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Managing landscape diversity on a whole farm basis

Robert Lance

"Stillwater", Yarra, via Goulburn NSW 2580

Abstract: This paper documents changing landuse on our property, and how planning has altered over time to cope with this. Since we have owned the property, we have gradually recognised that managing landscape diversity is an essential part of sustainable land management. "Stillwater" is being developed according to the principles of land capability, aspect, land contour and the location of remnant vegetation and, where possible, paddocks are linked by laneways. Development strategies and priorities for different areas are based on land capability. This has been a challenging exercise, but by taking a fresh look at the landscape and recognising its limitations and opportunities and planning accordingly, we believe we are becoming more sustainable and profitable.

Our new home was in the flatter, more lightly timbered country. Its situation near to schools and railways and town had advantages, but I never forgave it for its inferiority....Its first sight filled me with a sense of desolation....Mother named the place Stillwater. So wrote Australian author Miles Franklin about her arrival at Stillwater in the early 1890s. Clearly she was less than impressed with the landscape.

"Stillwater" is now our family farm, located 25 km south of Goulburn on the Federal Highway. We have owned it since 1983. It covers 521 hectares and the country is variable with major drainage lines on either side of a central hill that reaches around 800 m above sea level. Soils are derived from Ordovician sediments laid down around 400 million years ago. They are fragile and typically infertile podsolic or solodic sandy loams. They are acidic and subject to water logging in winter. We have small areas of alluvial soils on our creek flats.

The climate is temperate, with frosts occurring from March to October. Total rainfall averages around 725 mm per year, uniformly spread throughout the year, with winter and spring being the most reliable seasons. Autumn rainfall is notoriously unreliable and is a major weakness in our production system. Reliable breaks usually don't occur until late May, by which time it is too cold for significant growth. Autumn-winter feeding is usually essential for even moderate productivity. Ideally we run around 2500 medium wool merinos and 120 head of Murray Grey cattle.

History

"Stillwater" and its surrounds were first cleared in the 1830s, and the area always appears to have been owned by small landholders. The creek flats were probably cleared first and, if early records from an adjoining property are any guide, these farms were mixed livestock farms, running milking cows, a few sheep and beef cattle. Certainly by the1880s when the Franklins arrived, dairying was the principal activity, and a dairy factory was located a few miles away. The flats were intensively managed. They were broken into numerous small paddocks which appear to have been cultivated with a mouldboard plough. The outlines of the old paddocks still become visible during drought periods. In general they appear to fit the landscape remarkably well.

In the early 1900s disaster struck. A prolonged drought forced the closure of the dairy factory. The Franklins were forced to sell out to a neighbour and the principal enterprise changed from cattle to sheep. The old homestead was pulled down to build a shearing shed, and farm layout changed dramatically. Small paddocks centred on creek flats gave way to extensive paddocks that took little account of the landscape. Creek flats were amalgamated with hill paddocks and one can imagine that the grazing pattern lead to overgrazing of the hills and undergrazing of the flats. Paddock sizes ranged from 40 to 60 hectares. This layout persisted until 1950 when a change of ownership brought about more sensitive subdivision.

Appreciating Diversity

Shortly after our arrival at "Stillwater" in 1983, I approached the then Soil Conservation Service to draw up a farm plan. This consisted of a plan of recommended soil conservation measures and a land capability classification of the property (Table 1).

Upon receiving the report I was somewhat disil-

Table 1. NSW Department of Land and Water Conservation land capability classifications.

Class 1	Excellent cropping country. Deep fertile soils, well drained and well structured. No special soil conservation works necessary.
Class 2	Very good cropping country. Slopes up to 5%. Soil erosion and structural decline controlled by strip cropping conservation tillage and crop rotations.
Class 3	Sloping cropping country. Slopes up to 10%. Requires earthworks to prevent sheet and rill erosion.
Class 4	Grazing land. Not suited to regular cropping due to coarse texture, slopes up to 25% or rock. Suited to direct drilled crops or pastures.
Class 5	Grazing land similar to class 4, but requiring more careful management due to slope, erodible soils or past inadequate erosion control.
Class 6	Grazing land that must not be cultivated due to shallow infertile soils, waterlogging, salinity, slope, wind or water erosion hazard or rock.

lusioned. Like a famous predecessor, I became somewhat conscious of the "inferiority of the place." But land capability highlights the possibilities as well as the deficiencies. Over the next few years, I found these classifications more and more useful as they changed the way I looked at the landscape. Soon I was starting to see more than the Soil Conservation map indicated (Figure1). I wanted more categories based on slope, aspect, soil variability, tree cover and shelter. In essence, I was starting to appreciate the diversity of the place. Why did it take so long?

Australian farmers are well aware of some forms of diversity. We prepare for diversity in seasons by storing grain and fodder. We know there is diversity in the prices we receive and we are being forced into forward marketing strategies to minimise their impact. Also, we are encouraged to run a diverse range of enterprises wherever possible. We can often pick the difference between cropping and grazing land, but beyond that it is easy to be oblivious to the potential and the limitations our land might have. Too often, light grazing land (Class 5 and 6) has been regularly cropped or "improved" with exotic species beyond its capability, with the result that the species soon die out and the useful native species that were present are severely depleted and replaced by annuals. The end result is accelerated rates of acidification, salinity and erosion.

Strategies

Having started to appreciate the benefits of land capability analysis, we got down to the business of planning. A central aim seemed to stand out. It seemed logical that we should try to use the land to the maximum of its capacity. A motherhood statement perhaps, but much easier said than done in our environment. I would like to say that I followed an ordered set of principles in this whole process. Unfortunately I didn't but, over time, the more I looked the more I saw, and a set of principles began to emerge.

The arrival of foot rot in 1984 and a fencing system in an advanced state of decrepitude meant that we had to seriously rethink our fencing systems and

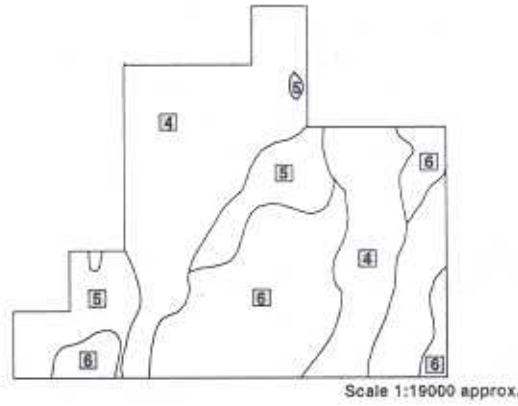

Figure 1: "Stillwater" - Land capability

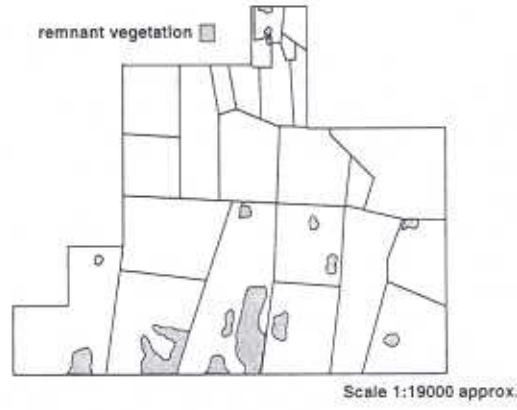

Figure 2: "Stillwater" - Farm layout 1978.

get serious about our planning. The existing layout was not ideal for stock movement and tended to be imposed on the landscape rather than reflecting it (Figure 2).

Land Capability

We have tried to sub-divide the property according to land capability. This has been a long and difficult process, particularly as I was still seeing every thing in squares and rectangles. We hope to have the property fully refenced by 2003 roughly according to this principle.

Aspect

Land of a similar land capability may vary considerably in aspect. This has significant implications for farm planning and productivity. Northern slopes tend to be warmer in winter and may start to grow earlier in spring than other aspects. Southern slopes may stay greener longer into summer. Eastern slopes are naturally more sheltered and western slopes are drier and more exposed. Subdividing land to take aspect into account seemed sensible.

Contours

Seeing contours occurred rather late in my planning experience, but I now believe that they are essential to recognising diversity on a farm scale. Land capability frequently changes on the contour or on the break of slope. Unfortunately this means that if you are trying to fence to land capability, fence lines will rarely be straight. This means a lot of strainers and increased costs. We have found the switch to electric fencing and pipe strainers have made break of slope or contour fencing more feasible. A contractor should be able to drive a pipe strainer for around $6.00. When we run fence lines down slope we try to run them down ridgelines to minimise the erosion risk. We have plenty of evidence to show that running fences down hill on our light country can cause erosion.

Laneways

Laneways seemed to be an essential part of the ideal farm plan, and we went for them. In keeping with maximum efficiency I felt they should cover the shortest distance between two points. I was wrong. Laneways need to follow the same principles as fencing - follow contours, breaks of slope or ridgelines. If I had realised this principle 10 years ago, I would have saved a lot of time and money in refencing.

Remnant vegetation

Maintaining and enhancing remnant vegetation has been a very high priority on "Stillwater". Unfortunately it tends to complicate the whole planning process. Such vegetation seems to occur in the most inconvenient places, and totally ignores my high minded planning principles. With much thought we have now just about resolved how to incorporate such areas into our plan. We have looked at each remnant in conjunction with its surrounding land capability, and the end result is that we are setting aside much larger areas for regeneration than we would have ever considered early in our planning process.

Common sense

This is probably the most essential ingredient in planning for and managing diversity. Any development plan must be functional and affordable. In recent years we have had to work through the frustration of being excited about a planned development, but not being able to afford it. The best that can be said is that periods of poor profitability have

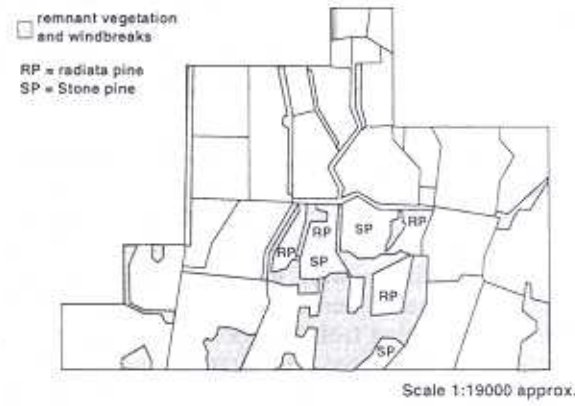

Figure 3: "Stillwater" - Proposed farm layout 2003.

given us an opportunity to refine our plans so that, hopefully, when we do undertake a development project, we make fewer mistakes. The end result is a farm plan that is reasonably flexible and reflects the diversity of the landscapes which confront us (Figure 3).

Management implications

I believe the management implications for this approach to planning have been significant. The key outcome is a move to more appropriate landuse and a more logical development sequence. Using the Soil Conservation land classification system (Table 1), the way we see our management priorities is as follows:

Class 4 country

This is our true "grassland" and our top priority for development. It is not cropping country, because of structural and profile limitations, but it is capable of moderate and possibly high productivity if well managed. Significantly, it is the land that is most likely to have an "autumn". If there is rain about, it will respond and hold on longer than other land classes. On this country we work through a full development program, starting with superfine lime or an equivalent product, followed by spray topping with glyphosate and direct seeding with sub and white clover, cocksfoot, fescue, ryegrass and, occasionally, phalaris. These pastures are usually fertilised annually with 125 kg/ha of single super. Because of its more reliable autumn starts, this country lends itself to block grazing in late autumn and winter, which enables us to budget our winter feed.

Class 5 country

Pasture development on this country now remains a lower priority. I have learned this the hard way. The first paddock I attempted to improve on "Stillwater" fitted into the Class 5 and 6 categories. I limed it, worked it up and sowed a pasture. It failed. Five years later I spray topped it with glyphosate, sprayed again the following autumn and

direct drilled it with cocksfoot, phalaris, rye grass and subclover. Now, five years further on, it is showing signs of thinning. With each sowing taking at least six years to recover costs, the exercise was not exactly profitable.

Where areas of Class 5 country do need to be redeveloped, largely due to the invasion of annual grasses such as vulpia and soft brome or serrated tussock, we modify our approach slightly. We endeavour to achieve what might be called "non destructive pasture enhancement". This simply involves switching from glyphosate as our principal herbicide to Sprayseed® or Gramoxone®. Work by Mike Keys and Peter Simpson in the late 1980s showed that our key native perennial grasses (*Danthonia* spp. and *Microlaena stipoides*) were tolerant of these herbicides at the rates we were using. This meant that they could be used to remove competitive annual grasses whilst keeping valuable acid tolerant native species. The end result seems to be a good balance between native and exotic pasture species, at least in the short term. We have now given up on phalaris on most of our Class 4 and all our Class 5 land. Even after liming on this light acid country, the more acid tolerant variety Holdfast is easily smothered by cocksfoot.

Class 6 country

This land class presents a special challenge. I believe its carrying capacity ranges from 2 to 5 dse per hectare at the maximum, depending on the paddock. However, even at these modest rates, some degradation is probably occurring, particularly during dry summers and autumns. On current returns, pasture development is out of the question, and serrated tussock lurks in the wings awaiting a moment's inattention.

This land class is frequently on ridgelines that may be part of recharge areas for lower slopes. Originally, most of this land was covered by forest or woodland, and I believe that remains the most appropriate land use. The challenge is to how achieve this in a manner that will be profitable at least in the long term. We have adopted three approaches at "Stillwater":

- Where there is existing remnant timber, we are fencing it out and linking it to other remnants via vegetation (and hopefully wildlife) corridors.
- We are planting the increasingly ubiquitous radiata pine. It has many advantages. The growing strategies have been well documented; markets appear assured for well managed crops; pines tolerate and enhance acid soils over the course of a rotation; there is sound management advice available and; they are far more profitable than the existing grazing alternatives. ACT Forests data predict annual net returns of around $497 per ha based on 1998 prices (ACT Forests 1998). This compares with a gross margin of $11 per dse for merino wethers. We hope to have 20 ha planted by July 2000, and we believe that the lost carrying capacity can be sustainably compensated for by increasing the carrying capacity of our Class 4 and 5 country.
- In areas where we wish to retain some grazing (or a view), we are experimenting with Stone pines (*Pinus pinea*) as a source of edible pine nuts. These trees are deep rooted, acid and drought tolerant, but have little potential as a horticultural crop because of the low yields per tree and the 8-9 years before they commence bearing. However, as a multi-use agroforestry species they may have considerable potential. They have the ability to lower water tables, provide shade and shelter for livestock and, because of their deep rooted nature, they allow grass to grow right to the base of the trunk. In addition, with a potential yield of 5-15 kg per tree (Hart and Newcombe 1998) at around $10 per kilogram, they have the potential to provide a more sustainable source of income in conjunction with grazing on light hill country. Lester Snare (pers. com. NSW Agriculture 1997) suggests that stone pines may make an excellent and productive shelter crop for hazelnuts, which opens up other possibilities. I certainly can see no reason why, given time, they cannot be incorporated into our more productive Class 4 and 5 grazing country as an agroforestry crop.

Conclusions

The planning process at "Stillwater" has been a challenging exercise. It has meant taking a fresh look at the landscape and trying to recognise the limitations and the opportunities that it has to offer, and then trying to develop the property accordingly. It is an ongoing process, not a one off exercise.

The more I reflect on our planning, the more I feel it has highlighted the opportunities rather than the limitations. For too long we have had an oversimplified view of the productive potential of a grazing property. Graziers might have either consciously or subconsciously broken their country into heavy grazing and light grazing but, in doing so, we asked too much of our lighter country and not enough of our heavier country. In both cases it is a recipe for degradation through acidification, salinity and erosion. By recognising diversity and changing our management practices accordingly, we can take positive steps towards greater sustainability and profitability.

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