

Regenerative Agriculture

farmer motivation, environment and climate improvement

Abstract

Regenerative agriculture has become a social movement in farming. It embraces the environmental basis of farming. Land, water and nutrients are viewed as an ecological whole. This includes bacteria and mycorrhiza as essential to soil health and plant diversity, and mob stocking and no-till farming above ground. Regen ag, as regenerative agriculture is often called, is a paradigm shift for farmers, who are often perceived as resistant. There is a mismatch between academic and policy interest focusing on the scientific need for and value of regenerative agriculture, and the social and human motivating benefits of regenerative agriculture. This crucial willingness, not simply the turn away from denialism, is the signal significance of this new form of farming. In New Zealand and globally, climate change and environmental degradation can be addressed much more quickly, more thoroughly and less contentiously if regenerative agriculture is supported and extended, even as science documentation is achieved over time.

Keywords carbon sequestering, emissions policy, environment, regenerative agriculture, regenerative farming, regen ag

The quality of discussion about regenerative agriculture/regenerative farming in New Zealand is impressive. Indeed, both 'regen ag' (the practice) and regenerative agriculture (the discussion) are exploding nationally. These things are so new that the term regenerative agriculture itself is only just coming into public awareness – or is barely even there yet – though it has a long provenance in multiple forms. It is a term used in multiple countries and encompasses a diversity of approaches to farming, including agro-ecology, holistic farming, sequence farming and many others (Raven, 2020). Regenerative agriculture can be called a 'broad church' concept, mostly inclusive of new ideas rather than distinguishing and excluding them (Lal, 2020). It is all about questioning current farming practices in the light of environmental change and damage.

There are many things to be said about the importance of regenerative agriculture, what it is, how it works, how it is being adopted, and what it might mean for

farming, food and fibre supply chains, and society more generally. Making a summary which represents the phenomenon, yet in a way that invites understanding of the nuances, is difficult and varies according to purpose or audience. The intention here is to acknowledge and applaud both the advocates and practitioners of regenerative agriculture, and the part played by those who ask questions about what is currently unknown as they engage with regen ag. The primary goal is to open up the subject of regenerative agriculture in terms of farmer motivation.

I write as a sociologist, respectful of and interested in the science and economics around agriculture generally, and regenerative agriculture in particular (Gosnell, Grimm and Goldstein, 2020). I assert that research talk and direction too quickly defaults to focusing on biophysical science questions rather than centring on the efforts of farmers. Adjusting this STEM mindset would allow greater energy and funding to go towards examining linkages and studying motivations on the farm and in rural communities and towns. This is pro- not anti-science, but sees some scientists' attitudes as circular, defeating the very adoption of practices their work indicates is needed. In supporting this needed shift to centring the social world that will make the change, instead of the experts who document the problems, I recently published a piece in an environmental educators' journal (Burns, 2020). I was aghast at the near-complete absence of previous references in the journal to farming, let alone regenerative farming.

Setting an outline

Regenerative agriculture is a proposal about changing farming in order to undo the degradation of the farmed environment. It is a shift towards farming *with* the environment, rather than treating it as merely a platform. Such an approach recognises catchments, water flows through farm landscapes, erosion of soil and leaching of excessively added nutrients (Brunetti, 2014). A verbal play on the term 'regenerative' itself is sometimes made, that we are long past retrieving sustainability; instead we need to *regenerate* soil and natural systems. Accounts of how creating

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a few centimetres of soil sequesters many tonnes of carbon and thousands of litres of moisture (Smith, 2020) imply new environmental farming practices.

There is no single promise by which regenerative agriculture creates motivation, but multiple items can be identified. Rebuilding soil profiles is a central theme. Brown's farmer account centres on experimentally rebuilding soil health, chemistry, bacteria and mycorrhiza and minimising fertilisers (Brown, 2018). Others emphasise year-round ground cover, no-till planting, mob stocking or increased plant biodiversity (General Mills, 2020). The promise of environmental regeneration connects these in changed farming practices. Evans (2020) says: 'regenerative agriculture [is] the idea that farming can reverse soil degradation and bring vitality back to the land, its plants, waterways, animals and people.'

New Zealand writers and scholars are contributing substantial and balanced information to the discussion exploring regenerative agriculture. Social, economic and science aspects of regenerative agriculture can be found in Siegfried (2019a), Evans (2020), Merfield (2019) and McAleer (2020). These and other writers also provide individual New Zealand farmer accounts (e.g. Eb, 2019; Siegfried, 2019b; Smith, 2020). Making use of this breadth of thinking and questioning is the task before government, academics and

policymakers. Roche (1994) provides a summary of the bureaucratic failures in addressing soil and water degradation; Raven (2020) is part of the recent upsurge in writing using the longer historical sweep from his own career.

Global significance is also the national promise

There is global significance in regenerative agriculture. Blaschke and Hall's exchange about a 'careful revolution' reducing emissions locates the discussion in Aotearoa New Zealand (Blaschke, 2020; Hall, 2019). A wider global promise is implied or explicit, but is not necessarily foremost in the minds of those describing themselves as interested in or doing regenerative farming. This is the potential importance of regenerative agriculture, not just nationally but globally in helping to slow climate change (Toensmeier, 2016; Sanderman, Hengl and Fiske, 2017; FAO, 2020; Gosnell, Hill and Voyer, 2020; Sharma, 2020; Smith, 2020).

This 'big' argument of regenerative agriculture can be sketched as:

- farming today occupies nearly 40% of earth's land surface;
- farming and cropping produce 30–38% of greenhouse gas emissions (the precise figure depending on sources relied upon);
- this amount of atmospheric greenhouse gas emissions is greater than that of other major emitting sectors – for example, more than global industrial and transport combined;
- the idea of stopping food production sounds like a greater problem than addressing other sectors contributing to climate heating;
- regenerative agriculture has the potential to reduce (mitigate) the amount of carbon emitted by farming currently and increase water resilience, rivalling forestry plantations and in a much quicker time frame.

Quantifying how much carbon can be drawn down, and differentiating the range of circumstances and time frames, is the continuing valued task of science. But any disapproval of or attempt to control the farmer-led move to regenerative agriculture until answers have been found misses the point. Like climate change itself, scientific

investigation is often a post hoc process, confirming or modifying understanding. Lived reality happens – in this case a movement within farming. Science did not invent something called regen ag and then decide to analyse it. Rather, the phenomenon has grown and the appropriate scientific assessment subsequently takes place (Fulton, 2019).

To the global statistics – different sources provide varying or updated percentages, but the basic story is the same – can be added the New Zealand statistics, which are uncomfortably parallel and increasing, such as half of our greenhouse gases coming from agriculture, with dairying comprising half of this (Ministry for the Environment, 2019). Various parliamentary commissioner for the environment reports over 20 years have documented this trend. The regenerative agriculture claim is that indicative measures suggest that massive amounts of carbon and water could be retained in the soil. This would benefit farmers and food production, reduce landscape degradation and restore water quality. As with issues of complexity in any situation, the interaction of sectors/stakeholders involved in causing the problem needs to be part of the solution (Bardsley et al., 2020, p.14; Dockstader and Bell, 2020; James, Iorns and Gerard, 2020). Food provenance and consumer demands, as well as urban requirements for clean water and less sediment, are no longer a shoulder shrug of ‘that’s what happens in farming’ but part of the pressure supporting change.

The story of carbon sequestration can be retold in terms of water pollution, nutrient loss and erosion. Two years ago, Journeaux et al. (2018) managed just a mention of ‘[r]egenerative agricultural techniques like holistic grazing that sequester carbon into soil and planting perennial polyculture food systems with integrated animal systems’. Mike Joy’s repeated explanations of the degraded state of New Zealand’s waterways are only surprising because of the national inculcation from drinking our own Kool Aid: ‘clean and green’ we are not, the tourist success of that tag line notwithstanding.

Government policy: moving right along

In July 2020 the New Zealand government accepted the report of the Primary Sector Council, a body it had set up in 2018

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(Primary Sector Council, 2019; Ministry for Primary Industries, 2020). Murphy reports the government agreeing with ‘the vision and the need for speed’:

After a long period of consultation and research, the council’s vision for New Zealand’s primary industries is all encompassing: ‘We are committed to meeting the greatest challenge humanity faces: rapidly moving to a low carbon emissions society, restoring the health of our water, reversing the decline in biodiversity and, at the same time, feeding our people.’ (Murphy, 2020)

This is, of course, not policy but setting the strategic direction for policy development. As might be expected, the positivity in the public release emphasises building New Zealand’s rural economy and

adding economic value. Regenerative agriculture is one of six topics discussed in the middle section of three main sections (‘Productive’, ‘Sustainable’, ‘Inclusive’) of the government’s report. Case study 3, ‘Regenerative farming at Rehoboth farm’, outlines a South Otago sheep operation (Ministry for Primary Industries, 2020, pp.12, 20).

As Murphy points out, regenerative agriculture is, from the government’s point of view, a component in addressing ‘the Government’s existing emissions targets’, but nine references to ‘emissions’ in the report are not directly attached to regenerative agriculture. The potential, however, for regenerative agriculture to far outrank other solutions to greenhouse gas emissions points to a particular urgency in expanding policy attention to current innovation happening within the farming community. The desire for inclusivity – to enhance well-being, jobs and communities – is the third main plank of the report.

Now received by government, the report becomes its ‘acceleration roadmap’ for policy formation for te taiao, the natural world. Regenerative farming at page 17 gets two bullet points under ‘Regenerative farming and establishment of Te Taiao’:

- Investigate the use of regenerative farming to help meet our Te Taiao goals.
- Develop a programme for realising Te Taiao across farming systems including pilot farm projects and science development.

‘Freshwater and productive land’ also gets two policy bullet points, but with no mention of mātauranga Māori, with which ecologists find a deep affinity:

- Implement new regulatory frameworks for improving water quality and management of productive land, including introducing mandatory farm environment plans.
- Enable catchment groups and other ‘on-the-ground’ collective groups to take action to improve the health of waterways.

For both, these are high-end general strategy statements, not detailed proposals; that comes later in policy elaboration of the big picture. What is significant, however, is the prospective nature of the points – somewhere in the future, despite the

rhetoric of ‘acceleration’. Clearly, policy formation is an accumulative process, involving stakeholders and interests. But this is lagging behind the reality of the adoption of regenerative agriculture by New Zealand farmers.

It can be noted that Te Mana o te Taiao, the Aotearoa New Zealand Biodiversity Strategy (Department of Conservation, 2020) does not even pick up regenerative agriculture at all, although some concepts of sustainable agriculture supporting biodiversity conservation appeared in the first strategy in 2000.

Regen ag motivates farmers, and why that is important

Energising policy

The potential policy importance of regenerative agriculture is that it energises, brings forward and sees enactment of environmental changes consistent with these strategies for policy formation. It does so in comprehensive, cultural and attitudinal ways. It can be argued, as Eb’s title indicates, that ‘With the walls closing in, regenerative farming is a way forward for agriculture’, a pattern of much human change (Eb, 2019). But regen ag is much more than pre-emptive compliance, regulatory concession or ‘getting in first’. The farming community’s interest in regenerative agriculture, its internal group discussions and willingness to experiment have yet to create a ‘tipping point’ that can be called a paradigm change.

Previous lack of change, or resistance to change, has deeply concerned regional councils, innovative farmers, environmental scientists and policymakers, even as the science has settled. Today, the keen interest and the willingness to adapt and radically change farming practice is something to be celebrated and supported, so that it continues and expands. Whatever the science suggests by way of future modifications, regenerative agriculture is a good thing in multiple ways. It takes a whole-of-farm approach. In ecological terms, it aims to respect the environment, not ignore it. Against unthinking extraction of more and more, whether water, animals, trees or crops, there is a new recognition of environmental limits. There is a corresponding willingness to experiment to establish what works, or does not, in

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different parts of the country, given this new motivation.

Deflecting critique

What has long been criticised globally as ‘industrial farming’, ‘fertiliser capitalism’ or with similar negative epithets is turned around in regenerative farming to start with the farm’s ecology and hydrology as the engine of results (Masters, 2019). Criticisms of farming, particularly dairying, include it being extractive, polluting, leaching, and letting degradation extend beyond farm boundaries. The new paradigm improves soil organic matter and water retention, and reduces nutrient run-off and erosion. Regenerative agriculture’s environmental drive seeks better ways to manage pasture and farmland. In policy terms, this is the difference between building a ship and getting it out of the port and rudder work modifying direction given existing forward momentum.

Criticism of ‘regenerative hype’ and demand for prior biophysical research are too late; the horse has bolted (Rowarth, 2019; Anderson, 2020; Fulton, 2019). These

sensible enough points need to be made as part of the paradigm shift taking place. Worse, perceived negativity by experts or advisors (Hickford, Rowarth and Edlin, 2020), even if positively intended as sensible precaution, must be advanced in such a way as to keep the forward momentum of this once-in-a-century shift in farming orientation. The still mid-20th-century attitudes shown by Hickford et al. compare poorly with an equally long-standing soil science oeuvre referenced in Lal’s (2020) positive assessment of regenerative agriculture. Granted there is need for cool-headed evaluation, but this shift, like the second half of a rugby match, is about momentum, not plans. Farmer motivation for the environment is the holy grail politicians, scientists, ecologists and some farmers have been seeking for years.

Regen ag as a social movement

Regenerative agriculture can be understood sociologically as having the characteristics of a social movement: it has an overarching but diffuse purpose; there is a group solidarity that includes events and organisation but is part of a wider network; specific and still-emerging projects are understood within the overall agenda about soil, fertiliser, erosion and biodiversity recombinations; it is a progressive movement, not a reactionary one. There are still plenty of farmers who think erosion of tonnes per hectare per year is ‘normal’ farming, but that understanding is starting to shrink; it will shock the laggards as the change sinks in.

Diffusion theory (Rogers, 1995) recognises that regenerative farmers, like farmers generally, comprise multiple groups, with early adopters, mainstream adopters and resistant late changers. Farmer motivation, ergo, is not one thing, but varies by sector, land use and region; the Quorum Sense group, describing itself as ‘NZs regenerative farming network’ (www.quorumsense.org.nz/), is one example of early adopters. Phrases like ‘rapidly growing’ or ‘widely promulgated’ (Bardsley et al., 2020) used about regenerative agriculture indicate an emerging sense of urgency and possibility among farmers. All humans, not only farmers, are social beings; the present sense of renewed solidarity of purpose

rather than solidarity of resistance translates opposition to motivation. Regenerative agriculture creates important direct and indirect motivations for farmers. It is no longer a matter of waiting for the science, government policy or tougher regulations.

From denialism to environmental stewardship

The stereotype of farmers in the larger urban centres is of them being conservative and resistant to change. While there has been sensitivity to the demands for, and costs of, changing environmental farming practice, Evans remarks that, 'No farmer wants to degenerate their land' (Evans, 2020). McAleer expresses this in more general terms: 'New Zealand is thirsty for knowledge about regenerative agriculture' (McAleer, 2020). She cites Manaaki Whenua Landcare Research and Beef + Lamb New Zealand as organisations initiating regenerative agriculture research in 2020. Over some decades a limited number of scholars have excavated knowledge about farming practice and values from farmers themselves (McManus, et al., 2012; Hunt et al., 2013; Stephenson et al., 2020), Gosnell, Gill and Voyer (2019) doing so specifically about regenerative agriculture.

Regenerative agriculture motivation taps into fundamental farmer identity. Farmer autonomy turns out to be a motivational lever for getting on with the job of a new kind of farming. Why is climate denial among farmers waning? First, American corporate conservative activist-denialists (and Rogernomics) for a time hijacked farmer conservatism. Hunt et al. (2013) showed the narrowing effect on farmer understanding. Second, antipathy to politics is a related but distinct sensibility. New Zealand farmers' anti-politics is part of society-wide dislike of politicians' veniality and perceived self-serving or corporate-serving behaviour (Copland, 2020). The fusion of anti-environmentalism and anti-politics is dissolving, however, as traditional care of land is reasserted. Third, my perception is that farmer denialism is significantly fading as children bring ideas home from school and university, and a greater awareness that neo-liberal corporate ideologies are not, after all, in farmers' best interests.

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Farm viability and regen ag economics

Regenerative farming is motivating farmers to reposition farming. At a July 2020 presentation to 100 people at Clive, near Hastings, Peter Barrett of Linnburn Station, Central Otago explicitly rejected sentiment or philosophy, saying that for him it is all about the money. Previous costly fertiliser application was making no difference, wasting money. Trial and error since 2014 to economically survive, spreadsheet-based, led to diverse planting and mob stocking. Regenerative agriculture on this understanding is just good farming. Farmers commonly focus on farm viability, yet financial discussion often turns to demotivating aspects of well-being, social negativity about farming and similar. Evans asks:

Could these more intangible human benefits be one of regenerative

agriculture's greatest contributions? For years, farmers in New Zealand have felt beleaguered and misunderstood, persecuted for their cows' farts and blamed for the state of the waterways. Switching to a kind of farming that places the well-being of land, people and animals at its heart helps farmers feel like they're part of the solution. (Evans, 2020)

The relationship of farm economics to these major changes in farm practices is a priority for detailed examination (LaCanne and Lundgren, 2018). The New Zealand parliamentary commissioner for the environment has consistently recommended 'more sustainable' farming as economically sensible, drawing on a large body of pre-existing research on water and soil conservation work.

This economic emphasis is especially important as links between farming environmentally and the financial implications continue to shift, potentially quite quickly. What could be the different consequences for early adopters, or farms on marginal country? What changes when regen ag is adopted at scale? Positive and adverse experiences will affect motivation for this necessary shift. Negatively, there are no guarantees that all farmers will be able to survive under regenerative farming. Positively, sudden economic change (Oram, 2020) or scientific discovery (Beerling et al., 2020) can leverage the regenerative paradigm shift. Carrington (2020) headlines the latter with a new research finding that 'Spreading rock dust on fields could remove vast amounts of CO₂ from air'.

Conclusion

The motivational benefits of regenerative agriculture for farmers and farming are separate from and antecedent to scientific documentation of its effectiveness. Motivation is separate from but equally as important as the technical measurement of biophysical parameters, not a mere add-on to the science. Attempting to reframe regenerative agriculture in STEM terms as needing biophysical assessment and evaluation before going ahead misses the point. Of course regenerative agriculture needs full inquiry. It is much better,

however, to accept the principal framework that the motivational energy is broadly in the right direction – a profound reversal, in fact – and build the science, economic implications and feasibility questions from there.

The potential of regenerative agriculture is sequestering carbon, reversing environmental degradation and

maintaining food production by farmers, benefiting New Zealand's national economy and the global environmental crisis. There are dangers of the term being superficialised and overused by journalists and politicians. Policy dangers for regenerative agriculture include ignoring, downplaying, superficialising, regen-washing or 'overcooking' what it might offer. Attention

to the core of motivation will best enable regulation, positive support and measurement. This is achieved by replacing individualising and psychologising talk of 'barriers' to motivated change with less judgemental and less simplistic language about 'frictions'.

References

- Anderson, D. (2020) 'Regenerative ag's "mythology" questioned', *Rural News*, 30 June, <https://www.ruralnewsgroup.co.nz/rural-news/rural-general-news/regenerative-ag-s-mythology-questioned>
- Bardsley, A., B. Coates, S. Goldson, P. Gluckman and M. Kaiser (2020) 'The future of food and the primary sector: the journey to sustainability', discussion paper, June, Kōi Tū: Centre for Informed Futures, University of Auckland
- Beerling, D.J., E.P. Kantzas, M.R. Lomas et al. (2020) 'Potential for large-scale CO₂ removal via enhanced rock weathering with croplands', *Nature*, 583 (7815), pp.242–48, <https://doi.org/10.1038/s41586-020-2448-9>
- Blaschke, P. (2020) 'Integrated land use options for the Aotearoa New Zealand low-emissions "careful revolution"', *Policy Quarterly*, 16 (2), pp.26–34
- Brown, G. (2018) *Dirt to Soil: one family's journey into regenerative agriculture*, White River Junction: Chelsea Green
- Brunetti, J. (2014) *The Farm as Ecosystem: tapping nature's reservoir – biology, geology, diversity*, Greeley: Acres USA
- Burns, E.A. (2020) 'Placing regenerative farming on environmental educators' horizons', *Australian Journal of Environmental Education*, 37 (1), pp.29–39, <https://doi.org/10.1017/aee.2020.21>
- Carrington, D. (2020) 'Spreading rock dust on fields could remove vast amounts of CO₂ from air', *Guardian*, 8 July, https://www.theguardian.com/environment/2020/jul/08/spreading-rock-dust-on-fields-could-remove-vast-amounts-of-co2-from-air?CMP=Share_AndroidApp_Gmail
- Copland, S. (2020) 'Anti-politics and global climate inaction: the case of the Australian carbon tax', *Critical Sociology*, 46 (4–5), pp.623–41, <https://doi.org/10.1177/0896920519870230>
- Department of Conservation (2020) *Te Mana o te Taiao: Aotearoa New Zealand Biodiversity Strategy 2020*, Wellington: New Zealand Government, <https://www.doc.govt.nz/globalassets/documents/conservation/biodiversity/anzbs-2020.pdf>
- Dockstader, S. and S.E. Bell (2020) 'Ecomodern masculinity, energy security, and green consumerism: the rise of biofuels in the United States', *Critical Sociology*, 46 (4–5), pp.643–60, <https://doi.org/10.1177/0896920519885010>
- Eb, D. (2019) 'With the walls closing in, regenerative farming is a way forward for agriculture', *Spinoff*, 4 November, <https://thespinoff.co.nz/business/04-11-2019/with-the-walls-closing-in-regenerative-farming-is-a-way-forward-for-agriculture/>
- Evans, K. (2020) 'Regenerative agriculture', *New Zealand Geographic*, 164, pp.36–59
- FAO (2020) 'Conservation agriculture', <http://www.fao.org/conservation-agriculture/en/>
- Fulton, T. (2019) 'Evidence needed to support regenerative ag', *Farmers Weekly*, 30 May, <https://farmersweekly.co.nz/#>
- General Mills (2020) 'The six core principles of regenerative agriculture', <https://www.generalmills.com/en/Responsibility/Sustainability/Regenerative-agriculture>
- Gosnell, H., N. Gill and M. Voyer (2019) 'Transformational adaptation on the farm: processes of change and persistence in transitions to "climate-smart" regenerative agriculture', *Global Environmental Change*, 59, pp.1–13, <https://doi.org/10.1016/j.gloenvcha.2019.101965>
- Gosnell, H., K. Grimm and B.E. Goldstein (2020) 'A half century of holistic management: what does the evidence reveal?', *Agriculture and Human Values*, <https://doi.org/10.1007/s10460-020-10016-w>
- Hall, D. (2019) *A Careful Revolution: towards a low-emissions future*, Wellington: Bridget Williams Books
- Hickford, J., J. Rowarth and B. Edlin (eds) (2020) 'Special issue on regenerative agriculture', *AgScience*, 57, December
- Hunt, L.M., C. Rosin, H. Campbell and J.R. Fairweather (2013) 'The impact of neoliberalism on New Zealand farmers: changing what it means to be a "good farmer"', *Extension Farming Systems Journal*, 9 (1), pp.34–42
- James, V., C. Iorns and P. Gerard (2020) 'Sea level rise and local government', *Policy Quarterly*, 16 (1), pp.62–66, <https://doi.org/10.26686/pq.v16i1.6356>
- Journeaux, P., E. van Reenen, S. Pike, D. Miller and G. Austin (2018) *Literature Review and Analysis of Farmer Decision Making with Regard to Climate Change and Biological Gas Emissions*, AgFirst, <https://www.mpi.govt.nz/dmsdocument/32137/direct>
- Joy, M. (2020) 'New Zealand government ignores expert advice in its plan to improve water quality in rivers and lakes', *The Conversation*, 28 May, <https://theconversation.com/grattan-on-friday-which-leaders-and-health-experts-will-be-on-the-right-side-of-history-on-covid-19-policy-134801>
- LaCanne, C.E. and J.G. Lundgren (2018) 'Regenerative agriculture: merging farming and natural resource conservation profitably', *PeerJ*, 6, pp.1–12, <https://doi.org/10.7717/peerj.4428>
- Lal, R. (2020) 'Regenerative agriculture for food and climate', *Journal of Soil and Water Conservation*, 75, pp.123A–4A, <https://doi.org/10.2489/jswc.2020.0620a>
- Masters, N. (2019) *For the Love of Soil*, Reality Press
- McAleer, A. (2020) 'What do we know about regenerative agriculture in New Zealand?', *Our Land and Water*, 27 May, <https://ourlandandwater.nz/news/what-do-we-know-about-regenerative-agriculture-in-new-zealand/>

- McManus, P., J. Walmsley, N. Argent, S. Baum, L. Bourke, J. Martin, B. Pritchard and T. Sorensen (2012) 'Rural community and rural resilience: what is important to farmers in keeping their country towns alive?', *Journal of Rural Studies*, 28 (1), pp.20–9, <https://doi.org/10.1016/j.jrurstud.2011.09.003>
- Merfield, C.N. (2019) *An Analysis and Overview of Regenerative Agriculture*, report 2–2019, BHU Future Farming Centre, www.bhu.org.nz/future-farming-centre
- Ministry for the Environment (2019) 'New Zealand's greenhouse gas inventory, 1990–2017', <https://www.mfe.govt.nz/sites/default/files/media/Climate%20Change/nz-greenhouse-gas-inventory-2019.pdf>
- Ministry for Primary Industries (2020) *Fit for a Better World: accelerating our economic potential*, Wellington: New Zealand Government, <https://www.mpi.govt.nz/dmsdocument/41031-fit-for-a-better-world-accelerating-our-economic-potential>
- Murphy, T. (2020) 'A shake-up for the land and her export billions', *Newsroom*, 9 July, <https://www.newsroom.co.nz/a-shake-up-for-the-land-and-her-export-billions>
- Oram, R. (2020) 'Now we can see our future', *Newsroom*, 12 July, <https://www.newsroom.co.nz/economic-recovery/oram-now-we-can-see-our-future>
- Primary Sector Council (2020) *Fit for a Better World*, https://fitforabetterworld.org.nz/assets/Uploads/PSC-Report_11June2020-WEB.pdf
- Raven, M.R. (2020) 'Regenerative agriculture and implications for agriculture, food, and natural resources education', *Journal of Agricultural Education*, 61 (1), pp.1–12, <https://doi.org/10.5032/jae.2020.01001>
- Roche, M.M. (1994) *Land and Water: water and soil conservation and central government in New Zealand, 1941–1988*, Wellington: Historical Branch, Department of Internal Affairs
- Rogers, E.M. (1995) *Diffusion of Innovation* (4th edn), New York: Free Press
- Rowarth, J. (2019) 'Regenerative agriculture – context is everything', *New Zealand Herald*, 3 October, https://www.nzherald.co.nz/the-country/news/article.cfm?c_id=16&objectid=12273396
- Sanderman, J., T. Hengl and G.J. Fiske (2017) 'Soil carbon debt of 12,000 years of human land use', *PNAS*, 114 (36), pp.9575–80, <https://doi.org/10.1073/pnas.1706103114>
- Sharma, S. (2020) 'Milking the planet: how big dairy is heating up the planet and hollowing out rural communities', Minneapolis: Institute for Agriculture and Trade Policy, www.iatp.org/milking-planet
- Siegfried, A. (2020a) 'What is Regen Ag and why is it big for NZ?', *Newsroom*, 4 May, <https://www.newsroom.co.nz/2020/05/04/1155648/alina-siegfried-good-bad-opportunity>
- Siegfried, A. (2020b) 'Regenerative agriculture: how a dairy farmer learned to trust his instincts', *RNZ News*, 8 May, <https://www.rnz.co.nz/news/country/416143/regenerative-agriculture-how-a-dairy-farmer-learned-to-trust-his-instincts>
- Smith, G. (2020) 'The New Zealand dairies sinking carbon and healing watersheds', *Daily Churn*, 22 May, https://www.darigold.com/the-new-zealand-dairies-sinking-carbon-and-healing-watersheds/?fbclid=IwAR1B1efsKXuVBkQdNhkGhLWBjSFkct7bz4aluCfu8vw4Don_wNWniev_qw
- Stephenson, J., J. Barth, S. Bond, G. Diprose, C. Orchiston, K. Simon and A. Thomas (2020) 'Engaging with communities for climate change adaptation: introducing community development for adaptation', *Policy Quarterly*, 16 (2), pp.35–40
- Toensmeier, E. (2016) *The Carbon Farming Solution: a global toolkit of perennial crops and regenerative agriculture practices for climate change mitigation and food security*, White River Junction: Chelsea Green