Carbon and Multi Storey Farming

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Trees and carbon – facts and some positives and negatives
Perspective of the magnitude of the role trees can play in addressing climate change
Camaray Farm and a journey towards improving resilience
Turned in MSF which happens to provide a range of carbon sequestration opportunties

Background

- Family – 4th gen
- Farm 147 acres – beef, lucerne and trees
- Forest Scientist since 1995.
- Africa
- Just Add Trees
- Multi storey farming
- Waiver

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Knowledge of the background is great to help better understand the story

Planted and managed millions of trees and >50 species across native forest, plantations and farms for a range of outcomes.

Mainly for timber and water production and land protection

Not telling you how to farm

Farming apprentice

Trees and Carbon (1)

- Photosynthesis
  $6CO_2 + 6H_20 \rightarrow$(light energy) $\rightarrow C_6H_{12}O_6 + 6O_2$
- 35% water and 65% solid dry mass
- 50% of a trees dry mass is carbon (C);
- 20% of tree biomass is below ground;
- 1 tonne of C = 3.67t of CO_2 equivalent (CO_2-e);
- Trees sequester C at maximum rate when they are growing fastest;
- Carbon stored in wood is only released when burnt or decaying

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Firstly as some background about trees. Much of which Will already be known.

Photosythesis

The reaction of water and CO2 in trees via chlorophyll and sunlight as fuel produces sugars and Oxygen. The sugars helps the tree grow bigger and stronger and in the process C is stored in the wood

A standing tree is ~ 35% water and 65% solid dry mass

~50% of a trees weight is carbon

20% of tree biomass in underground

1 tonne of C = 3.67tonnes of CO2.

Trees are generally growing fastest between the ages of 10-30 on most sites that have been established and managed according to best practice. Therefore this is also the time when they are sequestering the most C

A big advantage of C sequestration in wood is that it only released when burnt or decaying. This is very important when considering trees and carbon farming

Trees and Carbon (2)*

- Long term perspective vital
- Species choice matters;
  - Higher density timbers store more carbon
  - Durable wood products store C for longer
- Trees are designed to offer multiple benefits
  - Try not to put them in little boxes
- Trees require management for best climate outcomes
  - Growth makes management necessary
  - Without management the equation changes substantially

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If trees are to be a major tool in your carbon sequestration strategy there are several things non-negotiables for achieving the best outcome:

- Long term perspective is best. Think about multiple rotations and long lived species that are well suited to your climate
- Ask yourself about the legacy that benefits future generations best
- Avoid quick fixes i.e species that grow fast for a few years in good conditions and suffer when going gets tough
- Choosing the right species is a vital step in your strategy
    - Suited to site, fire resistant
    - Timber density/durability
    - Sawn wood

- Management is fundamental to success
- Trees grow and offer us a substantial range of services
    - Shade/shelter/timber/ecosystem development/wood for heating and cooking
- All of this is powered by photosynthesis - free

- And yet we sell them short not letting them do what they were designed to do.
- We put them into boxes.
    - We plant them as monocultures for one purpose – timber, food production etc – underselling what they can offer
    - We plant them, lock them up behind fences, enjoy them for a while and somehow forget that they keep growing and changing. Weeds, pests proliferate, fences get knocked down, fuel loads build and the risk of fire grows
- Trees have been designed for more than this

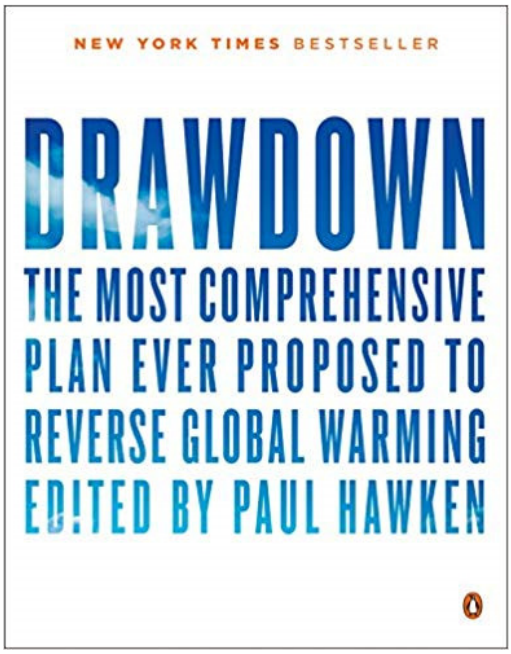
Perspective

Book published 2017 rankings of solutions (1-100) to reverse global warming:

9 – Silvopasture
11 - Regenerative Ag
14 – Tropical staple (food) trees)
15 – Afforestation (timber plantations)
17 – Tree Intercropping
28 – Multi strata agroforestry
35 – Bamboo

Trees combined with agriculture dominate top 20

Consensus that integrating trees with agriculture is superior to either by themselves.



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Further persective rooftop solar 10 etc

The value of a tree

- "When times are hard we go to the trees"
- Food, timber, firewood – cooking & heating
- Land protection
- Quality of life
- Hope
- Multi purpose benefits - amplified

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The African experience taught me the real value of a tree

Camaray Farm – poor resilience

- "Autumn is the worst time on the farm"
- Our mgt led to poor resilience
- 3 to 4 months min. growth
- Feeding out thru autumn and winter

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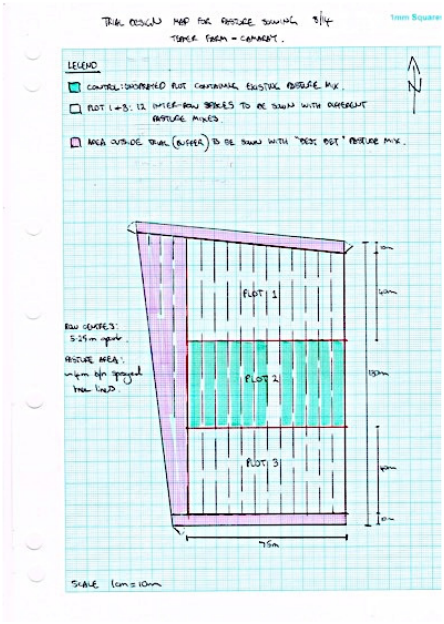
Jimmy's return trip

An opportunity

- WPCLN Demonstration site project
- “Alternative designs for optimizing holistic values of farm tree plantings”
- 140*80m site
- 3 plots
- 3 species mixes
  - silvertop/silver wattle
  - silvertop/spotted gum
  - spotted gum/silver wattle
- 13 inter-row spaces
- Assessment



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In 2 014 An opportunity arrived to put into place a number of dieas that had been swirling around my head for a long time.

June 2014

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3 months post planting

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This is the site 3 months post planting

15 months post planting

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18 months post planting

Crops and pasture in trees

Triticale at 4 months

Brome blend Dec 15

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Crops and pastures

Oats Dec 2015

Lucerne Dec 2105

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Grazing at age 19 months

- (Sept 15 – April 16) one of 3 driest periods ever
- Setaria, brome, lucerne offering excellent fodder
- Silver wattle fodder
- Trees > 3metres tall, no damage
- Valuable drought reserve
- Grazeable windbreak or productive firebreak!

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3rd sowing - 2016

Red clover on left
Beerseem on right

Result – 3rd sowing

Plantain on left
Cocksfoot on right

Note impact of shade

Later sowings – grain sorghum, white chia

Now moving into a shade tolerant grass establsihemnt stage – focussing on bromes, setaria, cocksfoot and clover mixes

Results 5th sowing -
Nov 17

November 17

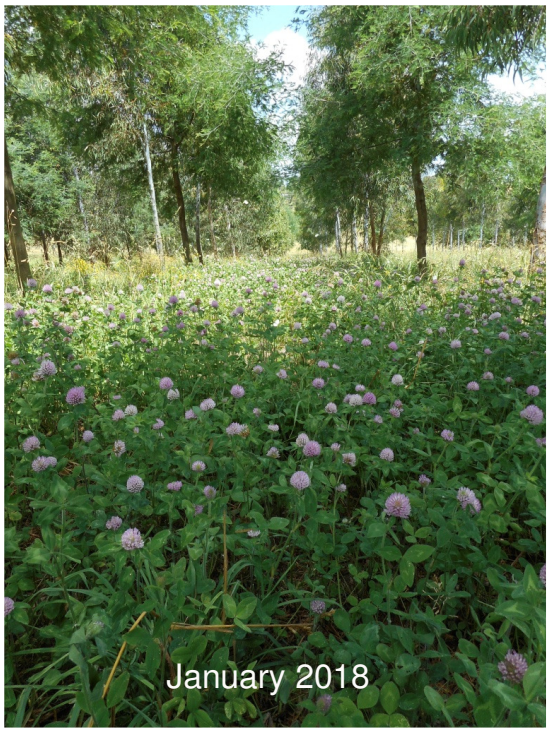
Turnip and perennial red clover

Results 5th sowing

Grazing in November 2017

22 December 2017

Moisture retention better in the MSF



Red clover early January. Previously grazed

Clover lasting longer

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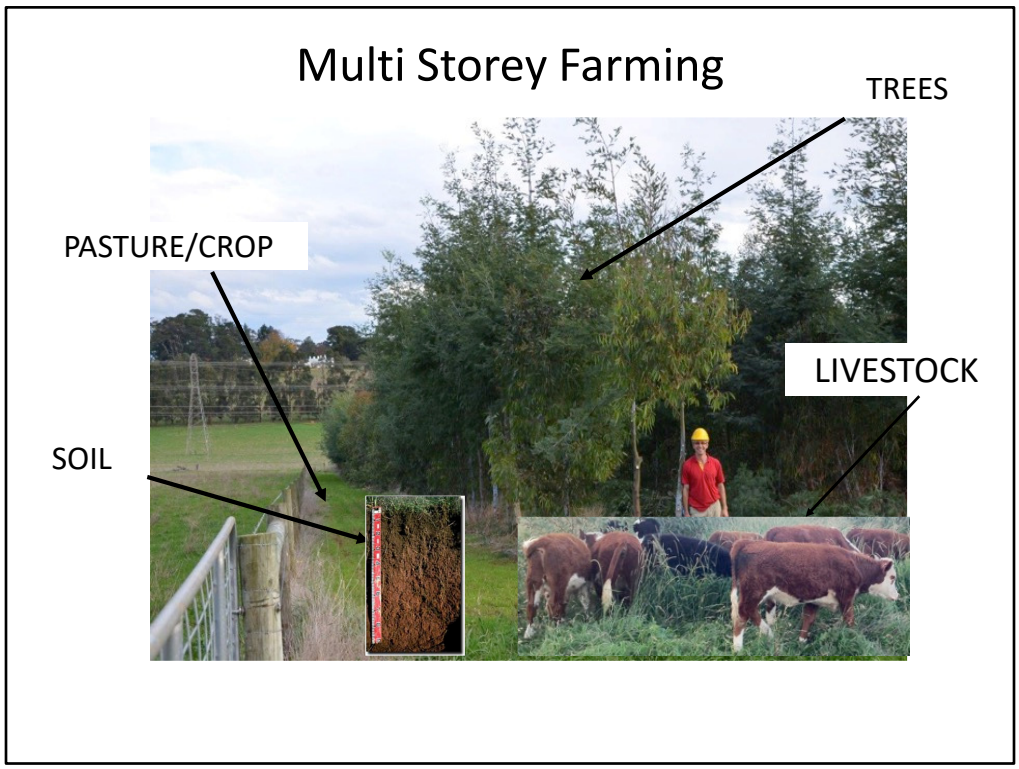
After mulching 11 months ago. Mulching is vital part of the system



About 2 years after establishment I started thinking about this system as multi storey farming. The name has stuck.

The term has its origins in forestry.

Explain concept of storeys

On this farm this system is comprised of a number of storeys
1 – Soil: it all starts with the soil. For MSF to work for you, soil needs to be viewed as a living system in itself. It must be looked after before you start, not after you have started
2 – Pasture and crops: you will see that there is a wide variety of pastures and crops suited to this system. A lot of flexibility
3 – Livestock can be incorporated into the system. On this property it has been cattle and soon it may also be chickens. Sheep would also work well on this farm, with some infrastructure modificatoipn
4 – Trees. On this farm I have selected timber trees because that is what I know best. The trees provide shleter, add OM and provide valuable timber for farm use and off farm sale.

Productive system

Accesses more soil reserves - water and mineral

Intercepts more sunlight - solar energy

All this adds up to a system that can have a bigger engine if the design is right because soil is accessed and sunlight intercepted fueling photosynthesis for longer periods of the year

Using more soil and sunlight makes sense to me. And the DS showed me that it could increase production on our farm

Results - Trees @ age 4.9 yrs

- Stocking ~200 stems per ha
- Excellent diameter growth
- 14-17cm dbh,
- Height growth below average
- Exposure
- Silvertop best growth
- Spotted gum best form
- Silver wattle requires active mgt
- Growing timber, fodder and meat products simultaneously
- Nutrition vital

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The value of a tree

- Part of the staff!
- Micro climate change for the better!
- Vegetative and product diversity
- Improved system resilience - genetics of perennials
- Deep roots - accessing more soil mineral and water
- Beneficial soil impacts

Soil results at age 4.4 years

- Preliminary
- Action occurring at 10-30cm layer
  - Total organic matter (+17%)
  - Total N (+25%) (legumes)
  - Total Organic C (+25%)
  - Labile Carbon (+45%)
  - Carbon t/ha (+25%). +6.3% over 0-100cm
- Carbon results consistent with other projects

Lets go operational!

Early Jan 2016 - pasture

27 Dec 2018 - lucerne

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Gone from minimal grazing returns to $1900/ha/yr profit + grazing

And when hay is finished the cattle have good pick through later autumn and winter months

Unproductive period closed in that part of farm

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3 cuts in 2018/19
Yield 5.7 tonne per ha
Profit 13K+grazing for 2018/19 over 6.8ha

2 April 2019

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Autumn and winter grazing opportunities are substantial. My best winter paddock

Lucerne production around trees

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Trees planted into Lucerne. Lucerne production generated the funds to plant the trees

Key principles of MSF (1)

- A bigger engine – top to bottom;
- True integration through intelligent design;
- You don't have to be big to be successful;
- Think and aim beyond your generation;
- Design to meet your capability;
- Continuous/dynamic management;

Key principles of MSF (2)

- Don’t sell trees short;
- Micro-climate change;
- Biomass retention
- Crops and pastures before trees;
- Know and look after your soil first
- Weed control

Advantages

- Early income generation
- Income planning
- Value adding to farm plantings
- Grazeable windbreak and shade areas
- Ecosystem development – mulching
- Carbon farming – above and below ground
- Fire protection
- Improved resilience
- Microclimates
- Aesthetics

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This system offers the following benefits

Conclusion

- Carbon farming outcomes can be improved by considering multi-storey systems;
- Integration of trees in an informed way improves farm resilience
- A better way for us to farm at Camaray!

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Trees add value to carbon farming

Multi-storey systems can improve carbon farming outcomes

Good nutrition, soil management practices have an enormous role to play in optmising returns from C farming

Resources

- http://www.wpcln.org.au/wp-content/uploads/2018/07/Multi-Storey-Farming-case-study-report.pdf
- Practical Landcare Guide – Multi Storey Farming http://www.wpcln.org.au/wp-content/uploads/2018/05/MSF-Brochure_Print.pdf
- www.justaddtrees.com.au (after 5 Dec 2019)
- Youtube – Multi storey farming
- How is carbon stored in trees and wood products – https://forestlearning.edu.au