Rescue Me! Grass Land Restoration on Moorunde Wildlife Reserve

John Endersby

Taking the "Spear Grass Seeding Trials and their Results on Moorunde Wildlife Reserve" to the next stage – a plan to re-establish the grassland areas of Moorunde's Twelve Mile Plain.

***Grasslands**: Native Spear Grass at Sandleton, 8km west of Moorunde, 2014*

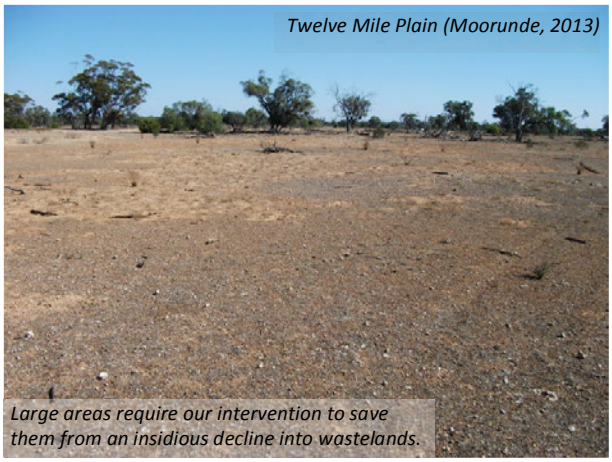
"… Fine plains thinly studded with trees; grass up to the horses knees…" – 1839

Part 1 – Lessons from the Past

"Change is the law of life. And those who look only to the past, or the present, are certain to miss the future." – President John F. Kennedy

The original plan of the founding members of the Natural History Society of South Australia was to manage Moorunde Wildlife Reserve by leaving nature to take its course – in the belief that nature alone would correct 150 years of damage caused by European settlement. Unfortunately, they were wrong!

But let's go back and look at a little of the past and then the present situation, so that we can get the future into perspective and understand what needs to be done to restore this area of semi-arid wilderness – so that it can become and remain the wildlife reserve it was meant to be. We need to use this history as our baseline for the complex human intervention that will be required to save Moorunde. Large areas of the Reserve require our intervention to save it from an insidious decline into a wasteland. This is the essential point that I want you to understand.



Twelve Mile Plain (Moorunde, 2013)

Large areas require our intervention to save them from an insidious decline into wastelands.

The vegetation immediately west of the River Murray and south of Blanchetown, was once comprised of three habitat types: (1) **Mallee Scrub**, (2) **Open Shrubland with Scattered Myoporum Trees**, and (3) fertile **Grasslands**. The photo above shows what these grasslands would have once looked like (see page 3 for examples of vegetation types 1 and 2). The first Europeans to see this area were the "overlanders" Joseph Hawdon and Charles Bonney, when in 1838 they drove about 340 head of cattle to Adelaide from the eastern colonies. They followed the Murray River from New South Wales, passing where Blanchetown and Swan Reach are now sited to about where Mannum is sited, before heading over the Mount Lofty Ranges to Adelaide. The "South Australian Gazette and Colonial Register" reported from Mr Hawdon: *"The water and feed were abundant during the whole route, …the capabilities of the land within the South Australian boundaries as out of all question superior in fertility to any yet known on this continent."*

Another overlander Alexander Buchanan, who took 13,000 sheep from Sydney to Adelaide in 1839, considered "…the west side of the Murray below big bend, really the most beautiful, like a gentleman's park all the way. Fine plains thinly studded with trees; grass up to the horses knees…".

These men, and others, were stockmen and therefore had a vested interest, along with the interests of the early settlers (that had started colonising South Australia in 1836) in the extensive grasslands of the state. They saw the areas of dense Mallee Scrub as "desert areas" and not important to their interests. Not unlike people today, they took more notice in, and remarked upon, what interested them most. Yet these once highly-prized native grasslands are now the most endangered wildlife habitats in Australia. Conservationists also, to some extent, are partly responsible for this decline in grasslands, because for many of them, the focus and measure of their success has been the saving and restoration of those wildlife habitats dominated by trees and shrubs – to the detriment of those species of plants and animals that are dependent on the existence of what was once one of the most common and widespread ecosystems in Australia – grasslands! Which are now among the most endangered habitats.

At least three quarters of the 7,000 ha area of Moorunde Wildlife Reserve (including the Twelve Mile Plain) was once grassland habitat. Now, all of the grasslands areas of the original 2,000 ha of Moorunde are gone – smothered by various species of encroaching shrubs that are gradually becoming denser. Meanwhile, most of the grassland areas of the Twelve Mile Plain are currently weed-infested, soil "hard-panned" wastelands, and continuing to decline. But more on that later…

A major objective of one of Australia's most noteworthy explorers, Edward John Eyre (the first European to cross Australia east to west and the first European to penetrate into South Australia's central inland regions as far as Mount Hopeless) was the search for grasslands suitable for settlement. He was the first Australian explorer to be awarded the Royal Geographical Society's Gold Medal.

After numerous expeditions, Eyre purchased a property of 4,000 acres by the Murray River, close to the site of present day Blanchetown, for the purpose of farming, grazing stock and establishing a settlement. At about the same time, Governor Grey offered him the position of Resident Magistrate and Sub-protector of Aborigines in the Murray River district. Eyre

Abundant Spear Grass on Moorunde in 1970
Photo: Alwin Clements

At least three quarters of the 7,000 ha area of Moorunde Wildlife Reserve (including the Twelve Mile Plain) was once grassland habitat.

The grasslands areas of the original Moorunde are now gone. Smothered by various species of encroaching shrubs.

took the position and established a station on the property that he named "Moorunde", from the local Aboriginal word for the river and from which the present Moorunde Wildlife Reserve has gained its name.

This was an excellent choice by Governor Grey, as Eyre was ahead of his time in his attitudes, knowledge and understanding of Indigenous Australians. He was also an extremely brave, resourceful and fair man, respected by the settlers of South Australia, the overlanders, and most important of all, the Aboriginal people along the river – from Lake Alexandrina all the way up to the Darling River. So much so that Aboriginal parents were prepared to leave their children in his care for extended periods. When Eyre decided to leave South Australia due to ill health and return to England, many Aboriginal people from several different tribes begged to accompany him to England. Eyre's published journals include numerous writings on his thoughts of the plight of Aboriginal people in the presence of European expansion into their territories. While he himself was an active part of the expanding settlement, he was very sensitive to the negative impact it was causing to many Aboriginal people. In his role as Resident Magistrate, he worked to achieve peaceful relations between Indigenous Australians and the new settlers and urged for compensation for those Indigenous People displaced from their homelands.

This explorer, farmer, government administrator and human rights activist had great hopes for the land along the river and encouraged settlers to come to the region – because of the extensive grasslands!

Essentially it wasn't until all the grasslands and open woodlands in Australia where taken up by settlers that scrub clearing became a wide spread practice, using either teams of horses or more usually bullock teams, hauling huge logs. Hence the grasslands were basically gone or accounted for well before the era and concept of conservation for wildlife habitats began. By then, bulldozers dragging long lengths of ships anchor chains were tearing down vast areas of forest and scrub at alarming rates. Which, in South Australia at least, has only relatively recently been stopped.

Given that a large area of Mallee Scrub, adjacent to Moorunde Wildlife Reserve, was chained in the 1960s, just prior to Society members inspecting the area that they would later purchase for the Reserve, it is understandable that they considered the saving of scrub and shrubs a priority. As none of the early members were farmers and probably had little experience with farming history in the northeast pastoral districts, it presumably never occurred to them that grasslands were also a significant, yet largely destroyed habitat. Possibly, they assumed that European settlers had cleared *all* of the areas containing few trees and shrubs. In fact, many of these areas *had* been cleared, but *not* by European settlers, and *much* earlier than the early Society members could have imagined!

A large area of Mallee Scrub adjacent to the property that became Moorunde Wildlife Reserve was chain-cleared in the 1960s, just prior to Society members inspecting the area.

Photo: Alwin Clements

As the last glacial period (the Upper Peniglacial, commonly known as the Ice Age) retreated around 12,000 years ago, Indigenous Australians were maintaining the vegetation landscape across Australia as it had been for them during the Ice Age, which in South Australia was predominantly grassland. They did this by burning it!

This so-called "fire-stick farming" has long been underrated by European people. It was a far more sophisticated technique in terms of "science and technology" than what we have long given the traditional owners credit for. In settled parts of Australia today, very few people, Indigenous or European, fully appreciate and even less understand the detailed knowledge required to conduct what we almost contemptuously describe as "burn-offs". Yet even what is known could fill several volumes of books and take one many years of experience to put back into practice. However, The point that we need to understand is that when Europeans arrived in Australia, the environment they saw was a "managed environment". Managed of course, for the benefit of the First People's survival. That management, its methods, techniques, extent and detailed knowledge required to achieve it had created the widest possible range of the most diverse ecosystems on this island continent. This was the single largest area of "natural habitat" to be "man-managed" ever to exist in the entire world.

After the First People came to Australia sometime during the glacial period previous to the last one (the Lower Pleniglacial) they became an integral part of the ecosystem. They became the "top order" or "apex predator" and they learned to control and manage populations of their prey species such as wallabies and kangaroos (dingoes did not arrive in Australia until about 4,000 years ago). These people became, as the out-dated saying goes part of the "balance of nature" in Australia. Their management of the land, as it was happening for so long and throughout significant global climate variation, is (or was) part of that so-called "natural-balance".

Among the skills and qualities described earlier, Edward John Eyre was also a great observer and frequently recorded details of what he saw. The following passage, written in 1839, is one of his descriptions of areas of Mallee country in South Australia, which were maintained by Indigenous Australians for the purpose of managing and harvesting their major source of protein: *"Forcing his way through dense and apparently interminable scrub the traveller suddenly emerges into an open plain sprinkled over with fine silky grass*

varying in extent from a few acres to many thousands in extent, but surrounded on all sides by the dreary scrub he has left."

Eyre came to depend on these grassland areas during his exploration ventures, to feed his horses and the sheep that he used as "walking rations" of fresh meat.

By 1847, land along the west bank of the Murray River had been surveyed into pastoral leases. In 1847, Eardley Heywood was the first man to take up the lease on the property that he named Portee Station, an area of about 110 square miles or 28,500 ha – part of which is now the 7,000 hectares of Moorunde Wildlife Reserve (including the Twelve Mile Plain). In 1879, two years after Heywood died, Portee was put up for sale by auction. At the time 13,000 sheep plus their lambs were on the property.

This number of sheep and lambs equates to a "stocking rate" of about 0.7 Dry Sheep Equivalent (DSE) per hectare. Dry sheep equivalent is the term used by stockmen for assessing the carrying capacity of a given area of grazing land. It is similar in some ways to the term "bio-mass" used by ecologists when they refer to the "mass" of a species on a given area of land. Different areas will have different carrying capacities or DSE. One Dry Sheep (or one DSE unit) represents the feed required by a two-year-old, 45 kg merino (wether or non-lactating, non-pregnant ewe) to keep its weight. DSE can be related to other animals:

- 1 ewe carrying a lamb = 1.5 DSE.
- 1 milking cow = 15 DSE
- 1 beef cow carrying a calf = 12 DSE
- 1 kangaroo = 0.5 DSE
- 6-8 rabbits = 1 DSE
  (about 0.15 DSE per rabbit)

In 1879, Portee Station was running 0.7 DSE per hectare. However, since about one third of Portee is Mallee Scrub and of limited value for grazing, it could be reckoned that at the time, the Grasslands and Open Shrublands had a carrying capacity of about 1.05 DSE per hectare (0.7 ÷ ⅔). It is likely that Heywood employed his stockmen to minimise the number of kangaroos on the property in order to maintain his sheep numbers.

The settler activities quickly replaced traditional Aboriginal land management. Regrettably, for many reasons, the population of Indigenous People (the "apex" predator of the kangaroos) was rapidly diminishing in number, while those that did survive had had their previous lifestyle stolen away from them, along with their land. Land use and vegetation communities were changing more rapidly than ever before. Then the rabbits arrived!

In 2007 the Natural History Society purchased an additional section of Portee station known as the Twelve Mile Plain bringing the total area to 7,000 ha. An examination of the Reserve, including the Twelve Mile Plain, surveyed on foot, by quad-cycle and from satellite photos indicate that approximately 6,000 of the 7,000 ha would once have been suitable grazing land (some of which is Open Shrubland) with the remaining 1,000 ha being Mallee Scrub. However at the time of this purchase the stocking rate on Portee had dropped to 0.25 DSE per hectare (based on the available grazing area and information from the owner). And this stocking rate was still in decline. The native grasses have gone! But not just on Portee Station. By the 1980s, the original 2,000 ha of Moorunde that had been purchased by the Society in 1968 and fenced off from sheep had virtually no native grasses left either.

*Example of **Mallee Scrub** vegetation type.*

*Example of **Open Shrubland with Scattered Myoporum Trees** vegetation type.*

Society members visited Portee station in 1967-68, during one of South Australia's worst droughts. Possibly, they assumed that European settlers had cleared all of the areas containing few trees and shrubs.

Photo: Alwin Clements, 1967

But when it did rain in the 1970s, Portee Station (now the Twelve Mile Plain of Moorunde Wildlife Reserve) still grew good grass. However by then, as can be seen, trees had started to die.

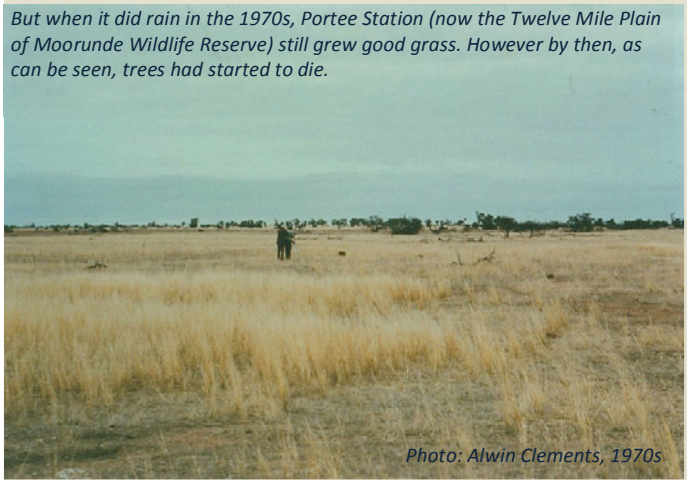
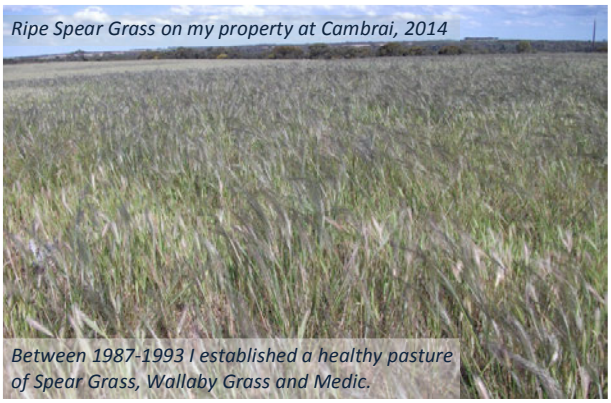


Photo: Alwin Clements, 1970s

Part 2 – Sowing the Seeds

"The greatest thing a human soul ever does in this world is to see something and tell what it saw…" – John Ruskin, 1819-1900

In October 1987, I moved with my family to Cambrai in the Murraylands (about 20 minutes drive from Moorunde Wildlife Reserve) and purchased a 30 ha "hobby-farm". At the time of purchase, this property was in a very poor state as a result of earlier over-cropping and grazing, leaving the soil bare, rocky and "hard-panned". In 1993 I joined the Natural History Society and began regular visits to Moorunde. During the six years before joining the Society, I had established a healthy pasture of native Spear Grass, Wallaby Grass and Medic pasture, with a stocking rate of 1.5 DSE per hectare or 45 DSE for the entire 30 ha property. In reality, I stocked at a lower rate to ensure I maintained self-sustaining pasture. By 1993, my property could have carried 90 kangaroos on the 30 ha, and still maintained a healthy stand of native Spear Grass and Wallaby Grass. When I first saw Moorunde in 1993, "what?" I wondered, was going on, and going *wrong* here!



Ripe Spear Grass on my property at Cambrai, 2014

Between 1987-1993 I established a healthy pasture of Spear Grass, Wallaby Grass and Medic.

Now admittedly, although Cambrai is nearby, the average rainfall at Cambrai is about 10% more than at Moorunde (300mm versus 270mm). However, my land had been virtually flogged to death with continuous and excessive traditional cultivation, and cropped every year for at least the previous 15 years. The ground was bare, barren and severely "hard- panned" due to this excessive over-use. And it was cheap for sale, because of it! On the other hand, Moorunde had always been free from cultivation. In 1993 it had also being free from sheep grazing for 25 years. Also, it had benefited from relatively good shelter (in the form of scattered shrubs and trees – although these were by then, starting to die off) and therefore not as "wind blown" to the same extent as my property. With that in mind, the extra 30 mm average rainfall at Cambrai is *not* the reason for the good stand of native Spear Grass on my property. Several properties around Moorunde (with the same lower average rainfall) had, and still have, good stands of native grasses (see photo from Sandleton on page 1). Some of these properties still continue to run sheep on them too.

In 1994 an annual rabbit-baiting program commenced on Moorunde (the original 2,000 ha reserve). These feral animals were in plague proportions. Every wombat warren was full of them. It is something of a paradox because in this area, rabbits generally find it very difficult to dig their own burrows, as the limestone layer, just under the surface soil, prevents this. Every second or third shrub had one or two rabbits "squatting" for shelter under it and rabbits would run out in front of anybody going for a casual walk. For ten years, from 1995 onwards, I conducted the rabbit-baiting program on Moorunde. This involved traversing the property with a vehicle-towed bait-layer, and consequently I became very familiar with the entire Reserve.

Rabbit baiting involves towing a bait-layer about the property with a vehicle such as a quad-cycle. A small plough disc mounted on the bait-layer cuts a shallow furrow into the surface of the soil, into which oat grains are trickled. To "train" the rabbits to come and feed on the oats, two or three "free feeds" of non-poisoned oats are initially trickled into the furrow between four to seven days apart. Then a final trickle of oats, laced with a poison called "1080" is run out four to seven days after the last "free feed". On that first baiting program in 1994, the day after the poisoned oats were spread in the furrows, there was not a live rabbit to be found on Moorunde! And it is still extremely rare to see a rabbit on the Reserve – either by day, or at night with a spotlight.

In terms of real effective conservation work, this was the first and most important management strategy that had occurred on Moorunde. But unfortunately it had commenced too late to save the native grasses and the seed bank was depleted. In the twenty-five years from 1990 to 2014 there have been twelve years suitable for Spear Grass to germinate and grow. Furthermore, since this grass can (and often does) grow as a perennial, some of the other years should or could have had "carry over" grass from the previous year.

The commencement of rabbit-baiting was too late to save the native grasses.

Moorunde, 1994. Photo: Alwin Clements

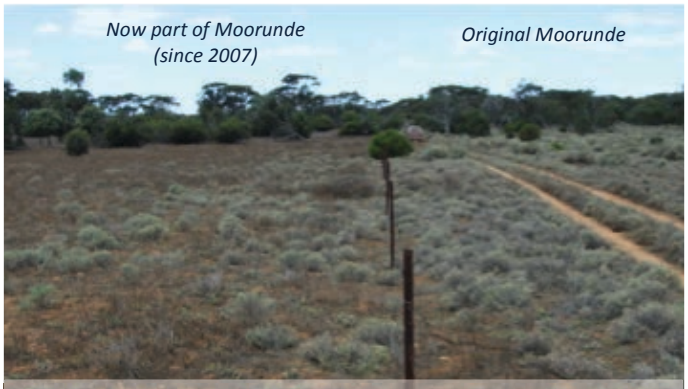
Ironically, as the existing shrubs and Myoporum Trees were dying of old age, the timing of the rabbit baiting and the subsequent absence of rabbits, allowed a regrowth of seedlings of these shrubs and trees to become established and replace the old ones. In some respects, the rabbit-baiting program was *too* successful, because, at a surprisingly quick rate, regenerating shrubs began to invade the areas that were once grasslands! Although by then, since these areas only grew exotic Wards Weed and Thread Iris, one could call them "weed-lands"! However these weeds were now the plants that were keeping the wombats alive. But the grasslands, as a habitat in their own right, are no longer present on the original 2,000 ha area of Moorunde. Areas were they were are now covered with thick stands of shrubs. Despite this, the wombats on original Moorunde (but *not* the Twelve Mile Plain) have recovered from the 1967 drought and their numbers are fairly stable – for the time being!

With the addition of the Twelve Mile Plain in 2007, the Reserve was extended by a further 5,000 ha all the way to the Sturt Highway, Brookfield Conservation Park being immediately on the other side. By this time, the carrying capacity of the Twelve Mile Plain had reduced to 0.21 DSE per hectare - having been grazed by sheep for 40 years longer than Moorunde. It was widely infested with the near totally, unpalatable onion weed and crawling with rabbits. With the sheep removed, and with rabbit baiting to be the

Moorunde, 2011

In some respects, the rabbit-baiting was too successful, with regenerating shrubs invading areas that were once grasslands!

March 1995, fence-line between the north end of original Moorunde and Portee Station. The grey vegetation in the foreground on the Moorunde side is dead Wards Weed. On the Portee side, sheep have grazed it down!



July 2011 – the left-hand side is now part of the Reserve. After rabbit baiting on both sides, shrubs are encroaching on what was once a grassland area, kept clear by Aboriginal burning, perhaps once every 15 years.

only form of land-management, the Society's Management Committee was hoping to "save it" by "letting nature take its course", to see it into recovery – not realising that land this badly damaged could not and will not recover without active intervention and still believing that the shrub and Myoporum tree recovery on Moorunde was an indicator of success.

Since then, nature *has* taken and *is* taking its course. But *not* the course to recovery. Nature's course has become one of self-destruction that is beginning to spill over into Moorunde. There are insidious implications for not just the Twelve Mile Plain but also for Moorunde too. However, I am writing this article because I have a solution and proposal to prevent and reverse this slow, almost imperceptible, but resolute advance of corruption of the once abundant grassland habitats.

When I first visited Moorunde in March 1993 I had already established (or rather, re-established) some scrub and more importantly, good "stands" of native Spear Grass and Wallaby Grass on my property at Cambrai. As it was only a "hobby farm", after the first few years, I had no further use for the old tractor I had bought or the old second-hand cultivation implements that I had rebuilt – so I sold them. Something I was later to regret when I saw what needed to be done on the Twelve Mile Plain!

A benefit of having a "hobby farm" and no longer being a full-time farmer, and with the luxury of a safe government job is that you can trial and test different and new sustainable farming methods and ideas – without the risk of threatening your income stream. Which is what I did during the six years prior to visiting Moorunde.

My aim was to establish a "perennial pasture" on my property – in a dry cropping zone. But there are no commercially available exotic pasture seed species for the type of soil and climate conditions in this semi-arid area. So I thought of trying the grasses that could grow and once *did* grow naturally. Grasses that had enabled the early European settlers to simply move in with their flocks and herds and quickly take over the land, long before the days of scrub clearing. I initially collected native grass seeds from around the margins and under fences of the paddocks. With a little trial and error, I developed methods of successfully sowing and establishing native Spear Grass and Wallaby Grass pastures, to which I added a component of Barrel Medic (an annual legume useful in nitrogen fixing).

More importantly, these were methods that dealt with the severely damaged and "hard-panned" soil and as such they required machinery! Machinery (tractor and implements) is necessary equipment to initially treat the "hard-panned" soil. To loosen, breakup, aerate and introduce moisture to the soil. Machinery also enables large areas to be sown within reasonable time and cost constraints. The trials conducted and reported on in "Spear Grass Seeding Trials and their Results on Moorunde Wildlife Reserve" were undertaken to demonstrate that the methods I had developed at my own property, could be used and would work successfully at Moorunde too.

Since conducting those trials I have developed two cheap and efficient methods of harvesting native grass seeds instead of having to collect it by hand – as I had originally done. These methods allow one to readily harvest seed from local properties in the vicinity of the Reserve (with permission from the owners), instead of purchasing it (often at high cost) from a commercial supplier, as the Society has previously resorted to. One method was to attach a homemade "catcher" to a common garden "whipper snipper" or brush-cutter. The other was to modify a lawn mower so that it only cuts off the heads of the grass and collects the seeds in its catcher.

I have also developed an efficient machine for distributing Spear Grass seeds, without the need to remove the seed shafts (awns), prior to sowing. As described in "Spear Grass Seeding Trials and their Results on Moorunde Wildlife Reserve", it was found necessary to remove these shafts prior to sowing the seeds with a traditional style mechanical seeder (I used a rabbit bait-layer in lieu of a seeder). During harvesting and while in storage, the barbed shafts of the seeds cause them to bind together, becoming something like "carpet-felt underlay" and the seeds cannot subsequently be spread easily nor can they "bury" themselves. I had used a chaff-cutter to remove the shafts, but this was a slow and tedious process, especially given the large volume of seed required. Despite all my inquiries I had been unable to find anybody who made a machine suitable for efficient sowing of Spear Grass seed over a large area. So I developed my own. The machine is based on a garden leaf blower with a number of modifications. It will be operated from a trailer, towed behind an open vehicle such as a tractor. It allows an operator standing on the trailer to rapidly spread seed over a large area without the need to remove the seed shafts prior to sowing. This "blower method" is a major improvement over that previously used – which was to remove the seed shafts with a chaff-cutter and then combine the seeds with a sowing medium (such as oat

A "whipper snipper" with a homemade catcher makes an ideal grass seed harvester.

Grass seed harvester made from a lawn mower, on "raised legs".
In the background, harvested Spear Grass seed is spread out for drying.

Garden leaf blower (left) with homemade hopper and feed system (right) make distributing Spear Grass seed a "breeze"!

seeds) to enable it to flow through the delivery mechanism of a traditional seeder.

Although this new "blower method" works well and enables the individual seeds to separate, spread and fall on the ground without the need for any additional preparation, and although grass seeds can normally germinate from this dispersion, it is not the sole solution for Moorunde's problems! Simply because there isn't just one problem!

The "seed blower" is mounted on a stand in a trailer and towed by a vehicle (preferably a tractor and not my ute), for broad area distribution.

Spear Grass seed (Austrostipa species)
Note the barbs on the shaft (awn)
Photo: Charles Sturt University

Spear Grass seed harvested using the modified "whipper snipper", hanging in bags to dry – about 6kg in total. Not bad for about 30 minutes work in the field.

Sowing seed may sound like a simple job, but when you consider that I am holding well over 100 Spear Grass seeds in my hand complete with their long shafts (awns), matted together like "carpet-felt underlay" you will appreciated that sowing on a broad scale requires some machinery and ingenuity!

Spear Grass seeds mat together during harvesting and storage (because of the barbs on their shafts). Ordinary seeding machinery cannot handle this matting aspect and the seeds will not germinate if sown like this. They need to be separated and individually distributed to allow them to "self-bury" into the soil.

Part 3 – Taking the Right Path

"How very little can be done under the spirit of fear." – Florence Nightingale

Those members of the Society who regularly come out to work at Moorunde on the monthly "Visitor and Volunteer Weekends" have done a commendable job in ridding the original area of Moorunde of weeds. The main weeds targeted including Horehound, Wild Mignonette, Stemless Thistle and Wild Sage, which have virtually been eliminated from this area with only the occasional check-up needed on the sites that they once infested. While the Reserve certainly looks much better for the removal of these weeds, none of these plants actually pose a significant threat to the welfare of either the native plants or animals that live there.

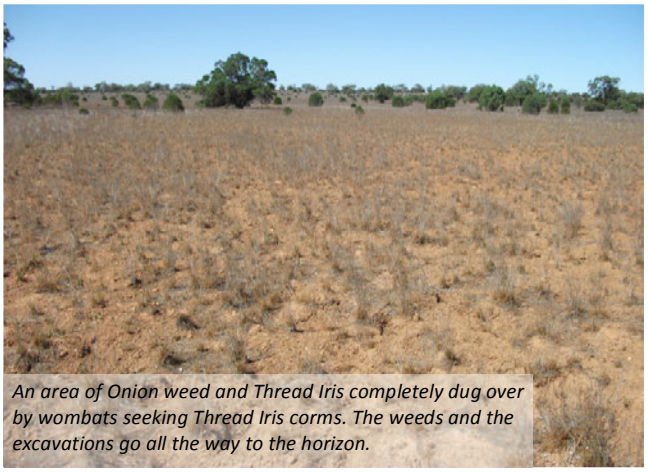
This is not the case with four other major weed species: Wards Weed, Thread Iris, Potato Weed and Onion Weed. These weeds have one particular feature that separates them from the others – they cannot be stopped in their spread and essentially, cannot be controlled! In the case of Wards Weed, this is just as well, as it has taken the place of the native grasses as the main diet for the grazing animals. Although it is slightly toxic, the Reserve's herbivores manage on it, supplemented by a few other plants. Thread Iris is also toxic, however in the past few years it has become a major food source for wombats during the dry season when they dig for Thread Iris corms. This digging for corms has become a major problem for the whole Reserve except in the Mallee Scrub. Potato Weed only appears in those years that experience heavy summer rainfall however it is extremely poisonous and although sheep have largely learnt not to eat it, it becomes very tempting to starving wombats. Autopsies have indicated that it is a serious danger. Onion weed, which is now widespread and becoming established on the original area of Moorunde, does not have a bulb, unlike the plant it is named after – rather, it is named for the similar foliage. It is not considered toxic, however it is almost

Onion weed has now penetrated right into the centre of original Moorunde's south section at Water Point 1. These plants, seen in November 2014 have already set seed!

completely unpalatable to any herbivore.

None of these four weeds have any significant impact on the native plants of the Reserve by themselves! None of them would have had any detrimental impact on the animals of the Reserve either – that is, if there were other plants such as native grasses or even exotic plants, which were safe to eat in sufficient quantity. These weeds, all of them, would still be on the Reserve, and pose some competition to other edible plants, but they are not, on their own, in any way, the problem. Rather, the massive infestation of these weeds and their current out-competing of the native grasses is a symptom of the problem – that being one of over-grazing. This is an important point, because I believe it mistakenly focuses the commendable efforts of some of our volunteers on attempting to totally eradicate Onion Weed outbreaks on Moorunde. This weed in particular will no doubt encroach across the entire Reserve like Wards Weed and Thread Iris, which could not be stopped in their spread. Yet Onion Weed is known to be a poor competitor against palatable pasture plants such as native grasses – if grazing pressure is alleviated.

I have these weeds on my property too, in small fragmented patches. But they actually offer three important services. Firstly, in small quantities, they offer some medicinal value for grazing animals. Secondly, as they are generally not eaten, they eventually go back into the soil, providing organic matter. Most importantly of all is that they serve as an "indicator gauge" for the health and quality of the main pasture – and I say main pasture because no pasture is totally "healthy" without some form of weeds.



An area of Onion weed and Thread Iris completely dug over by wombats seeking Thread Iris corms. The weeds and the excavations go all the way to the horizon.

Now, for these "pasture quality indicator gauges", let me draw an analogy. If your motorcar's temperature gauge or oil pressure gauge showed that the engine was running hot and the oil pressure was low, you would take your vehicle to a mechanic, but logically you would not tell the mechanic to waste their time (and your money) on checking and fixing the gauges! These instruments are indicators that something is wrong with the engine – and *that* is what needs to be checked and fixed.

Every good stockman knows that a healthy pasture (and therefore healthy animals) has to have some weeds. It is when there are too many weeds that a problem is indicated – there is something wrong with the soil, or there are too many animals grazing it, or both. In the case of Moorunde, and in particular the Twelve Mile Plain, both situations apply.

Attempting to simply eradicate or control these weeds will not solve the problem. In fact, like the mechanic twiddling with the warning gauges, it may ultimately lead to far more damaging consequences. In the meantime, money and labour is being redirected from solving the underlying problem. The "engine" needs to be stripped down, the cylinders re-bored, new rings and valves installed, then reassembled with new gaskets and bearings. All of this sounds quite drastic and invasive, and there is obviously a significant cost involved – so people will put off having the mechanic work on it immediately. Then one day they find themselves stranded on a lonely road with a piston rod smashed through the side of the engine and their RAA roadside assistance renewal fee unpaid!

We must look beyond any fear of the invasive remedial action required to save the Reserve, and the fear of spending or the difficulty of raising the required funds, to fix the problem now. This is where my analogy of the motorcar diverges, as we cannot simply purchase a new (or used) wildlife reserve from the local car yard! We have to repair what we have.

So what are our "weed gauges" indicating to us?

When the Twelve Mile Plain was acquired by the Society, the control of kangaroo numbers by the previous owner stopped abruptly. Whatever the "carrying capacity" of the property was at the time, it has now been exceeded for some years, primarily by the kangaroos. The wombats over the entire area have been so deprived of suitable grazing that they have learnt to, and are now forced to dig for Thread Iris corms, particularly in the dry summer months. These corms can be up to 10-15 cm deep in the soil, and it is this

incessant digging in the dry season that is causing the "hard-panning" of the soil. During the winter months, the wombats also eat the top of the Thread Iris plant (a long thin single strap-like leaf), and both top and corm are toxic in large quantities.

In 2008 and 2009, when I was conducting rabbit baiting on the Twelve Mile Plain, the Onion Weed, particularly in the many clay-pans, was dense and lush, growing up to 60cm tall. In isolated parts of the Reserve, this is still the case, but now, large areas of soil have become so "hard-panned", that even the Onion Weed struggles to germinate and grow there. You really need to "see it to believe it" (the damage that has been done to the soil, and the extent of land over which this has occurred) to properly comprehend the problem and its scale. In total, there are thousands of hectares repeatedly dug over in the dry season, and some of the individual "digging" sites run into several hundreds of hectares each, and they are expanding. The pits dug by the wombats are up to 15cm deep and each pit is immediately adjacent to or surrounded by other pits, resulting in a cratered "moonscape". The ground has been totally excavated again and again, for several years now.

This digging is done in the summer and early autumn when the soil is dry. The repeated digging breaks the dry soil down to a fine silt of individual grains. When the rains come, the silt cements together to form a "glazed" surface over the ground and subsequent rain can barely penetrate it. Following a rain shower, the water lies about in a mosaic of small puddles, and most of it evaporates before it can soak through into the soil. The soil capillaries are now so small that what water does seep in can rapidly rise to the surface again, speeding up the drying of the soil and causing more moisture loss. Most of the rainwater only wets the top 2-3 cm of the soil and regardless of the amount of rain the growing season has effectively been cut short. For a semi-arid region that already experiences low rainfall, this is a serious predicament.

Large areas of soil have been so "hard-panned" that even the Onion Weed now struggles to grow – these plants are struggling to grow more than 6cm tall.

The ground has now become so hard that even the wombats are reluctant to re-dig old areas of previous excavation, and are now tending to concentrate on digging around the edges. So each site is gradually expanding with many sites now merging. As a consequence, the vast areas that contained dense, lush and green Onion Weed in 2008-2009, up to 60 cm high, now only grow the weed to 6 cm or less!

The rabbit bait-layer cutting disc can no longer penetrate the glazed soil to make even the shallowest of furrows, and in some places doesn't even leave a scratch mark on the surface to allow the operator to see where the first "free feed" was laid. That hardly matters though, as these areas are now so pitted and undulating that it is not feasible to drive a vehicle towing the bait-layer over them. The ground is so rough that it is smashing the quad-cycle that I purchased to do the bait laying with. It is also smashing my body and at my age I can no longer tolerate the constant jarring. So, for some time, autumn 2014 will be the last time the Twelve Mile Plain is baited for rabbits. Paradoxically, as mentioned earlier, I see that this may actually be a temporary advantage for the Reserve, in so much as a rabbit population will help to keep the number of germinating "woody weeds" (shrubs) at a lower level in what were once grassland areas.

Some people have expressed reservations about the soil treatment I am proposing for the Reserve and understandably so, as these measures will appear relatively severe and invasive. Other people have expressed concern about how or if the Society can obtain the money required to implement the plan and understandably so, because the Society already struggles to meet the day-to-day costs involved in maintaining a large land area and the various administrative expenses. So "…very little can be done…" until these justifiable concerns can be addressed. In the meantime, the temporary re-invasion of rabbits will give a short-term "breathing space" for and until when, remedial action can commence.

*Dense green and lush Onion Weed (*Asphodelus fistulosus*) on the Twelve Mile Plain. This photo was taken in November 2011 and the Onion Weed has run up to seed, giving a copper tinge to the otherwise green plants that can be up to 60 cm tall – unless struggling to grow in "hard-panned" soil!*

Mature Onion Weed plants can have up to 50 seed stems with as many as 10 seedpods per stem, with each pod containing 3 seeds – or a total of 1,500 seeds per plant!

Seeds can remain dormant for many years, making control of the weed by spraying virtually impossible. Invariably, sufficient plants are either missed or survive the spraying. When ripe, the seedpods break open and "cup" the seeds until they are either blown out by wind or brushed by a passing animal. The seeds readily attach themselves to fur or hair, helping to facilitate spreading of the weed.

However, by itself, the weed is not a serious problem, but rather an indicator that a problem exists. It is easily suppressed by careful and timely cultivation and does not compete against a healthy pasture such as Spear Grass – provided that the grass is not overgrazed to the extent that it cannot seed down itself.

Careful, timely cultivation stimulates dormant seeds of the Onion Weed to germinate, which can then be killed off by a "follow up" cultivation. Importantly, in this semi-arid area, this type of weed control requires extreme care, precise timing and considerable operator experience. But when done properly, the reward of seeing the Onion Weed struggling to compete in a field of "fine silky grass up to the horses knees" is worth the effort! The author hopes to train others, particularly younger people, in the techniques required.

Part Four – Time for Action

"There's no problem, only solutions" – John Lennon

The Natural History Society owns and maintains Moorunde Wildlife Reserve for the benefit of the people of Australia. In particular, for those people who believe in the value of conserving at least some wilderness areas from the invasion of the various ills of modern day "civilised" development. It is therefore the responsibility of "conservationists" to look after it. And furthermore, it will now be the conservation community who will ultimately be held accountable for its welfare. No longer can farmers be blamed for its long-term condition, as the damage they have done to it in the past is largely repairable and reversible. It remains to be seen if "conservationists" can implement the necessary repairs.

Yet how can I say the return of rabbits on the Twelve Mile Plain will offer a temporary respite? Well, even native plants can be weeds in certain circumstances – in areas that have long been maintained as grassland habitats; and in this case it is the native shrubs that have the potential to invade these grasslands areas of the Reserve and choke them. These "woody weeds" as they are known by biologists will not provide feed to either wombats (for which the Reserve was originally established) or kangaroos. Not being herbaceous plants like grass or Wards Weed, their roots have superior penetrating power in the hardened soil. Eventually they can become so dense that nothing will grow under them. They are also far more difficult to remove and control than Onion Weed.

Rabbits eat the young seedlings of these shrubs and strip bark off juvenile plants, which kill the plants. They could very well prevent one of the few remaining open areas available for re-establishing native grass, from being choked out by "woody weeds". At least until the Society is in a position to rescue these areas. When the Society can eventually acquire the money for this venture; then the rabbits can be quickly eliminated and subsequently controlled – as it is as easy to kill 100 rabbits with bait-laying as it is to kill 100,000. But of course, it would be much more preferable to avoid using a "pest plague species" as a "Band-Aid" solution, even if it were only temporary. It would be much more preferable to implement an effective long-term strategic plan that will restore these areas in a well-managed and controlled fashion.

The Society currently has a fairly large membership base of supporters whose subscriptions and donations are vital to the administrative costs of managing the Reserve, primarily insurance premiums. There are no paid positions in the Society – all work, administrative or ground-work, is undertaken by volunteers. The law requires that all volunteer workers on our reserves must be insured. We are also required to insure against "third party injury" or "public liability" on all of the reserves. Other costs include printing and postage of the Society's bi-monthly newsletter, an essential mechanism to keep Society members informed of our activities. Additional costs include numerous small (but accumulating) expenses for items such as promotional material, website registration plus consumable materials and equipment for maintaining the property fences, tracks and campsite areas. Currently, the Society has relatively few active members participating in the management and maintenance of our reserves. These active members volunteer their spare time in either administrative work or physically working on our reserves and in some cases both. Unfortunately, they have little time left to engage in money raising activities. So currently, the Society's future survival, including our reserves and any major work to be undertaken on these properties, largely depends on donations. I am hoping that some readers of this article may have "solutions" to this problem.

As far as the plan to rescue the Moorunde Wildlife Reserve (and primarily the Twelve Mile Plain) is concerned, a number of problems now have solutions. With ample native grass seed available from my own property and other properties nearby Moorunde, combined with my two new seed harvesters, sourcing sufficient seed (which otherwise is often very expensive), is a problem solved. Machinery to distribute the seed over large areas has also been developed and constructed. The methods developed to treat the severely damaged soil for the re-establishment of native grasses have been trialled and proven. These methods achieve two desirable outcomes: the soil is prepared to an appropriate state for native grass seeding and germination, and simultaneously, the heavy infestations of Onion Weed are destroyed and suppressed for sufficient time as to allow the native grasses to re-dominate the areas. The proposed management plan is designed to accommodate the issue of kangaroo overgrazing, without the need to actively manage their population (at least at this stage). The plan is aimed at either achieving sustainable accommodation of kangaroo numbers (a desirable outcome), or in the longer term, demonstrate the need for some form of kangaroo management, be it in reducing their numbers or excluding them from certain areas of the Reserve sufficient in size that sustainable wombat populations can exist in those areas.

The problem and solution of a sufficient "work force" has also been considered. The project "scale" can and will be tailored to match whatever labour force is available. There are a number of sources of potential labour effort including our own dedicated volunteers, the Cadell Training Centre, the Australian government's Green Army program, and various other environmental and community groups within the district.

Recently, I had the opportunity to purchase some second-hand cultivation equipment and machinery at a good price – some of the equipment that is necessary for the soil treatment on the Twelve Mile Plain. Being old and used, much of it is broken, but it is reparable and can be rebuilt – something I will undertake myself. However, we still require a tractor for the purpose of towing this cultivation equipment for the initial soil preparations, and later for towing the new "blower method" Spear Grass seeder. If only I had kept my old one, the one that I had used for restoring the land at my Cambrai property! So this is one problem that still needs a solution. Either the Society stretches its funds to purchase a tractor (a second hand one is fine!) or we can hopefully find a donor prepared to support this requirement.

We also require funding for fencing. We have a range of planned fencing projects of which the primary one is a kangaroo and rabbit proof fence surrounding an area of at least 400 ha – requiring a 1.8m high fence (for the kangaroos) with fine mesh near the bottom (for the rabbits). The intention here is to establish an area free of kangaroos (which would be driven out as the enclosure fence neared completion) and rabbits (which would be baited), and then to actively re-establish native grasses in the presence of wombats alone. This area must be at least 400 ha so that it contains a viable, self-sufficient wombat population. The proposed site for this enclosure is in the most severely damaged northeast corner of the Reserve. It is an area that was once the single largest grassland area of the Reserve. It is now so severely damaged (from past sheep grazing, weed infestation, and "hard-panning" by the wombats digging for Thread Iris corms) that virtually no further harm can be done to it! And currently, this area has the lowest population numbers of wombats. So the problem of choosing the optimal location for starting the key part of the land restoration plan is solved.

The expertise required to conduct some of the work, including training and supervising new volunteers who are keen to learn, is available from current members of the Society. Expertise for research, monitoring and recording the results (surveys, photographs, remote camera monitoring) is also readily available from current members.

It is envisaged that a project of this nature and scale (restoring grasslands over a significant area of a 7,000 ha reserve) will attract more people to become active on the Reserve and indicators of this have already been forth coming. Basic accommodation (campsite, shelter shed and amenities) is available for researchers and anybody else keen to contribute to worthwhile conservation work, or to learn how to do it.

Sufficient finances remain the only major hurdle to overcome.

The Reserve is certainly worth the effort and expense, despite my sometimes pessimistic and jaundiced accounts thus far. When one walks over the Reserve, or rides a quad-cycle well off the established tracks, the first thing you have to notice is how sublimely beautiful the Mallee is, and how vast an area 7,000 ha is. Anybody who has an appreciation of, and an affinity with Australia's unique "outback" will not only see and recognise this, but also feel its exquisite and enticing charm, notice its delicate perfumes, colours and sounds, which change as the day and seasons progress, along with its rugged grace. It is a priceless place, and a piece of the outback that is closer to the capital city of this state than any other state in Australia.

The Reserve is maintained by a *public* Society that anybody can join, and therefore have access to the Reserve and participate in the management of it. Management plans and practices of the Reserve are not restricted or inhibited by government regulations. We have volunteers ready and willing to guide you through a visit of the property and to show it to whoever would like to see it. And if you decide to become a member of the Society, then you are most welcome to become involved in the management of the Reserve and to show others the wonders that can be found in this unique area of semi-arid Australia.

If you are in any way interested to find out more about our plans and activities at Moorunde Wildlife Reserve, you are more than welcome to contact me to organise a visit and tour of the Reserve.

December 2014

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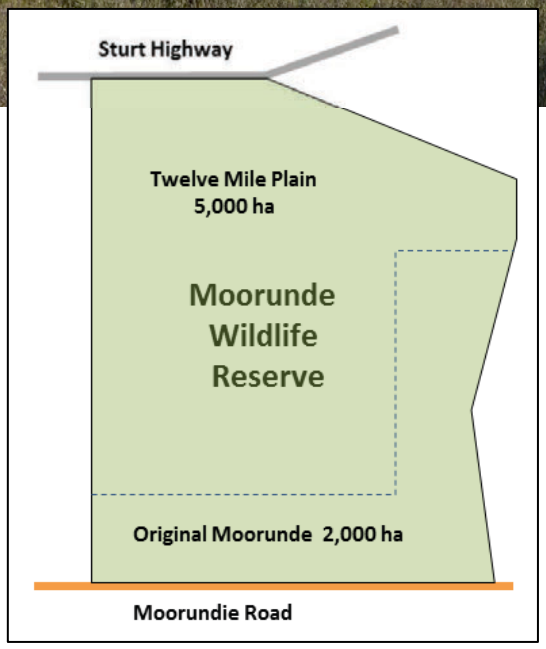
When one walks over the Reserve, the first thing you have to notice is how sublimely beautiful the Mallee is, and how vast an area 7,000 ha is.



The same area shown on page 2 that was chained in the 1960s – today. For some unknown reason, the follow-up work of land clearing was not done. It has since made a remarkable recovery – illustrating how resilient some of Australia's bushland can be.

Additional Photos of Soil Treatment Trials & Demonstrations

The ground at my Cambrai property was bare (except for Tumble Weed and rocks), barren and severely "hard-panned". The first step in treating soil this damaged is to run a ripper through it to break the hard crust, to allow rainwater to penetrate below the surface (left side of photo).

Endersby Farm, Cambrai, June 1990

Endersby Farm, Cambrai, August 1995

The same area, five years later, with an established pasture.

The results from ripping are obvious in this scene. What is also obvious is that ripping alone has the task only part done. This is an area where I did not explicitly sow Spear Grass seed, but it has naturally collected (or been "captured") in the furrows, along with the moisture necessary for germination!

Endersby Farm, Cambrai, November 2014

A claypan area of the Twelve Mile Plain infested with Onion Weed, and dug up so often by wombats that the top 15cm of soil has become "hard-panned".

This is the site of a soil treatment demonstration, the morning before commencing work.

Twelve Mile Plain, May 2014

Twelve Mile Plain, May 2014

The same area as the photo above, later on the same day. The treatment for soil damaged this badly is to "close-rip" the ground. This is a quarter-hectare trial site for the purpose of demonstrating how effective the method is for repairing damaged soil structure. Despite appearing harsh and invasive, the results can be the same as seen in photo on page 4, of thriving Spear Grass on my Cambrai property.

However, extreme care must be taken when conducting this type of work in a semi-arid region. The operator must pay careful attention to the moisture content of the soil, the speed of the tractor, selection of the correct implement and its use.

This "damaged soil treatment" has only superficial similarities to the agricultural cultivation used for growing commercial crops and it takes a considerable (and often underestimated) amount of experience and expertise.

After the close ripping, the dormant seeds of the Onion Weed (which can normally remain dormant for many years) are stimulated to grow. These plants are dealt with by "follow up" workings. The area then remains weed-free for long enough to seed and establish a Spear Grass pasture that can out-compete the Onion Weed – provided that the "grazing pressure" is not to great.

The implements used to prepare this particular demonstration site were purpose built from scrap metal by the author and towed by his 4WD ute. They are too small to be practical for a larger area. The ground is also too rough and undulating, even for a 4WD vehicle. A tractor is the ideal vehicle for this job.

Spear Grass seed will be sown in this area using the recently developed "seed separator and blower" machine and a section will be fenced off from grazing animals.

Twelve Mile Plain, July 2014

Twelve Mile Plain, September 2014

A different area that has been "close-ripped" with no "follow-up workings". In this case, there is no Onion Weed, however exotic Wild Sage proliferates over the entire area. Notice the fresh Wild Sage in the foreground! Dormant seeds were stimulated to germinate by the soil disturbance. Also, the ground having been ripped allowed rainwater to penetrate the soil, effectively "extending the growing season" for the Wild Sage. The soil in the background remains "hard-panned" and herbaceous plants in that area have already died off.

Note that the point of this demonstration is not to promote the spread of exotic weeds like Wards Weed, but rather to demonstrate the effectiveness of appropriate soil treatment. In this case, subsequent careful "workings" will destroy these weed plants before they seed. It also demonstrates the ability to promote germination of dormant weed seeds, which aids in reducing the seed bank of the weeds. After a final "working" to prepare the soil, Spear Grass seed could be sown over this area.

For a semi-arid region that already experiences low rainfall, "hard-panning" is a serious predicament!

This enclosed area of 0.2 hectares (30m x 70m) has a Kangaroo, Wombat and Rabbit proof fence around it. It is both a demonstration site and ultimately a native grass seed harvesting enclosure.

In treating "hard-panned" soil, the timing of each step is critical, as the soil must not be either too wet or too dry. Speed of travel over the ground must be very slow, less than a quarter of the speed used by a farmer preparing to plant a commercial crop.

If weed control is also an issue, the time between each "working" is also critical. In the photo, both area either side of the black post have received the same number of "workings". However the area on the left received the final treatment three weeks later than the area to the right. This meant that germinating weeds were destroyed on the left section, but they are now growing on the right section. In this case, for the area on the right, it is not an issue as it has been planted out by hand with both Wallaby Grass and Spear Grass, raised in tube-stock by Society members. This method of planting tube-stock by hand will ensure that these plants survive, despite the presence of weeds. However, it is not a practical method for larger areas of the Reserve.

0.2 ha Seed Harvest Enclosure, Twelve Mile Plain, September 2014

The area on the left has had Spear Grass seed broadcast with the recently developed "seed separator and blower" machine.

"When our soils have gone, we too must go…"
– Thomas C. Chamberlain, 1908

Bibliography

The following list is some of the reading I have done, to help formulate my ideas and opinions on the best way to implement remedial action on the Reserve and in particular the Twelve Mile Plain. Together with my own personal trials and experience, this literature helps to provide compelling argument for the type of action to be taken. If you are interested in more information, I encourage you to review some of this literature.

The farmer, to successfully cooperate with an environment which is not always smiling, must be resourceful and provident, and have initiative, keenness of perception, and personal experience, or the ability to apply the experience of others"
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