The New Zealand Institute of
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Hot Topic #12 – New Generative Agriculture – The Regenerative Update

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Hot Topics have been conceived to bring New Zealand agricultural and horticultural issues that need debate to the fore in a style and timeliness that cannot be achieved through traditional scientific publication approaches.

'Regenerative agriculture' is being supported enthusiastically by proponents despite information about reduced food production per hectare.

For a farmer on fixed land area, a reduction in income per hectare affects economic viability and succession plans for the next generation.

Research in New Zealand into regenerative agriculture practices continues, but data are not readily available to illustrate benefits.

Summary

So-called 'regenerative agriculture' is often promoted as a pathway to improved environmental and social outcomes. However, the evidence to date from New Zealand does not suggest that it routinely outperforms well-managed conventional pastoral systems. Further, there are concerns associated with the currently promoted regenerative systems, including decreased output per hectare, and reduced farm revenue. Our observation is that New Zealand farmers have long practised a form of continuous improvement that already delivers many of the outcomes now associated with regenerative approaches, including soil carbon maintenance, biodiversity protection, targeted nutrient use, and efficient food production. Also emphasised here is that farm succession depends not only on environmental aspirations, but on economic viability and the ability to pass on a resilient business to the next generation.

Accordingly, the current New Zealand conventional pastoral farming model is not fundamentally unsustainable *per se,* but neither is its sustainable evolution complete. Its long-term viability depends on continued adaptation to new challenges, be they environmental or economic, regulatory and political, or intergenerational. On this basis, the priority for New Zealand should not be to uncritically adopt regenerative agriculture systems, but instead to advance a robust, science-based, economically viable model of 'Generative Agriculture' that continues to improve environmental performance while sustaining food production, farm businesses, and succession.

Background

The 2026 KPMG Agribusiness Agenda (Proudfoot *et al.*, 2026) included the statement that New Zealand is not as focussed on 'regenerative systems that look to balance extraction with a level of reinvestment into natural capital stocks' as the rest of the globe. The authors went on to say that 'Contributors nonetheless suggested a range of opportunities for integrating natural capital into farming systems, with a particular focus on how actions can move beyond compliance and create value for farmers, growers and their supply chain partners. This included the establishment of biodiversity credit mechanisms that reward farmers for managing nature, **something that has been largely delivered as a public good to date**'. (Emphasis added.) This might suggest we are underperforming, and that we need to improve, or that farmers have been doing good things because they are the right thing to do…

The regenerative agriculture movement (*Regenerative Agriculture: How Did It Start And Where Is It Headed? | FoodUnfolded)* was established in the Midwest of the USA, where intensively cultivated and often monoculture cropping farms had inadvertently reduced soil carbon content. This resulted in reduced soil structure, less resilient production systems, and on occasion, yield loss. The response by some was to develop what became known as 'regenerative' methods of farming to restore soil structure through increasing soil carbon content. Damage to the soil of this kind has not been a characteristic of New Zealand pastoral production systems, and therefore the motivation and need for regenerative practice is less urgent, or not important at all. It is notable that most farming systems in New Zealand already largely align with the practices advocated for overseas. It is also of note that statements have been made in USA that the push for regenerative agriculture "romanticizes the past and risks food security" *https://geneticliteracyproject.org/2026/08/20/facts-fallacies-podcast-regenerative-farming-rfk-jr-s-federal-push-romanticizes-the-past-and-risks-food-security*.

Furthermore, there are now statements from the US that "'regenerative agriculture is no better for the planet or your health than conventional farming' *https://geneticliteracyproject.org/2026/08/28/viewpoint-no-regenerative-agriculture-whatever-that-means-is-no-better-for-the-planet-or-your-health-than-conventional-farming-that-uses-pesticides-judiciously/*

When regenerative agriculture started being promoted in New Zealand, agricultural scientists pointed out that our farmers have already been 'regenerating' with their pastoral farming practices. Notably, a special issue of *AgScience* (editors Rowarth and Hickford, 2020; *AgScience 57 Regenerative Agriculture Issue)* brought together information from experts in soils, pastures, and animals. The experts explained that working together, scientists, researchers, rural professionals and farmers have been addressing soil nutrient limitations, identifying pasture species suited for different topo-climates, and establishing farm management systems to optimise production, while also regularly reviewing, developing, adapting and improving those systems.

Because of this approach, and the nature of our soils, New Zealand has on average considerably more organic matter (carbon) in the soil than agricultural soils in other countries (typical content to 30 cm depth being 100 t/ha for New Zealand, 45 t/ha for USA and 30 t/ha for Australia). Despite international evidence that conversion of forest to grasslands leads to carbon loss due to overgrazing, quite the opposite has been observed in New Zealand, with Schipper *et al*. (2017) reporting that the conversion of native forests to farmed pastures increased soil C stocks by an average of approximately 13.7 tonnes C/ha. (This is not to say that any further deforestation of New Zealand would be desirable.) The key to the gain was the use of superphosphate fertiliser, which enabled legumes like clover to survive and fix nitrogen, this in-turn assisting growth of the grasses.

Further, productivity gains in agriculture (Stats NZ indicates multifactor productivity gains of 2.5% a year since 1978 in comparison with most other New Zealand sectors registering under 1% *Productivity statistics: 1978–2025 | Stats NZ*) have resulted in efficiencies and the concomitant result is that greenhouse gases per unit of animal protein production in New Zealand are lower than in many other countries. These productivity gains have been necessary because New Zealand farmers compete on the international stage for markets, but unlike most other countries, they do not receive government subsidies to support their incomes. What-is-more, at the same time as striving to sustain economically viable businesses, they have often been 'managing nature as a public good', as highlighted by Proudfoot *et al*. (2026).

One concern raised in the *AgScience* (2020) issue was that 'doing better' than what has already been achieved, and quantitatively proving that we are doing better, might be difficult. Whilst regenerative agriculture claims to reward constant improvement, the argument can be sustained that constant improvement is business as usual for New Zealand farmers. Organic matter has increased in the soil since deforestation, and precision agriculture has enabled enhanced targeting of nutrient replacement. There is improved pest control, and a wider range and higher quality of food has been provided. Biodiversity has been protected or enhanced through increased tree planting and wetland preservation (e.g., there are over 5,400 QEII National Trust open space covenants protecting nearly 190,000 hectares of private land across New Zealand, with Budget 2026 allocating a funding boost).

Despite these achievements, the regenerative push and associated rhetoric continued (e.g., Grelet and Lang, 2021; MPI, 2022) and in August 2022 the government co-invested over $54 million into regenerative agriculture research projects 'to develop a sound evidence base of what works well for our soils, climates and farming systems' (*Govt shows how millions of dollars are being directed into emissions-reducing initiatives – NZIAHS*).

When 'Fit for a Better World' was launched by the Ministry for Primary Industries in 2020, a desire was expressed to design a New Zealand based regenerative farming approach with increased profitability and decreased footprint. By 2023 it had done neither (Rowarth *et al*., 2023 and data therein).

To illustrate the problem, Align Farms, a privately owned group of dry-stock and dairy farms on the Canterbury Plains, states: 'Our vision is to align with nature to produce nutrient-rich foods, so we can advance human health, improve environmental outcomes, and create a resilient, diverse, and productive environment for everyone to enjoy'. In this context, the owners have been examining the impact of a regenerative dairy system in comparison with a conventional system. The data gathered (*Align Farms – Farming for a resilient, diverse, productive environment)* have been made publicly available, and the latest *(2024/2025 Season – Align Farms*), continues to illustrate that the conventional dairy systems produce more milk-solids per hectare than the regeneratively managed systems, with no significant change in the milk. Further, there are still no data to support whether the milks from the two different systems have differences in omega fatty acids, linoleic acid, or other macro- and micronutrients. Provision of these data might assist a decision on whether or not the regenerative farming approach leads to milk that's 'better for people and the planet'. Perhaps more concerningly, actual (rather than budget forecast) financial data from the 2023/24 season has revealed that the 22.4% decrease in milk-solids from the regenerative system was associated with a 22.5% decrease in revenue and a 26.5% decrease in earnings before interest and tax. Of further note is that animal health expenditure was 10% higher on the regenerative farm, than the conventional farm.

In the *Align Farms study*, environmental impact (measured by greenhouse gas (GHG) emissions and nutrient loss) was reduced per hectare on the regenerative farm in comparison with the conventionally managed farm, reflecting decreased nutrient inputs and the use of OVERSEER to model impact. **The GHG output per kg of milk-solids was, however, increased.** This result has also been reported for meat on dry stock farms (See Rowarth *et al*., 2023).

Overall, without evidence of improved nutrient composition, milk quality, or animal health, and with a higher GHG footprint, it is difficult to support the claim that regenerative systems are 'better'. This evidence also suggests the approach will decrease food production per hectare at a time of increasing global population and demand for high-quality protein.

Research at Massey University *Whenua Haumanu – Massey University* has been examining dairy production and dry-stock production with conventional or diverse pastures under conventional or regenerative (longer grazing intervals) management. Research has indicated that milk taste is influenced by whether cows are grazing conventional or mixed species pastures, and also by grazing management (see press release *New Whenua Haumanu research shows pasture composition and lactation influence milk flavour – Massey University*). The research plans to identify whether there are nutritional differences as well. As with the Align Farms, milk production has so far been the greatest on the conventionally managed farmlets.

At Lincoln University (Robb *et al*., 2025), sheep liveweight production was 131 kg/ha (23%) less for regenerative than conventional blocks (496 vs. 627 kg/ ha). This reflected the poorer quality (lower crude protein (13% vs. 19%), lower metabolisable energy (9.5 vs. 10.0 MJ/kg DM) and higher neutral detergent fibre (51% vs. 40%) in the regenerative pastures in comparison with the conventional pastures, even though dry-matter production was 22% greater (8,490 vs. 6,940 kg/ha). Some of the more detailed component research published from these studies have shown that some aspects such as nitrogen fixation (Sutharsan *et al*., 2025) and extracellular enzyme activity (Watson *et al*., 2026) are increased in diverse swards in comparison with conventional pastures, but translating these findings to farmer value has yet to occur.

It is important to note that most of the research done in New Zealand has involved pastoral systems, whereas the research from overseas has been more about rehabilitating cropping soil by bringing in animals and rotating crops. In conventional arable production systems in New Zealand, soil carbon can be increased through crop rotations, minimum tillage, the incorporation of animal grazing, and precise variable-rate fertiliser inputs, although typically not to pre-cultivation levels. This can be called a mixed-cropping approach, and it is a well-established practice. It points to a future pathway of improvement that aligns with both global objectives and farmers' practical goals. For specialist crops though, the downside of a regenerative sward being part of the rotation, is the potential for weeds to contaminate future crops.

Production and land area

The problem of reduced yield mentioned in the various trials discussed above has already received attention in the overseas literature.

In December 2020, a proponent of regenerative agriculture, Jason Rowntree, published results (Rowntree *et al*., 2020) from the multispecies pasture rotation (MSPR) system at the USDA-certified organic farm in the southeastern United States, White Oak Pastures. The system investigated 'symbiotically stacks multiple animal production enterprises (i.e., chickens, cattle, sheep, and pigs) on one landscape'. A whole-farm life cycle assessment (LCA) of the MSPR that was originally converted from partly degraded cropland was performed. Production outputs, greenhouse gas (GHG) emissions, land footprints, and soil health outcomes were compared with a conventional (for the USA) commodity production system for the individual species. The 20-year MSPR chrono-sequence of soil C and other soil quality indicators revealed 'dramatic improvement' since establishment, sequestering an average of 2.29 tonnes C per ha per year. Incorporation of soil C sequestration into the LCA reduced net GHG emissions of the MSPR by 80%, resulting in a footprint 66% lower than conventional approaches.

There was, however, a big 'however'... The authors reported that MSPR approach required **2.5x more land to give the same amount of food production** when compared with the conventional systems. They concluded that although the model indicated that MSPR can simultaneously produce protein while regenerating partly degraded cropland, the amount of extra land needed to produce the same amount of food was substantial, with the results being described as 'an important yet paradoxical conclusion on land and food production balance'. The dichotomy or tension was presented as: 'Should society prioritize an input-intensive, conventional system that produces more food from a smaller land base albeit potentially negatively impacting on that land? Or, alternatively, should systems such as MSPR that produce less food on a larger, but more ecologically functional landscape be more highly prioritized?' What was not mentioned was the point that the definition of 'negatively impacting' is a matter of starting point and treatment. Soils tend to reach a dynamic equilibrium in soil organic matter, even under the regime of continuous cropping. A total collapse of the soil's arable production capability is unlikely, but the organic matter content does change and so can affect production.

Four years earlier, Parsons *et al*. (2016) had examined the same problems using the Hurley Pasture Model. Lax grazing was sub-optimal for food production, whether for meat or dairy, but did increase the amount of C sequestered in the soil. Thus, Parsons *et al*. (2016) had paved the way for Rowntree *et al*. (2020) – and Parsons was ahead of the game as his work was not stimulated by regenerative agriculture, but instead by trying to optimise pasture management for food production.

Focussing on food production aligns with the benefits of (spatial) intensification (Trewavas, 2001) and Sustainable Intensification (Pretty and Bharucha, 2014). These concepts promote the idea that increased production to meet the nutritional needs of the global population must be met through higher yields on currently managed land, but with an ever-reducing ecological footprint. 'Sustainable Intensification', emphasises that there is no specification for how the goal can be reached, or which agricultural techniques should be used. The merits of diverse approaches in different locations and context should be evaluated carefully, taking biophysical and social contexts into account. It can be argued that New Zealand has been on this path for several decades because of the need for productivity gains, but that it has also done this while managing nature as a public good. The economic viability of land use for the owner is the driver, and this allows investment in environmental protection. Although indigenous land cover continues to decrease, it is not at the alarming rates recorded over 1250-2000 CE.

Farming families and succession

In a paper presented to the Australasian Agricultural & Resource Economics Society 68th Annual Conference, Canberra, in February 2024, Stephens *et al*., (2024) asked "do you want to make a living and even keep the show on the road for the next generation?" The title of the paper gives the clue: Doing it P*roperly: Regenerating Farms for Future Generations Requires Whole Analyses of Farm Systems, not Partial Analyses Masquerading as 'Holism'*. Professor Bill Malcolm explained that the true meaning of regenerative farming is to 'regenerate' the farm business with succession into the next generation and contributed the next section of this hot topic.

Succession is the ultimate form of regenerating the agricultural business.

Stephens (2020) and Stephens *et al*. (2022) asked: 'Why and how, in some cases, has the same family operated a farm for generations, and why and how do other such family farms cease to continue in the same ownership (despite the desire to do so?) The study investigated the intergenerational succession of family farm businesses in which there were three main aims of family farm business owners (Kaine *et al*., 1997), namely:

- Provide adequately for the retirement of the owners.
- Pass on to heirs a farm that has reasonable prospects of being a sound economic proposition and financially viable, that can cope with the risk and uncertainty, and that has the potential for the necessary future improvements in productivity and growth of wealth that is necessary for the farming child or children.
- Provide a share of resources for the non–farming children that they consider being adequately commensurate with their entitlement, and that they are content with that share.

Achieving these aims, means a business is meeting aspirations of regenerating and succession.

Stephens (2020) conducted sixteen whole farm business case studies looking into the question of succession. The cases were chosen from businesses that Stephens knew (nearly) all about – their history and how they operated and performed. In the cases in which these three main aims of farm family businesses – the business regeneration principles – had been achieved, the dominant characteristic that enabled this to happen was that the controlling generation set out to achieve the goal of regenerating. They had well-defined goals and worked hard to achieve them. They:

- Employed and retained the best people available.
- Provided choices for following generations.

- Farmed profitably consistently and expanded the capital base of the business in real terms to have a viable going concern to pass on and wealth to share.
- Ensured family cohesion within and between generations.
- Managed expectations of individual family members.

These measures can be summed up as building a business culture that fosters the growth of the critical resources of the people and the owned and managed capital. The family ensured that the people in the business consistently focussed on, and performed at a high level to achieve, the three main aims. From these cases, the conclusion was that no single step or strategic act would ensure the three main aims would be achieved, and that the business would regenerate. The most important feature of the farm businesses that achieved these aims was that control was handed over at a young age.

In all cases of farm businesses that regenerated, where the farm was handed on to the next generation with good prospects of succeeding, the family had taken a whole of family, whole of business, whole of farm approach to analysing and managing the business. This enabled them to deliver consistently on the culture, efficiency, liquidity, growth and risk management measures of farm performance for decades.

The question must be asked if whether focussing on just one aspect of the business (as the interest in regenerative agriculture grows), is going to ensure the business success that the advocates for regenerative agriculture believe. Managing the land well involves economic viability and environmental sustainability and both are an important part of being able to succeed or pass on the farm to the next generation.

Science and economics

In 2020, a perspective paper (Rowarth *et al*., 2020) suggested that scientific rigour and economic analysis were needed to back the claims being made about regenerative agriculture. Since then, the various pieces of research reported in the suite of papers cited here have revealed that most claims of benefit are in only one area or involve using the embracing and ill-defined term 'better'. Instead, both reductionist and integrated approaches are needed (Hickford *et al*., 2025) but when employed for regenerative agriculture, they do not support that the outcome is 'better'.

Important in the economics and Professor Malcolm's 'handing over control at a young age' are the latest data from StatisticsNZ (*Agricultural snapshot: Insights into farmers' lives | Stats NZ*; released June 5th 2026) indicating that the number of farmers aged 65 and over increased 66% between 2013 and 2023 (in comparison with 54% in the general population). Further, in 2023, the median age of farmers was 49.8 years, compared with 41.9 years for all employed people. Median age varied by type of farmer, with dairy cattle farmers (41.0 years) tending to be much younger than sheep farmers (55.8 years) or beef cattle farmers (62.2 years).

One of the claims for regenerative agriculture is that it is attracting the next generation of farmers, as well as re-engaging people seeking a change. The results from the 2026 survey on farmers might give some indication of whether this is or isn't true, but the main thing for the next generation is whether they can afford to take on the farm, and that depends on the ability to generate an income for economic viability, as Professor Malcolm has stated.

Conclusions

Nobody denies that a decrease in animal grazing pressure may allow an increase in soil carbon as the system adjusts to a new normal. This may be one way to increase soil carbon, if that is an ambition in the context of the historical conversion of native forest to pasture. However, the cost is likely to be born as reduced human food supply. It will therefore also potentially affect the economics of the farming business.

Neither were considered in the Rountree questions:

Should society prioritize an input-intensive, conventional system that produces more food from a smaller yet potentially negatively impacting on the land base? Or, alternatively, should systems such as MSPR that produce less food on a larger, but more ecologically functional landscape be more highly prioritized?

For the global population and the farmer's business, the question on how to provide increased food and stay viable are paramount. For New Zealand, the answer does not seem to be adopting strategies that have been revealed to have limitations. What might be possible in the future is instead promoting a New Zealand version of 'Generative Agriculture'. This would be where farmers continue to work with nature and science to produce high-quality food, whilst continuing to respond to market signals and adopting technologies and practices that assist in reducing environmental footprint and maintaining or improving soil carbon content. It would be a journey of continuous improvement: New 'Generative Agriculture' – fuelled by science and tempered by experience – or arguably what we otherwise already do.

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References

Grelet, G-A.; Lang, S. 2021. 'Think piece' on Regenerative Agriculture in Aotearoa New Zealand: project overview and statement of purpose Contract Report: *LC3954 LandCare Report. 15p.*

Hickford, J.G.H.; Goldson, S.L.; Caradus, J.R.; Rowarth, J.S. 2025. Reductionist science in agriculture and horticulture. New Zealand Journal of Agricultural Research. 68 (5): 829–838. *https://doi.org/10.1080/00288233.2023.2294783*

Kaine, G.W.; Crosby, E.M.; Stayner, R.A. 1997. *Succession and Inheritance on Australian Family Farms*, TRDC Publication No. 198, The Rural Development Centre, University of New England, Armidale, NSW.

MPI. 2022. *Regenerating Aotearoa: Investigating the impacts of regenerative farming practices*. 28p.

Parsons, A.J.; Thornley, J.H.M.; Rasmussen, S.; Rowarth, J.S. 2016. Some clarification of the impacts of grassland intensification on food production, nitrogen release, greenhouse gas emissions and carbon sequestration: using the example of New Zealand. CABI Reviews pp. 1-19. *https://doi.org/10.1079/PAVSNNR201611054*

Pretty, J.; Bharucha, Z.P. 2014. Sustainable intensification in agricultural systems. Annals of Botany. 114 (8): 1571-1596. *https://doi.org/10.1093/aob/mcu205*

Proudfoot, I.; Watene, A.; Love, B. 2026. From Status Quo to Status Change. *Agribusiness Agenda 2026 | KPMG NZ*. 59p.

Robb, L., Black, A., Mills, A., & Moot, D. (2025). Sheep liveweight and dry matter production from Year 3 of the Regenerative Agriculture Dryland Experiment. Journal of New Zealand Grasslands, 87, 161–173. *https://doi.org/10.33584/jnzg.2025.87.3781*

Rowarth, J.S.; Hickford, J. 2020. Special Issue on Regenerative Agriculture. AgScience *57 Regenerative Agriculture Issue*. 15p.

Rowarth, J.S.; Roberts, A.H.C.; Manning. M.J. 2020. Learning from the past: a comparison of food production systems for managing nutrients. In: Nutrient Management in Farmed Landscapes. (Eds. C.L. Christensen, D.J. Horne and R. Singh). *http://flrc.massey.ac.nz/publications.html*. Occasional Report No. 33. Farmed Landscapes Research Centre, Massey University, Palmerston North, New Zealand. 7 pages. *Paper_Rowarth_2020.pdf*

Rowarth, J.S.; Roberts, A.H.C.; Manning, M.J. 2023. The Goal, the Concepts and the Path to Success. In: Diverse solutions for efficient land, water and nutrient use. (Eds. C.L. Christensen, D.J. Horne and R. Singh). *http://flrc.massey.ac.nz/publications.html*. Occasional Report No. 35. Farmed Landscapes Research Centre, Massey University, Palmerston North, New Zealand. 8 pages. *https://flrc.massey.ac.nz/workshops/23/Manuscripts/Rowarth.pdf*

Rowntree, J.E.; Stanley, P.L.; Maciel, I.C.F.; Thorbecke, M.; Rosenzweig, S.T.; Guzman, A.; Raven, M.R. 2020. Ecosystem Impacts and Productive Capacity of a Multi-Species Pastured Livestock System. Frontiers in Sustainable Food Systems. 4:544984. https://doi.org/10.3389/fsufs.2020.544984

Schipper, L.A.; Mudge, P.L.; Kirschbaum, M.U.; Hedley, C.B.; Golubiewski, N.E.; Smaill, S.J.; Kelliher, F.M. A review of soil carbon change in New Zealand's grazed grasslands. New Zealand Journal of Agricultural Research. 60 (2): 93-118.

Stephens, M. 2020. Farming for Generations. Unpublished PhD, School of Agriculture, University of Melbourne.

Stephens, M.; Malcolm, B.; Sinnett, A.; Deane P.; Farquharson B. 2022. Farming for Generations. Australasian Agribusiness Perspectives, Vol.25, Paper 2. Farming for Generations: An investigation into the challenges of farm businesses remaining in the ownership of the same family for several generations.

Stephens, M.; Malcolm, B.; Sinnett, A.; Deane, P.; Shephard. 2024. Doing it Properly: Regenerating Farms for Future Generations Requires Whole Analyses of Farm Systems, not Partial Analyses Masquerading as 'Holism'. Paper presented to the AARES 68thAnnual Conference, Canberra, February 2024.

Sutharsan, R.; Jeyakumar, P.; Burkitt, L.; Matse, D. T.; Dhanuskodi, R.; Hanly, J.; Donaghy, D.J. 2025. Enhancing Biological Nitrogen Fixation Through Diverse Pasture Swards. Plants. 14: 2727. https://doi.org/10.3390/plants14172727

Trewavas, A.J. 2001. The population/biodiversity paradox: agricultural efficiency to save wilderness. Plant Physiology. 125:174–9.

Watson, K.J.; Alster, C.J.; Moir, J.L.; Condron, L.M.; Black, A.D. 2026. Regenerative grazing and grassland management enhance soil extracellular enzyme activity and alter microbial nutrient acquisition. Agriculture, Ecosystems and Environment. 411, 110595. *https://doi.org/10.1016/j.agee.2026.110595*