suitable for web-based automated reasoning and decision making processes.

In our proposed data driven open model, we plan to incorporate into the model complementary data sources i.e. Australian Water Availability Project Data (AWAP) [7], Australian Soil Resource Information System (ASRIS) [8], and Australian Cosmic Ray Soil Moisture Measuring Network (CosmOz) [9]. We intend to use these complementary data sources, together with the ontologies developed for the agricultural domain, as inputs to the model to perform real-time simulation and prediction. For this purpose, we have developed a knowledge integration framework [10] based on the Environmental Spatio-temporal ontology [11]. We are

currently developing a crop ontology that will be used by the proposed open data driven model. In addition, a web service framework will be provided so people can easily access the model.

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