

Agriculture Victoria's unique distribution channel for nutrient balances

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Abstract

Victorian agriculture faces significant challenges to meet the demands of growing markets and continue to deliver production gains, while also demonstrating responsible management of resources. Nutrient resources are a key management consideration for Victorian agriculture. Translation of our science into practical, everyday decision support is achieved with FarmBuild that delivers algorithms, calculators, and key agricultural datasets as freely available online functions.

Agriculture industry service providers and software developers can utilise FarmBuild web services, Application Programming Interfaces (APIs), integrated data sources and open source JavaScript API sample code, to build their own digital tools. This will enable providers to support their own clients, and be customised for their specific needs. Whole farm nutrient balance models, as well as farm mapping and soil information, are currently available as on-line FarmBuild functions.

FarmBuild is a unique distribution channel for Agriculture Victoria's science. Decades of scientific research and data collation to understand whole farm nutrient balances is being delivered as web services and API's. This allows third-party users to integrate this science into their own digital tools with free and open access via GitHub. Providing third-party users the opportunity to embrace the significant advances in digital technology, together with access to the best and current science for Victorian agriculture, will encourage evidence-based decision making on-farm.

Key Words

FarmBuild, open source, web services, Application Programming Interfaces, digital tools

Introduction

Victorian agriculture faces significant challenges to meet the demands of growing markets and continue to deliver production gains, while also demonstrating responsible management of resources. Nutrient resources are a key management consideration for Victorian agriculture. The scientific research of Agriculture Victoria has, over many decades, developed, enhanced and maintained a wide range of calculators, models, measurement tools and datasets to improve the use of farming inputs, particularly nutrients such as nitrogen. Translation of this science into practical, on-farm decision support is paramount. Leveraging digital technologies and services provided by agricultural service and software companies is the essential and timely next step to addressing the need of farm managers.

Historically, Agriculture Victoria developed web-applications and online decision support tools to enhance the practical application of science outputs. However, it became apparent that there are more efficient ways to create and maintain such digital tools, without the reliance on Government resources. FarmBuild, provides a unique distribution model that allows the Victorian Government to effectively deliver agricultural research science such as algorithms, calculators, and key agricultural datasets as online functions (Figure 1).

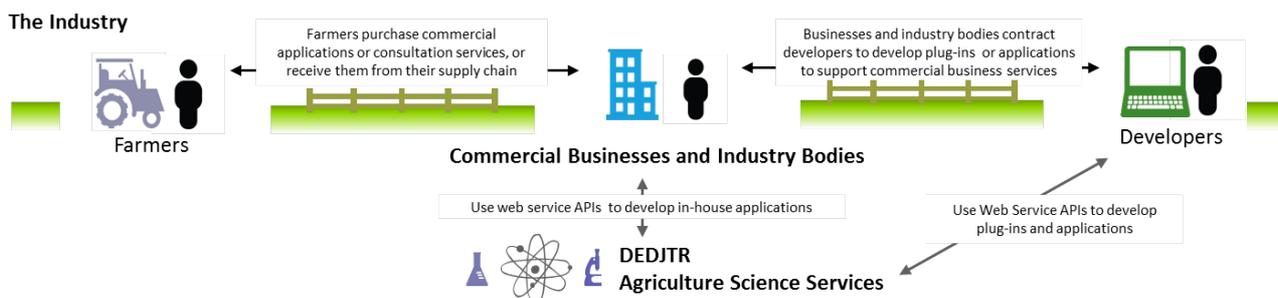


Figure 1. The supply chain of Agriculture Victoria's science through FarmBuild.

Commercial businesses and industry bodies are encouraged to collaborate with software developers to effectively utilise FarmBuild capability. FarmBuild enables the dairy, wool, grains and horticulture industries access to online Agriculture Victoria data and JavaScript functions. The integration of key agricultural data and resources with digital service offerings is demonstrated by the United States Department of Agriculture and their soil data access services (sdmdataaccess.nrcs.usda.gov/), while in Australia the Bureau of Meteorology is one of the few examples of services that can be integrated and utilised by third-party providers (e.g. Weatherzone, Elders).

Method

FarmBuild is a free and open-source suite of web services and Application Programming Interfaces (API). Users can access web services, APIs and associated data sources, as well as open source JavaScript API sample code and pages, to build their own digital tools and support their clients (Figure 2). Whole-farm nutrient balance models, as well as farm mapping and soil information, are current online FarmBuild functions.

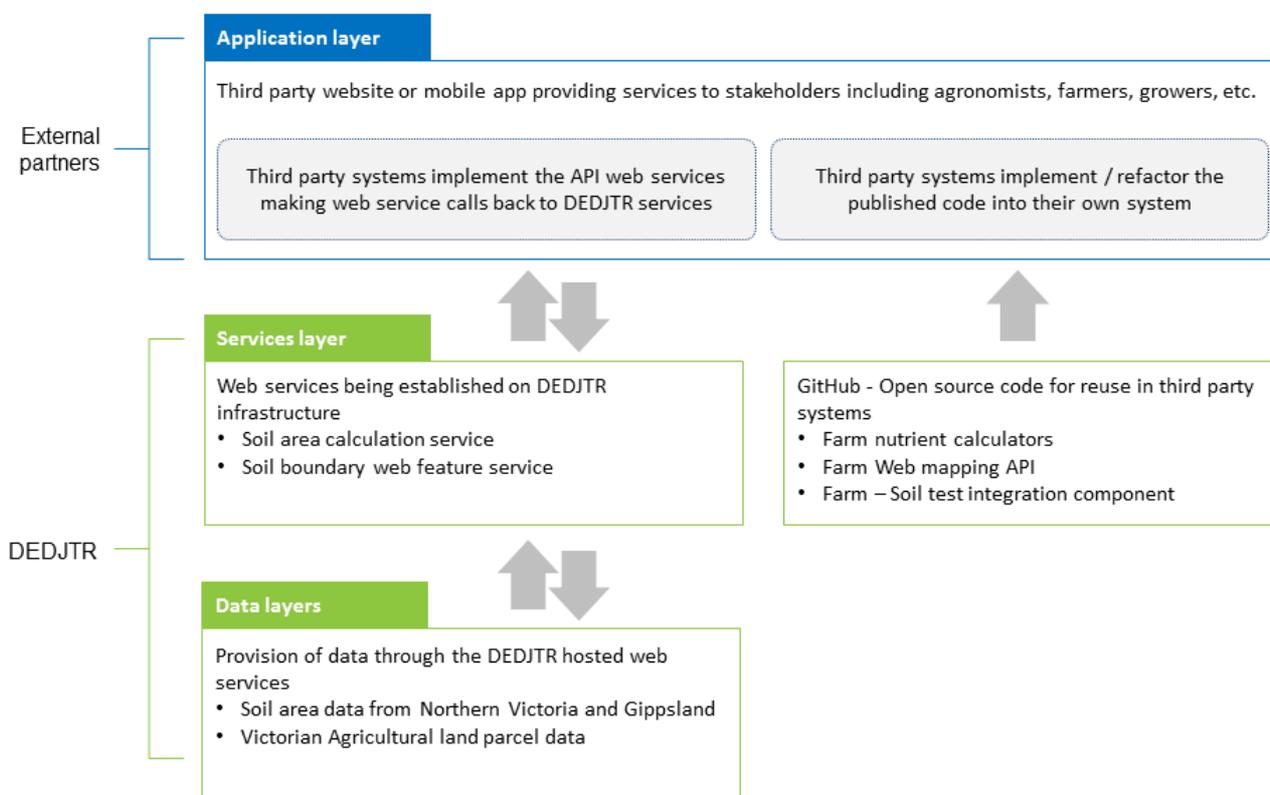


Figure 2. A schematic diagram of the data and service layers currently provided through FarmBuild.

FarmBuild was developed using a combination of JavaScript (Javascrpt.com, 2016) and JQUERY (The jQuery Foundation, 2016), Victorian Government VicMap API (State of Victoria, 2016), and Google Maps API (Google, 2016).

FarmBuild code is published via the open source repository GitHub. GitHub allows users to track and follow a large number of software developers, regardless of location or affiliation (Wikipedia 2016). The transparency of open-source software projects, such as FarmBuild, have the potential to radically improve collaboration and learning in complex knowledge-based activities (Dabbish *et al.* 2012).

Translating science to open source online functions – nutrient balance example

A commonly used approach to nutrient balances on farm is the whole farm nutrient mass balance (WFNB). Total nutrients imported and total nutrients exported, for nitrogen, phosphorus, potassium and sulphur, are calculated at farm-scale to determine net farm nutrient status, and nutrient use efficiency (Oborn *et al.* 2003, Gourley *et al.* 2007). Typically, calculators of WFNB are spreadsheet based and are therefore limited by: version control associated with file sharing, platform dependency and management of files through older to newer versions, data inputs sourced being incompatible, difficulty for multiple users to access a file based application at any one time, and lack of adaptability to mobile devices (Rugoho *et al.* 2016).

The whole farm nutrient balance calculator for Australian dairy farms, developed through a national 'Accounting 4 Nutrients' program (Gourley *et al.* 2012) was a Microsoft Excel based calculator. To deliver the calculator through the FarmBuild open source GitHub repository, the calculator was translated into JavaScript code.

Discussion

FarmBuild includes farm mapping API and code, a soil area calculation web service, soil import API and code and spatial layers of rural parcels and soil types in addition to the WFNB functions (Figure 2). It is designed so that users can pick and choose functions that meet their needs. There is no interdependency on the functions; they can work together, or stand-alone. The unique distribution channel of FarmBuild provides the user with the data and science required to build a specific tool that best suits their own, as well as their clients, needs. These primary FarmBuild functions have, however, been developed to complement each other as there are advantages, for example, in utilising the mapping and soil import functions in tandem with the WFNB functions. Clear identification of farm and paddock boundaries, generation of on-farm management zones by paddock labelling, and access to layers of information such as aerial photography and soils, can all inform a WFNB and provide land managers with a greater range of information to support their on-farm decision-making.

Conclusion

FarmBuild is a unique distribution channel for Agriculture Victoria's science. Decades of scientific research and data collation to understand whole farm nutrient balances is being delivered as web services and API's. This allows third-party users to integrate this science into their own digital tools with free and open access via GitHub. Providing third-party users the opportunity to embrace the significant advances in digital technology, together with access to the best and current science for Victorian agriculture, will encourage evidence-based decision making on-farm.

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