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A brief overview of raising soil carbon through grazing management.

Ken Sykes
Territory Manager
Southern QLD

Firstly let's explode the urban myth that livestock produce carbon and contribute to global warming. Livestock cannot manufacture carbon; nor can they mine carbon from deep below the soil surface. Several scientific studies have shown that grazing cattle in Australia is at worst carbon neutral. This should be self-evident. Cattle consume carbon contained in pasture. A small amount of carbon is stored in the animal, the balance is returned to the atmosphere as carbon dioxide and methane. We will return to methane later. The carbon dioxide is reabsorbed by the growing pasture to continue the cycle as it has done for millions of years. Of course livestock can only graze that portion of the pasture that is above the surface of the soil. The portion that is below the soil surface may represent a short or long term store of carbon.

Isolating one small part of the carbon cycle; the point at which it is emitted from the beast is totally nonsensical. If we are to look at small parts of the cycle in isolation we might as well say that a herd of cattle is a carbon store. After all a stable herd of 1000 head contains 90,000kg of carbon, equal to 330,300kg of carbon dioxide. As long as cattle that die or are slaughtered are replaced with new calves this is a permanent carbon store. Our politicians consider carbon stored in trees as permanent carbon sequestration in an environment where our forests burn on an average once every thirty years.

Now to methane. A short lived gas that breaks down to carbon dioxide and water vapour in the atmosphere. Methane is the product of bacterial digestion or decomposition of organic matter. If we were to look at the hotspots of methane production on earth from space we would see the primary source as tropical rain forests, followed by wetlands, then human activity. The average person emits one litre of methane per day dependant on age, diet etc., this is only a small part of methane production by humans with the major source of methane production being rubbish dumps, sewage works, etc. and of course from mining. Methane production by livestock is effected by age, genetics, and most importantly by diet.

Storing carbon in the soil is a win win situation up to the point where soils are no longer productive and are prone to combustion such as peats. It has been estimated that lifting the carbon level in the soil on two per cent of our agricultural soils by one half of a percentage point would absorb all the carbon produced by human activity in Australia for a year. CSIRO "Saving the life of farmland soils" gives the following figures for carbon levels in the top 1 meter of soil. Tropical forest 122.7 t per hectare, tropical savannah 117.3t, temperate forest 96.2 croplands 80t and temperate grasslands 236t. Dr. Christine Jones has quoted figures of 516t for well managed grassland in Queensland. It is relatively simple to store carbon in the soil, however storing it there long term is a totally different story. The wide spread flooding of 2010/2011 has resulted in a huge biomass both above and below ground over much of eastern Australia. This has temporarily stored decades of Australia's carbon production. With the inevitable fires and droughts this carbon will return to the atmosphere. This is a totally natural occurrence and the cycling of carbon is essential to life on earth. Carbon is stored in soil and plant growth during good seasons and lost to the atmosphere during droughts and fires. This is a particularly concerning aspect of involving farming in carbon trading.

Soil carbon levels can be lifted and stored for long periods of times as a result of grazing management. Soils with higher carbon levels store more moisture and are more productive. It is important when considering management practices to lift soil carbon that we are results orientated. There are not necessarily good or bad management methods but good or bad outcomes. Unfortunately there are those who have extremely strong beliefs regarding there management systems and like all fanatics where they cannot convert people to their beliefs would try to enforce them by other means. This type of approach has no place in the business and science of livestock production. Systems such as cell grazing and some aspects of biodynamics may be valuable tools but they do not necessarily provide the best outcomes for all environments and all management systems. We need an holistic approach but unfortunately even the term "holistic" appears to have been hijacked and in some interpretations means anything but.

Increasing soil carbon requires a basic understanding of plant growth and natural carbon cycles. In grasslands plant growth above ground is mirrored by the growth of roots below ground. Similarly the amount of life below ground from microbes to earthworms usually exceeds the mass of livestock grazing above ground. Increasing soil carbon may have a snowballing effect. As the organic matter below the surface increases plant growth increases, increasing the organic matter below the surface. When a plant dies or is eaten the below ground portion dies back in balance. With new growth the below ground portion regrows resulting in a pulse or pump effect building the organic matter and carbon in the soil. The difficult part is holding that organic matter long term. If the above ground portion is kept short roots will remain shallow and contribute little to soil carbon. If the surface of the soil is bare the carbon will combine with oxygen and volatise as carbon dioxide.

The two main aims of grazing management is to encourage maximum above ground growth which is periodically removed and maximum soil coverage both with growing plants and litter. We often hear the argument that Australian grasslands evolved without hoofed animals. As much as we would like to think at times we are separate from the rest of the planet the same rules of physics and chemistry apply. The only way to restore and build our grasslands is through management and only domestic livestock can be effectively managed. Cattle are the cornerstone of grassland management through grazing, trampling to increase surface litter, and surface disturbance through high animal impact. Sheep graze some plants and pasture not suitable for cattle. Goats are a prime example of an animal that can either destroy or rehabilitate a pasture dependant on management.

Two grazing systems that have been used in Australia to increase soil carbon are cell grazing and the four paddock system. In a classic cell grazing system stock are rotated through paddocks depending on the rate of pasture growth. Stock are used at high density to rapidly defoliate plants and then moved on before damage due to overgrazing can occur. In the four paddock system paddocks are spelled through the main growing and seeding season for one year in four. Remember it is not the system that is important but the outcome. The aim is to encourage maximum above ground production which is then removed to encourage the next cycle of growth together with minimum bare soil. Drought requires particularly careful management such as destocking prior to denuding pasture. This may be off the property completely or to a sacrificial timbered paddock where the stock are fed. To quote from a recent MLA study over 4 years and 9 properties "Improved grazing management does not require highly intensive forms of grazing. For example, systems based primarily on continuous grazing can just as readily improve land condition and productivity as long as there is careful and regular management of stocking rate, use of wet season spelling to assist recovery of pasture condition and a sufficient level of infrastructure to permit flexibility in management and to minimise the area of paddocks that are either over used or under used by cattle."

Where does supplementation fit into the picture? Appropriate supplementation increases digestion efficiency with a resultant significant increase in livestock health and production, it has the additional bonus of decreasing methane emission. Supplementation will lift weaning percentage by an average of 10%. This means the same weight of beef can be sold of the farm from a smaller breeding herd reducing stocking pressure. Supplemented cattle grow more rapidly allowing them to be turned off at a younger age further reducing stocking pressure.

Mechanical intervention may often be warranted. Such as regrowth control. Remember well managed grasslands may store 516 tonnes of carbon compared to96t under temperate forest. Ripping may boost compacted pasture. Establishing and strategic fertilization of perennial pasture may significantly boost plant biomass. While fire is the least preferred method of removing above ground biomass it may be appropriate for hazard reduction and revitalisation of moribund pasture.

In the authors opinion involving livestock production in carbon trading is fraught with many hazards. Conversely encouraging better grazing management through such things as strategic supplementation, fencing to allow better control of grazing, and better landcare practices in general should be actively encouraged. We need to be cautious of attempts by the extreme green movement to drive a wedge between farming communities. Replacing meat with grain and vegetables in the human diet is not practically achievable or environmentally desirable. The majority of grazing land is not suitable for long term cropping. Well managed, bio diverse grazing lands have major environmental advantages compared to cropping monoculture. Replacing grazing land that has historically been grassland or open forest with dense stands of timber is not only environmental vandalism but has huge implications for human food security.

Ken Sykes *Territory Manager Southern QLD*