YARRAWEYAH FALLS

2013 BIODIVERSE CARBON PROJECT MONITORING REPORT

carbonneutral

THRESHOLD environmental

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2013 BIODIVERSE CARBON PROJECT
Establishment Monitoring Report

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THRESHOLD ENVIRONMENTAL

2014

A project commissioned by Carbon Neutral

EXECUTIVE SUMMARY

In June 2013, Threshold Environmental implemented a Biodiverse Carbon planting project on behalf of Carbon Neutral at Bill and Jane Thompson's Yarraweyah Falls property. Across the project area, direct seeding of native plant species was employed in an effort to re-establish four main plant communities. In total, 99.3 hectares were direct seeded. Bill and Jane Thompson personally contributed to the project through some seed collection and seedling planting, as supported by a grant under the Australian Government's Clean Energy Future Biodiversity Fund.

To assess the initial recruitment of this effort, Threshold Environmental staff returned to the site in December 2013 – approximately 6 months after seeding – to undertake monitoring across the different systems. A total of nineteen 225m^2 plots were measured across the site, positioned appropriately to capture a representative view of the germination and recruitment of native plants.

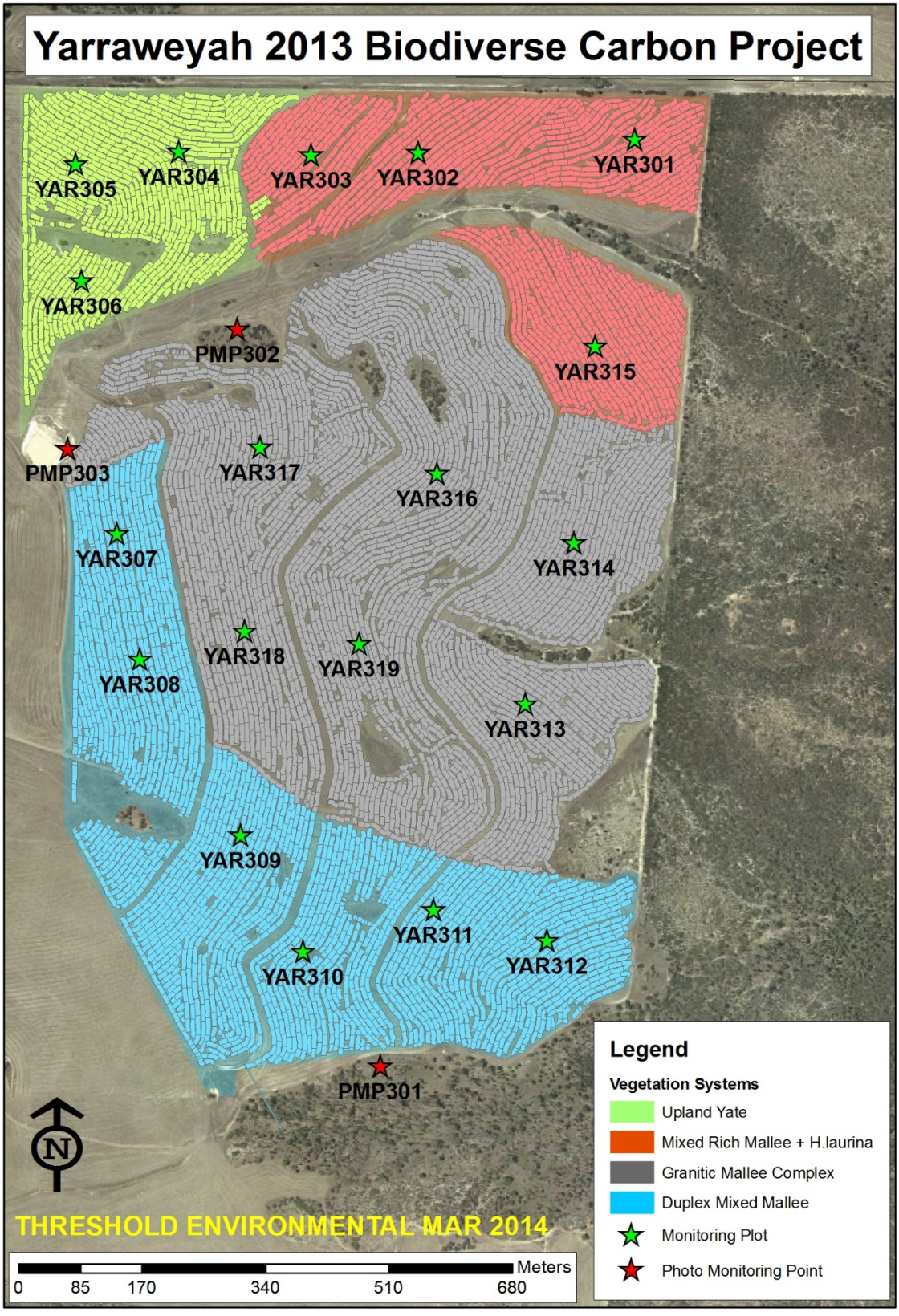
The observed results indicate the project has successfully achieved the first stage of desired outcomes:

1) strong recruitment of carbon focused species from tall and long lived Eucalypt and Allocasuarina trees have been established in appropriate densities across all systems of the site.

2) a diverse mix of native plant species have recruited across all systems, at various compositions and densities, to provide a rich mosaic of native vegetation able to conserve local biodiversity.

Based on the initial results provided in this report, Threshold Environmental is confident the project will succeed in providing strong outcomes for the region for both the conservation of biodiversity and the sequestration of atmospheric carbon. The project will well compliment other initiatives undertaken in the local landscape to support the broad objectives of the Gondwana Link initiative.

Image 1: Site map of 2013 Biodiverse Carbon project areas at Yarraweyah Falls. Image shows actual tractor passes (7 m wide) via GPS mapping for each of the vegetation systems sown. Also shown are the 19 post-seeding Monitoring Plots (green stars), and 3 Permanent Photo Monitoring Points (red stars) established for this report.

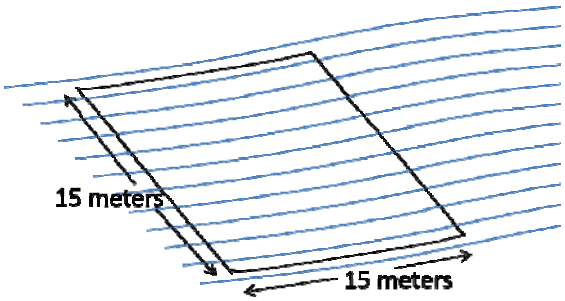


Monitoring Results

Initial recruitment of direct seeding indicates successful establishment has been achieved for the 2013 Biodiverse Carbon Planting at Yarraweyah Falls.

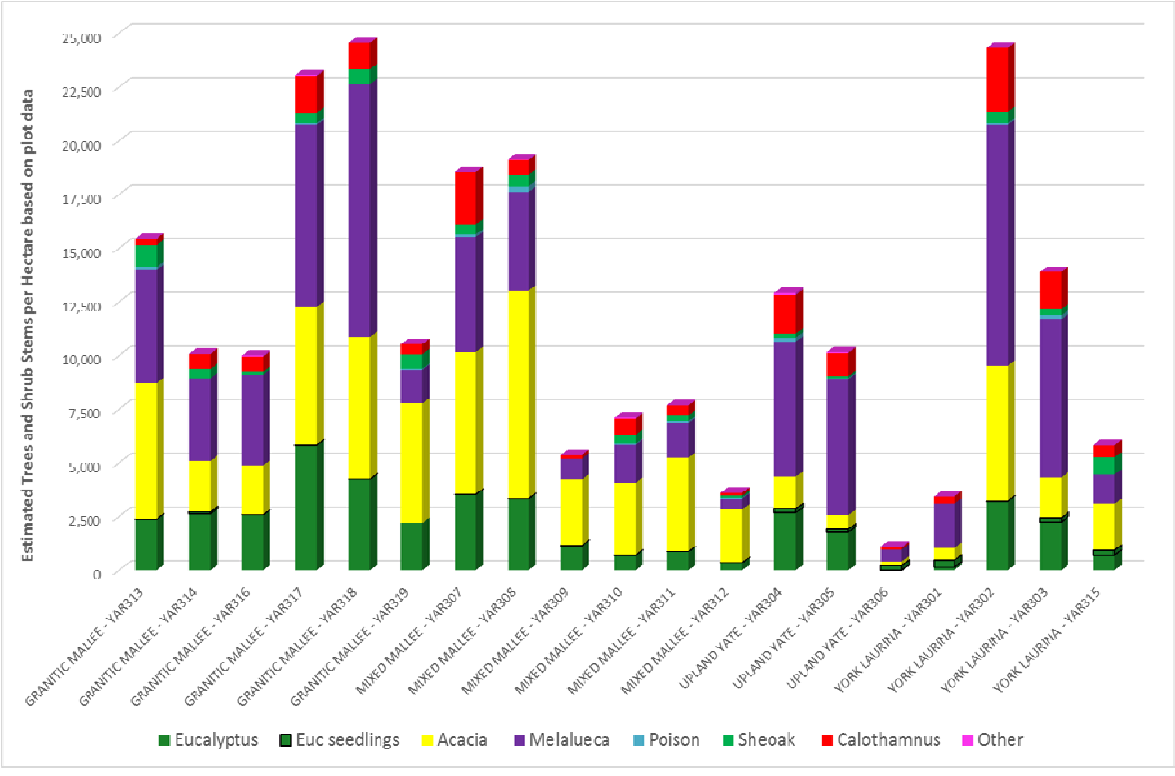
While monitoring cannot provide measurements for every area across the entire project envelope, a number of monitoring plots established within each of the main revegetation systems can provide an initial representation of what we can reasonably expect across the majority of the site. This in turn provides a proxy measure for seeded areas both across and within each respective vegetation system.

Consistent with other direct seeding projects undertaken in the region, recruitment was generally higher in lighter soils than in the heavier soils. Variability of recruitment across different plots measured for a given seed mix (i.e. vegetation system) are likely to be due to variations in soil quality found at smaller scales, as is commonly found within this landscape. Small discrete patches of lighter or heavier soil are often found within a larger area of a specific soil type. It is this innate variation in the soil that leads to the mosaic of different plant associations and high diversity of flora for the region.



For this effort, 19 monitoring plots were established to measure ten seeding rows, or two passes of the five row seeding machine, to assess recruitment and consistency of seed flow rates. The length of the plots measured 15 meters, resulting in an average plot dimension of 225m^2. The image to the left shows the plot layout. Crawling up and down each row, recruits were recorded by genera to assess the progress of seed germination and the emergence of post seeding recruitment.

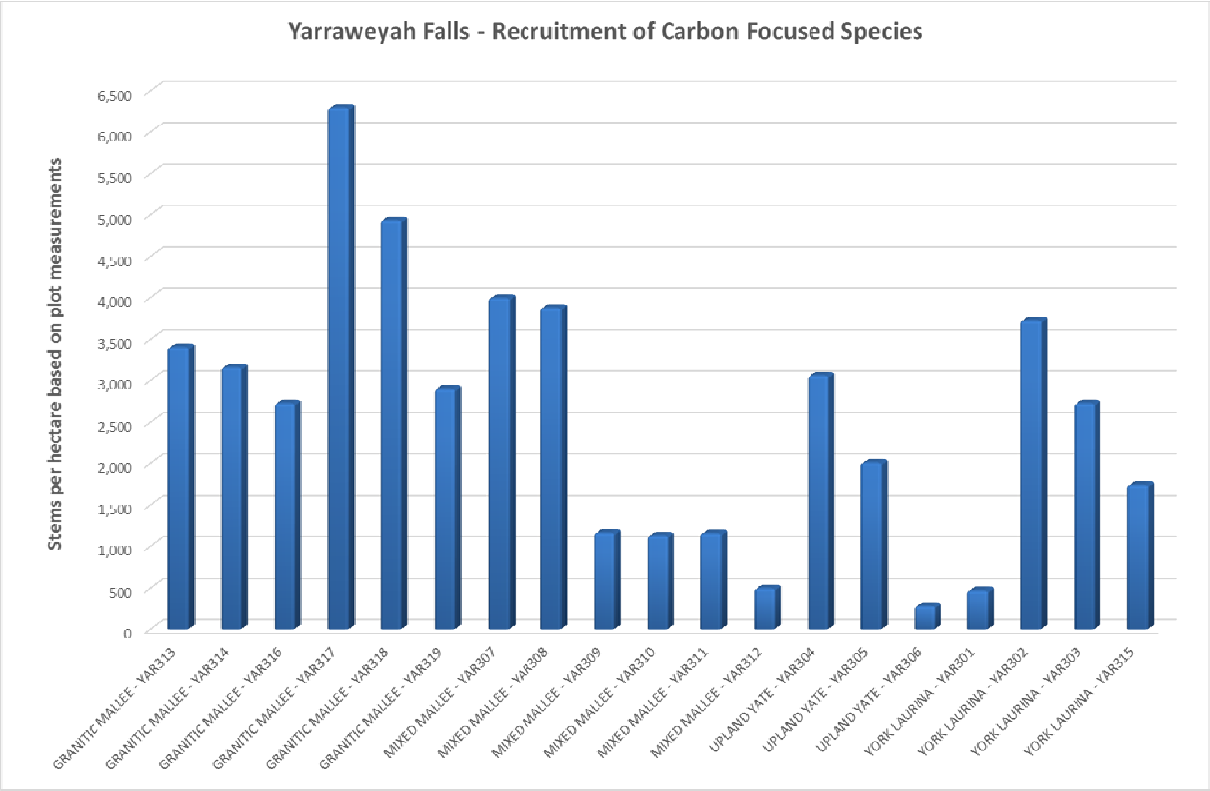
Chart 1. Monitoring results via a graphic representation of total tree and shrub recruitment observed at each monitoring plot for the 2013 Biodiverse Carbon planting at Yarraweyah Falls.



Monitoring results clearly indicate a diverse mix of different vegetation densities and species compositions will provide excellent habitat conditions for local fauna. Stocking of species targeted for providing carbon sequestration is also shown to be sufficiently high, and we estimate this will result in the establishment of a substantial biodiverse carbon sink over the next 100 years.

Image 2. Pictures of some direct seeding recruits at Yarraweyah Falls 2013. *Eucalyptus melanophitra* (far left); *Calothamnus gibbosus* (cntr lft); *Acacia saligna* (cntr rt); *Eucalyptus ecostata* (far rt).

Chart 2. Graphic representation of the stocking rates for carbon focused species (in this case Eucalypts and Rock Sheoak - *Allocasuarina huegeliana*) across all of the monitoring plots.



Recruitment for carbon focused species was generally strong across all plots, indicating a large number of trees have been established across the site.

UPLAND YATE WOODLAND SYSTEM (10.6 Hectares)

Monitoring results for the Upland Yate System show good to strong recruitment was achieved for this seed mix. Plots YAR304 and YAR305 show consistent recruitment for the northern section of this landform unit. Plot YAR306 shows a proportional reduction in each of the genera seeded, indicating a soil related influence on observed reduction of recruitment.

Image 2. Map of Upland Yate revegetation area and location of monitoring plots.

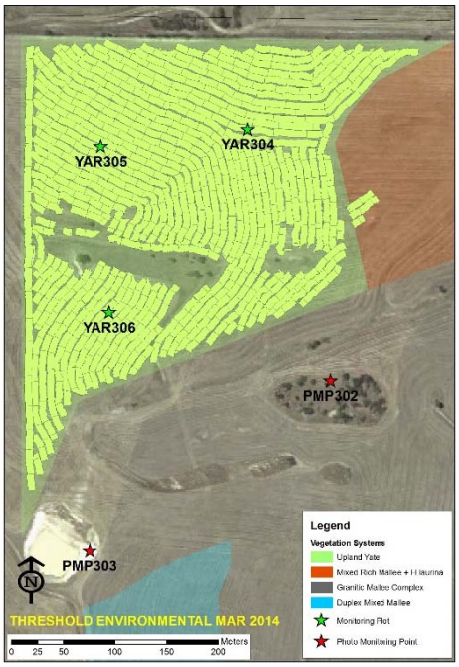
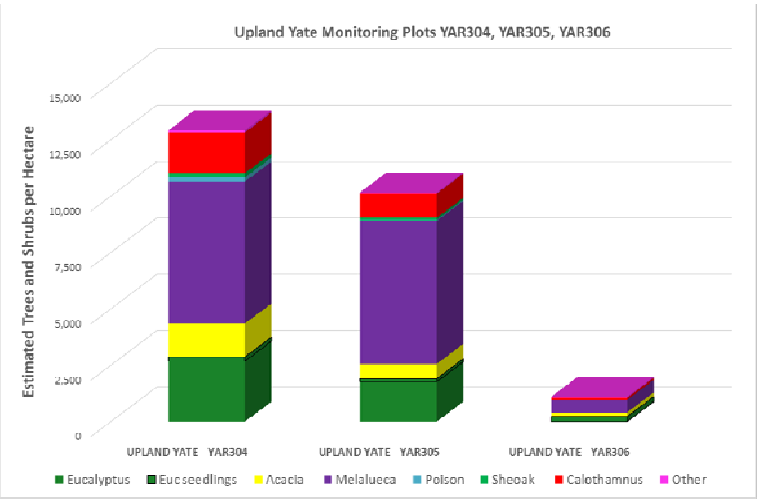


Chart 3. Monitoring results for the Upland Yate system.



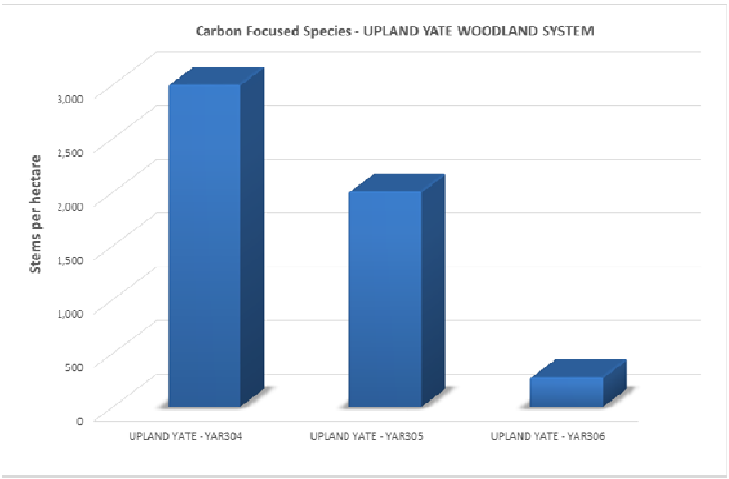
BIODIVERSITY

A strong representation across several different genera of plant species was achieved which will result in a diversity of habitat conditions and flowering times. The high recruitment of Melaleuca and Calothamnus plants will provide low vegetation cover to compliment mid-story Acacias and Sheoaks, and over-story Eucalypt trees. We estimate at least 21 species have recruited in this system.

CARBON

Strong to very strong recruitment of Eucalypts and Sheoaks for this system will ensure a sizeable pool of carbon will be grown in this area. While plot YAR306 shows a substantially lower measure of recruitment, the estimated 276 stems per hectare calculated from this plot are all based on hand plated, and strong growing Yate tree seedlings. This type of planting should provide an Open Woodland style layout which will well compliment the mixed Yate and Mallee closed woodland areas observed in YAR304 and YAR305. The combination will result in a good mix of biodiversity and carbon sequestration outcomes.

Chart 4. Estimated stems per hectare of carbon focused species.



YORK GUM AND MALLEE WOODLAND WITH HAKEA LAURINA (15.9 Hectares)

Monitoring results for the York Gum and Mallee Woodland with *Hakea laurina* show strong recruitment was also achieved for this seed mix. While there is variability from plot to plot, there is a general trend of good recruitment across all areas of this landform unit.

Image 2. York Gum & Mallee Woodland with *Hakea laurina* system, and location of monitoring plots.

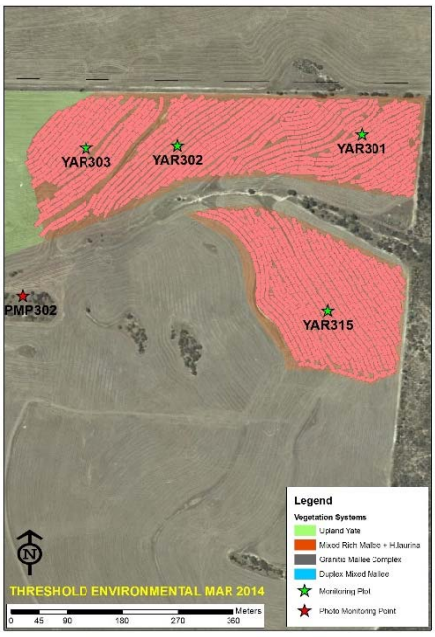
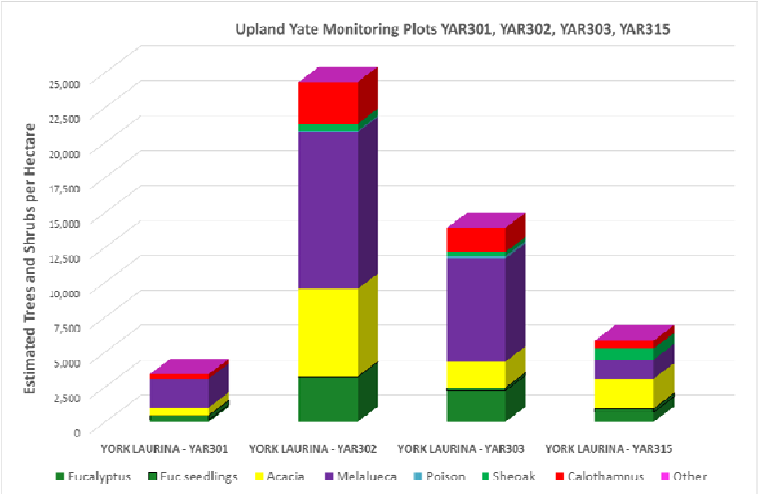


Chart 3. Monitoring results for the York/Laurina system.



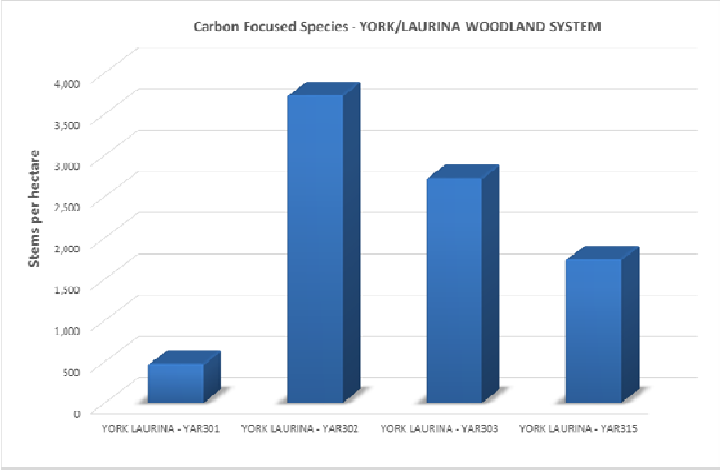
BIODIVERSITY

Variability in species density and composition will again support a diversity of habitat conditions within these re-established vegetation associations. The high recruitment recorded in plot YAR302 is likely to be the result of high levels of available moisture during establishment, with a hillside seep observed not far from this plot location.

CARBON

Strong to very strong recruitment of carbon focused species for this system will ensure a sizeable pool of carbon will be grown in this area. Areas surrounding plot YAR301 will need to be monitored over time to determine whether observed recruitment of carbon focused species in this plot are representative of the surrounding area. This will best be achieved in 2016, when recruits are more easily assessed. The soil fertility and water holding capacity of these soils suggest good capacity for growth. York gum seedlings compliment the direct seeding. Across all areas for this system, we anticipate strong yields in carbon growth will be achieved.

Chart 4. Estimated stems per hectare of carbon focused species.



GRANITIC MALLEE WOODLAND (43.7 Hectares)

Monitoring results for the Granitic Mallee Woodland system show strong recruitment once again, which is encouraging considering this is the most extensively planted system for the 2013 project area. Sandier patches within this system, as observed in plots YAR317 and YAR318 showed higher recruitment that other plots which did not benefit from these deeper and easily infiltrated soil types.

Image 2. Granitic Mallee Woodland system, and location of post-seeding monitoring plots.

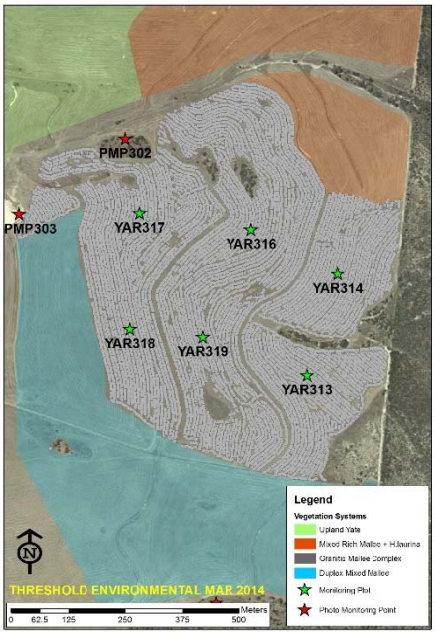
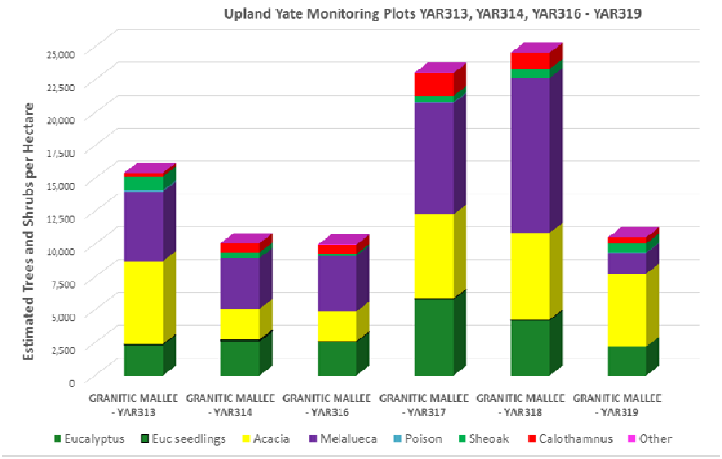


Chart 3. Monitoring results for the Granitic Mallee system.



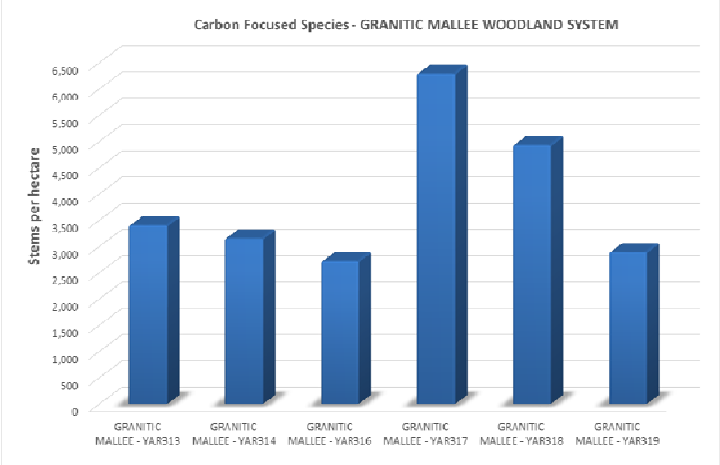
BIODIVERSITY

With over 42 different species seeded, and excellent observed recruitment, this system is likely to form a solid core area for the 2013 Yarraweyah Falls project. Variations in the species composition and density from one area to the next – as shown through the plot results – will provide a spatially complex mosaic of high plant species diversity for local fauna use.

CARBON

An especially important system in which to achieve good carbon results – given its extent area is nearly 50% of the project area – post seeding monitoring results show this is likely to have been achieved. Consistent with plots measured in the Mixed Mallee system (next page) across the central zone of the project area, plots YAR317 and YAR318 showed very high carbon species recruitment. It is likely that these 'lighter soils' will self-thin over the first summer and bring stem counts closer to those found in the other plots. This system is going to grow a lot of carbon.

Chart 4. Estimated stems per hectare of carbon focused species.



MIXED MALLEE WOODLAND (29.1 Hectares)

Monitoring results for the Mixed Mallee Woodland system show strong recruitment was once again achieved. All plots showed good recruitment across all areas of this landform unit. High counts in plots YAR307 and YAR308 was again likely to be a result of a more pronounced sandy soil at the surface. These areas are located just upslope from the high recruiting areas observed by plots YAR317 and YAR318 in the Granitic Mallee woodland system.

Image 2. Mixed Mallee Woodland system, and location of monitoring plots.

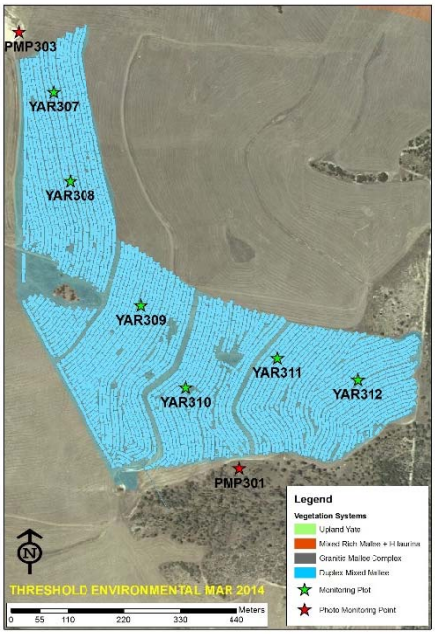
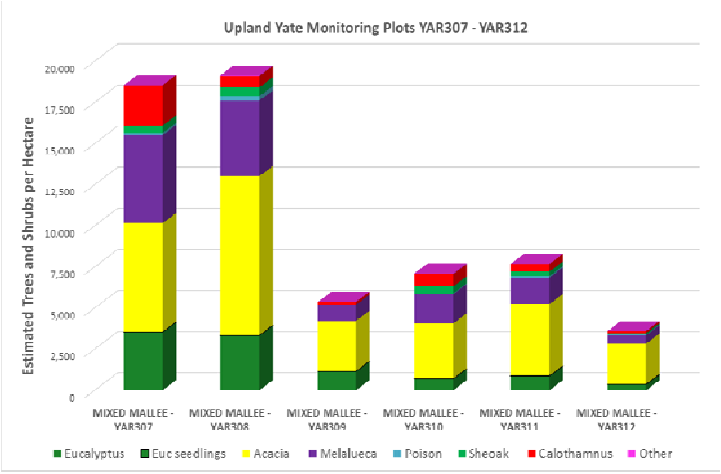


Chart 3. Monitoring results for the Mixed Mallee system.



BIODIVERSITY

A total of 12 different Eucalypt species were seeded for this area, hence the system name of Mixed Mallee. In addition, 16 different Acacia species were seeded, mostly those which have the growth form of a low shrub. Complimented with the low growing and red flowering *Calothamnus gibbosus*, this system will provide a rich diversity of flowering plant species to support local fauna.

CARBON

The very high levels of recruitment for the carbon focuses species (Eucalypts and Sheoaks) observed in plots YAR307 and YAR308 for this system will hopefully be reduced following some natural attrition. Recruitment of carbon focused species in the other compartments for this system, as observed through the monitoring results, provide a consistent and uniform stocking. Areas surrounding plot YAR312 will need to be observed over time to determine whether the counts of carbon focused species within this plot are representative of the surrounding area.

Chart 4. Estimated stems per hectare of carbon focused species.

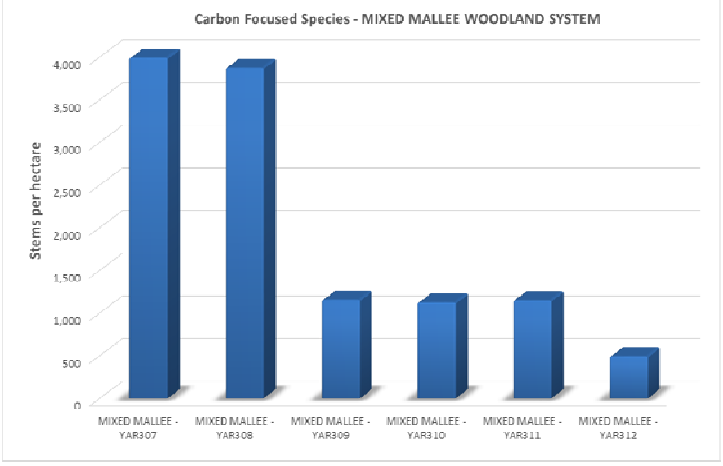
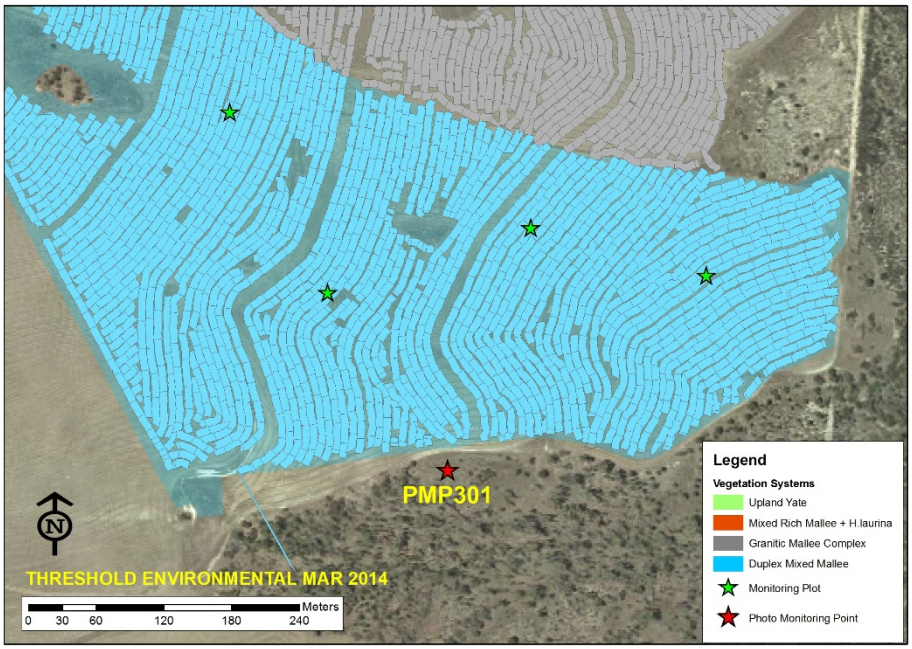


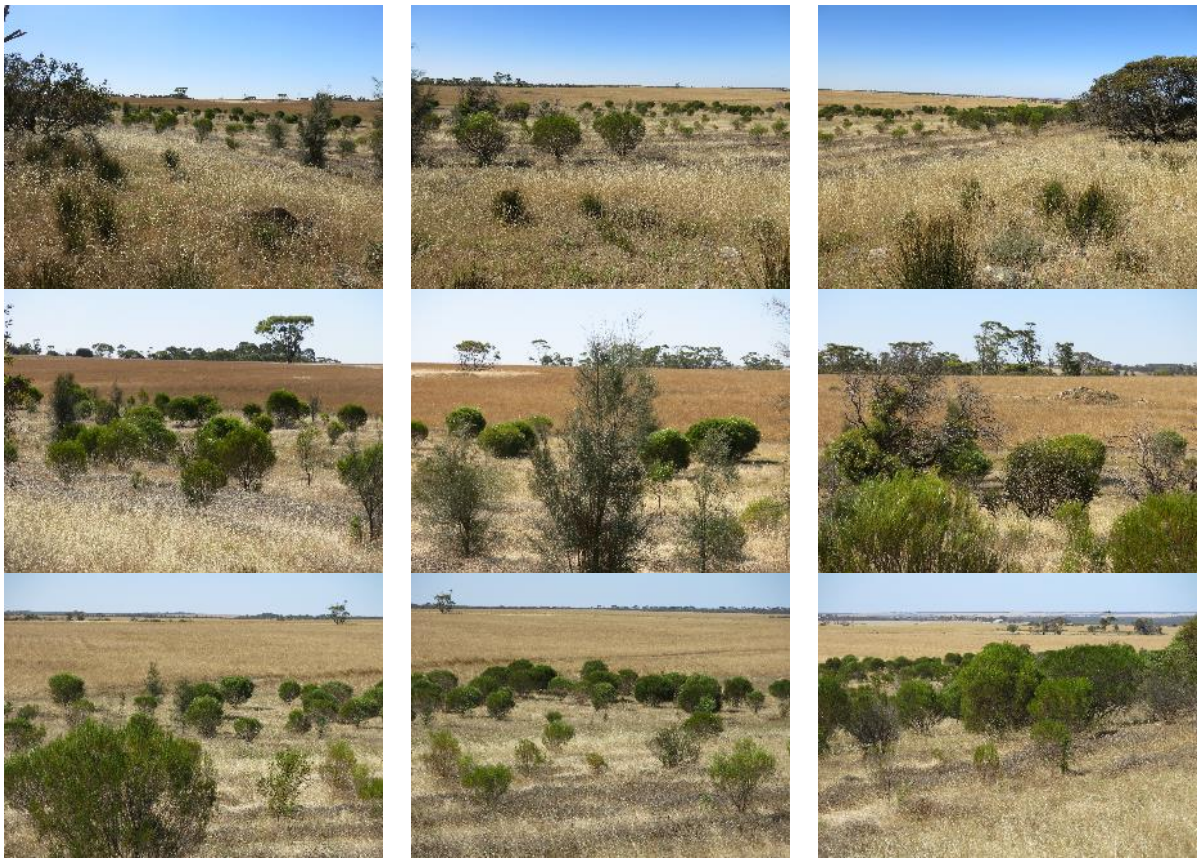
PHOTO MONITORING POINTS

PMP: YAR301
STAKE TAG ID: 02751

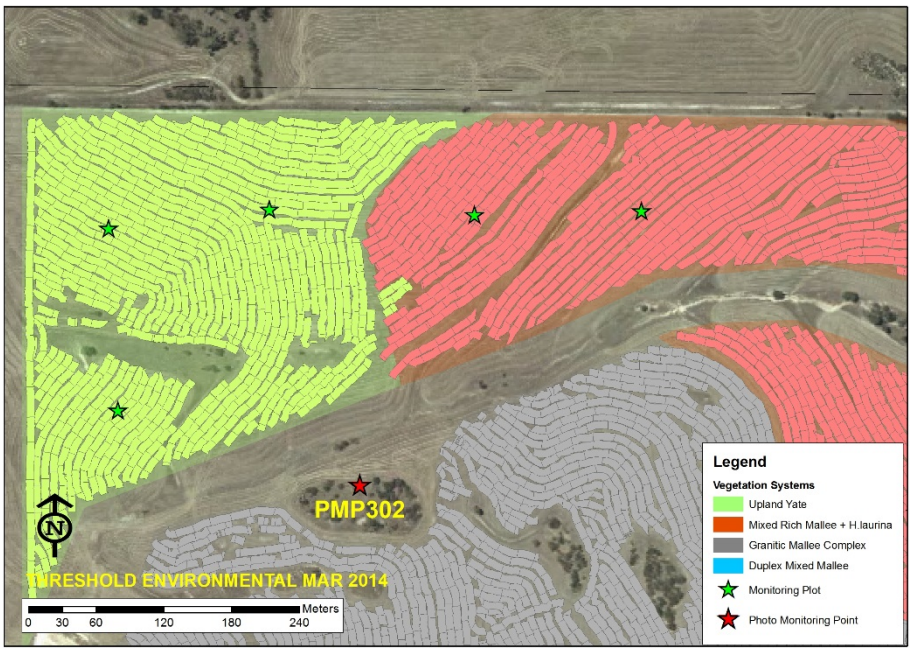
Looking north-west, north and north-east from PMP301 the following photos were taken. A full description of the approach, along with the high resolution photographs, will be included in an addendum to this report.



PMP: YAR302
STAKE TAG ID: 02732

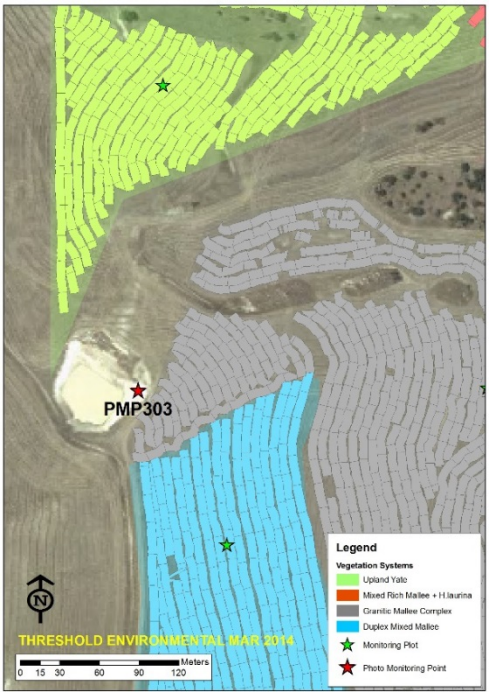


Looking north-west, north and north-east from PMP302 the following photos were taken. A full description of the approach, along with the high resolution photographs, will be included in an addendum to this report.



PMP: YAR303
STAKE TAG ID: 02744

Looking northeast, east and south PMP303 the following photos were taken. A full description of the approach, along with the high resolution photographs, will be included in an addendum to this report.



CARBON NEUTRAL REPORTING PROFORMA CHART

RISK ASSESSMENT UNDERTAKEN

Provide details of how the following criteria may have impacted recruitment and survival of the site, either over all or a PMP or at a patch**.**

Risk	Details	Recommended Actions
A. **Weed management**	The site had very good weed management in the lead up to works, with a canola crop in the previous season. Two 'knock down' weed management sprays were undertaken in the lead up to the project.	Keep an eye on thistle. Establish additional trees via seedlings in areas which did not establish via direct seeding.
B. **Site selection**	The site is very well suited for a Biodiverse Carbon planting. Granite outcrops throughout the areas, and a tendency for becoming too wet make it well suited for woody vegetation.	NA
C. **Soil testing and hydrology**	Precision agricultural mapping was undertaken in the lead up to define soil boundaries and identify any saline areas.	NA
D. **Species selection**	All species were locally sourced and matched to soil type.	Infill planting with plant species of interest for the conservation of biodiversity can be ongoing in the next 5 to 10 years. Where stocking of overstory species is low, consider matching plants to soil type.
E. **Seedlings or Seeds Planted**	Seedlings were generally of good condition. Some Yates were elongated, however this is unlikely to affect carbon sequestration capacity. Seeds were all harvested using best practice approaches in the lead up to the season.	Infill planting with seedlings can be initiated where suitable. Initial monitoring results suggest strong recruitment across the site, so targeting patchy areas where this was not the case (hard red clays) is recommended.
F. **Site preparation and tree planting**	Site preparation was consistent with previously successful practice. Special attention was paid to seeding directly on the contour, which is likely to lead to increased water harvesting capacity on the site in future years. Swales established on the contour were observed to be	Consider widening the drainage channel on the York/Laurina swale, to ensure drainage in a high rainfall event. Sand bagging overflow points previously observed for that swale will ensure catastrophic failure and subsequent erosion damage does not occur.

	functioning well, aside from one located in the York/Laurina system. A drainage channel was established to ameliorate the potential for failure.	
G. **Local and Feral Predators:** Stock Locusts Rabbits Kangaroos	Large numbers of agricultural insects were observed on site post seeding and during monitoring. Possibly Rutherglen bug. Landholder undertaking rabbit baiting. Landholder engaged Roo shooter for pest reduction.	Ongoing roo and rabbit pest management recommended.
H. **Fencing**	Fencing was established on the western border by a neighbouring farmer.	Northern fence was in decline and, as a property boundary, may allow sheep into site if not replaced or improved.
I. **Absentee Landlords**	No.	NA
J. **Lessons learn**:	Avoid establishing water infiltration swales in heavy clay.	