VegMachine.net. Online land cover analysis for the rangelands.

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Abstract

VegMachine.net is an online land cover monitoring tool funded by the Fitzroy Basin Association (FBA). The tool focuses primarily on Queensland, but has functionality for much of Australia's rangelands. The website went live in July 2016 and recently logged the 1000th user session. Users can view seven different seasonal time series of cover products across the landscape and interactively interrogate and graph ground cover change in six different on-the-fly and email delivered reports. Results can then be exported for use in other software.

To date, users have generated over 400 VegMachine® FORAGE ground cover reports which provide paddock-by-paddock, landtype-by-landtype analysis of ground cover change from 1990 to the present. Detailed help is available in multiple formats, including website popups and a dedicated YouTube channel. The web application was designed for two main user groups; technically equipped RD&E personnel including those servicing land manager clients, and a subset of the grazier community willing to operate the service themselves. Initial rollout of the application focused primarily on training events for government agency, private consultancy and natural resource management (NRM) staff in regional Queensland. These users form the core of the current user base.

In this paper, we outline the development of VegMachine.net. We demonstrate the primary functionality of the website, provide an overview of user experience including a case study and discuss major learnings and future directions.

Introduction

Remote sensing provides important rangeland monitoring datasets at global scale to local scales, and the range and number of available datasets has increased rapidly over the last four decades. Correspondingly, as rangeland managers and their advocates have recognised the value of these data to inform management and demonstrate stewardship, demand for property scale data in accessible formats has also increased.

From 2002 to 2015 the VegMachine® software played a pioneering role in delivering remotely sensed land cover data to land managers and NRM groups in Queensland (Beutel *et al.* 2015). The VegMachine computer software allowed users to interrogate bespoke land cover data sets. Local cover trends on a user defined area of interest (AOI) were benchmarked against cover in the surrounding region, and because the region and AOI share largely the same rainfall history and landtype, this approach can clarify the impact of management on cover change, and produce management insights and decision support. During this period, the software was trialled by 22 grazing properties and used by NRM groups on over 300 assessments of potential investment sites.

In 2015 the FBA funded a project to develop VegMachine online and ensure FBA's access to VegMachine services. However, the resulting web tool is open to public use, providing the full level of service (see below) for all of Queensland and a subset of services to a large part of Australia. In this paper we outline the results of VegMachine.net development. We describe its core functionality and outputs, provide data on user experience including a user case study, and outline the major learnings of this development and future directions for the web application.

VegMachine.net

The VegMachine.net website went live on the 28th of July 2016 (Figure 1). The site is free to use, open to public access and does not identify individual users. The site includes badging for FBA and the Australian Government in acknowledgement of their funding of the project, as well as the Queensland government, VegCover (developers of some of the core programming), and AusCover (primary hosts of the cover data).

User AOIs are defined by polygons in VegMachine.net and the site tools include drawing, deleting, naming, importing and saving polygons. The website displays a number of image layers; users can display one of two base maps, and overlay these with any of seven cover product time series with adjustable transparency and toggles to display each image date. Users can also search for locations within Queensland using land parcel identifiers, and nationally using address or coordinates. The site also includes a range of user help tools including a dedicated help page, help popups ad a YouTube channel featuring detailed help videos.

VegMachine.net provides three different on-the-fly cover analyses and three reports that are delivered by email (Table 1). The most detailed of these is the VegMachine FORAGE regional comparison report. All cover data are Joint Remote Sensing Research Program fractional cover products (Scarth *et al.* 2010).

Table 1. VegMachine analyses and reports.

Product	Description
Single polygon analysis	On-the-fly analysis of seasonal ground cover or fractional cover for a single AOI (1990 to present).
Polygon comparison	On-the-fly comparison of seasonal ground cover or fractional cover in two AOIs (1990 to present).
PEPER analysis	Modelled estimate of soil erosion from an AOI (1990-present) under three separate historical cover scenarios.
Regional comparison	Detailed analysis of ground cover change across multiple AOIs (1990-present). Designed for property/paddock monitoring, delivered by email as pdf. See details below.
Foliage projected cover	Graphic and tabular summary of recent woody vegetation cover for single AOI. Delivered by email as pdf, identical to synonymous report from https://www.longpaddock.qld.gov.au/forage/
Ground cover	Graphic and numeric summary of ground cover for single AOI. Delivered by email as pdf, identical to synonymous report from https://www.longpaddock.qld.gov.au/forage/

The VegMachine FORAGE regional comparison report allows users with existing property mapping to rapidly generate a comprehensive paddock-by-paddock and landtype-by-landtype ground cover report for their property. Users upload their property shape or kmz file to VegMachine.net and the report is generally emailed to the user within ten minutes. The report includes a single page analysis for each paddock, focusing on up to three landtypes per paddock, and benchmarking cover in each landtype to cover in the same landtype of the surrounding region (Figure 1). Over 400 reports have been generated, and this report is critical to making VegMachine data more widely available to producers. It summarizes a large amount of data in a single accessible document. It is also easy for third parties (e.g. NRMs, consultants) to generate on behalf of grazier clients, since such third parties often have, or can be given the required property mapping to generate the report. This frees the grazier from the task of extracting the report, and gives the task to personnel generally better equipped to extract the report and with an incentive (client engagement) to deliver and work through it with the client.
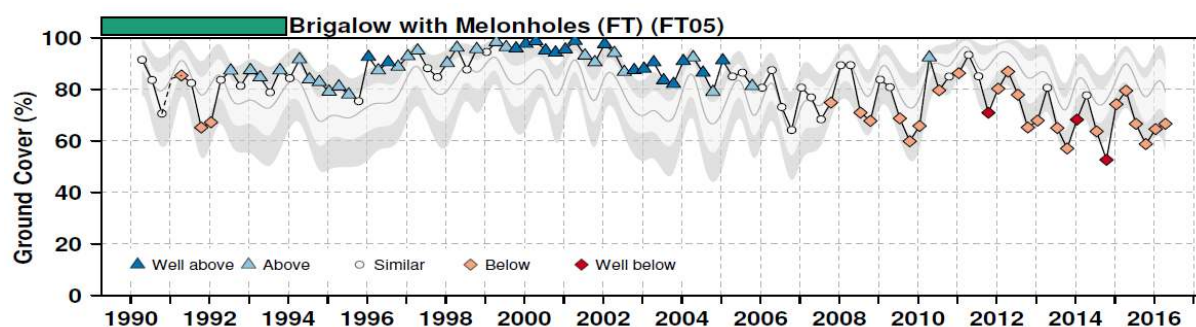
Figure 1. This extract from a regional comparison report shows ground cover in a paddock that was very heavily grazed from 2002. The pale grey bands show the percentiles of ground cover in the FT05 land type of the *surrounding region*. The overlaying time trace shows median ground cover in the same land type *within the paddock*. The symbols along the time trace classify the level of cover in the

paddock relative to the regional ground cover percentiles, and show a steady decline since 2002 from well above / above to below / well below expected levels of ground cover.

User experience

Table 1 shows Google Analytics data for the VegMachine.net website for the period June 1st 2016 to June 30th 2017. About 70% of sessions were conducted by Queensland users, reflecting the higher level of service availability and promotion in Queensland though usage is significant in other Australian jurisdictions, most particularly New South Wales. About 60% of all sessions were completed by returning users, with 13 users completing 10 or more sessions and 38 completing five or more sessions.

Table 1. Google analytics data (www.google.com.au/analytics/) for VegMachine.net (July 1st 2016 to June 30th 2017). A session is a period of time in which a user is actively engaged with the website beyond simply opening the site. New sessions are sessions completed by first-time users. Duration indicates the average length of all sessions in minutes.

Region	Sessions	New sessions	Duration
Queensland	722	236	11.7
New South Wales	101	58	19.7
Australia Capital Territory	55	29	9.5
Northern territory	51	21	14.8
Western Australia	42	22	9.3
Victoria	36	23	10.7
South Australia	15	9	6.8
Tasmania	9	8	6.5

VegMachine.net does not identify individual users. Anecdotal feedback and the presence of high frequency repeat users suggests that substantial use is made by corporate users in NRMs, agencies and other groups. Figure 2 provides a perspective from one such user.

'*In my work promoting sustainable agricultural land management, one of my uses of is VegMachine to identify areas of high erosion risk. VegMachine provides an objective and effectively independent dataset for stakeholders working towards sustainable property management, monitoring and evaluation. It can inform and evaluate land management for private and corporate grazing enterprises. One of the major challenges in promoting grazier uptake of VegMachine is overcoming technical confusion and capacity on farm. Part of the solution to this problem will be capacity development in networks like NRMs, Landcare and banks to support producers in better understanding and use VegMachine.net*'.
Paul Webb (Technical Officer, Queensland Murray-Darling Committee)

Figure 2. VegMachine.net user case study.

Lessons learned and future plans

There are three main lessons that can be drawn from the development and rollout of VegMachine.net. Firstly, it is clearly feasible to provide a service for land managers that allows them to interrogate very large land cover datasets and produce meaningful summary data. Secondly, with over 1000 user sessions recorded on the website, there is clearly a demand for the service. Thirdly, despite this demand, there are a large number of land managers who are yet to engage with the service.

This last point highlights wider grazier adoption as a required future focus for VegMachine.net. This challenge is being addressed via promotion at industry events and in communication through traditional and social media. We are also raising awareness through extension into grazing related industries including mine rehabilitation and property valuation. However, the core approach for some time will remain fostering wider networks of third party supporters, who can operate the service on behalf of their clients, delivering client support and enjoying better client engagement in the process.

References

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