Notes for the **Regrarians Advanced Design** course run by Darren Doherty, Bendigo, Victoria, May 2014. By Byron Joel.

The Regrarian Charter:
"Our primary responsibility is to the regenerative enhancement of the biosphere's ecosystem processes. Our secondary responsibility is to provide the potential for people to be informed about the regenerative economy, whether it involves their work in agriculture, land management, corporate life, domestic services, manufacturing or other activities that are within the reasonable domain of humans…"

In May of this year, 2014, I had the fortune of sitting the Regrarian's Regenerative Agriculture Design(R.A.D) course run by internationally recognised teacher, designer and practitioner Darren Doherty outside of Bendigo, Victoria.

Darren Doherty has spent over twenty years assimilating theory and practice from within conventional Agriculture, Permaculture, Holistic Management(H.M), Keyline, Biodynamics, Natural Sequence Farming and more. He has travelled the world as a designer, consultant and implementer of Regenerative Agricultural systems, forever assimilating applicable study and practice and tweaking his design methods. The results of which he offers as his Regrarian Platform(R.P), the ten point design template based on P.A Yeomans' 'Scale of Permanence'. It was this R.P that formed the basis of the course curriculum. Each of the ten days focussing on one of the ten points in sequence.

As with P.A Yeomans' Scale of Permanence, the R.P addresses the *least* easily human manipulated phenomena(or most permanent) to the *most* easily human manipulated phenomena(or least permanent) in sequential order when approaching farm design. This may sound like an abstraction but is in fact an invaluable tool for directing the flow of decision making upon design elements. For instance take the third node in the platform, Water; it holds far greater priority in the functioning of all aspects of day to day, season to season farm process than say... Fencing, the seventh node and their relative places within the platform are located accordingly. By using the R.P(coupled with all we may have gleaned from conventional Agriculture, Permaculture, H.M, Keyline etc.) we can feel confident that in reflecting the realities of the project's greater context our resulting design will be as robust, resilient, smooth flowing as possible.

Darren Doherty has long stressed his choice of the word Regenerative over Sustainable. For a start, the latter has been so over used as to render it almost meaningless, but by very definition it is a mediocre end goal. To be sustainable means a system can run in perpetuity but only breaking even. Energy out is equal to energy in. Net gain just covers expenses. In essence it is like treading water. You can keep doing it, but you aren't going to get anywhere. Regenerative however is a step further up on the ladder of life. It describes a system that not only sustains itself but appreciates with every cycle. It *agrades* rather than *degrades*. This is perfectly possible in a world perpetually injected with a powerful, free source of energy in the form of of Sun light and is in fact self evident in the diverse fecundity of the natural world. This is the type of system thinking fostered by the Regrarian Model.

Please remember that these notes represent those particular points that felt most relevant to me at that stage of my growth and learning. As a result there were many points from the course that were omitted. These notes are not intended to represent the full breadth and depth of the RAD curriculum or the Regrarian Platform. The following is my point by point exploration of the R.P as applied in the design of an agricultural property.

1. CLIMATE

The Climate is the broadest and least easily effect able of the variables of design and as such is our first consideration. A number of the platform's sections hold a dual or even treble application. Climate refers not only to the *Atmospheric* or *Meteorological* climate of the region but also the climate of the *Clients* particular context and the *Legal* climate pertaining to the proposed project. In the R.P the Legal and Client context are defined as climatic due to their relative permanence. Often our personal and cultural positions and habits are the most difficult to alter and as a result they represent a relatively permanent constant in our designs.

Upon beginning our design process we start by investigating the...
Meteorological Climate

- Research the **Meteorological climate** of the greater region and the project site.
    1. Precipitation patterns
    2. Seasonal temperature. Highs, lows, averages etc.
    3. Fire history
    4. Wind directions
    5. Extreme events in regional history: floods, droughts etc.
    6. Brittle rating
    7. Frosts
    8. Growing days etc.
- Keenly observe what plants(crops, ornamental) grow in the area, especially those with no apparent signs of cultivation(roadside weeds, abandoned lots, oldfield etc.). This will give one a keen appreciation for local atmospheric climatic conditions especially with practice.
- Enquire into local/regional agricultural enterprises current and past.

Mental Climate/Client Context

- Beyond just the Meteorological Climate one explores the **Mental Climate** of the client and their personal C**ontext** which includes relevant experience, budget, available resources, support network, time availability, desired outcome, likes/dislikes etc. This section draws heavily on the Holistic Management tool of establishing one's Holistic Context as a greater, visionary roadmap or set of parameters in which we make further decisions. For example, say the client was a veterinary doctor and animal welfare was of the highest importance to them, then that would be described in their Holistic Context and all decisions regarding livestock would be made from an absolute best practice position.
- Always come back to the established context to stop from getting to grandiose. Our job is not to create the full Permaculture ideal with all the bells and whistles(that is rarely ever possible anyway due to lack of funds, experience, poor people systems etc.). Our job is to remain loyal to the TRUE ACCOUNTING(triple bottom line) established in the context. Get to know the clients context as deeply as they will allow.
- It's easier to break the ice with a new client via an online introductory consultation.

Holistic Management practices are ideal for establishing and clarifying the climate of the client.
Define the Whole Under Management

What is the enterprise being managed? Who is involved? What are it's resources?

1. Decision makers: Anyone with veto power over decisions regarding to management of the whole i.e. Business partners, spouse, key employees, children etc(all must be involved in creating the Holistic Context and signed in).
2. Resource Base: Anything you have access to that can/does assist you in achieving your goal i.e. relevant qualifications, skills, relationships, support network, vehicles, warehouse/storage space, land, tools, machinery etc. Include things you can borrow and keep in mind the Eight Forms of Capital.
3. Money: Cash in hand, cash in the bank, access to credit etc.

Articulating an Holistic Context

1. Statement of Purpose: Succinctly capture what the whole was formed to do and why. Ie Oak Tree Designs SOP is "To assist in the creation of abundant, resilient and beautiful landscapes and human settlements through design, implementation and education.". This does not need to be shared publicly but acts as a reminder, a 'true north' to guide decision making.
2. Quality of Life Statement: Things that the decision makers want to be true of the whole that they manage i.e. quality relationships, challenge and growth, purpose and contribution, economic wellbeing etc. Use present tense, positive language. Ie 'Our relationships are honest, fulfilling and deep.'
3. Forms of Production: What you need to produce in order to create the quality of life that has been described. You only need to describe *what* needs producing not *how(*the how is a decision that will need testing in a later process). Ie Profit from meaningful work, work or leisure time of XYZ nature, time for learning, meaningful decision, companionship, exercise, a warm, hospitable home environment etc.

This allows for a clear and focussed context to assist all involved parties in directing the enterprise.

Legal Climate

- Clarify the exact zoning of the titles involved. Be clear on definitions within Zoning documentation.
- Familiarise oneself with the local Health/Safety, Environmental and Planning schemes and framework bureaucracies
- Seek permission in documentation.
- Investigate what insurance you may need as a consultant i.e. Public Liability(standard), Professional Indemnity(optional).
- Have a well written, legally watertight disclaimer visible on all contracts.
- If need be then outsource any work which is high risk and/or legitimately beyond your scope of expertise i.e. Geotech.
- Consider a Planning budget within greater budget if it is a sizeable chore.
- Environmental/Health law: Note both private and Govt. bodies. EPA are interested in pollution potential.

2. **GEOGRAPHY**

Like Climate, Geography has multiple applications.

Geology

- The Geology of the area and site are made familiar including the landforms, topography, a brief overview of soils in the region and all things geological.
- What are the common landform patterns? Foothills, Coastal Plain, Desert Plateau etc.

- A firm grasp of geography and terminology as it applies to Keyline Design is highly valuable i.e. Primary, Main and Secondary Ridges, Crests, Valleys, Saddles, Primary Land Units, Keypoints, Point of Inflection etc.
- An understanding of basic Geomorphology is valuable. Research the processes effecting the landscape i.e. Fluvial, Aeolian, Hillslope, Glacial, Tectonic, Igneous and even Biological processes and there effects on the geo-history of the region.
- In steep V shaped valleys of high rainfall areas i.e. Nth NSW, the productive land is on the ridges while the valleys are fenced off and wooded.
- Saddles are the highest possible catchment dam.
- Primary Land Unit: Mini catchment area between the larger ridge at the top, the creek at the bottom and the two smaller ridges at either side.

Regional Culture

- In this platform Geography also refers to the regional culture, demography, psychography and history of the area to gain greater clarity on potential markets, supply/demand, taboos, character and culture at large.

3. WATER

"You have to be Blue before you can be Green or Black".

"Our ultimate goal is to allow all species and functions to express their full potential. The role of the farmer is to produce the most organic matter possible; Water is the key." – Darren Doherty

Water as it relates to human settlement; storage, harvesting and reticulation.

Note: Water, Access and Fencing are so integrated that they are best designed with each other in mind.

Dams

- Survey the site. Calculate how much water is needed to run the projects desired enterprises(irrigation, stock water, House water etc.). This calculation goes in tandem with finding out how much feed the site can produce, which in turn determines the stocking rate and thus the stock water needs...
- Identify the greatest potential dam sites, highest in the landscape to provide gravity fed water to as much of the property as possible.
- Catchment is calculated for each of the potential dams taking the runoff co-efficency of surface areas into account including the reduced future runoff off of incrementally improved pasture. This is in part where Water and Access are so intimately tied and are often designed in tandem. Be precise when measuring dam catchment. Include differing surface areas and their run off coefficiencies(R.O.C) For example... for roads made of compacted, clay/gravel 'road base' we can assume a 60% run off coefficiency. For instance... road length x road width x mm p/yr x R.O.C = water caught of road. The surface area of a dam is the only 100% R.O.C
- 8º 'magic' slope angle for dam construction. The steeper the land above 8º the less efficient the storage capacity of a dam.
- When calculating material for dam walls account for approx. 50% compaction rate.
- Granite soil dams: Granite soils are so crystalline and free draining that they can take 2-3 fills before the ground saturates and seals.
- Dam walls seal by becoming saturated. Thirsty trees dehydrate the soil so keep trees 10m away from dam walls.
- To improve quality of water held in dams fence of from stock, mulch dam walls Inside and out) with old hay and cover crop seed(optional). The resulting vegetation will stabilise the bank, reducing sediment wash and assist in filtering the water. It will also attract wildlife

which is in itself a vector for further introduction of extra wetland species i.e. Juncus, Typhus.
- *Obtain a thorough Geotech analysis for all proposed dam sites.*
- The softer and more dispersed the local rainfall pattern then the steeper the incline on drains can be i.e. 1:3-1:4. The harder, larger, more sudden the rain events the gentler the slope i.e. 1:5.
- 'Resist' water at every opportunity, finding ways to slow, spread and sink.
- Qualitate all important Dam info. Ie volume, elevation, depth, full water level etc. and place on Key i.e. D2: 3.45mgl, 175m, 5m deep etc.
- In high evaporation regions dams are most efficient with smaller surface area to volume ratios. Dams are most efficient at 4-5m deep and hold 2-4yrs water for drought proofing. 1.5m of evaporation p/m2. Deeper dams can have a 1:1 batter on internal walls allowing for minimal surface area to volume ratio.
- The longer the dam the higher the Freeboard has to be to accommodate for wave action.
- Curved dam walls increase dam volume but require more material to build than a straight wall.
- Allow for 4-5m for road width on a dam wall.
- The best time to construct earthworks in Mediterranean climate regions in late Autumn due to ideal soil moisture level. Moist but not saturated.
- The Keypoint is not only the highest ideal placement for water catchment in a valley but is also a likely place to find both a spring and good clay as it is the initial point of deposition in the landscape.
- Foster a general rule of 'resisting water' whenever possible either with soil carbon(humus), dams, litter etc. Slow, spread, sink.

Wetlands
- Naturally wet areas are amended forming Wetland habitats with viable vehicle crossings.
- Wetlands are not necessarily designed and built as water storage for agricultural use. They provide safe, convenient crossing through otherwise tricky wet areas. They act as the livers and kidneys of the landscape, filtering the system of excess nutrient and/or runoff from adjacent properties potentially containing unwanted substances. They also attract great amounts of wildlife adding to the overall diversity, resilience and beauty of the overall system.
- They are easily constructed. Strip topsoil, dig out basin, build road, return topsoil. Planting is not necessary as wildlife will bring in seed.
- The decomposition of carbon in wetland systems in anaerobic resulting in a slow methane release.
- Wetland plants don't build soil downward through the rhizosphere. Instead they build soil upwards through the accumulation of the great masses of organic matter they produce. Inevitably the soil level will rise and will likely need cleaning out from time to time. To mitigate this give yourself plenty of freeboard and a generous Spillway and/or Rolling Dip.

Pumps and Reticulation
- Piston Pumps(windmills) are far more efficient than Centrifugal pumps for pumping to higher elevations.
- Reticulation lines are designed in, usually along ridge lines, following roads and fencing, and lengths and gauges are calculated.
- A flexible watering system ensures a flexible grazing pattern. Aim for a 'take off' every 50 - 100m.
- When pumping from a dam position the filter *between* the pump and the header tank. This

allows for clean, filtered water while maintaining pressure from gravity that would be otherwise lost if the filter was between the header and the emitter.
- Avoid subsurface and 'inline' drippers.
- Livestock will walk up to 7km for water and can be considered good exercise in milder weather.
- When burying 2" mainline reitc. Drop it to 20cm until you reach a riser point then raise the pipe to 10cm under.
- Where a water line has to cross a road either find a nearby culvert to go through under the road or use a collapsable fire hose to minimise damage from vehicles.
- 'Rolling Dip': The road flattens of and drops to become a spill. See Bill Zeedyk.

4. **ACCESS**

Access refers to the way or means of approach of traffic. This can be roads, tracks, lanes, paths, foot, stock, vehicle, wildlife etc. In the R.P it also refers to relative proximity and ease of approach to towns, markets, neighbours etc. Also to wether or not services such as Utilities can be provided to a building site. I.e the best house site according to view, aspect etc. may be in Paddock A, but that may be too far from the road to feasibly provide on-grid utilities. Does the cost of connection to utilities outweigh the benefits of aspect, view etc. and/or is it cheaper in the long run to go off-grid and build in Paddock B? These are the design questions.

- The first choice for road placement is along convex land form(ridge lines). Ridge lines receive least rainfall in the landscape, allow for natural, gentle drainage(low erosion=low maintenance), they are often already hard and shallow(sometimes already exposed bedrock) and they are high in the landscape allowing for optimum vista of the site when driving. Ridge roads are best planted with avenues of trees.
- When access is required across a valley, connecting two ridges, the road is built not on contour(contour makes for welling and soaking of the soil which often undermines stability). but on a subtle incline(approx. 1:200-1:400 gradient), falling toward any adjacent dam. The surface of these roads tilt gently toward the hillside sending water into a drainage trough dug out between the road and the hill face. The resulting dam walls create excellent avenues over otherwise impossibly boggy valley soils. In a landscape where soils have been remediated to such a degree that their runoff co-efficiency is reduced to almost zero(this is our goal), we often have to accommodate by designing these catchment drains to feed dams. Observing the Permaculture principle of Multiple Function, these drains offer perfect opportunity to also place excellent main roads for travelling across contour.
  Main roads are constructed according to function, use, material availability and budget.
- Smaller tracks used by ATVs etc. may not require as much engineering however the same reasoning can be applied to their placement.
- When building a new road, save the topsoil to spread over the slopes and gutter. Seed with cover crop then mulch. Vegetation stabilises surface.
- Roads cost approx. $2-$5p/m. Best built with a Grader.
- Ultimately Access is degenerative infrastructure as are the vehicles that use them. Long term, low energy thinking should consider a return to animal transport(horse) in the future.
- 'T' sections of main roads can be 'roundabouts' with a feature tree in the centre.
- Flat bottomed road drains carry more water and erode less than incised drains.

Building a Road

1. Design. Multi-function/integrated. Analyse catchment and flow for pipes, spills, culverts, rolling dips etc.
2. Survey.
3. Mark out. Peg in the middle of the road.

4. Strip topsoil to subsoil.
5. Form subsoil to slop toward catchment and/or convex. May include compaction(Wheeled Roller or just Cars and Tractors). Roads expecting to carry large loads need high compaction.
6. Add gravel.
7. Grade gravel.
8. Compact.
9. Seal if required. Sealing aids in R.O.C as well as strength.

5. **FORESTRY**

In the context of the R.P, Forestry refers to the many and varied uses of trees within the agricultural landscape. Timber Blocks, Shelter Belt, Savannah, Orchards, Natural, Woodlot, Riparian, Road/Avenues, Wildlife Habitat, Forage/Fodder plantings etc. Some general guidelines apply.

- Ridges and crests usually have shallow, dryer soils(sandy/gravelly) and are thus usually less productive crop/pasture land. They are best put to use by being wooded to both minimise erosion and act as high elevated, nutrient deposition points that will seep down hill adding fertility to pasture.
- Valley/streams are of such importance and are so potentially at risk from erosion and incision that Riparian plantings are always strongly suggested.
- All tree plantings are fenced from stock at least until establishment and some like riparian and ridge/road plantings remain permanently fenced. It is in anticipation of a low energy future that Forestry plantings of all types become more feasible and important than ever.
- As we look to Appropriate Technologies like Rocket Stoves and Wood Gasification units and other wood powered devices, the value of woody bi-products of all forms of Forestry(that in recent times have been viewed as waste/liability) becomes very clear.
- Observing the Permaculture principle of Multiple Function we can see the stackable applications of Forestry plantings. Ie a Riparian strip of Willow may not only ensure against erosion and incisement but also provide coppice thinnings as fuel and craft wood as well as supplementary fodder for stock.
- We will likely also see a return to valuing timbers above more modern, conventional building materials as industrial fabrication drops in productivity. Coupled with cheaper, easier fencing options Farm Forestry is an increasingly important element of agricultural design.
- Yeomans' 'Contour Strip Forests' create ideal windbreaks from field to field.
- Well constructed shelter belts can protect 10-20 X their height.
- At equinox a 16m tree will yield 15m of shade at the sun's zenith. A 5m tree at 5pm will yield 20m of shade.
- If a planting runs east-west then long shadows will block a lot of light to pasture. Try shorter/low evergreens 3-5m with tall deciduous trees in between.

The Difference Between a Tree and a Forest

Whereas in conventional agriculture it is standard to remove trees from paddocks, in the Regrarian model not only are existing paddock trees paid homage but in many cases -context permitting- fields are dotted with Savannah style tree plantings.

- Lone trees standing unfenced in paddocks become the obvious camping ground for shelter hungry stock. The inevitable compaction and over supply of nutrient causes premature death for the tree. Besides the negative effects of over camping, most trees are not designed to stand alone in nature but are accompanied by an guild of mutually beneficial understory

species; plant, animal and importantly, fungal.

- Major over story, staple food/pannage producing species like Oaks can be planted at wide(approx. 40-60m) spacings, providing all the benefits of a natural Savannah system such us spreading out stock camping, fodder/pannage, mottled windbreak, wildlife habitat and mosaic shelter/shading opportunities while minimising loss of pasture.
- Ideally in the R.P model these Savannah trees are fenced off and underplanted with guilds of compatible understory species creating a mosaic of 'Zone 5' islands throughout an otherwise exclusively grassed eco system. Specific species can be chosen for extra function like fruit production, habitat, N-fixation, wildlife attraction etc.
- **Fungi** play an very important role in the health of woodlands. Saprophitic fungi breakdown fallen dead wood. Mychorizal fungi(i.e truffles) work with plant roots exchanging polysacharides for minerals. Some Mychorizal fungi have above ground fruiting bodies. Australia has the worlds largest truffle diversity. Australian mammals have co-evolved to eat them, manure them and spread their spores.
- Once fenced off an area will likely go into self succession and may not need planting.
- Fence beyond drip line of over story trees to take full advantage of light, moisture and nutrient. To determine fencing radius observe the surrounding pasture and find the full extent of alleopathic effect in species like Eucalypts, Conifers and Juglans etc. Fence where the pasture noticeably regains its vitality.

Darren's Ploughing For Tree Planting Regime.

1. Year 1: Yoemans plough on Keyline guides.
2. Year 2: Use visible rips to count out planting lines. Subsoil rip the planting lines deeper in autumn after first rains and/or MIG. Avoid hoeing instruments that cause glazing.
3. Year 3, Step1: Autumn. Repeat subsoiling on planting lines ideally with plough-power harrow-seeder combination. Step 2: Spring. Repeat subsoiling with plough-power harrow-planter combination.

Spot Cultivation.

1. Year 1: Autumn. Subsoil plough to full depth.
2. Mark out tree spacings
3. Lime, rock dust etc.
4. Add rotted compost and fungal inoculant, oak litter etc.
5. Mulch with rotted, compressed hay biscuit, 4-6 inches thick(don't bury compost as it will turn anaerobic and release methane; toxic to plant roots.)
6. Year 2: Spring. Plant trees.

6. BUILDINGS

A distinction is best made between Degenerative structures and Regenerative structures, permanent buildings and portable buildings. Structures like homes and sheds will likely remain permanently fixed on the landscape for some time, however many farm structures like milking sheds, chicken houses, shearing sheds, slaughtering houses etc. can be made to be portable. This removes the issues of land degradation surrounding the structure like tracking, erosion, excess manure/nitrogen etc. It also means that Farmer Co-ops. can share the costs of some portable infrastructure amongst themselves i.e. stock yards, abattoirs, wine bottlers etc. In an age of stainless steel, reticulated electricity and hot water there is no reason why we can't have safe, efficient and affordable portable abattoirs. Their use would mean a more humane, stress free experience for the stock as they remain on their home farm right up until slaughter and aren’t subjected to long, noisy and frightening truck rides to strange and disturbing abattoirs. Also it means the bi products conventionally seen as 'waste' like viscera and bone can be left on the farm to be processed and returned to the pasture in the form of soluble biofertiliser.

Permanent Housing

Permaculture Sector/Vector analysis is invaluable for house site selection. Relative location of farm buildings to enable best flow of work and energies of all forms.

1. Access: Can the site be easily accessed by vehicles and will utilities reach there?
2. Aspect: Facing sunward ensures best solar-passive design.
3. Views: Pretty views are ideal and can make for optimum surveying of ones land but are not a priority when considered next to other more points.
4. Drainage: A matter of soils and slope.
5. Fire: Fire sector analysis is often over looked and can be easily optimised with water bodies, fire breaks, flame retardant foliage and gravity fed, non-melting sprinkler systems.
6. Elevations: Best chosen with gravity fed water and thermal sweet spot in mind. Allow for 8m elevation difference between the top of the house and the bottom of the water feed for adequate pressure.
7. Soil: Both horticultural and engineering qualities should be considered.
8. Slope: No slope means less opportunity to optimise for gravity fed water, drainage etc but too steep a slope makes for expensive, inefficient and unsafe pads.
9. Encumbrances: Title division, subdivision potential, shade from trees and landforms, unsavoury neighbours etc.

- Scoria: Exploded volcanic rock for slab insulation.
- Where appropriate place garage or water tank on west side of house for afternoon sun protection.

Stock Housing

- Aim for a deep understanding of the animals needs, functions and intrinsic factors(permaculture element analysis) when designing their buildings.
- Remember, animals and plants aren't fussy about architecture. As long as they function well these buildings don’t need to be perfect. Form follows function.
- Keep mobile chicken houses to highlands in winter to avoid bogging.
- Use old fridge panels as roofing and walls.
- Study Temple Grandin's work on stock yards I.e 'Grandway' in QLD.

7. FENCING

In generations past fencing was a major undertaking involving countless, gruelling hours of work to install and then maintain. As a result paddock design was usually a matter of locating the shortest path between two convenient points. This approach saved time and money but failed to take other factors into account such as topography, hydrology, access etc. and even today farms experience many resulting inefficiencies. Nowadays we are blessed with increasingly affordable, lightweight effective electric fencing options for both permanent devisions(paddocks, forestry plots etc) and moveable in-paddock cells as are used in H.M and Management Intensive Grazing(M.I.G).

- In the R.P model permanent fencing position is largely informed by roads and the various tree plantings such as riparian, which in turn are dictated by the landform itself. This most often results in every Primary Land Unit becoming a major, permanent paddock.
- Main roads are commonly planted with avenues of trees and permanent fencing is required on the stock-side of the plantings.
- Kiwitech, based in New Zealand is the electric fencing brand most recommended.
- It is always wise to meditate upon a potentially low energy future scenario and what techniques and materials may replace our current options. In this regard Living Fences such as the U.K's traditional Hedgerow system is a valid study.

- In a holistically planned system stock are less hungry, undernourished, frustrated or bored and thus are less likely to try and force their way through fencing.
- Use aluminium coated wire to mitigate the corrosive effects of acids from grasses.

8. **SOILS**

Long ignored by conventional agriculture, soils are slowly receiving the recognition they deserve as one of, if not THE most important of natural resources. It is with soils that the meaning of the term Regenerative becomes so apparent and important. It's improvement and constant aggradation are key to any agricultural enterprise and culture at large.
The environmentally regenerative aspects of modern, progressive grazing modalities are largely dependent on well timed, high intensity stock rotation made feasible by modern, portable electric fencing. Far from the environmentally degrading effects of Set-stocking, the implementation of H.M and M.I.G finds pastoral soils increasing in carbon levels, perennial species diversity, minerals and overall productivity.

- Soils may be studied as a combination and exchange of chemical, biological and physical properties.
- There is a difference between ideals in soil for agricultural application(ideally high in humus) versus engineering, earthworks etc(ideally low in humus).
- Sands have a low Cation Exchange Capacity(CEC), clays have high CEC.
- The Sodium(Na), Calcium(Ca) and Magnesium(Mg) ratios have great effect on soils physical character.
- Ca and Mg have ++ charge. Clay and Humus have a – charge.
- Soils high in Sodium are known as Sodic. Sodic soils, while plastic, are dispersive i.e. they collapse and liquify when saturated and thus are extremely precarious when building structures like dams, swales, house pads etc. They can collapse and/or form Tunnel erosion i.e. Milkwood dam saga. To remedy(may not be remediable) add Gypsum to boost Mg and Ca levels, or add lime(Calcium carbonate).
- Soils high in Magnesium are highly reactive. Swelling, shrinking and cracking. These soils are a good base for agriculture(though are improved by adding humus) and poor for engineering. To amend for engineering add Na to gain some plasticity.
- Agricultural soils often become more and more reactive as humus is depleted and Ca is moved off site with cropping.
- "Droughty" refers to soils that both wet and dry quickly. This coupled with low humus *especially low colloidal humus* causes them to 'cement'.
- 'Self Mulching Soils': High fertility, reactive, Not great value in ripping as they shrink, swell and crack. Once rain gets into a rip they swell and seal up. Best enhanced by ground cover and humus. Their tilth has been lost largely because of their conversion from perennial to annual pasture. Focus on ground cover, humus, trees and MIG.
- Aerating soils raises pH because it displaces volatile Hydrogen.
- Darren suggested the value of familiarising oneself with geological parent rock material(i.e. granite, basalt etc.), the types of soils they form and the type of vegetation they foster.
- He explained his preference for allowing stock access to a range of Free Choice minerals, letting the animals decide for themselves which supplements they need and then allowing them to spread it out over the pasture in soluble form through their waste as appose to getting soil tests done, bringing in X tons p/hctr of deficient minerals and spreading it manually.
- Anaerobic decomposition is low energy versus providing an aerobic system with regular oxygen.

- Fosfito: Burn your bones to break the Ca/Mg bond, then burn again with high silica substance(rice husks, dry Casuarina needles etc.) to make soluble.
- Bokashi: Good for breaking down non-compostables i.e. meats, fats, bones, citrus, alliums etc. Add resulting liquid to compost or use like vermicast.
- Mollases is the better part of sugar, still full of minerals.
- Meal Mud is the minerals from the soil removed during the sugar refining process.
- He draws heavily on the soil studies of Dr Elaine Ingham, Dr William Albrecht, the work of the Mexican soil science team Mas Humus and more...

KEYLINE PLOUGHING(excluding Keyline design: see MAPPING)

- Keyline ploughing is a means of extending the Rhizosphere, thus increasing topsoil depth and carbon levels.
- "Aggressive" ploughing causes surface disturbance and thus creates hyper oxidisation.
- Ideally a plough should be followed by a roller to close the 'gaping mouth' of a freshly opened rip line.
- Compost tea sprayers are effective if one can justify the cost and difficulty of building/acquiring the rig.
- Different ploughs: Yoemans, Agroplow, Gessner, Wallace etc. Wallace has rigid tines, concord point on foot, blunt shanks, not ideal. Yoemans tine is sharp making for less disturbance thus less oxidisation.
- Be careful when Yoemans ploughing on steep hills as changing the hydrology may cause slipping.
- When Keyline ploughing on a Ridge start ploughing *above* the marked contour and move uphill. When Keyline ploughing a Valley start *below* the marked contour and move downhill. When the angle of turn becomes too acute for the tractor mark a new line. The resulting space may be used for a copse of trees or a pocket pond etc.
- Use two different colour flags to mark row to row to avoid confusion.

PASTURE/GRAZING

- What can your pastures yield? How many head can it carry? How much water do we need?
- Standard Animal Unit(SAU) = 1X 450kg dry cow.1 SAU eats 9-15kg of dry matter.
- C4 plants: Warm season active, more efficient with water in photosynthesis. Kangaroo Grass,, Wire Grass, Red Grass, Love Grass.
- C3 plants: Cool season active, less efficient with water in photosynthesis, more nutritious, holds nutrient when dry. Rye Grass, Wheat Grass, Weeping Grass.
- CE plants: Hyper efficient with water. Aloes, Cacti, Agave.
- 'Bullseye': Rangeland Health target.

1. Bare ground: test area approx. 20 – 30m
2. Erosion
3. Plant pedestalling
4. Litter amount: Litter on surface
5. Litter distribution: Consistent or mosaic?
6. Litter incorporation: Biological decomposition incorporates litter into the soil. Good micro-biology will assist i.e. compost teas etc.
7. Dung breakdown: Biological decomposition incorporates litter into the soil. Introduction of dung beetles. Bio-innoculants, compost teas, vermicasts, mychorhizal fungi etc. all add life to break down litter. Cropping decimates macro-biol. habitat
8. Percentage of desirable plants
9. Age class: Consistent or varying?

10. Plant species diversity & functionality: Legumes, forbes, grasses, herbaceous, broadleaves etc.
11. Living organisms: Diversity of micro. And macro. Across all orders
12. Plant canopy: Creates nursery microclimate for the next generation
13. Plant vigour: How fast is the growth after rain? Largely a function of micro-biol.
14. Plant distribution

- Dung/litter incorporation: Introduction of dung beetles. Bio-innoculants, compost teas, vermicasts, mychorhizal fungi etc. all add life to break down litter. Cropping decimates macro-biol. habitat
- Bare ground can be mitigated by leaving 2-3inches of litter after grazing.
- Omnivores/Monogastrics fare better on poorer ground than do Herbivores/Ruminants as they are not so dependant on good pasture. The input of feed/mass/nutrient coupled with good management improves the site until the pasture is ready to run ruminants.
- All flesh is sunlight. Offal, bone, blood is mineral and best returned to the site as fertility.
- The less efficient digester an animal is the better it is for Land Regen. Cows are less efficient than sheep. Thus as cattle land degrades due to poor management it often transitions into sheep country and then in to goat country. Cows are also superior at breaking up compaction due to their weight and sharper hooves.
- Dairy animals have much higher nutritional requirements than meat animals. Beef is better to start with on poorer pastures.
- Silage acidifies ruminant guts.
- Chickens(layers) make more $ than beef/dairy so optimise system around them.
- Grain has more Omega 6s. Grass has more Omega 3s. Both result in a different flavour. Grain creates more fat. Minerals are stored in fat.
- Bigger herds are relatively easier to manage. Cattle become a 'Super Organism' at approx. 150 head demonstrating quite different collective behaviour.
- The most important times for mammal nutrition and hydration are conception, last trimester and lactation.
- If you don't supplement chickens pasture feeding with grain etc. the number and size of eggs goes down but the quality goes up.
- Humus is the final or near final, stabilised form of organic carbon compounds after a series of biological decompositions.
- Forest soils have a shallow A layer and a thin, rich O layer. They are fungally dominated.
- Grassland soils have a deep A layer. They are bacterially dominated.
- Perennial grasses put their energy into root growth, starch reservoirs and Polysaccharides(liquid sugars) production for feeding soil micro-biol(think Sugar Cane) and thus increasing soil humus. Whereas annual grasses put their energy largely into seed production i.e. grain crops.
- Polysaccharides are Long Chained Carbons, very stable, already soluble/bio-available, easy to absorb/breakdown, short steps toward becoming humus.
- Harder/heavier materials like leaves, twigs, bark wood etc. are Short Chained Carbons that need much more processing before breaking down into stable humus.
- No known plants roots can penetrate soils at greater than 300psi.
- If/when flail mowing as a secondary option to stocking then aim for leaving 3-4inches of cover. Mow at the 'boot' stage.
- After a grass fire get stock on asap for disturbance to limit potential wind/water erosion.
- Orders of Soil erosion: Raindrop–sheet flow-rill–runnel–creek–river–estuary–ocean.

9. MARKETING

In a world were social media is so popular, accessible and user friendly it is easier then ever to

market yourself wide and well. The internet is allowing for the individuation of enterprise at an open, level playing field for the smaller player. So long as you can build an attractive narrative there will be a market for you.

- Build an attractive Narrative: Your story sells. People don't buy *what you do* they buy *why you do it*. Who are you as an enterprise? Why do you do what you do? What are you offering?
- Know your markets: Psychography – The psychology of your potential local market. Purchasing attitudes and preferences. Demography – Is the area in economic growth or decline. Grow with growth. Old suburbs are established and not prone to change. Young areas are often home to young, growing families who consume a lot of produce. Market accordingly.
- Explore non-commodity retail options such as farmers markets, CSAs and farm shops and weigh against each other.

1. Farmer's Markets: Inefficient, producers take home excess. Exclusive. Good for building market base.
2. CSAs: More efficient. Spoke and Hub model, can be heavily refined.
3. Farm Shops. Most efficient but very dependant on local legislation.

- Be systemic, pragmatic and incremental in your approach to establishing yourself... Start with one 'signature enterprise' e.g. organic Olive oil, then once you have established yourself in that practice and market branch out into a second operation i.e. organic lamb, education, consulting. Innovation is expensive.
- If necessary find a business mentor.
- Make your regular work process clear for clients from as early on as possible. Ideally have it shown on your website I.e How to contact you/initiate a dialogue, phases of work I.e initial discussion, site visit, report, treatments, design and all pricings etc.

10. ENERGY

All discussion on Energy within the R.P model takes place within the context of planning for a low energy future but also within the realism of current feasibility vs idealism. The horse has bolted on the era of cheap, available energy in the form of fossil fuels. Much has been discussed on this subject and there are many still who ignore the signs and claim that we will be using petroleum derived fuels for decades yet to come. They may be correct, but unless we come across previously undiscovered oil deposits soon the petrol products we use will continue to be those rung out of bare rock(Fracking). Not the greatest return on investment.
Ever erring where possible toward locally available, human scale, low energy options we discerned energy sources/forms into the categories of...

1. Gravity: Tank stands/mounds, 'turkey's nests', hi dams etc.
2. Electricity: Photo voltaic, wind, fossil, hydro, wood gasification.
3. Liquid/Gas: Bio-diesel, ethanol, methane.
4. Biological: Animal, micro-biological, Photosynthetic.
5. Combustion: Wood heaters, steam.

- Conventional pressure pumps are an ineficient means to provide mains water pressure versus using gravity and/or a wind/solar pump to a header tank.
- It is the energy efficiency of gravity fed water that largely informs out relative placement of both buildings(rain catchment for drinking water) and dams.
- Vastly under appreciated and mature Wood Gasification technologies as a serious contender for farm enterprises.
- Other low-energy, human-scale Appropriate technologies like rocket stoves and RAM pumps.

- As discussed in the Forestry section the low energy future brings the importance and feasibility of Farm Forestry as a fuel source to the fore.

GENERAL DESIGN/CONSULTATION

"You've got to begin with the end in mind." - Edward De Bono

- Reduce actions/input for increased marginal reactions. What can you not do and still ensure progress/increase in capital(all kinds). Smallest expenditure for the greatest return on investment. I.e you COULD go and keyline the entire property at the expense of diesel, time, machine hire etc. or just implement MIG(wire and water), improving soil while building saleable product and then ploughing later when we have capital.
- Codify major design features. Eg Label pastures P1, P2, P3 etc. Dams D1, D2 etc.
- Best not rush into implementation of big picture design. Secure H2O systems, increase soil carbon whether by plough and/or MIG before you rush into building swales and all dams etc. After a few seasons you will have arrived at a 'New Normal' i.e. reduced landscape water run off coeffieciency, also your understanding of the site will be more refined by orders of magnitude. You will be more confident of where proposed infrastructure should be put i.e. water lines may now be buried etc.
- Initial design move: Mark out major land features i.e. ridges and valleys. Lay roads on ridges thus dividing the property into Primary Land Units. The issue then is to provide valley crossing. This is where dams and wetland wall provide reliable access.
- Calculate Headlands. Minimum required turning circle for your particular farm machinery.

MAPPING/SURVEYING(Including Keyline Design)

- Daz's drone is a DJI Phantom II
- Map gathering costs approx. $20 p/hctr
- Skill up and/or team up with local pro-mappers/surveyors.
- Is the map cartesian or spherical? Spherical is flat and doesn't acknowledge topography.
- 'Contours on the Cheap.' - Use A-frame or Water Level. Cary a GPS and enter a point at every pace/section. Download into Google Earth.
- When ploughing on a ridge start ABOVE the contour and move UPHILL. Conversely when ploughing a valley start BELOW the contour and move DOWNHILL. When the angle of the turn becomes too acute for the tractor then mark a new starting run and use the resulting gap for a tree copse or pond etc.
- Start Keyguides with approximation. Check for valley to ridge fall. The 'parallel offset' starting with wide offsets.
- Currently RTK GPS services are the best for achieving accurate contour mapping, with ever more exciting, affordable and democratised techniques being developed at a rapid pace.
- Lazer Levels with a bevelled top are best. Get a staff with levels on the back.
- Use aluminium rod flags to peg out. They are light and you can carry hundreds.
- Darren uses Map Info Pro software for design.
- Make a copy of full design including the headland offsets and keyguides, however remove them from the final design but still inform the client of them.
- Common package includes Design, Report and Bill of Quantities.
- Two types of report.

1. Short Report: Standard front page. Bullet points, concise. Small section for each R.P point. Use templates but still customise for site/client context. Use hyperlinks.
2. Long Report: Similar but fleshed out. See HennanDoherty public Google Drive under 'Reports'.

For me this course felt like a culmination point of years of study and practice coming together to be organised and directed into a clear design template. In this line of work there are *so many* points to be taken into account when designing(climatic, geographic, economic, cultural, legal, mechanical, biological, etc) that it is quite easy to be swamped by what feels like an endless sea of details, variables and potential choices. This course offered me the template necessary to systematically approach the design of primarily broad scale agricultural systems point by point in an incremental, pragmatic and systemic fashion.

To conclude, agriculture is at the heart of any culture. It is the means by which a society produces it's very sustenance and at the industrial scale we currently practice it has immense destructive capacity. It has been cited as the number one cause for such environmental woes as deforestation, erosion, desertification, habitat destruction, bio-diversity loss and for such human health issues as malnutrition(the result of applying synthetic fertilisers to biologically dead soils and having our once diverse diets reduced to a mere handful of options i.e. Soya, Rice, Wheat, Corn etc.), toxicity(the result of applying millions of litres of biocides) and we have yet to see how a generation or two of ingesting GMOs will prove to impact us.

As Bill Mollison said... "*The only ethical decision is to take responsibility for our own existence and that of our children. Make it now."*

Of all places in the world Australia needs to address and act upon these issues. 200 plus years of insisting upon north-western European agricultural practices in an environment that in no way resembles their place of emergence has rendered much of the once thriving and fecundant regions of this island continent salty, bare and desertified. It is for these reasons perhaps that so many of these progressive and revisionist cultural/agricultural modalities have been born in Australia. Yeomans' 'Keyline design', Mollison and Holmgren's 'Permaculture', Andrew's 'Natural Sequence Farming' and now Doherty's 'Regrarian Platform'... It is suggested that these are a natural and sane response to living in an land where environmental degradation has been overtly visible from one generation to the next over such a relatively short period of time.

Let me state that I believe everyone does their best given the information and means available to them at any given time. In the case of agriculture farmers often apply certain techniques at the behest of the Government only to realise it as environmentally and/or economically deleterious in retrospect. It is up to those of us with a vision for a new cultural model to recognise and respect the immense Intellectual, Experiential, Material, Cultural and Social capital our often multi-generational farming communities hold and to walk hand in hand with those who are willing to explore these Regenerative methods.

I believe strongly that by coupling these Regenerative methods of design with a mature and open minded study of traditional, Regenerative agricultural forms from other Mediterranean climate regions of the world (see the work of Dr Imma Farre of the Dept. of Agriculture and Food re. implementing 'Dehesa' system trials in sth Western Aus.) we can improve and regenerate Western Australian farm lands. Remediating the vast, multi-faceted, destructive effects of such environmentally impacting events as the Wheat belt deforestation will not happen in one generation. It will take time and patience. We need to think long term, multi-generational. We need to think in terms of Ecological function. We need to position ourselves as stewards of the land not masters of it. We need to appreciate the dynamic nature of the land we live and realise just how profoundly abundant we could assist it in being... It can be done... and in fact, if we do want to be living in the kind of world most of us claim to want... it HAS TO be done.

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RESOURCES/REFERENCES

- Free Choice Minerals
- Jaime Elizondo Braun – 'Regenagraze'.
- 'Bullseye' Rangeland Health Target from the Quivira Coalition.
- 'All Flesh Is Grass' - Gene Logsdon.
- 'The Art And Science Of Shepherding' – Fred Provenza.
- Hawkes Bay Carbon Farming – Greg Hart.
- Abe Collins – superlative U.S grazier.
- 'Vegetation and Soils' – S.R Eyre
- 'The Intelligent Gardner' – Solomon
- 'The Albrecht Papers' – Uni. Of Missouri
- Australian Perry Agricultural Laboratories
- 'How Trees Effect Soils' – CSIRO
- 'The Diffusion of Innovation' – Everett Rogers
- 'Rainwater Catchment Systems' – Erik Nissen-Peterson
- 'Water Harvesting From Low Standard Rural Roads' – Bill Zeedyk
- 'The E-Myth' – Michael E. Gerber