Mosaic Farming Systems

This is part of an essay on sustainable land management that Bill Hill wrote for his Sustainability course, it was complemented by a mindmap and a powerpoint presentation.

1: Methodology.

The following material briefly outlines the eclectic blend of complementary models that I have adapted to my own system over many years of trial and error.

1.1: Natural step methodology

Refer to my Natural Step Methodology, "So you want to be a farmer".

1.2 Philosophy & Connection.

Our vision: We will run our grazing enterprise in an economically viable, ecologically responsible manner, respecting and enhancing biodiversity.
By using regenerative management practices we will work in harmony with nature achieve a productive, happy and rewarding lifestyle.

1.3: Holistic Management

The principles outlined in Alan Savory's Holistic Management [1] form the basis of my grazing management and decision making process.
His approach considers humans, their economies and the environment as inseperable and interdependent.
At the heart of this approach lies a simple feed-back testing loop that allows people to simultaneously consider economic, social and environmental goals in both the short and long term.

1.4: Keyline Farming

P.A.Yoeman's [2] developed a landscape architectural process that is based on land shape and water movement through that landscape.
All agricultural land is contained in watersheds of various sizes.
These start in primary valleys that then flow into larger secondary valleys and then into creeks and rivers.

Understanding and using these principles he designed systems to capture the water high in the landscape and use, and reuse it through a network of interconnected dams and irrigation systems.
His ability to lift water out of the "valleys" and onto the ridges through pattern plowing made his concept groundbreaking.
His work on pattern (contour) plowing that caught and stored water in the soil profile while increasing the fertility by working the soil with chisel ploughs employing non-inversion techniques.

Later he designed a deep ripping plough called a "Slipper Imp" with a variety of specially designed earth engaging digging points.
He proved that by "keyline plowing" to just below the topsoil [3], over several seasons he could increase the depth, fertility and water holding capacity of the soil remarkably quickly.
He also planted trees on the contour to enhance the natural beauty and

biodiversity within the grazing system.
His keyline process developed a farming system designed to work in harmony with our ancient soil and variable climate.

1.5: Permaculture
David Holmgren [4] in his book Permaculture, Principles & Pathways Beyond Sustainability [5], says permaculture is about values and visions, and design systems of management that are based on holistic understanding, especially on our bio-ecological and psychosocial knowledge and wisdom.
These deceptively simple designs mimic nature and reinforce the mutualistic relationships and high biodiversity within sustainable ecosystems.
Permaculture gives priority to using existing wealth and energy to rebuild our natural capital.
It emphasises bottom up "redesign" processes starting with individuals and household as drivers for change at the market, community and cultural level.
Permaculture sees pre- industrial sustainable societies as providing models that reflect the more general system design principles observable in nature, and relevant to post industrial systems.

1.6: Balanced soil, Fertilizer Strategies
Soil balance is necessary for sustainable agriculture.
Dr William Albrecht (1888-1974) was a professor of Soils at Missouri University in the USA.
As a biological scientist, he proved that nutrition was correlated to disease, not only in the soil but also in the plants.
He recognized and taught that soil chemistry and nutrition were directly tied to biology.
Balancing the soil is the key to productivity.
A balanced soil will have a calcium , magnesium ratio of 7:1 and a phosphorous, potassium ratio of 2:1 when soil exhibits a pH of 6.5.
Independent soil testing is necessary to establish nutrient soil levels to establish soil nutrient levels and ascertain what elements and trace minerals and in what quantities are necessary to balance the soil over time.
Soil aeration enhances plant growth buy allowing air and water move freely through the soil profile.
Relieving soil compaction is one of the most effective methods for boosting soil health and productivity, and enhanced water holding capacity.
Fertilizer inputs should be tailored to suit individual soils and can be energetically matched [6] to maximize crop and pasture production.

1.7: Ecological indicators.
Ecological indicators including biological state; water and mineral cycles and energy flow, allow us to understand where we are in relation to our goal of sustainable land use.
Soil that is in a good biological state has high organic matter and vigorous, high density plants with extensive root systems with a broad distribution of plants, animals, insects and soil biota.
The key to a good water cycle is the good management of the topsoil.
This includes good ground cover and litter on a permeable, well aerated soil, combined with high successional, deep-rooted perennial grasses.

These perennials should be capable of efficient, year round, water use and provided with adequate rest and a well-managed rotational grazing system will provide a hydrological system in balance.
A good mineral cycle is indicated by a rapid turnover of a high volume of litter, minimum runoff and wind blow, deep cycling of minerals, rapid break down of dung and healthy root systems on grazed plants, stable mulch and a porous soil rich in organic material.
Man and animals only survive on the photosynthetic energy in excess of the plant's requirements.
Good energy flow requires a high proportion of broad-leafed grasses, high plant density with a vigorous root system in a permeable, well aerated soil.

1.8: Land use capability, High, medium & low input systems
Land use balance is based on soil types, aspect, fertility and rainfall.
High input, high production country includes irrigation and creek flats to undulating country, with fertile well-drained soil, sown with highly productive perennial grasses, clover and high value crops.
High rates of fertilizer are applied to maximize productivity.
Generally used for cattle finishing and prime lambs.
Medium input country has a variety of native and exotic perennials and clover, generally undulating to hilly country of good soil.
Fertilizer rates are more moderate, with less cultivation and resowing of pasture.
This country is used predominantly for sheep breeding and wool production.
Low input country is the more fragile high rocky knolls and degraded gullies and low lying, wet and salt affected land.
This land is fenced, revegetated and managed discretely. Stock may be grazed occasionally, perhaps twice a year.

1.9: Grazing management system.
Rotationally grazing large mobs of stock through small paddocks for a short time, allows enhanced animal production and long rest periods for pasture between grazing. Rotational grazing has the ability to grow more, better quality feed because the grass is evenly grazed and adequately rested. Animal health and welfare are a bonus in this system.

1.10: Sharing knowledge & experience, life long learning
We have been very fortunate in having generous mentors in our search for a more sustainable farming system and now have the pleasure of sharing our experiences, knowledge and considerable networks with fellow travelers.

2: Production Systems

2.1: Fine Wool
For the last four years we have been sourcing our merino rams from Greenland Merino Stud, from Nimmitabel on the Monaro, New South Wales.
This challenging environment produces hardy, "good doing" sheep.
The studmaster really bends the production curve by producing big framed, heavy cutting, fine-woolled sheep that are highly fertile.

Fine wool growing has been a major part of our production system for fifty years.

2.2: Merino sheep, Self-replacing.
We strive for high lambing rates that we can put greater selection pressure on our replacement ewes coming into the fine wool breeding flock.
The ewe are joined to lamb in mid August, the lambs are marked before the end of September [7] and weaned generally by mid- December.
We generally wean them into Debbie's trees [8] and then move them into fresh paddocks that have been saved for them.
Some supplementary feeding is usually necessary to get them through until the autumn break. We choose to use high protein pellets for this supplementary feeding.

2.3: Prime lambs
Ewes that are surplus to our requirements for fine wool breeders can be joined to terminal sires.
We choose to use White Suffolk rams as terminal sires.
The ewes are joined to lamb about a month earlier than the merino lambs.
Early spring lambing enables us to successfully manage the spring flush of grass and get the lambs off before around New Year.
The lambs sell well to both butchers and store buyers who shear and grow them on to higher weights to sell in the autumn and winter.

2.4: Angus cattle, self-replacing
We run a heard of self replacing Angus cattle.
They are calved in the early spring to take advantage of our abundant spring growth (match the peak feed and to the animals peak need, which corresponds to the cows peak lactation.)
Angus cattle are very sought after and although we choose to sell our calves as weaners (8-10) months old, they can be sold at all weights in either prime or store condition, depending on seasonal conditions and market requirements.

2.5: Backgrounding Steers, feedlot
Although we choose to breed our own replacements, we have investigated the possibility to buy in young cattle and "background" (grow out to a required weight) for the feedlots to finish on grain for the supermarket trade.
The more flexibility that is built into the system the more resilient it can be.
With three breeding enterprises we can become vulnerable in a drought situation, having to hand feed too many animals.

2.6: Pasture cropping
Pasture cropping [9] is a concept developed by farmers in the central west of new South Wales.
The technique of pasture cropping, involves sowing cool season annual crops into dormant, warm season perennial grasses.
By using large numbers of sheep as weed controllers prior to the direct drilling of the crop, chemical can be substantially reduced.
As the groundcover of native grass increases chemical use can probably be

eliminated.
The pasture cropping technique improves the diversity of native pastures, the soil is improved and retains 100% ground cover 100% of the time.
As soon as the crop is harvested the sheep can be put into the paddock that has an abundance of fresh green grass growing happily amongst the stubble.
The crop yields are more than comparable to the district average and if the crop fails, the extra feed is a very welcome addition to the grazing enterprise.
Although this technique is not as suitable for our area as we have more winter dominant native grasses, it has a lot to recommend it and hopefully techniques can be modified to our conditions.
Complementing grass hay paddocks with cereals for more winter feed and better hay and silage crops in the spring time, is a definitely an option.

2.7: Alley farming
Alley farming is generally used in a broadacre cropping system to create rows of trees between areas of crop.
This modifies wind and creates biodiversity within a system which would otherwise be a monoculture.
There is a place for a type of alley farming in grazing systems. In particular it could be used in saline areas, where direct seeded saltbush, and other salt tolerant fodder trees could be sown amongst pasture for browse to complement a rotational or pulse grazing system.

2.8: Mosaics
Mosaics create patchiness and biodiversity by planting trees and understory within the landscape providing multiple benefits including livestock protection, aesthetic appeal and enhancing the value of the real estate.

2.9: Agroforestry
We have been actively planting trees for over twenty years with grants from landcare and land protection incentive scheme.
In 1994 we were involved in an agroforestry trial. As a result we planted spotted gum (eucalyptus maculata) as shade, shelter and a future timber crop.
We also have a small area of pruned pine trees (pinus radiata).
We have began to form prune trees that have potential for furniture timber, even though they were originally not put in with that intention.

3: Income

3.1: Production
As graziers, we run sheep and cattle. From the sheep, our main income is derived from wool, store sheep and cast for age ewes and wethers, mutton and prime lambs.
The cattle are sold into various markets including weaner, store and prime cattle, for both the local and export trade.
We also have some agroforestry that ius being silverculturally manged for timber production.

3.2: Services
In the future we will be able to trade carbon credits and be rewarded for maintaining biodiversity and enhancing the production of ecosystem services from our farming system.
Perhaps this will include some of the off site benefits such as better air and water quality.

3.3: Real estate benefits
The design and implementation of a mosaic farming system not only enhances biodiversity and natural habitat, it encourages flora and fauna, and has a significant positive effect on the sale price of the land if it is sold.
Estimates of between 10-15% above similar district land that is farmed traditionally is not an unrealistic expectation.

3.4: Off farm Income
Some off farm income is necessary to smooth out seasonal and commodity price fluctuations and to create an asset off the farm to allow for intergenerational transfer of the land.
City real estate and shares are useful vehicles for investment off the farm.

4: Frog Hollow.

4.1: Practical model
We have been actively using and refining landcare principles on our property and in our farming system for more than 20 years.
Frog Hollow is one of the most recent opportunities to use our collective knowledge and skills to rehabilitate a degraded drainage line and the surrounding area on Broom Hills.
We called this area Frog Hollow, to celebrate the return of frogs to this paddock.
With Frog Hollow rehabilitated we now have fenced and revegetated , the entire sub-catchment and drainage line, from the hill to the main road.

4.2: Control without being Controlling
We try to use the principles of biomimicry and work with nature to repair the environmental damage for which we have been partly responsible.
It never ceases to amaze us how nature regenerates itself with some well directed energy from us in the form of fencing, spraying, ripping, aerating, mounding, direct seeding, resting, waiting and then managing the area discretely.

4.3: Land Protection Incentive Scheme
With a plan and some "seeding" funds from LPIS and Landcare we were assisted with our revegetation and rehabilitation work and the mosaic design of our farming system.

4.4: Solar electric fencing
The solar powered electric fencing has made the implementation of cell grazing and the fencing off of degraded areas to be managed discretely

economically and physically possible.
Effective electric fencing has proven to be a cheaper and more efficient method of controlling livestock.
It forms a psychological; rather than physical barrier and allows us to have many more paddock than if we used traditional fencing.

4.5: Solar water pumping
Although not fully operational yet, the solar powered water system to deliver water to troughs for the animals, will be a tremendous asset.
Although the farm is adequately watered through dams it will enhance both livestock health and productivity with a reticulated trough system.
Animal performance can be enhanced by 20% using troughs to water livestock

4.6: Direct seeding
Direct seeding trees and understory has been a real boon to our revegetation strategy and allowed us to experiment with our mosaic planting system.
Using up to 20 species of trees and understory plants considerable areas can be quickly and effectively sown.
Timeliness and adequate preparation are the keys to successful establishment.

4.7: Regeneration
Natural regeneration occurs to compliment our revegetation strategies and nature puts back what will survive and thrive in a particular area.
Using local provenance, especially adapted to our unique environment.

4.8: Discrete management
We do not subscribe to the "shut it up and leave it alone" conservation system, we aim to use active adaptive management strategies to deliver ecologically sustainable and economically viable outcomes.
We find that although the low input areas are managed mainly for their environmental benefits; they deliver useful strategic grazing, to wean lambs into, in drought times or just a quick graze to spin out a rotation.

4.9: Water quality
One of the most significant spin offs of fencing off dams and waterways and implementing rotational grazing, is that water quality has improved dramatically and sediment and nutrient loss has been substantially reduced.

4.10: Nutrient traps
The revegetation of degraded areas with grass, trees and understory has provided an environmnent to trap and rebuild soil and grass cover in severely degraded drainage lines.

4.11: Flora & fauna habitat
One of the most rewarding parts of mosaic design is the interconnectivity that it provides for the safe and easy passage of both native birds and animals.
We are encouraged and rewarded by mother-nature as she shares her bounty and beauty with us.

The quantity and variety of birds and animals that inhabit Broom hills continues to grow each year.

4.12: Shade, shelter, refuge & safety
We would not be able to lamb and calve so confidently in early spring without adequate shelter for our new calves and lambs in the colder days that occur periodically at this time of year. Shade in the hot weather is of equal importance.
We have saved many lambs and sheep as a result of these strategic areas that provide protection during extreme weather conditions.

4.13: Remediation not triage
Environmental degradation does not generally happen quickly, except of course as a result of wildfire or flood.
During drought stock should be confined in specially prepared sacrifice areas where feed, shade and water are provided until the drought is over.
Degraded areas, such as saline seeps and scalds should be fenced, rehabilitated, revegetated, rested and strategically grazed.
Riperian zones can also be fenced, revegetated and strategically grazed.
Woodlots can be strategically established for shade, shelter, timber production and firewood.

4.14: Nature votes
The real "payoff" of mosaic farming is the way nature returns and enhances the work that we have done. It never ceases to amaze us as to what happens when we "try" to rehabilitate fragile and degraded areas.
We learn so much from mother-nature and are in awe of her ability to regenerate.
We now actively employ the methodology of biomimicry to be more successful in our endeavour to work in harmony with nature.

4.15: Aesthetics
Aesthetics are an intrinsic part of land care, a regenerated, vibrant, healthy ecosystem that is productive, sustainable and multiuse is a delightful and rewarding environment in which to live and work.
There are hard nosed benefits to aesthetics, they add substantial real estate value to the land.

4.16: You get what you manage for!
Whether we actively or passively manage a system, we get what we manage for! So if we don't like what we have we should stop doing what we are doing and use biomimicry, adaptive management and seek better more effective ways to work in harmony with nature.

Footnotes
1 Allan Savory, Holistic Management (2nd edition, Island Press 1988)
2 P. A. Yoeman's (The Challenge of the Landscape, 1958, Keyline Publishing, Sydney, Australia).
3 into the clay subsoil
4 co-founder of Permaculture with Bill Mollison

5 Permaculture, Principles & Pathways Beyond Sustainability (Holmgren Design Services, 2002)
6 Using Radionic instruments, also known as electronic scanners. See Arden B Anderson,
Science in agriculture, (Chapter 23) Acres USA 2000
7 Lambs recover quickly, before the blowfly season begins
8 Debbie's trees is a small, well fenced area adjacent the sheep yards that allow the lambs to settle down in a protected environment, where they have ready access to good grass, shade, shelter and water.