Against all odds: turning sand into profit



PROSPECT PASTORAL COMPANY

Farm Facts

Wyalkatchem, Dowerin, Cunderdin and Meckering districts, around 190 km north east of Perth, WA Central Wheatbelt

Enterprise: Crops. Sheep.

Cereal grains and cereal hay crops; speciallybred sheep for wool and premium grade fat lambs

Property Size: 8000 hectares

Average Annual Rainfall: 200-300 mm (home farm)

Elevation: 320 m (home farm)

Motivation for Change

Reducing rainfall and rising input costs

Innovations

- Introduction of biological fertilisers and zero tillage to improve soil function and structure
- Integration of grazing with cropping to enhance nutrient cycling and soil structure
- Revegetation to limit spread of salt
- Innovations commenced: 1994

Key Results

- Successful crop production on 100mm rainfall
- Increased soil water-holding capacity
- Sheep bred to adapt to local environment lambing at 90%-150% and producing high quality 17-20 micron wool





I nitially investing in 660 hectares of marginal and degraded wheat country, lan and Dianne Haggerty have built up a successful production area of 8000 hectares producing cereals and sheep on limited rainfall and sandy salt-affected soils.

Ian and Dianne Haggerty, and their son James, run a holistic and integrated program of cropping and grazing. The program is underpinned by their shared deep commitment to the regeneration of the fertility of the marginal soils of their area. This is achieved through use of biological fertilisers, zero tillage and the consequent growth of healthy cereal plants to deliver high tonnages of premium grain per hectare. The healthy ground cover of the cropping and pasture also provides the key to maintaining high levels of soil moisture and ensuring weed control.

Over the years, Ian and Dianne have developed their own Merino stud and a working sheep flock from local and South Australian bloodlines. This indigenous flock has been bred to be totally acclimatised to the land farmed by the Haggertys.

Their production area is now spread over a number of holdings equalling 8000 hectares of their own property, leased land and share-farming enterprises. This diversity has enabled more effective management across various landscape conditions and rainfall availability.



Settling In

Ian and Dianne came to the original property in Wyalkatchem in 1994 after having run a successful business at Derby in the north west of Western Australia. They had a long shared desire to be farmers and naturally gravitated towards their origins in the Eastern Wheat belt of Western Australia.

The original property purchased by Ian and Dianne lies on undulating semi-arid country to the north of Wyalkatchem WA, bordering on Wallambin Salt Lake. Due to the size and location of the property, farm advisors originally suggested the best alternative was to get out before they got started, however this only challenged the Haggertys to make a good go of things. For the first few years they made a start with the help of machinery from Dianne's father who owns a neighbouring property.



Local landscape with salt lake in the distance

During the remainder of the 1990s rainfall proved relatively reliable with mostly average rainfall seasons, some excellent seasons and a couple of dry seasons. Following conventional best practise at this time proved profitable and enabled Ian and Dianne to begin acquiring their own machinery.

However, through experiencing the couple of dry seasons, the Haggertys realised the vulnerability of the farming system they were following, as the production decline in these years was significant. Observations of poorly developed root systems and the low resilience of plants to short springs encouraged Ian and Dianne to explore what might be limiting these factors within the soil. This instigated an ongoing pursuit of knowledge regarding soil health and soil productivity.

In addition, rising input costs without a corresponding rise in productivity also provided cause for concern. From this grew a desire to enable the soil to produce an optimum outcome with whatever seasonal conditions unfolded without expensive inputs.

With the coming of the new decade the rainfall patterns made a determined turn for the worse, with mostly belowaverage rainfall patterns or significant "dry spells". This gave the Haggertys a clear indicator that moisture was king, and rainfall preservation and optimal use would be the most powerful profit driver for the enterprise.

Whilst in Derby, Ian and Dianne had made contact with Robyn Tredwell¹, manager of Birdwood Downs Station. It was here that they learnt the principles of using livestock as "weeders, seeders and feeders" in regenerating pastures with appropriate management. This experience was an early trigger for Ian and Dianne to investigate many of nature's processes; how careful management could enable successful utilisation of nature's efficiencies at minimal cost. This view was also supported by Dr Elaine Ingham and Dr Arden Andersen with whom the Haggertys commenced their education in biological agriculture. Understanding of livestock management and interaction with the soil environment was further enhanced by learning with Jane Hinge of South Australia.

The original 660 hectare purchase has since been expanded over the years by leasing and share farming enterprises throughout the districts of Wyalkatchem, Dowerin and Meckering. These additional properties are not adjacent, so distance is a constant factor in farming management.

Holistic Management

Each of the properties managed by the Haggertys produce cereal grains (wheat, oats and barley), cereal hay and sheep for wool and meat. The inclusion of leased land and share-farming enterprises in various locations in their operations has given Ian and Dianne the option of cropping and grazing on different soil types and in different rainfall zones. They can also move sheep to optimise feed on offer and water supply and can choose the location and intensity of cropping operations against landscape conditions and rainfall availability from one part of the enterprise to another. Ian and Dianne are careful to ensure that each practice that comprises the holistic management of their cropping and grazing operations contributes to the whole. Only the highest quality components underpin the individual and carefully thought out farming practices.

Cropping

To grow cereals, Ian and Dianne use a process of no-tillage direct drilling of grain seed, supported by application of biological fertilisers, based on high grade worm liquid and compost extract at a cost of \$30 a hectare. Cereal stubble and areas of perennial shrubs - *Rhagodia spp.*, saltbush (*Atriplex spp.*) and tagasaste (*Chamaecytisus palmensis*), or tree lucerne, - provide grazing for sheep in summer and autumn. Winter and spring grazing is provided by annual volunteer plants, grasses and legumes.

Enhanced microbial activity in the soil and the use of specially-bred sheep as the 'farm machinery' above the surface has lifted the resilience and fertility of the land, improving the soil function, structure and water-holding capacity and continuing to value-add to the productivity of the landscape.

"We truck our worm juice and compost from the Victoria and New South Wales suppliers with a proven record of providing only the highest grade products. The compost extract is produced by our own centrifuge which was sourced from the United States", Ian notes.

The Haggertys have a preference for older varieties of grain that were in common use before the introduction of farming methods which rely on high levels of chemical intervention. They are constantly on the lookout for additions to their seed bank.



Grain head size is seen as a reliable indicator of soils health



Seeds are microbiologically coated before sowing. Ian has integrated a low pressure liquid fertiliser circuit into their seeder so that the microbiologically coated seed is drilled into a microbial environment stimulated by the liquid fertiliser. This ensures that the plant is supported from germination to early growth.

When Ian digs over a shovel full of heavy red soil in the paddock it becomes obvious how each plant growing in it acts as a carbon pump. The plant root growth has broken up sub-surface hard pan in these heavier soils affected by earlier farming methods. By not providing water soluble fertilisers with the seed, extensive root system growth is stimulated and the plant is able to reach wider and more deeply for moisture and nutrition.

Similarly, observation of root growth in the poorer sandy soils in other paddocks being cropped, show the extensive root growth which adds carbon and nutrients to the soils. These roots hold the soils together and spread the microbial environment within the soil.

As Ian describes, "Healthy flourishing plants slow down runoff from the meagre rainfall, that can be as little as 100mm during the growing period, the microbial activity and associated improvement in soil structure maximises the retention of moisture in the soil".



"Crop quality is checked by periodic testing of tissue

nutrient levels and inspection of grain head development during growth. We find this is a more reliable measure of what is available to plants from the soil, rather than testing the soil itself."



Extensive root growth is a sign of a healthy nutrient system

Grazing

"Once grain is harvested, the stubble of the crop grown in this high microbial environment provides nutritious grazing fodder for the sheep. In due course, remnant stubble is trampled down and is broken down by fungi to add to the organic carbon in the soil. Together with the dung provided by the sheep and their stimulation of the soil surface by walking on it, the soils become a gift that keeps on giving."

Ian and Dianne have carefully bred their line of sheep to be adaptive to their local environment. Through a combination of their breeding and grazing practices, including short, controlled periods of grazing in individual paddocks, the sheep are resistant to stomach parasites and do not require drenching. The sheep have been bred for clean legs, faces and crutches; the Haggertys do not practice mulesing but maintain regular crutching.

The sheep thrive on cereal stubble and native shrubs and grasses as their rumen flora is totally adapted to



Pregnant ewes amongst wheat stubble

maximising nutrient extraction from roughage. The livestock do not receive any grain supplementation. The sheep are shorn every eight months and produce lambs at a rate between 90 and 150% per annum. As the Haggertys say, "We couldn't afford to replace our ewes. They have developed into hardy, efficient producers with minimal artificial support highly adapted to our local environment. They could not be replaced easily".

Alpacas run with each flock of sheep to reduce the threat from foxes

Dianne points out, "The grazing operations are integral to the whole. The cropping and hay production contribute to our production of premium wool and lamb, but the sheep are playing their part in fertilising the land and working the soil for us".

The sheep produce high quality 17-20 micron wool (8-

9kg average per fleece adjusted for 12 months growth) and premium grade fat lambs. Some of the Haggerty's stud rams are sold to other farmers looking for robust, economical performance.



The sheep have been specifically bred to suit the environment

The Whole

The Haggertys note, "The spread of our operations throughout the district enables us to maximise the virtues of each piece of land and minimise its shortcomings. We have learnt what each paddock can contribute to our operations season by season and what we need to do for that paddock to ensure the continuation of its productivity".

"None of this would be completely effective without our understanding of the land as a living organism and our connection to its life cycle. As we contribute to it, we live from it, we live with it - we must understand its nature and its inner life, what it gives to us and what it needs from us to work on our behalf."



Predicted seasons and conditions are strongly considered when choosing land for cropping. The potential for productivity when biological processes are introduced can be clearly seen on these sandy soils

With What Water?

The farming operations continue to deliver high quality grains and cereal hay at significant yields even when the rainfall during the growing season has been as low as 100mm. Average annual rainfall has been only 200-300mm since 2000.

Because of the low average rainfall and the predominance of lower rainfall and drought years over higher than average years, Ian and Dianne plan for operations in drier conditions as being the norm. Their cropping strategies and practices emphasise retention of water in the soils through soil quality management and by minimising runoff and evaporation. In this context, they choose cropping land with the best potential for a high yield in the predicted season ahead.

The runoff in all paddocks is so minimal that they do not rely to any great degree on dams for stock water, although at least one dam in one of the cropping/pasture paddocks is fed by ground water. The mainstay of stock watering is water from the wheat belt watering scheme that pipes water from Mundaring Dam.





On What Soil?

With the varied properties, the enterprise is spread over diverse soil types. These include the heavier red clay loam known locally as 'Morrell' soil, light acidic sands known as 'Wodgil' soil, deep leached sand, sand over clay and ironstone gravels. The biological and no-till strategies and practices adopted by Ian and Dianne are aimed at:

- breaking through shallow, sub-surface hard pan in heavy soils caused by previous high till, high chemical farming
- breaking up clay mosaics
- opening the soil's surface to water penetration
- building up soil structure that allows roots to penetrate deeply and widely
- efficient breakdown of stubble and litter by microbes and fungi
- weaning newly acquired land from chemicals while maintaining production

Ian and Dianne are faced with considerable dry land salinity, particularly on land close to Lake Wallambin where salt is picked up by wind and deposited on their land. They have planted lanes of saltbush and acacia in these areas. They use sheep to graze these areas and contribute to soil fertility through dung deposit. In the more saline areas they sometimes put out hay to attract the sheep to these areas and concentrate dung around the feeding point.



Fungi growing in the crop

Below the surface, the action of microbes, worms fungi, and beetles dung is obvious in any shovel full of paddock soil. Above the surface, shrubs trees, and ground cover sustain other micro biodiverse environments that support insect life and reptiles, including a few hardy frogs.

There are numerous bird species and macro fauna using these areas. This biodiversity can be traced back to the strategies and practices Ian and Dianne have developed under their vision for biological farming.



The sandy soil (on spade) is visibly improved with organic matter after only two crops

Vegetation Management

The saltbush lanes help to control the movement of salt from the salt lake. Ian and Dianne have also planted a number of different species of annuals and perennials to help manage the spread of salt. Many failed, and they learned from that experience that the annual pasture legume, yellow serradella, has proven a good survivor. It does well in acidic soils, has deep roots and is a prolific seed producer.

Native grasses are returning to cropping paddocks and grow well if there is summer rain. However, the prime source of grazing fodder in summer and autumn is cereal stubble.

Ian and Dianne are careful not to impact on the residual paddock trees or clumps of bushland. They have also planted salmon gums (*Eucalyptus salmonophloia*) and other species to foster the growth of stock shelter and wildlife corridors, and to reduce the impact of salt from the nearby Lake Wallambin. Use of a tree planter allows for large numbers of seedlings to be planted quickly. In one location they have fenced off a particularly representative plot of ancient residual Mallee to preserve its integrity.

As they work up and develop the potential of a newly acquired piece of land, Ian and Dianne will immediately use the livestock to begin the process of biologically inoculating soil that may not have had biological activity encouraged for some time. They are quickly able to reduce rates of chemical use by altering the soil surface and not providing the excess nitrogen and phosphorous that weeds seem to thrive on. The main species of weeds are barley grass (*Hordeum spp.*), annual rye grass (*Lolium*) *rigidum*) and wild radish (*Raphanus raphanistrum*). The former respond to herbicides, but, in some cases of heavy radish infestation, which is hard to kill with herbicides, Ian prefers to slash whole paddocks and then turns them over to grazing significantly reducing seed set for the following crop season.

The Team Works

Ian and Dianne are working together in a close partnership, Ian managing cropping and Dianne managing animal production, but working together to integrate both production streams. Eldest son James is also working on the property, having graduated from agricultural college. Other members of their families are located on nearby properties.

Together, the Haggertys are continuing and improving regeneration of farming landscape in every part of the enterprise in terms of both soil fertility and soil waterholding capacity, whilst minimising the impact of ground salinity. Their production is showing a continuing trend to higher yields per millimetre of rainfall and higher quality of cereal grains and cereal hay. The home grown Merino stud and flock ewes acclimatised to the property are producing high grade wool and fat lambs for 'boutique' butchers.

Ian and Dianne keep detailed records of inputs to their enterprises and have an encyclopaedic knowledge of the success and failures over the years. They believe that landholders must monitor carefully the transitions in their own land and their financial capacity to enact change. They note that there is always good advice out there somewhere but, even when you find it, external input can only help you so far. Ultimately, the farmer is responsible for their own learning and farm development.

The Haggertys also reinforce that farmers must be prepared to try things that may not necessarily work. Ian and Dianne have been involved in trialling many species of perennial pastures, both grasses and shrubs, to extend the 'green grazing window' throughout the prolonged dry summer and autumn period which is typical in Western Australia. To date some introduced species are managing to survive including Rhodes grass (*Chloris gayana*), Gatton panic



Ian Haggerty showing the healthy root development of plants grown in sandy soil

(*Panicum maximum*) and tall wheat grass (*Thinopyrum ponticum*), however the most reliable performers in dry seasons are the saltbush, Rhagodia, native wattle and tagasaste shrubs. Encouraging the right environment for native perennial grasses to flourish in the event of summer rain is a priority

The Prospect Pastoral Company is very much a busy family enterprise and a personal priority. Ian and Dianne work closely together to integrate cropping and grazing with the geography of their operation enabling much opportunity along with a large commitment of time to monitor and manage. Nonetheless, they are always willing to share their knowledge and experience with others, attending field days on a wide range of topics and themes and maintaining involvement with the local Landcare group.



¹ Robyn Tredwell was the Australian Rural Woman of the Year 1995





Innovations for Regenerative Landscape Management: Case studies of regenerative land management in practice

REPORT SUMMARY

The Need for Change

Despite good practices of many of our land managers and farmers linked to some good science, the realities of an increasingly arid and degraded landscape will impact significantly not only on the productivity and viability of agricultural enterprises, but also on the health of our environment and the wellbeing of every Australian.

Landscape degradation is an issue of national and global concern. Landscape management practices including, but not limited to agriculture, forestry and fire have caused significant damage and in the process have altered the earth's natural biosystem. Consequently the precious resources of soil and water necessary to sustain life are being lost at unsustainable rates.

Unprecedented global challenges are arising in the face of this massive degradation of the landscape.

Soil erosion due to traditional agriculture is occurring at a rate between 10 and 100 times faster than the soil's natural formation process (pedogenesis)^{1,2}. Healthy soils are necessary to provide sufficient amounts of food with quality nutrition and fibre to meet global requirements.

Three billion people globally already have inadequate water and sanitation. It is assessed that 80% more water will need to be accessed by 2050 to feed the potential global population of more than nine billion³. Unless all limited soil and fresh water resources are understood and wisely managed, we are at risk of escalating social disruption and regional instability.

Even with its significant land area, Australia is not immune to the consequences of landscape degradation and increasing future needs. The realities of an increasingly arid and degraded landscape are already being experienced across the country. These include:

- increasing acidification, particularly in the south-east;
- declining soil health, caused by the loss of soil organic carbon (SOC);
- erosion;
- severe salinity;
- diminishing river flows;
- high evaporation and runoff rates;
- decreasing availability of groundwater; and
- reduced resilience to impacts of extreme and variable weather events such as drought, flood and fire.

The current state of the Australian natural landscape is further challenged by stresses from our changing climate, unsustainable management practices (such as reliance on high energy inputs), increased mining activity and urban expansion. The national and global challenges being faced are interrelated and can be best met through a comprehensive coordinated approach focused on improved regenerative environmental management practices.

Landscape Regeneration for our Future

The key process drivers for landscape regeneration are **soil**, **water** and **vegetation**. Together in a natural system, supported by a constant flow of solar energy, these provide a regenerative cycle.

By restoring natural systems through improving landscape management practices, we can maximise water use efficiency, improve soil health, nutrient cycling and biodiversity of vegetation. A properly structured soil, with good levels of SOC, allows greater infiltration and retention of rainfall. Every gram of carbon in the soil can retain up to eight grams of water.

Currently, approximately 50% of rainfall on the Australian landscape is lost to evaporation due to poor soil structure and insufficient groundcover. By improving soil structure – particularly carbon – through increasing organic matter in the soil, we will be able to better capture and retain any rain that falls, making it available to plants for longer.

Through revegetation, groundcover is improved, and subsequently so is the quality of the soil, enhancing water infiltration. In turn, improved soil health and efficiency in water use contributes directly to the ability to support a biodiversity of vegetation and species.

If properly supported, this regenerative cycle can continue to sustain and improve the natural resource base and therefore landscape resilience and productivity.

Restoring these natural cycles and becoming more efficient in the use of natural resources is fundamental to the provision of sufficient food, fibre and water for a growing population. Business as usual is neither viable nor sustainable. Effective practical policies and actions are needed now.

Landscape Regeneration in Action

Innovative farmers are using high performance regenerative landscape management methods and fighting the trend of continued degradation of the landscape with its heavy reliance on external inputs. They are demonstrating sustainable, regenerative practices on their land. With relevant policies and incentives these practices could be extended successfully and quickly to involve a significant number of Australia's 135,000 farmers. Whilst there are always opportunities to learn more, enough is already known to take action now.



Soils for Life has documented some of these regenerative practices in 19 case studies across a range of locations and land-use types. Experiences shared by the 17 innovative farmers and two community organisations in the Soils for Life case studies demonstrate successful action being taken to restore the landscape. Due to the interrelated nature of soil, water and vegetation, benefits can be experienced across all process drivers regardless of the particular area of focus.

The Soils for Life case studies describe a range of techniques being used to obtain positive, regenerative outcomes, including:

- Applying organic composts, fertilisers and bioamendments;
- Encouraging natural biological cycles and nutrient transfer;
- Implementing time-controlled planned grazing;
- Using grazing management and animal impact as farm and ecosystem development tools;
- Retaining stubble or performing biological stubble breakdown;
- Constructing interventions in the landscape or waterways to slow or capture the flow of water;
- Fencing off water ways and implementing water reticulation for stock;
- Investing in revegetation;
- Pasture cropping;
- Direct-drill cropping and pasture sowing;
- Changing crop rotations;
- Incorporating green manure or under-sowing of legumes;
- Managing for increasing species diversity;
- Controlling weeds through increased competition by desirable species;
- Reducing or ceasing synthetic chemical inputs; and
- Integrating enterprises.

PRINCIPLES FOR REGENERATIVE LANDSCAPE MANAGEMENT

Our case studies show that many different techniques can be applied to regenerate the landscape. Farmers and land managers commonly tailor a variety of methods to their own landscape and personal preferences. There is no single solution to landscape regeneration.

The following principles consistently emerge as underlying their regenerative practices – regardless of location or enterprise. These can be applied by other landholders as a basis for their own regeneration journey.

- Improve the structure of soil, through enhancing organic matter content
- Use and conserve rain where it falls
- Manage holistically
- Care about the land as a resource
- Commit to education and constant learning
- Search out communities of interest for help and advice
- Work on best land and extend from there
- Strive for maximum groundcover, for the majority of the time
- Manage times of plenty for times of shortage
- Reduce reliance on off-farm inputs
 - Observe, measure and respond

Notes:

- 1 United Nations Environment Program, 2012, UNEP Year Book 2012: Emerging issues in our global environment, http://www.unep.org/yearbook/2012
- 2 Pimentel, D., 2006, 'Soil erosion: A food and environmental threat.' Environment Development and Sustainability, 8, pp119-137
- 3 Barlow, M., 2007, Blue Covenant: The Global Water Crisis and the Coming Battle for the Right to Water, McClelland & Stewart

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Other case studies and the full Soils for Life report are available at: www.soilsforlife.org.au.

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Soils for Life is actively working to change landscape management from the top down and the ground up - but we need your help! Be part of the solution - join in, contribute, share learning with others and change your practices!

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