Regenerative Agriculture a Practical Solution
What is Regenerative Ag?
The context is decisive

Regenerative farming involves a complex learning system:

It is a whole systems approach
Not an ‘add on’

Applied in local contexts

Farmers are the ‘experts’

(ROLING, 2007)
What is the number 1 limiting factor in production?
To be truly regenerative is to be Holistic

Ecological  Production  Social

Measured by outcomes
Regenerative Ag Systems

• Enhance natural cycles
• Repair disturbance events
• Minimise harmful inputs
• Build resilience
• Grow microbes
• Sequester carbon
• Enhance diversity
• Output focused and measured
Diagnostics are key:

What is putting a drag on your production?
Many agricultural scientists deny that there is any link between human health and what happens on-farm, however...
The Mineral Depletion of Foods Available to Us as a Nation (1940-2002)
Microbiome

• You are more microbes than you are you
Gut microbes:

• Make us grow
• Regulate our health
• Provide vitamins, enzymes, minerals
• Help our whole body to function
We’ve blown the microbial bridge
Gut microbiome & health

Acne, Asthma/Allergies, Anxiety and PTSD, Arthritis, Autism, Autoimmune diseases, Cancer, Crone’s, Depression, Diabetes, Eczema, Inflammation, Longevity

Motor Neuron, MS, Obesity, Parkinsons, Sleep issues, Tooth Cavities....and more....

It is epigenetics that determines our gene expression.
We’re doing the same to our soils

They have indigestion, constipation, gas and diarrhoea
NZ loses 192 million tonnes of soil each year*

*44% from pasture

*Our land 2018 Ministry for the Environment and Stats NZ
Are you building or losing soil?
One table loaded with soil combined with ‘Essential Soil’ mix (compost and compost tea)

One table loaded with same soil without the special mix – Bare Soil - Control
Rain Events Applied: Collection devices to collect sediment and water

3 x 10 year storm events applied.
And finally a 50 year storm event.
5mm/hour for 30 minutes
50mm/hour for 30 minutes
5mm/hour for 30 minutes.
Soil Loss from the Treated Table (1) was 98% less than Bare Soil Table 2.

Treated Table (1) had 32% less runoff than Bare Soil Table 2.

Side issue: Water Run-off water of better quality than the initial water source used for the trial.

http://www.hendrikus.com
Slaking test

• Slaking test indicates the stability of soil aggregates/structure and erosion potential
• Glues and microbe by-products protect and form soil crumbs
Disturbed vs Healthy Soils

5,000 species = 4 bulls/10 acres

25,000 species = 20 bulls/10 acres
EVERYTHING comes back to soils, soil carbon and soil microbes

- Climate regulation
- Water quality
- Fishery beds
- Food quality
- Human wellbeing
- Planetary health
- Financial wellbeing
What is soil?

Pore spaces
40-60%

Solid
40-60%
Healthy Soils

- Hold onto and release nutrients
- Hold onto and release water
- Have great structure
- Are full of life
- Protect against pests & disease
- Grow few weeds
- Optimise production
Healthy soils cont...

- An anchor and habitat
- Decompose and detoxify
- Buffer to changeable climate
- Are full of secondary metabolites, plant growth hormones, vitamins and enzymes
- Grow healthy, nutrient dense crops
Which all means...

Resilience
Productivity
Animal health
Reduced need for inputs
Reduced costs $$

= PROFIT!

In the beginning...

There was LIGHT
Two major carbon cycles

Decomposition pathway ends in CO2

Sequestration pathway or liquid carbon pathway which produces HUMUS
Carbon is the planets currency
The battery which stores sunlight energy
Franklin J. Crider, United States Department of Agriculture, February 1955.

When 80-90% of the leaf is removed all of the roots stop growing.

When less than 50% of the leaf is removed none of the roots stop growing.
Grazing and Roots
Grasses have evolved to flourish under periodic grazing pressures.

<table>
<thead>
<tr>
<th>Amount of plant grazed</th>
<th>Time for root recovery</th>
<th>Root growth on 33\textsuperscript{rd} day</th>
</tr>
</thead>
<tbody>
<tr>
<td>90%</td>
<td>No root growth for 17 days</td>
<td>60%</td>
</tr>
<tr>
<td>60%</td>
<td>55% after 5 days</td>
<td>192%</td>
</tr>
<tr>
<td>30%</td>
<td>117% on 3\textsuperscript{rd} day</td>
<td>250%</td>
</tr>
</tbody>
</table>
Grazing for soils

Adequate recovery time is crucial

In equal time periods grass will grow this much if it starts high on the growth curve, but much less if bitten way down.
Root exudates and the rhizosheath
Mucilage, root exudates, fats, waxes, carbon, sugars, hormones, acids, secondary metabolites...
Without AMF Mycorrhizae
Mycorrhizal mycelium
With AMF

C → N → C

P → C

Zn → C

H₂O → C
Components of humus

- C ~ 60%
- N ~ 6-8%
- P ~ 1-2%
- S ~ 0.8-1.5%

Organo-mineral complex (ie carbon plus minerals)
Refractometers

The function of plants is to produce sugar (CHO) which leads to the manufacture what goes out the ranch gate!

= PROFIT
Brix

• A measure of sugars & dissolved solids

• Optimal photosynthesis and plant health occurs when the brix in corn is > 12 and >16 in lucerne and avocado
Impact of forage quality on ADG

![Graph showing the relationship between Brix (measure of nutrient density) and average daily gain (lb/AU/day). The graph indicates a positive correlation, with average daily gain increasing as Brix increases.]

Source: Grass Fed Insights, LLC
Optimising biological diversity and biomass is CRITICAL

• 80% of plant health and nutrition is driven by biological functions
  • More communities = more signals = more gene expression = increased crop health and resilience
  • Greater productivity and profitability
Diversity is key

Fostering diversity provides multitude of benefits… secondary metabolites, health properties, beneficial insects/animals, weed competition, mycorrhizal guilds, access to water, soil microbes, nutrient exchange, humus…etc etc etc
As above so below

Root Systems of Prairie Plants

Conservation Research Institute

Kentucky Blue Grass
Poa pratensis

Lead Plant
Amorpha canescens

Missouri Goldcreeper
Sotalias missouriensis

Indian Grass
Sorghastrum mitchellianum

Common Plant
Silphium laciniatum

Prairie Grass
Sporobolus sparsus

Beard Grass
Aster laciniatus

Prairie Caud Grass
Sporobolus heterolepis

Big Bluestem
Andropogon gerardii

Pale Purple Coneflower
Echinacea pallida

Prairie Dropseed
Sporobolus heterolepis

Side Oats Grama
Bouteloua curtipendula

False Bristle Grass
Koeleria repens

Switch Grass
Panicum virgatum

White Wild Indigo
Baptisia tinctoria

Little Blue Stem
Andropogon scoparius

Rosie Wood
Stipa capillata

Purple Prairie Clover
Pedicularis purpurea

Ivory Grass
Koeleria cristata

Cylindrical Blazing Star
Liatris cylindracea

Buffalo Grass
Buchloe dactyloides
Jena experiment
(Germany)

High-diversity plots (8, 16 or 60 plant species) accumulated **21.8%** more carbon compared with low-diversity plots (1, 2 or 4 plant species)
78,000 tonnes of nitrogen gas hovers above every hectare...so why do we need to apply Nitrogen?
What stops N-fixation?

Temperature
Lack of Co, Mo
Compaction

No inoculation
High soluble N
Lack of species diversity

Ways to increase N efficiencies

• Address compaction
  is it due to - mineral/microbes/management?
• Diversity of plant species (rooting depths)
• ALWAYS add carbon to fertiliser
• Crop rotation, legumes
Difference in grazing styles

- Measurement
- Formulaic
- Shorter residuals
- Regrazing based on plant growth rate and animal needs
- Stick to the plan
- Low diversity pastures

- Observation
- Adaptive
- Longer residuals
- Regrazing based on recovery time of plants, soil biology, animal needs
- Monitor, adjust and replan
- High diversity pastures
The Context is Decisive

• It is not what you do but how you think about things
• If you are going first to WHAT to do you have missed the opportunity
Weeds: Friend or Foe?

• Out compete desired forages
• Are costly to deal with
• An ongoing/never ending issue
• Reduce farm productivity
• Develop resistance to current treatments
Weeds: doctors of the soil
Read your weeds:

• 1. Quickly protect bare/disturbed soil
• 2. Low organic matter
• 3. Balance minerals
• 4. Microbial imbalances and
• 5. As a safety valve for toxins.
Weeds as indicators
Reframing how we see things

- Many weed species are indicating low available Ca and low humus
- Foxtail barley grass (primitive grasses): low Ca, nitrates, compaction
- Broadleaf weeds often prefer low P or high K
Bacteria are essential. However,

- Bacterial dominance can lead to compaction
- High bacteria and low predators tie up nutrients
  - Increases nitrates in plants
- Germination signal for many “weeds”
DNZ Frei Dairy Case Study (2009-2012)

- 3 Year Southland Dairy Case Study – DNZ monitor farm
  - To change system with no loss of production
  - Key outcomes
    - Increased pasture quality & resilience
    - Significant Nitrogen Input Reduction
    - Increased Clover Performance
    - DM to Milk Solids feed efficiency
    - Sustained Production
N:P:K Inputs [kg/ha]
Annual Production [MS per season]

Annual Production 3 Years

- 2010: 1063 kgMS/kgDM x100
- 2011: 420 kgMS/kgDM x100
- 2012: 411 kgMS/kgDM x100
- MS/Cow/season
- MS per hectare

- 3Yr Av: 1028 kgMS/kgDM x100
- 355 cows @ 2.5/ha
- 360 cows @ 2.53/ha
- 350 cows @ 2.46/ha
Feed Efficiency [kgMS/day] %

Feed Efficiency

% Efficiency

- 2010: 167
- 2011: 132
- 2012: 150
- 3Yr Av: 149

DNZ
BioAg Production

19/09/2012
How do we transition to a regenerative approach profitably?
By repairing and regenerating the microbial bridge
How can we create regenerative operations?

• Optimise sunlight capture
• Let it breathe
• Energy storage
• Optimal cycling:
  • nutrients, water, carbon
• Diversity, diversity, diversity
• Holistic grazing
= support vital, alive ecosystems
Regenerative Agriculture

• It is the quality of the questions we ask
• What would nature do?
• What would nature not do?
• Are we addressing the cause or symptom
• Does an action address long term goals
“We need real farmers who grow real food, and the will to reform a broken food system. And for that, we need to not only to celebrate farmers, but also to advocate for them.”

-MARK BITTMAN

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