Final report

FAP Pasture Tools & Calculators Update project

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Abstract

This project was undertaken to address the limited accessibility and obsolescence of six MLA (Excel spreadsheet and Adobe Flash) pasture tools and calculators. It was identified that the current state of these tools was not equipped to meet the modern expectations of an interactive user experience. Consequently, it was proposed that these tools should be redeveloped as mobile responsive, web-based applications that can work offline across any device. This was achieved by reverse-engineering the tools, extracting the key functionality and calculations involved and integrating them within an improved user interface. Redevelopment has resulted in tools that are now easily accessible, user-friendly, maintainable, and more compliant with present standards and requirements. Red meat producers and advisors directly benefit by having these upgraded tools at their disposal.

Executive summary

Background

The purpose of this project was to redevelop a collection of pasture tools to extend their utility and lifespan. This is beneficial to MLA's producers who have been provided more ways to access and interact with the tools. The intended outcome was the improvement of all tools and increased accessibility.

Objectives

- Update and improve the existing suite of online pasture management tools.
    - All tools were converted to responsive web-based applications.
- Improve ease of use through enhanced design, accuracy and operability.
    - The tools are now easier to access, navigate and operate within a modern web-based framework that is compatible with all devices.
    - Where applicable, a method of storing and accessing data for offline use was achieved through implementation of local storage and browser service workers.
- Increase producer participation through the eLearning portal.
    - Provided ability to reference tools within eLearning training packages that contain relevant context.
- Deliver a quantifiable method of improving end user uptake.
    - Determine baseline for comparison.
    - Cooperate with stakeholders to devise method.
- Improve end user experience and operability of the tools and calculators.
    - Reduced complexity of user interfaces and focused on responsive design.
- Enhance accuracy of calculations and participant analytics for spatial analysis.
    - Integrated Google Analytics for key insights on audience participation.
- Provide a simple maintenance and updating system that allows cost effective management of the system over time.
    - Used industry standard development environment for modern web based applications.
    - Produced a manual that documents the process of maintaining and updating for each tool.

Methodology

The tools and calculators were built as mobile responsive websites and can be accessed from a single domain (http://www.etools.mla.com.au). They were developed with a focus on improvements to design consistency and functionality. Requirements for cross device and offline capability were at the forefront of the design and development strategy.

Results/key findings

All objectives listed in this project were completed. Demographics based on user analytics show that the target audience has been exposed to and are currently engaging with the new tools.

Benefits to industry

Improvements to productivity for red meat producers and advisors is the primary benefit of this project. Less tangible benefits include opportunities for education, exposure to new ideas and a better understanding of fundamental industry practices. The inclusion of analytics also means MLA can pinpoint who is using the tools and how they are being used.

Future research and recommendations

Due to the success of this project there are now viable opportunities for development of other MLA tools and calculators that are approaching expiry.

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1. Background

This project was initiated to provide a solution to both the immediate and long-term issues associated with six MLA pasture tools and calculators. These issues included the reliance on outdated technology, a lack of accessibility across modern devices, convoluted and difficult to navigate user interfaces, and an inability to update and maintain. Four of the tools existed as Excel spreadsheets which, while serviceable, had certain software and hardware prerequisites that excluded many users. Another tool, the stocking rate calculator, was built in Adobe Flash which has since reached its end of life and is no longer supported. Using these two examples it is easy to identify the problem of obsolescence and begin to strategise a solution.

To contemporise these tools and make them available to a wider audience they needed to be rebuilt as responsive websites. These websites needed to be accessed from a single domain and integrated with relevant content providing further context. Cross device and offline support, user-friendly interfaces, consistency in design (to produce familiarity between tools) and the ability to maintain and update with minimal effort were all requirements. Each of these requirements are necessary to benefit the end user (red meat producers and advisors) and improve engagement.

Red meat producers and advisors are the main beneficiaries of this project as the tools are intended to help them make decisions about their pastures. Variability in technical skills and industry knowledge as well as situational discrepancies such internet connection and working environments were acknowledged early on. As such, responsive design for mobiles and tablets, offline support (particularly for unstable connections) and a simplified user interface (UI) were prioritised. Lastly, data input and navigating between steps within the tools has been made more intuitive by formatting and presenting content with more clarity than is capable via spreadsheets.

2. Objectives

2.1 Convert six tools and calculators to responsive websites

The main objective of this project was to convert six existing tools and calculators to responsive websites. This was accomplished through the implementation of up-to-date technology and design standards. Prior to the upgrade the tools were difficult to use and navigate, particularly on mobile devices. A mobile first approach to design was applied as well as a host of interface improvements to improve readability and provide direction. All six tools were successfully remodelled and deployed as web-based applications. However, due to issues identified with the original excel version of the feed demand calculator, this tool was taken offline after deployment and requires further updates outside the scope of this project.

2.2 Offline functionality

Providing offline functionality for each tool was another high priority for this project. This is due to the variable circumstances concerning the way the target audience can access and use the tools effectively. Browser service workers and local storage were employed to successfully cache critical data after the initial use. Data could then be preloaded from the browser upon follow up usage of each tool without the need for an active connection.

To allay any data privacy concerns, user-entered data is only stored locally in the browser of the device used to access a tool or calculator. No data is stored in the cloud or within an external database to circumvent any potential breach or exposure of confidential information. The ability

to save and load a particular scenario is available to each tool, however, the user has exclusive ownership of this data and if cleared from local storage the data is unrecoverable.

2.3 eLearning Integration and entry point to calculators

The eLearning site "The toolbox" https://elearning.mla.com.au/tools-calculators provides a central point (hub) for logging in to myMLA and accessing each tool.

2.4 Deliver a quantifiable method of improving user uptake

The final objective of the project was to deliver a quantifiable method of improving user uptake and engagement. This occurred in consultation with stakeholders. Several proposals were considered in which the efficacy of their respective application could be measured. Integration of the tools within eLearning modules and providing surveys for user feedback have been implemented. Promotion of the tools via email, workshops, and social media have been identified as options to improve user uptake of the tools. This will be carried out by the MLA Communications Team now that the tools are hosted on MLA servers. Response to this promotion, gauged partially by analytics, can be compared to the baseline established at the start of the project to assess if improvement has taken place.

3. Methodology

3.1 Design

The design phase started with an examination of the original tools to create wireframes that incorporated all core functionality (navigation, buttons, tables etc.) in a web responsive style. Design concepts were sent to stakeholders for feedback and recommended changes were applied. Some tools such as the Soil Phosphorus Tool had multiple design concepts drafted to provide further options.

3.1.1 Responsive design

Responsive design is the act of ensuring an application or website is optimised for display on small and large devices alike. Accessing a website designed with this approach should not significantly change the user experience depending on the device of choice. The old Pasture Trial Network (PTN) is an example of a non-responsive website that was not intended to be scalable and hence performs at a disadvantage to users on mobile devices (see Appendix 7.1). It was important to use the elements of responsive design such as the grid and breakpoints throughout the project.

3.1.2 Grid and breakpoints

Two fundamental components of responsive design are the grid and breakpoints. The grid is a sequence of rows and columns used to divide and structure content. Breakpoints are the point at which a website's content will adapt in a certain way to provide the optimal user experience (UX). Using these to concepts in unison, a template could be formed for the tools. The template aims to display multiple columns on larger screens (laptops and desktops) while restricting the amount (often to a single column) on smaller screens (mobiles and tablets). Using this method, content is no longer indiscriminately scaled to fit

the screen size resulting in text, images, buttons, input fields and menus being presented in a much more user-friendly way (see Appendix 7.2).

3.1.3 Navigation

The ability to easily navigate around a website is an integral part of the user experience (UX). It should not be a challenge to find information or follow a step-by-step process. For this reason the typical model of header and footer menus along with a collapsible menu on mobile was applied. In certain scenarios menu items will be locked, for instance when a user attempts to access the results page, before entering any data. Buttons have also been employed throughout the tools when a user action is needed like continuing to the next step. Consistency in navigation design was key as it develops a familiarity that can be called on when jumping between different tools.

3.1.4 Consistency and branding

Design consistency is vital when exposing a user to multiple new and often interconnected websites. Part of a good UX is not overwhelming the user with a complicated or inconsistent UI. This was primarily achieved through the application of typography, colour, and layout. By using a common template across the majority of the tools an inherent understanding of how things work is established. MLA's characteristic branding such as the green, yellow, and white colour schemes along with the logo was used to distinguish each tool as unique intellectual property.

3.2 Development

Prior to development, time was spent investigating which technology was best suited for the task. Ultimately, the Vue JavaScript framework supported by the Vuetify component library was selected as the best option. Vuetify is based on Material Design, a design language developed by Google that provides a system of guidelines supporting the best practices of user interface design.

Four of the six tools were originally created in Excel as spreadsheet-based tools accompanied by VBA macros for extended utility. They had to be deconstructed to extract the logic and formulas needed to replicate calculations. The process was often difficult as the spreadsheets were lacking context and much time was spent cross-checking results from matching data sets. To prevent this issue in future iterations of the tool, where possible, code was grouped and contextualised throughout development.

3.2.1 Stocking rate calculator

The stocking rate calculator was first to be prototyped and would set the standard for the remaining tools. It was a straightforward remodel of the tool with the added functionality of printing and saving results.

3.2.2 Soil phosphorus tool

The soil phosphorus tool was embedded inside a single page stepper component that divides the process into five distinct steps: soil testing, stocking rate / soil fertility, phosphorus application, budget analysis and other considerations. The graphs presented in the first two steps are now dynamically updated with value changes and have interactive capability. Vast

sections of text have been reformatted and split into smaller subsections to streamline the process flow. The ability to save and load different scenarios in the budget analysis step was included for revisiting users to prevent them having to re-enter datasets multiple times. Further feedback from users resulted in a request for an update to the tool. This update allowed previously saved scenarios to be reloaded from alteration and interrogation. This update was completed at the end of May 2022.

3.2.3 Pasture improvement calculator

The pasture improvement calculator was a one-to-one remodel of the spreadsheet with a few minor adjustments. The data entry and results pages were combined into a single page to quickly toggle between the two. There is no longer a fixed limit to the number of entries that can be added for multiset data such as seeds and fertilisers as the user can add or remove rows at their own discretion. Validation has been added to each required field and the user will be alerted about missing or invalid data before progressing to the results page. Lastly, the ability to save and load scenarios (like previous tools) has been included.

3.2.4 Feedbase planning and budgeting tool

The feedbase planning and budgeting tool exists as a collection of eleven sub-tools split across three categories: simple, seasonal, and other useful tools. These tools can be accessed by selecting from a category dropdown which will then load the tool into the current view. Generally, the tools where structured as tables separated into three columns field (description of data), value (actual input value) and calculations and comments. Links to data tables in the comments column now open as modals to avoid shifting the user away from the active tool, however, selecting the data tables tab will display the entire array of tables in a neatly assembled list.

Some tools have the capacity for multiple stock selections which have been labelled as optional and hidden by default to save space. Horizontal scroll buttons were added to each table to assist navigation on mobile devices. Finally, each tool can be given a scenario name and date to be saved and loaded for future reference.

3.2.5 Feed demand calculator

The feed demand calculator was the most difficult tool to reconstruct as the complexity of the spreadsheet far exceeded the other tools. A systematic approach to breaking down each segment was undertaken to ensure precise replication of results. Notable changes included:

- Merging the area, growth, and supplement pasture tables into a single table.
- Combining the cattle and sheep pages into a *livestock* page.
- Full width inventory table and dynamic head of stock chart.
- Combining the supply and demand pages into a *feed* page with charts, options, KPIs and printing functionality.
- Navigation guards and validation to assist the user as they progressed through each stage.

Initial user testing internally and externally found the tool to be functional and consistent with the Excel version of the spreadsheet over the 18 months of development and testing. Unfortunately, in a final external test, it was found that some of the fundamental calculations contained within the original Excel tool were incorrect and had been for some

time. This spreadsheet will need to be reviewed and updated in the future with the correct calculations. Once this is complete, the web version of the feed demand calculator will need to be updated and deployed. This work will occur outside the scope of this project.

3.2.6 Pasture trial network

The Pasture Trial Network (PTN) was developed with its own unique template. This was primarily to maximise usable space by opting for a smaller header section and a collapsible sidebar menu. The layout of the tool remained largely unchanged with trials being searchable via region or species. Dropdown filters were added above this to make finding specific trials a little easier. The map was upgraded to a full-scale interactive view of Australia in which respective regions containing trials are displayed as map markers.
The lack of flexibility in the way data was processed and displayed in the old PTN was expressed as the chief concern needing to be resolved. To do this a model for new and existing data was created that could be imported to a database and exported to the new tool. The presentation of this data could then be customized in numerous ways as opposed to being confined to a predetermined structure.

3.2.7 eTools (hub)

A basic hub website was created to provide a single maintainable connection point across all current and future tools and calculators. The site permits users to log in to their myMLA accounts as well as delivering information about the current state of each tool (i.e. under maintenance). Each tool is hosted within its own directory within the domain to provide clear separations of concern.

3.3 Testing and maintenance

Testing occurred at regular intervals throughout the duration of the project. Prototypes of each tool were made available to the stakeholders to trial and supply feedback. Unfortunately, the participation in these periods of testing was lacking and may result in more follow up maintenance than anticipated. Maintenance is ongoing and encompasses everything from minor formatting updates to major changes to underlying formulas. An error tracking software known as Sentry has been integrated with each tool to log and mange issues as they occur.

3.4 Deployment

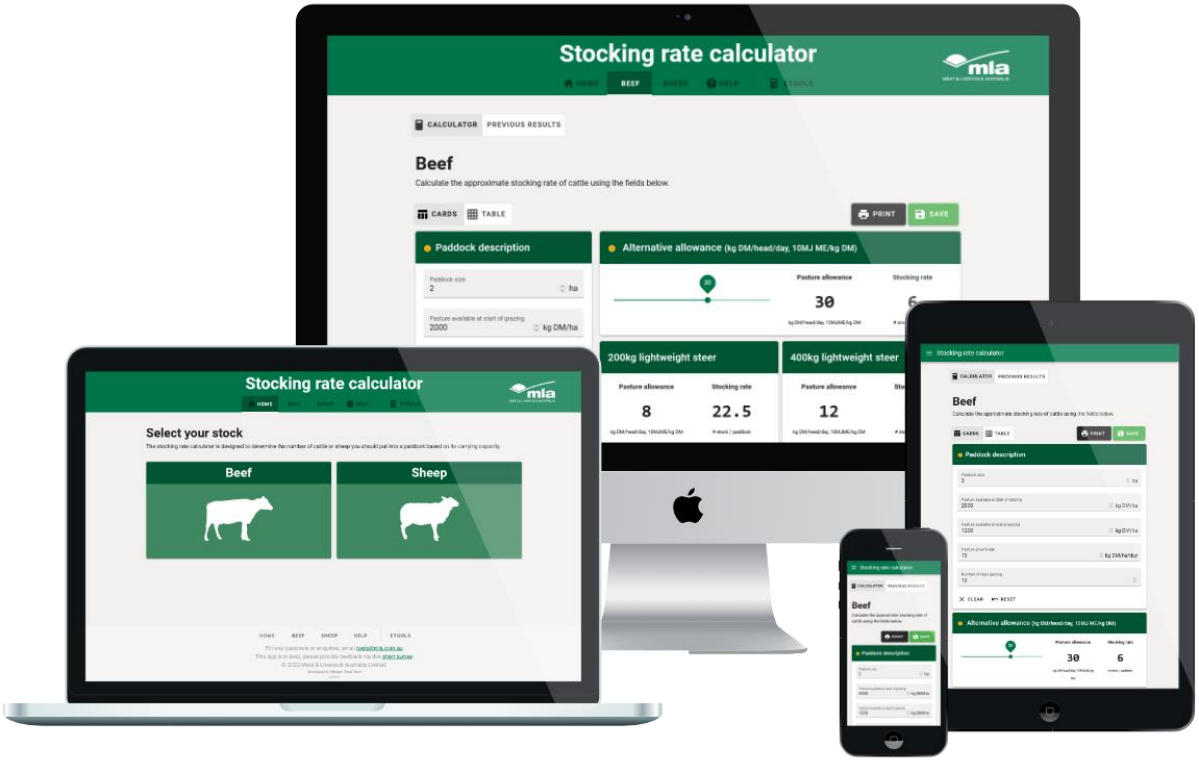
3.4.1 Web hosting and domain

During development a virtual machine (VM) running Linux (Ubuntu 18.04.5 LTS) was provisioned at the Equinox data centre in Sydney, through the service provider Crucial Paradigm. On this VM, Plesk Obsidian (https://plesk.com) version 18.032 was installed for hosting both the etools.mla.com.au and elearning.mla.com.au websites. Plesk is a secure web hosting platform with a centralized control panel for managing Domains, Domain Name System (DNS), email and website hosting. In May 2022, the hosting was migrated to a similar environment on MLA servers.

4. Results

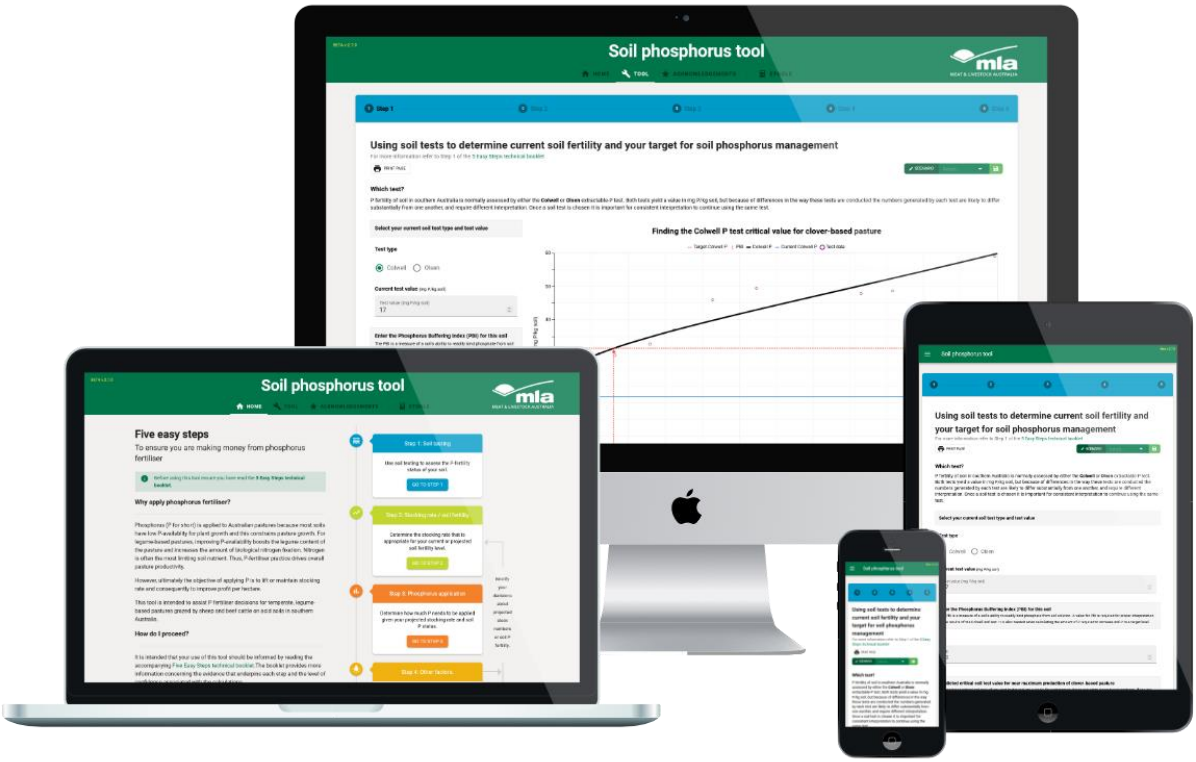
4.1 Stocking rate calculator

The remodelled stocking rate calculator is a marked improvement from its predecessor. Full screen and cross device support along with a UI overhaul work in combination to make a more available and practical calculator.



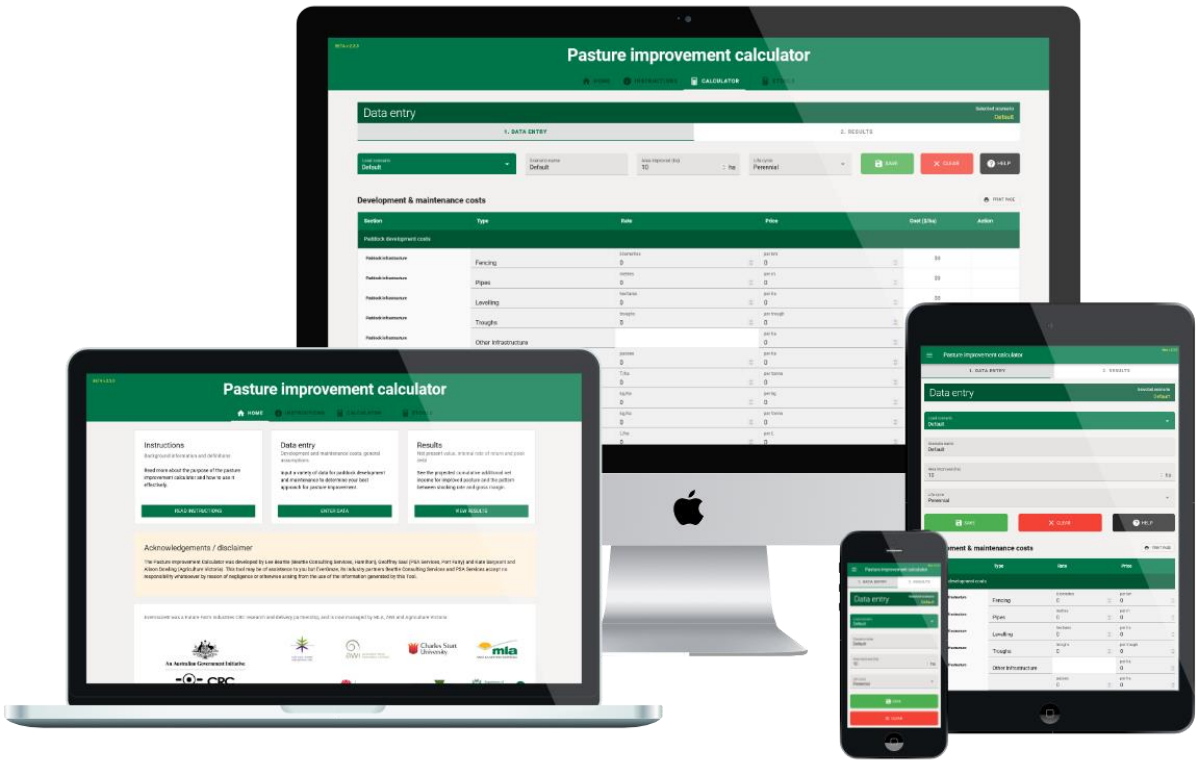
4.2 Soil phosphorus tool

Shifting from a spreadsheet to a responsive website has resulted in a mobile friendly and succinctly organised tool with a superior UX. The barrier to entry such as being able to download and open the spreadsheet file has been eliminated and replaced with a fully accessible alternative.



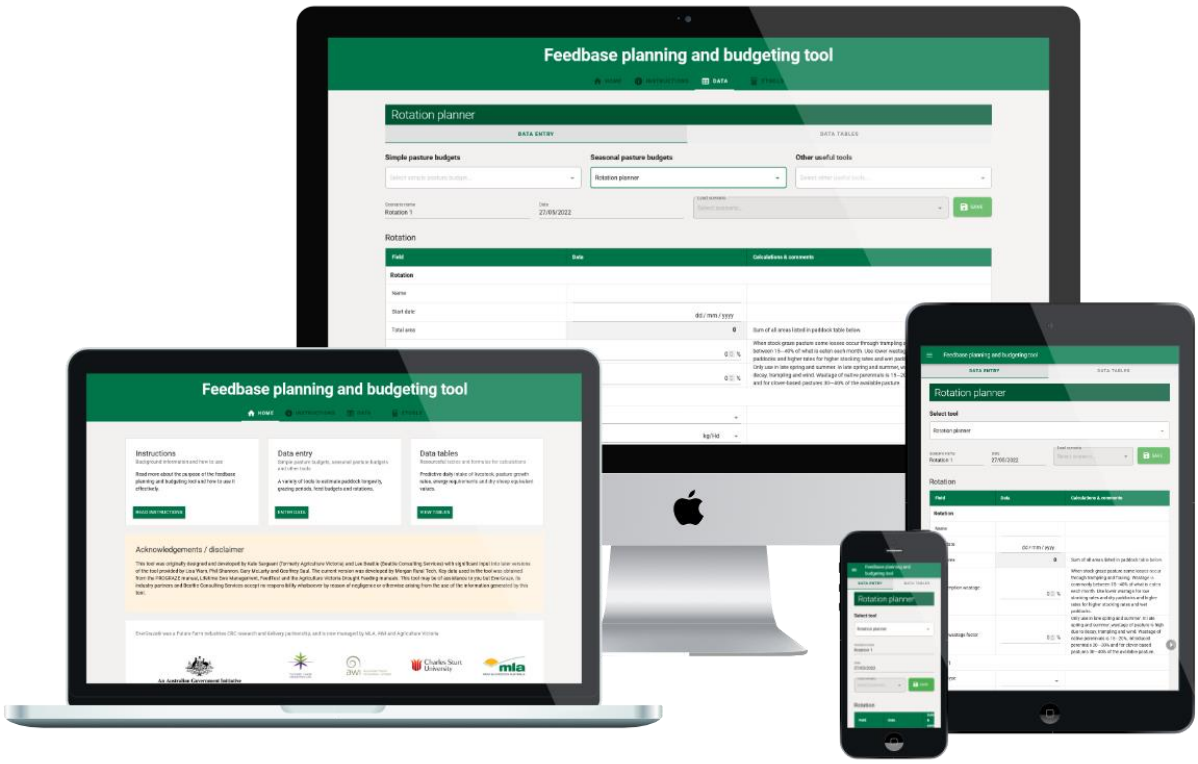
4.3 Pasture improvement calculator

The pasture improvement calculator was successfully consolidated from an expansive spreadsheet to a simplified website.



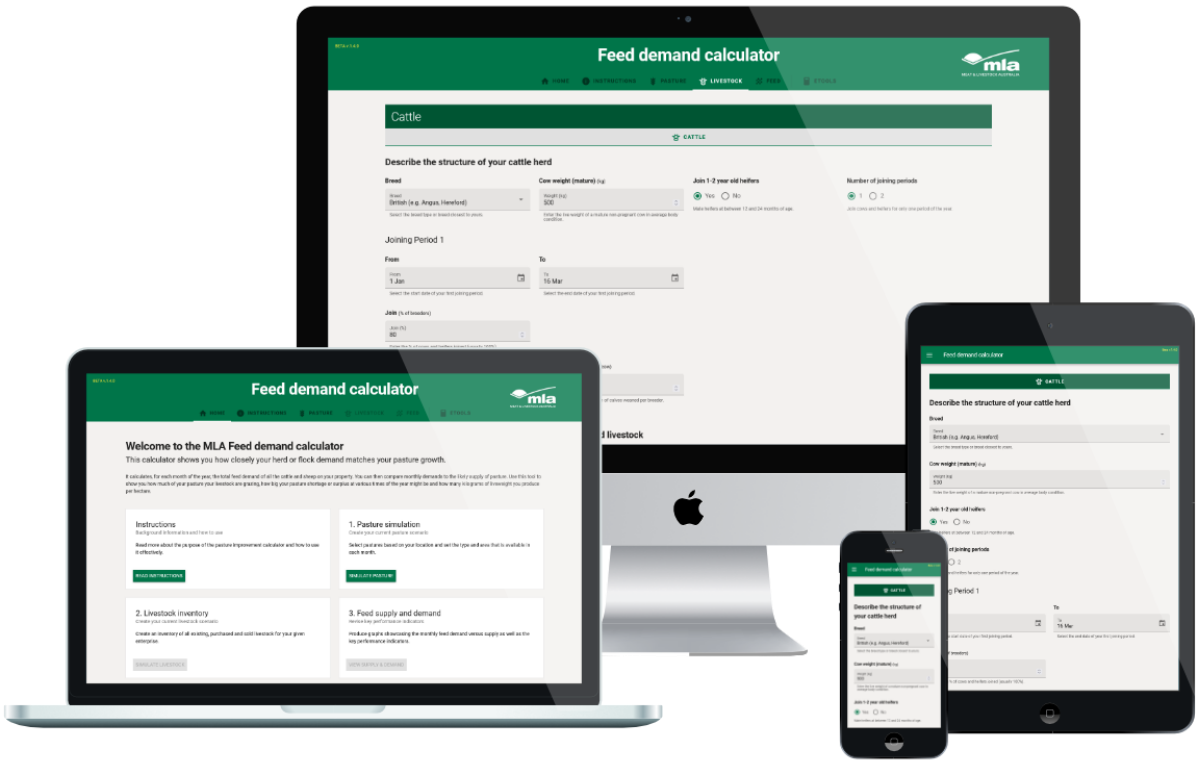
4.4 Feedbase planning and budgeting tool

Each tool adapted to the new responsive template now offers the same level of utility with enhanced functionality and a more approachable layout.



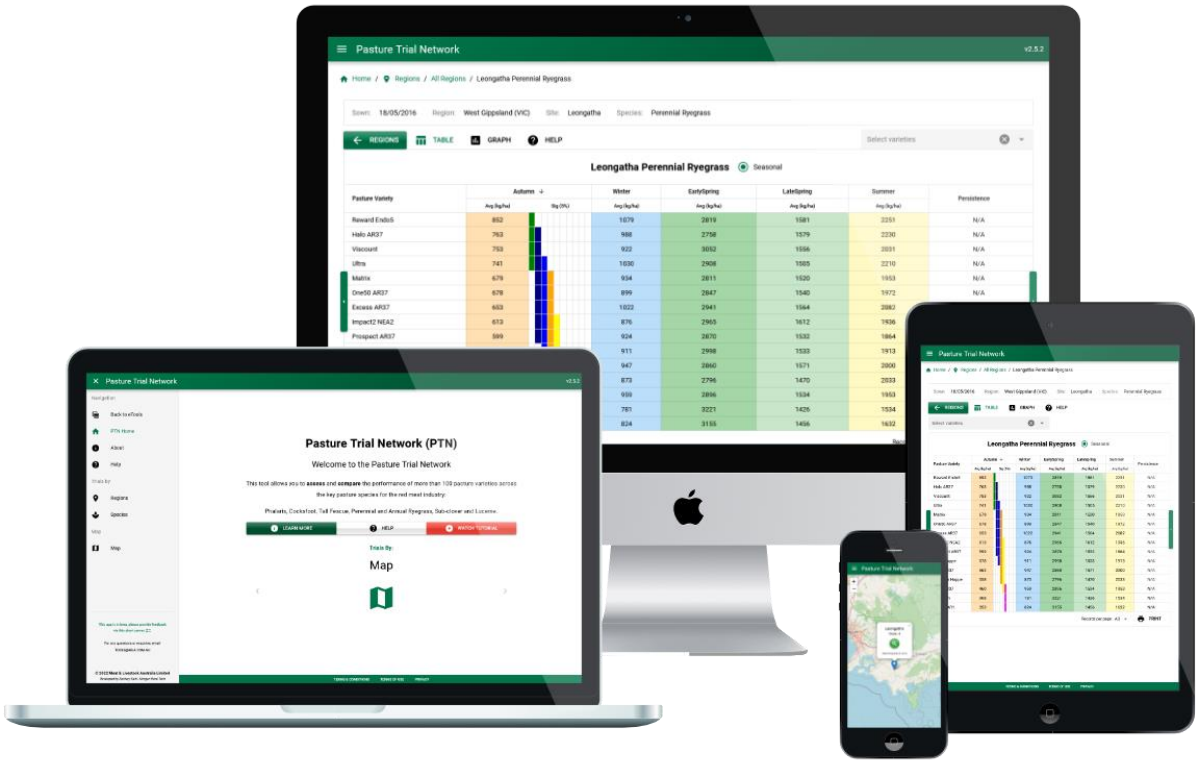
4.5 Feed demand calculator

The transition between each stage of the calculator and the presentation of data and results has been elevated in all aspects in comparison to the original tool.



4.6 Pasture trial network

The core design of the original Pasture Trial Network was maintained in the remodel. Several modifications were made to fulfill the expectations of a modern-day responsive website.



4.7 eTools (hub)

A centralised landing page with the myMLA login button at the top of the page and the tools and calculators in a grid below.

5. Conclusion

The objective of this project was to address the limited accessibility and obsolescence of six MLA (Excel spreadsheet and Adobe Flash) pasture tools and calculators. There were seven objectives outlined which were designed to improve the state of the tools. These included the conversion from older formats to responsive websites, offline access, eLearning integration and the ability to evaluate user engagement. Fulfilling these objectives has resulted in a user-friendly and maintainable suite of tools and calculators with the potential to engage a wider-ranging audience than was previously possible.

5.1 Key findings

- All tools were successfully deployed to production and are available to producers The feed demand calculator was made unavailable in May 2022 until further updates to calculations can be provided, tested, and deployed.
- User feedback indicated a reluctance to store data in the “cloud”. Due to this feedback, all tools store data locally to satisfy this concern.

5.2 Benefits to industry

Improvements to productivity for red meat producers and advisors is the primary benefit of this project. Less tangible benefits include opportunities for education, exposure to new ideas and a better understanding of fundamental industry practices. The inclusion of analytics also means MLA can pinpoint who is using the tools and how they are being used.

6. Future research and recommendations

Based on the results of this project there are opportunities to upgrade other outdated MLA calculators such as the Breeder Mortality Calculator and Refrigeration Index Calculator. There are also opportunities to develop new applications that provide value to the red meat industry producers.

Nearing the conclusion of this project, external testing found some calculations in the Feed Demand Calculator produced incorrect results. These calculations were based off the original public Excel Feed Demand Calculator. For the web version to be released it is recommended that correct calculation methods be documented or updated in the original excel tool. This update should be conducted by the appropriate subject matter experts so that the tool can be updated and validated in a separate project.

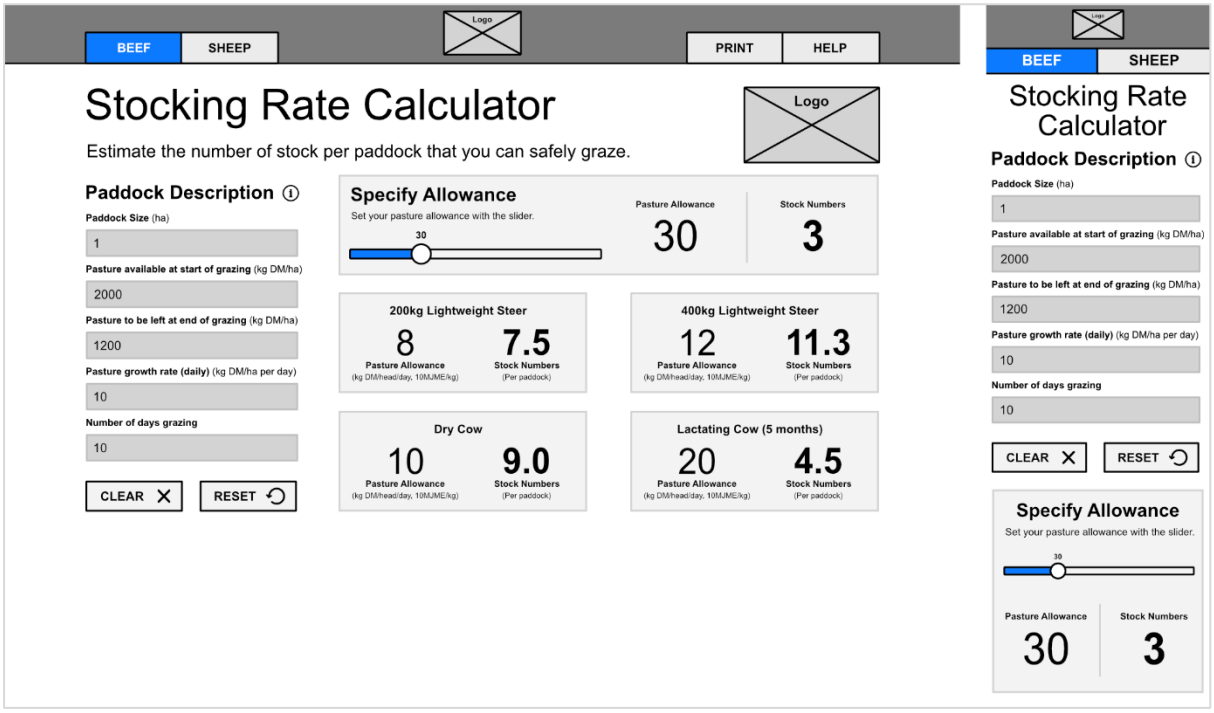
7. Appendix

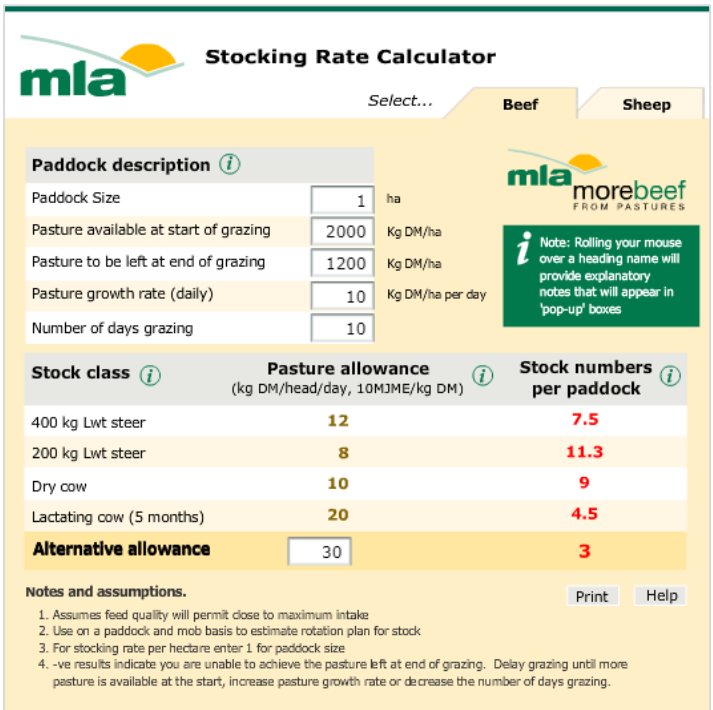
7.1 Non-responsive design example

The old PTN website is not responsive and scales poorly on mobile devices.

This produces problems with readability and navigation between pages.

7.2 Responsive design example





Demonstrated above is the responsive design for the stocking rate calculator showing the scalability from desktop (top left) to mobile (top right) devices.

The original Adobe Flash tool (left) was not designed to be responsive and as a consequence was difficult to use on smaller screens.