

DATA DOES GROW ON TREES (FORESTREE)

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Introduction

In July 2020 the City of Marion purchased the Forestree tree management software to improve our service delivery and asset management of the trees under our care and control (council land). The system is highly capable and identifies each tree as an individual asset and works as a tool to provide whole of life works management. Our field staff, who had been using a generic asset management system previously, quickly found Forestree to be user friendly and, recognizing its benefits, embraced its implementation and use.

Embracing continuous improvement and corporate values around innovation, the Open Space Operations team was keen to ensure the system could work in sync with other corporate applications such as our Customer events system and broader GIS platform. Beyond this was a capability requirement to provide detailed data analysis to support the recently completed service review and whilst Forestree has some excellent reporting capabilities inbuilt we felt by connecting it to Microsoft Power BI we could gain greater insights into our operations through deeper levels of data analysis.

Within 6 months we realised the powerful data the system was giving us and to visually present this to council we created a webpage which ultimately became the Marion Tree Interactive. This was officially launched in June 2021.

Why Forestree was developed for Councils

Urban Forestry has changed considerably over the years with a greater focus on the benefits trees provide as a community asset and the way they are managed to maximise these recognized benefits.

Technology has now enabled Councils to map trees through the use of remote sensing (satellite or Lidar) and with this provided Councils with a greater understanding of canopy cover level, tree health, potential opportunities to plant as well as a number other indicators to help benchmark and prioritise efforts to increase greening.

Council trees are however a physical asset and decisions made in regards to their retention, removal or species type is largely determined by those decisions, made every day at ground level. These decisions are made by arborists, suppliers, contractors, community, landscape architects and a range of others all of influence the way Council trees are managed, that in turn influence the performance or benefits public trees provide and Council's ability to deliver greening targets.

Council managed trees are unlike any other Council assets. The number of trees a City Arborist manages typically exceeds all other Council assets combined, their value accumulates over time, their conditions change routinely based on variable environmental conditions, growing environment and cultural practices.

For a Council, managing such a diverse asset class does not negate those basic principles of effective asset management, which includes maximizing the asset performance or condition, managing its risk and through this understanding cost. Forestree was built to not only help Councils capture their tree assets and keep data up to date but to manage, monitor and share this information with others including those key decision makers who influence how these assets are managed. Forestree was designed through a recognition that a unique software solution was required to help Cities manage one of their most diverse, variable and valuable assets.

Since its launch in 2020 Forestree has gained wide adoption and recognition by progressive Councils of various size across Metropolitan South Australian and abroad, due its unique ability to address those key challenges Councils face in managing arguably their most valuable public asset.

Marion Tree Interactive (Marion - A Green City)

A presentation on the implementation of the *Tree Management Framework 2018-2022* was provided to council in February 2021 to review its success to date and identify future opportunities to better manage and increase our urban forest across the city. To help facilitate this session an interactive web page was created to showcase the data collected from the use of Forestree. Feedback from Elected Members present at the session was overwhelmingly positive and they requested the web page become the basis for a public portal that residents could visit to see information about the trees in their suburbs. The page was transformed into the Marion – A Green City <https://trees.marion.sa.gov.au/> which was launched June 2021.

The portal consists of 5 pages which showcase information under the following themes:

- **Urban Forest Home Page** – The portal front page allows users to see the total number of trees in the city* with a breakdown of tree by suburb represented graphically. The map can be rotated, laid flat and zoomed in to show individual tree data. Clicking on any existing tree will show individual data attributes include species type (total number of this species across the city and order ranking), height, spread and Google Street View image. Users can search by street address to find their street to see the types of trees located there.
- **Planting** – When this page is selected the map of the council runs a visual graphic of every individual planting location which has occurred within the last 3 years. It shows the total number of trees which have been planted in that time with a breakdown by suburb represented graphically for residents to see how many trees their suburb has received. Select Future planting and this will expand to open a 7-year suburb planting plan and when each year is clicked on, will show only those suburbs we are looking to plant that year. Approved planting locations are shown in a different colour and can be clicked on so the user can see the species type selected for that location. A forward projection of how we project our tree canopy to increase is shown graphically and provides data calculations annually projected out to the year 2040**. Alternatively, this also shows our projected canopy decline if our planting targets are not met.
- **Watering** – When this page is selected the map of the council area runs a visual graphic of every individual tree currently on our watering program, with trees watered today pulsing in a light blue colour. This data updates every 15 minutes and is the first of its kind anywhere in the world. Users can click on an individual tree and see its entire watering history by date and time and the total amount of visits by our water tankers in a season and the total amount of water used. Our water is recycled storm water which is captured at the Oaklands Park Wetlands, injected into the aquifer and re-extracted for use. Trees are watered via two 9,000L water tankers***.
- **Works** – When this page is selected the map shows the operational works and inspections undertaken within the last 12 months. This is visually represented with different colours allocated by work type. Each type can be selected individually to filter out and only show that work type across the city. Inspection locations are shown separately, this map has been integral to changing public perceptions about our tree management and public perceptions about council works in general.
- **Species** – When this page is selected the map shows our top 10 tree species, this list is generated according to the total number of each type of tree species we have across the city with a separate colour assigned to each one. An individual species can be selected which filters out the others and shows their locations on the map. We often receive enquiries about our Jacarandas and this is way the public can easily see the streets they are on. Tree species are shown using common names for community understanding and some species/cultivars are grouped under generic titles to provide a greater understanding on population diversity.

The Marion Tree Interactive (Marion – A Green City) has been an exciting initiative to work on and implement. It has received many positive reviews from our Elected Members, internal stakeholders and members of the public. It has been demonstrated multiple times to external stakeholders such as Flinders New Venture Institute (Flinders NVI), South Australian Local Government Urban Forest Alliance and has received 1,500 hits publicly, including hits from Europe and the USA.

Power BI (Data Analysis/Dashboards)

A critical consideration when purchasing Forestree was the ability to undertake detailed data analysis on a daily basis to inform operational decision making and ensure staff are achieving their set program maintenance targets. Forestree has excellent inbuilt reporting capabilities however we wanted to take this to a far greater level of detail. The decision was made to link Forestree to the Microsoft Power BI platform and this was set up via an API with data transferring twice a day.

Eleven data dashboards have been created which allow us to interrogate the information at an individual user/crew level and benchmark targets for staff to achieve were established. Power BI takes data and displays this via charts and graphs to show how our programs are tracking and if these targets are being achieved.

Highlighting the key dashboards below I have provided a summary of each dashboards capabilities and tangible outcomes which inform our business decisions.

Work Orders – Provides the number of work orders generated versus completed, with a breakdown by suburb, month completed and works function actioned. We use this to show when our peak periods are to inform resourcing decisions around which suburbs to target our pruning activities in based on the type of works being undertaken.

Planting – Provides the total number of trees to be planted by year, total number of trees to be planted in each street and total number of species required for each year of planting. Further filtering and analysis can reveal house numbers which are to receive planting and number of trees required at street level. This informs budgets, reduces wastage and gives certainty to future stock ordering and procurement for planting contracts.

Watering – Provides the number of trees watered per day and sets a benchmark average of what can be consistently achieved within existing resources, provides individual watering numbers daily bay user and counts the amount of trees watered in each suburb each month. Additional filtering can bring this down to street level to see how often individual trees are being watered. This data was instrumental in showing how drastically under resourced we were to water the trees we were planting annually and based on the targets set how much additional funding was needed to ensure we could water sufficiently.

Block Pruning – Our Elected Members and senior leadership have indicated this is one of our most critical service delivery programs, to implement this program a base line time average has been set and agreed by staff for pruning each individual tree (7minutes per tree). This is based on time in motion studies undertaken during our service review and factoring different tree size variables. Daily average number of trees to be pruned has been set accordingly and the projects created in Forestree and allocated to the crew with start and finish deadlines. Dashboard shows total number of trees per suburb to be pruned and how our team is tracking to complete this in time. This is visually represented by a speedometer type indicator with green, orange and red for tracking purposes. Daily number of trees pruned is recorded and number of trees pruned by street is displayed.

Reactive Works – Provides the total number of reactive style works our crews undertake, including the number of customer events we receive and our timeframes for completion versus those still to be completed. It shows the daily number of inspections and completed customer events and gives a monthly indication of works volumes which has shown significant increases in work during COVID lockdowns and after storm events or when tree branch failures have received media attention. Additional filtering can focus on works allocated to contractors by individual company and provide information about number of jobs allocated and timeframes for completion. We anticipate the data will show additional internal resources to meet our service level demands will be required in the near future.

Pruning Time – Based on a 7-minute individual tree pruning average we can calculate the amount of time it will take to prune every tree in every suburb in the entire council area. At the current count of 42,700 trees we calculate it will take 4.2 years to complete the program. The dashboard also displays this figure calculated by months, weeks and days. Additional filtering can show number of trees by suburb or street and we can identify pruning type by tree species.

It is hoped over time this will give us data on the species types and specific suburbs which require more frequent visits to undertake maintenance pruning, thus informing our decision making around which species we plant and better targeting our maintenance programs to reduce customer events being raised.

Conclusion - For many years the operational works divisions of council's have continued to absorb the increasing risk management, customer demand and service level expectations of our communities to ensure we can successfully maintain our urban forest. This has largely been expected to occur without understanding of the resources it takes to achieve this. The implementation of Forestree has given us a data capability unheard of previously in local government. For the first time in the operational space we can show with certainty the volume of work we undertake daily and the resourcing impact it takes to successfully maintain a viable urban forest.

In the initial phase of operations, we have been able to demonstrate the need for additional resources to water newly planted trees to ensure they successfully establish to meet tree canopy increase targets and employ an additional arborist officer to undertake inspections and better manage our existing trees. With councils around Australia currently planting thousands of trees to increase tree canopy this will inevitably result in a need to increase resources to manage these trees when they grow.

Most communities have little understanding of what it takes and the costs involved to meet this demand and data driven analysis and applications like the Marion Tree Interactive will tell this story in real time to inform the community about this.

Key Learnings - Implementing Forestree over the last 12 months has been uniquely challenging and rewarding, some of the key learning I have experienced are:

- **Identify Key staff to drive implementation** – Any business improvement/operational platform requires key staff to drive its implementation and success. Forestree is no different.....however what makes this system stand out from the crowd is its ease of operation and its web based application. It can be installed on any device (Android/IOS) making it easily deployable in the field. It uses aerial imagery with high resolution which is updated every couple of months and its simplistic and uncomplicated data collection style means anyone can learn it easily.
- Engagement with internal stakeholders such as IT and GIS/SIS departments will be critical and it will be commonplace for these departments to be wary of a stand-alone 3rd party platform beyond their administrative control. What overcomes this is its ability to integrate seamlessly with corporate applications via proven API's and the local access controls granted to the council administrators to customise the system and export data at will. Any new change management process will cause concern and field staff may be wary and may not want to become involved. Claims of 'not my job' and "*this is spying on us*" are common. So to combat this I recommend getting them involved early on in the process, show them the data it can produce and the functionality of the system, take the time to answer their questions and show them how this can translate into additional resources to ease the workload on them.
- Data collection is now an essential tool in the kit bag of a professional Arborist and has become as common place as a chainsaw and secateurs.
- **Ongoing data administration (Who will do this)** – When we installed Forestree we had 36,000 trees in our database which we imported into the system, we now have 45,000 trees captured and this is increasing every day. By the time this goes to publication I would anticipate that number to be pushing 48,000. Daily data administration is a critical part of your organisations senior arborist or urban foresters role. As the asset owner they are best placed to undertake the ongoing management of the system and provide oversight of the data being collected to ensure appropriate levels of accuracy.

This needs to be factored into their capacity and some other daily functions will likely have to be delegated to free up time for them to take this on. Inevitable there will be local troubleshooting, administration, data cleansing and reporting which will need to be focused on. Service delivery projects and work allocation will need to be implemented via the system, staff will look to them to problem solve minor glitches with hardware and be available to listen to their suggestions on improvements or changes to the system. One of the best features of the software is it is locally customisable to meet local application needs and you as the administrator will take ownership to set this up and manage this.

- **Build the Application Program Interface (API)** – If you want to get the most from the system you need to connect it to other corporate systems. Forestree can connect to multiple corporate applications and the data generated can be implemented as above. It can also connect to customer event systems such as Salesforce and Technology One to allow customer requests to be allocated to individual staff and actioned in the field. If you want to access the full power of the system setting this up is a must and will prove hugely beneficial to your organisation.
- **Promote the value of what you do** – For the first time urban forest managers have a capability to showcase the dynamic work we undertake daily to ensure our communities have a healthy urban forest. The days of council workers leaning on a shovel are long gone but the perception is not. This data driven system is changing that and having a community portal where residents can see what tree work we are undertaking daily has been hugely beneficial. We have found they are becoming more receptive to our planting initiatives, want to become involved and we are slowly changing the negative perceptions around trees and the issues they cause.
- **There is no limit** - Realistically we have only scratched the surface of this and I believe there are huge improvements to come in the future as other corporate applications come on line. We have successfully incorporated Forestree into our Smart Cities initiatives and we are making the Marion Tree Interactive visible on smart message boards in our reserves. We are hoping to establish a volunteer program which will allow a citizen science aspect to collect and update data for us. Tree Watering will receive a higher level of focus and we partner with research groups to develop technology to better tailor make our tree watering programs. It also must be said we have only had Forestree for a small amount of time, just imagine what we can do with the data once we have capture two or three years' worth.

On a private note I am truly thankful to TREENET for the opportunity they have provided to showcase our recent accomplishments and I hope I have given you an insight into what we can achieve through technology and prove beyond doubt that **Data Does Grow on Trees**

**Mapping Data is incomplete and not every tree in the council area is on Forestree, mapping is still being collected daily with the web page updating its dataset twice a day*

***Percentages are based on Council owned Road Reserves & excluded Parks/Reserves. A number of factors are taken into account including, number of trees planted per year and mortality rates. The equation below provides an indication on how the projected percentage is calculate:*

(Current Canopy Coverage + (New Planted Trees - Planting Mortality Rate + % New Tree Grow) - Natural Canopy Decline)

****Watering capacity is being increased with the upcoming addition of 2 9,000L water tankers taking the fleet to 4 tankers overall, it is further anticipated that additional funds may still be required to undertake contract watering*