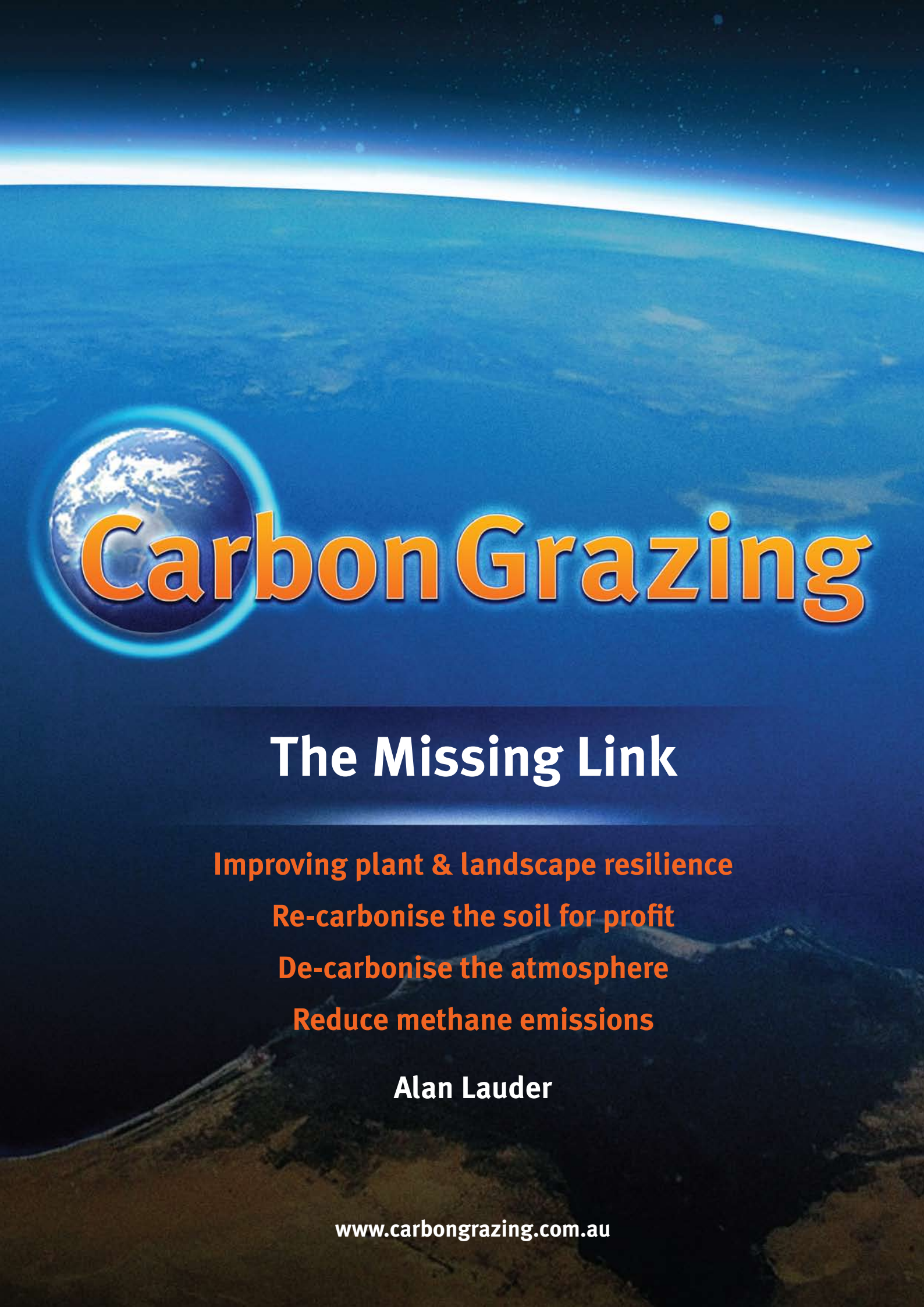

The Missing Link

Improving plant & landscape resilience

Re-carbonise the soil for profit

De-carbonise the atmosphere

Reduce methane emissions

Alan Lauder

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CHAPTER 22

CONCLUSION

This book expands the debate on carbon beyond it just being a resource for industry (modern society is based on a carbon economy). It is also a valuable ingredient for rural output. Farming and grazing systems with low carbon stocks in the landscape are less productive than those managed to maximise this important factor of production.

Plants are the entry point for carbon from the atmosphere to the landscape. Therefore, animal management is critical to the maintenance of carbon flows. If livestock are allowed to continually restrict grass and edible shrub growth, (ie photosynthesis), then carbon levels in the soil will fall. Soils with low carbon levels produce less grass which is also of a lower quality than soils with a higher carbon level.

Recognising that pasture rest is **timing** not **time** cements an understanding of the importance of removing animals for a short time immediately after rainfall to maximise carbon flows into the landscape. It has also been shown that contrary to popular belief, it is possible to remove animals from pastures without the need to sell them.

While managing carbon has always been important as part of successful landscape management, it will be even more critical for the economic survival of rural producers, if the predictions of climate change prove correct. What we have witnessed recently is consistent with what the climate change models predict. Predictions include increases in variability of rainfall, higher temperatures and more extreme weather events, including higher intensity rainfall and more destructive cyclones.

The greenhouse outcomes of rural production are a reflection of financial efficiency. High methane production reflects inefficient digestion due to low quality diet (high C:N ratio). Nitrous oxide increases with inefficient fertiliser use. These two gases are among the worst of the greenhouse gases, with the better operators contributing less per unit of production. Fortunately, being environmentally responsible through reducing emissions of these two greenhouse gases requires the same management as being profitable (ie managing to introduce more carbon into the landscape).

While on the point of financial efficiency, it is the movement of carbon into the landscape part of the carbon cycle that is the measure of how successful we are in capturing the sun's energy. If we are losing carbon from the soil to the atmosphere in an average year, then in financial terms, we are conducting a very inefficient grazing operation. This is because soil carbon levels are a major determinant of production. Importantly, production systems can be modified to be more profitable while at the same time reducing negative greenhouse aspects. This is the message of Carbon Grazing, which is a "systems" approach, (ie it looks at the big picture). Carbon Grazing sees methane reduction as another outcome of good carbon management.

Changes in the way we farm must be linked to changes in the way we think.

Before we can successfully manage a rural operation, we have to understand how both animals and plants function, as well as how the two interact in both the short-term and the long-term, and how this impacts on the soil. Understanding this partnership is the beginning of understanding carbon flows. The Carbon Grazing principle is all about understanding carbon flows.

Each member of the "below-ground" food chain is fulfilling a different role that plants rely on. The soil can be viewed as a construction site where all the workers leave the site or die if plants do not feed them. Stressed and dying plants lead to an unproductive soil. New, productive topsoil can be made, so there is no need to struggle with degraded country.

These pages were written to help raise awareness of the extent to which carbon is involved in all the processes in the landscape. It is what follows carbon that best explains its role. **Energy, nutrients** and **water** all follow carbon. As part of the bigger picture, the protein cycle follows carbon and is a reflection of soil fertility. If carbon is managed properly, then everything else just falls into place.

It is not possible to maximise the volume of carbon in the landscape without understanding carbon processes. This is why rural producers need to fully understand the issues of how carbon enters the landscape and how it returns to the atmosphere.

A lack of carbon is responsible for destabilising the landscape, just as excessive carbon is responsible for destabilising the atmosphere. Looking at the big picture, the carbon pools are now out of balance and humans will have to live with the repercussions until a way is discovered to get these pools back into balance, sometime in the future. There is no cause for agriculture to panic but there is an urgent requirement to look at how we need to adapt as things change. The climate change chapter highlights how an existing process will change in response to other changes elsewhere. This is why we have to take a systems approach in our adaptations.

The purpose of initially discussing the carbon cycle was to highlight how the carbon pools are always changing (ie carbon is always moving). Carbon management is an ongoing issue, with the need to keep the carbon balance of rural operations in the black.

In Chapter 13 on the different plant types it was discussed how nature has catered for the needs of animals under a diverse range of conditions, except perhaps extreme drought. Nature achieved this by evolving groups of plants which are very different in what they supply and how they survive. Some producers are at a disadvantage by not having all the required plants. As a team, plants combine to support animals. They are capable of maximising animal production in good years or keeping them alive in dry years. However, nature also designed the process to cater for the needs of plants and the soil. Unfortunately, domestic animals are often managed in a way that reduces the health of plants, which in turn leads to a deterioration of the soil. Animal production and the environment are then both put at risk. The Carbon Grazing principle provides direction regarding what has to be done to allow all the natural processes to function the way nature intended.

Carbon Grazing looks at all the cycles and processes that occur in the landscape, and demonstrates how carbon is the common linkage between them. It is for this reason that mismanaging carbon is, in reality, mismanaging all the cycles and processes in nature.

Carbon Grazing deals with how to maximise carbon stocks in the landscape in order to maximise profits for rural producers. At the same time, Carbon Grazing endeavours to reverse many of the environmental degradation issues that currently plague Australia, and for that matter the rest of the world. It also has the added bonus of making a contribution to reversing the greenhouse effect which is becoming more widely accepted as the cause of climate change.

Carbon Grazing concentrates on the pasture and soil components of the carbon cycle. It deals with the terrestrial landscape between the trees. Carbon Grazing focuses on how plants and animals impact on each other, and how this interaction affects the health of the soil. Thus Carbon Grazing addresses a wide range of significant principles that apply to the broader farming and land management community.

The concept of pasture cropping combines the activity of grazing with the activity of cropping. It increases carbon introduction into the soil by maintaining perennial plants in the soil all year round.

There is a need to build resilience into the landscape. This applies to plants and the soil as well as to animals. The landscape must be managed so that it can withstand whatever the hard times throws at it, be they wet or dry. In our "sunburnt" country I have always suggested that "the only time you can prepare for drought is when it rains". This is the only time the resilience of the landscape can be increased. Resilience determines the severity of drought and its long-term effect, just as it determines the damage from floods and extreme rainfall events.

The importance of placing more emphasis on the "common denominator" carbon, is that it simplifies our response to what are currently considered a multitude of unrelated problems. Carbon management impacts on salinity, drought, water quality, bio-diversity, acid soils, erosion, weeds, and soil fertility. Some people have over simplified the problem as merely a case of removing too many trees. I accept that trees are 50% carbon when the moisture is removed, but they are not the only carbon process in the landscape. We can have too few trees just as we can have too many trees. There has to be biodiversity to maximise the introduction of carbon into the landscape. There also has to be biodiversity to maximise nutrient recycling in the landscape. By biodiversity, I mean there has to be the correct balance of grasses, shrubs and trees. Unfortunately, there is a minority of environmentalists and graziers who are too narrow in their thinking on this delicate subject. Both these minorities need to widen their concept of what makes for a productive and sustainable landscape.

We can not successfully manage anything we do not fully understand. For this reason, I have outlined the processes of plants, animals and soil function, and how they all interact as part of the big picture. The discussion has promoted carbon as the catalyst for keeping the different processes integrated and functional.

The people whose understanding of cars is limited to knowing that a key starts them, are unable to fix them when they fail. It is the same with degraded landscapes. I repeat my opening reference to Einstein's comment, "The problems of today cannot be solved by the level of thinking that caused them."

Once landholders fully understand how their natural resource base functions within the carbon cycle, they will be better equipped to address the mounting environmental pressures that are eroding the viability of their farming and livestock-based businesses.

Reducing the frequency of drought, and its duration is achieved by increasing carbon in the landscape. The good carbon managers often suffer a dry spell while others are in drought and have to make soul-destroying decisions. The good carbon managers enter drought later and exit it earlier, because their pastures respond better to what little rain does fall. With any downpour, they have maximum water infiltration and retention in the soil, plus the correct cross section of plants to utilise the rain. Some are fortunate enough to have the hardy drought and frost resistant perennial edible shrubs like saltbush, which fortunately are not consumed by kangaroos.

After I left the land I read that the mental health of rural producers is directly proportional to ground cover. In hindsight I now know this to be true. It could be said that better land management is just as important as diet for better health.

> *"Instead of looking at what we have got in a pasture, we should look at what is missing, and understand why it is missing."*
>
> (Ian Greenhalgh, "Mt Harden Blackall")

Animals do not just eat out the most palatable plants, they are also capable of changing the landscape, with the result that the landscape can then become unsuitable in the short term for the plant they have eaten out. Conversely, animals are also capable of improving landscapes.

I have not set out to say what the cut-off point for carbon loss is. It is the role of sustainability science to determine and quantify the critical thresholds beyond which natural systems rapidly deteriorate. Some say 1% is the warning level and the landscape starts to fall over at 0.6%. The issue for rural producers at this stage is not what the exact figure is, but rather the need to appreciate the importance of carbon management and prevent carbon levels from falling too low. The photo in Figure 21 on page 56 of a sick and dying perennial grass plant highlights the repercussions of allowing carbon in all its forms to become too low.

Carbon Grazing is the basis for an environmental management system. Not only does the principle have far-reaching environmental outcomes, but the principle is transparent and the required actions are easy and cost-effective to document and implement. After a given amount of rain, the animals are either removed or they are not. There is no need for expensive pasture monitoring, as all the outcomes of pasture rest are known, and any variation in outcomes are due to other factors of nature such as temperature. Carbon Grazing is a transparent way for rural producers to prove to the rest of society that they can be responsible caretakers of the land.

To obtain general acceptance of any landscape management system, the system must achieve the outcomes society wants while at the same time increase the profits of rural producers. Carbon Grazing achieves this, as there is no conflict of interest. For the communication of management solutions to the custodians of the land to be successful, the proposals have to be accepted by them as sensible and practical. More importantly it has to be consistent with their goals. I have set out to present the relevant science in a lay person's language, while the big picture approach of uniting scientific disciplines makes it beneficial to scientists and decision makers. There has also been a focus on both short-term as well as long-term profit, while at the same time dealing with environmental issues. The emphasis has been on **knowledge** not **capital expenditure**, as financial resources are limited for many rural producers.

As a rural producer I initially saw animals as my source of income, so I concentrated on genetics. Then I decided that pastures were really my source of income, so paid more attention to regenerating them. Over time I came to realise that it was the soil and its health that was my source of income, as it determined the level of pasture production, all else being equal. Finally I realised that it was soil carbon levels that were responsible for the performance of the soil, especially harder soils with a tendency to seal over. At the same time I developed a better understanding of the importance of energy reserves (carbon compounds) in the roots of perennial plants for their production and survival.

I set out to explain why Carbon Grazing which is four to six weeks of rest immediately after plant growing rain, achieves the following outcomes:

1) Spells all plant species for greater health and increased production;
2) Leads to plant regeneration in favourable years;
3) Increases the fertility of soil and its ability to absorb and hold water;
4) Postpones drought;
5) Maximises profit; and
6) Contributes to improving the country's greenhouse balance and addressing many other environmental issues like water quality, salinity, erosion, biodiversity, acid soils etc.

The South African rangeland scientists with whom I have exchanged ideas are focused on rest after rainfall. While I was visiting their country they explained that with average pastures, three to eight weeks of rest after rain can see an increase in pasture production of 50-80%. **At the time when pastures are emerging from dormancy, there is the potential for so much lost production (and carbon introduction into the soil)**.

As a rural producer I would shift animals to give them every opportunity to perform. It took a while to appreciate that I could give perennial plants equal support, although they could not be shifted. Just by allowing plants to grow when they wanted to, it was possible to let them help themselves by building up more extensive root systems and energy reserves to become more resilient. It also allowed them to improve the soil they had to survive in. The survival process for perennial grasses is dormancy when the going gets tough, but going into dormancy can be fatal if they do not contain sufficient energy reserves to return to life later.

Grasses regenerate the soil much quicker than trees, as their roots grow and die. The CSIRO stated recently that grasses are better stores of carbon, because they have so many roots below the ground.

When groups of plants are missing, we are reducing the number of energy pathways, and thus the total efficiency of the system. We require both C3 and C4 perennial grasses wherever they are possible. More emphasis needs to be placed on the differences of the C3 and C4 photosynthetic pathways, given that all plants fall into one or the other of these categories.

It is a commonly held belief that drought occurs when there is below average rain for a certain length of time. While such a perspective has some definitional advantages, I believe it is not of much practical use. In my opinion, a more practical definition of when a drought exists, is when the pasture can not supply the protein and energy that animals require. Put another way, we are drought stricken when animals have consumed the last of the plants that are drought and frost resistant.

Such a definition of drought places far greater responsibility on the producer as the manager of his or her pasture, and less on the variability of the weather, although the latter must be taken into account. Successful drought management comes down to appreciating that the only time you can prepare for drought, is when it rains. Managing for drought is all about ongoing carbon management to increase the landscape carbon reserves in all the forms they take.

Carbon Grazing is all about maximising accumulation and cycling of the premier factor of production, which is carbon. Carbon management is about “fuelling” up a balanced group of plants in the landscape. Plants rely on current carbon via photosynthesis as well as all the benefits that accrue from past investments in carbon storage. Productive plants need a productive landscape. Weeds are the repair agents that reintroduce carbon into the landscape, after we have been careless. When nature sends in a local weed to repair the topsoil and create groundcover, we often over react and take out the weed instead of letting the missing plant out compete the weed when it has more in its favour.

It is only recently becoming accepted that landscape management has an influence on the actual rainfall that reaches any given area. It now appears that the stock of carbon in the landscape has an influence on the processes that deliver rain.

Every tonne of carbon lost from the soil adds 3.67 tonnes of carbon dioxide (CO_2) gas to the atmosphere. Conversely, every tonne increase in soil organic carbon represents 3.67 tonnes of CO_2 sequestered from the atmosphere and removed from the greenhouse equation.

It is ironic that climate change is going to make us focus on what we always needed to do to run a successful rural operation, that is “to manage carbon better”.

> ***“I trust you all now understand and appreciate that Carbon Grazing® is the unification of all the carbon processes. Therefore the only logical conclusion is that the time to prepare for drought and a more sustainable world is the period immediately after rainfall.***
>
> ***This is why pasture rest is TIMING not TIME.”***

"I HAVE FINALLY GOT TO RE-READING CARBON GRAZING. HOW DIFFERENT IT IS ON THE SECOND READ. I AM CAPTIVATED AS YOU REVEAL THE "SECRETS" OF GOOD GRAZING MANAGEMENT."

...SHANE JOYCE, GRAZIER, THEODORE, QUEENSLAND, AUSTRALIA.

"ALAN HAS THE GREAT ABILITY TO THINK ACROSS SCALES FROM THE MOLECULES INVOLVED IN CARBON FIXATION, THE GREEN PICK NEEDED FOR SHEEP AND CATTLE DIGESTION, TO THE GLOBAL CHALLENGE OF CLIMATE CHANGE."

...DR DAVID FREUDENBERGER, FORMER CSIRO SCIENTIST, CANBERRA, AUSTRALIA.