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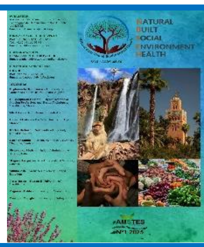

BOOK REVIEW

Managing Biodiversity in Agricultural Landscapes: Conservation, Restoration and Rewilding, edited by *Nick Reid and Rhiannon Smith*. Burleigh Dodds Series in Agricultural Science, *Cambridge, 2024*. *543 p*., *ISBN*: *978-1-80146-454-3 (hardback) £150*; *ISBN*: *978-1-80146-456-7 (PDF)*; *ISBN: 978-1-80146-455-0 (EPUB).*

There are two literatures: of what we know (and find useful) and what is new (which we find interesting). Therefore, it seems to me better … that we should translate certain books which are most needful for all men to know, into a language that we can all understand.

Alfred the Great to Bishop Waerferth, c890 [1]

This book comes late on the scene of what is most needful for all men to know because we have been slow to realize that our daily bread depends as much on unseen, hard-to-see and largely unknown biota as on our artifice and a handful of domesticated species. Biodiversity has been consigned to David Attenborough; alternatively, to Aldo Leopold: '*If the biota, in the course of aeons has built something we like but do not understand, then who but a fool would discard seemingly useless parts? To keep every cog and wheel is the first rule of intelligent tinkering* [2]. The Burleigh Dodds Series on Agricultural Science offers a reliable map. This is a text book; it weighs two and a half pounds; 16 essays cover principles, farmland and conservation practices, the role of government and the private sector, and rewilding; and this review is only a sketch.

Agriculture is driving mass extinction. If there is a will, it might be managed to retain essential biodiversity but crops and pasture already occupy one third of the land – another third is desert – so future biodiversity will depend on how well species and communities can be sustained within and alongside farmland. Andrew Bennett and colleagues from La Trobe University lead off with *Key concepts* in such a way that novices will not flounder and experts can nod sagely.

Species move between natural elements of the landscape like forest patches and wetlands; modified elements like hedgerows; and manmade ponds, ditches and cropland. So, enough – and big enough – habitats are needed for viable populations; and key issues include the frequency and scale of changes, interactions between them, time lags, and irreversible effects. Land is limited so there must be trade-offs between farmland and land for nature: *land sparing* aims for intensive production on the best farmland so that other land can be spared for conservation, *land sharing* requires wildlife-friendly practices on farmland. For most species, land sparing is the least-worst option but most agricultural landscapes occupy a middle ground. The people who live there must be part of the solution but engagement has had mixed success and it is too early to say whether market-based solutions will be any more successful.

Geoff Squire and Cathy Hawes of the James Hutton Institute follow up with *Integrated farm management.* Every productive process depends on wild plants, the soil microbiome, detritus feeders, pollinators, pests and their natural predators, pathogens of crops and livestock, and higher organisms living within managed crops and grassland: defined as Biodiversity for Agriculture (B for A), to distinguish it from Agriculture for Biodiversity (A for B) where management supports iconic plants or animals. Integration implies that the various activities on a farm, and ecological processes they support, are complementary – crop rotation is a long-standing example of integration – but recent intensification has abandoned many traditional, integrated systems in favour of extractive production of very few crop species and varieties, exacerbating soil erosion, pollution and loss of biodiversity.

Early farming systems cropped a small area supported by a hinterland from which nutrients were scavenged by cutting and carrying vegetation or by grazing livestock; or, in slash-and-burn, moving on when fertility was depleted. Both need a lot of land per person. The *green revolution* raised production per unit area by new crop varieties, manufactured or mined fertilizer, irrigation, mechanization, and chemical pest control. Societies that could afford these inputs could dispense with scavenging and recycling but, now, depend on a narrow genetic base susceptible to pests and disease, severe and unpredictable weather, and inherent imbalances. For instance, when livestock are raised on feed grown elsewhere, cycling can be achieved by spreading their manure on the homefields; but the mass of manure from intensive livestock cannot be contained, and the outflow pollutes land and water downstream.

Regeneration may be achieved through increasing species, functional and habitat diversity; safe ranges for soil organic matter, nutrients and seedbanks; chains-of-effect of crop choice, application of fertilizer and pesticide, or tillage; complementary crops, wild plants, invertebrates and soil microbes, and ecological processes such as primary production and creation of soil architecture – *i.e.,* A for B. But all of these require rare skill and judgement. Moreover, action on the field and farm cannot, by itself, arrest the decline of land area per person and depletion of soil resources: the main impediments to sustainability remain extractivism, conflict over land and water resources, and lack of political will.

We are in a world of wicked problems [3] where different people see and know the world differently – not just concerning what should be done but what is the problem, or whether there is one! Theodore Alter and colleagues from Penn State University and Lauren Hull and colleagues from Energy, Environment and Climate Action, Victoria, survey the philosophies, processes and politics of *Engaging local voices.* It may be that individual selfishness impedes social change. And, yet, Elinor Ostrom illustrated case-upon-case of resilient, adaptable natural resources management by local communities drawing on trust, reciprocity and cooperation [4]. Our authors present two current case studies. In Victoria, 150 years of campaigns against rabbits, gorse, blackberry and serrated tussock grass established a range of effective controls but no coordinated action. On the premise that common ownership of the problem and collective action required parties with differing interests to come together to find possible solutions, in 2016, Community Pest Management Groups were established wherein the people most affected by the pest define the problem, create strategies to deal with it, and share investment decisions: a big shift from government-led decision making that marginalized rural and regional stakeholders. There have been no ‘quick fixes’ but empowering people to take personal and collective action has raised community capacity deal with these and future issues.

The Chesapeake Bay catchment embraces six states with a population of 17million whose water is contaminated by sediment, nitrates and phosphates from agricultural runoff. Individual landholders have rights up to heaven and down to hell but not the means to tackle the problem. Yet, over the last decade, community-led initiatives have doubled the no-till acreage, and increased cover crops and edge-of-field practices that have cut phosphate loading by one third and nitrates one sixth. Community engagement requires time, effort and humility. Millions of conversations, public information sessions and negotiations have generated precious public information; and local leadership committees including farmers, agriculture organisations, local government and state agencies, technical service and educational providers focus on understanding the impacts of proposed programs, prioritizing goals, bridging information gaps, and ensuring that all the stakeholders know that their voices are heard and valued. Our authors summarize an immense, inchoate literature on public engagement with check lists of engagement principles but, in one phrase, *we need each other*.

Alice Day and David Johnson of Manchester University and Ezekiel Njeru of Kenyatta University boil down the fuzzy concepts of *Soil health and ecological restoration* to plant-soil feedbacks and biodiversity-ecosystem functional relationships – in particular, plant-microorganism interactions like symbioses with nitrogen fixing bacteria and mycorrhizal fungi, which have co-evolved with green plants over 450 million years. Webs of mycorrhizal hyphae vastly extend and combine the root systems of partner plants, offering: inter-plant signalling to respond to stress, pests and diseases; decomposition of waste and toxins; better access to water and nutrients; stabilization of soil architecture, increased aeration, water infiltration and storage; enhanced soil formation and less erosion; all combining to enhance primary production and, potentially, crop yields. Only potentially, because these biodiversity-soil function relationships evolved in nutrient-limited environments, not fertilized fields and we know little about the interrelationships of 250 000 plant species that form mycorrhizal relationships with a few thousands of fungal species and all their intra-species variations. Transferring theory to practice might require diversifying the plant community; introducing microbial inocula, and changing cultivation practices, in particular by minimum or no-till to avoid disruption of hyphal networks.

The impact and design of field margins by Jane Morrison of Bishop's University, Quebec, is a gem. Agricultural landscapes are increasingly uniform, natural habitats more fragmented, but every field has a margin that may provide a cost-effective and minimally invasive biosphere reserve. It may be a fence, hedge, wall, terrace, track, waterway, grass strip or some combination of these. The biodiversity supported by field margins is only a fraction of what would have been present in the natural landscape but it makes a difference and pays its keep: agronomically – by keeping livestock or trespassers in or out, cutting runoff and erosion, sheltering crops and livestock, enhancing pollination and pest control, providing organic matter, fruit and wood; environmentally – by promoting farm wildlife conservation including soil microorganisms and as a corridor or refuge for beneficial plants and animals, buffering pesticide drift and reducing the need for pesticides, improving soil carbon capture; and socially – by providing access, supporting game, and enhancing the landscape. Our author gives detail on design and management for pollinators, seeding mixes, optimum width and configuration; and the need for policies to support farmers and develop effective context-based management plans.

Ian Montgomery and Neil Reid of Queen's University Belfast, present a paean on *The impact and management of hedgerows:* their history, ecology, biodiversity and benefits of increased diversity, management, and barriers to their conservation. Hedgerows are unrivalled habitats for farmland biodiversity while providing pest, pollination and other environmental services that can be multiplied by not flailing them to within an inch of their lives every year. But farmers remain sceptical, daunted by the scientific complexity and contradictions; demonstration of improved hedgerow management drawing on the experience of local farmers is more effective than convoluted ecological advice from other sources. But our authors offer no clear policy direction other than diversity is *a good thing* [5].

This inability to trigger the existential-threat reaction in society confronts the following section on the role of government and the private sector in promoting on-farm conservation. Jennifer Dodsworth and Rachel Lasko from Oxford University and Ruth Little from Sheffield University lead off with *England's new Environmental Land Management policy* following the UK's departure from the EU, devolved particularity in Wales and Scotland, and dithering as the Dept for Environment, Food and Rural Affairs struggled to co-design the policy of public money for public goods with the people expected to deliver the goods. The sentiment acknowledges that farming simultaneously delivers private goods paid for by the market, and public benefits not paid for by the market but it also, wrongly, assumes that the market adequately pays the production costs of private goods (*i.e.*, food) [6]. Farmers are frustrated by a lack of engagement; rushed and overlapping timelines, with their positions undermined by public pronouncements about policy that their insights were supposed to shape; and eventually abandonment of hope for innovative policy that might meet anticipated needs.

Gordon Rausser and David Zilberman of UC Berkely consider *Developments in agri-environment schemes: North America.* Economic theory suggests that government intervention is needed to counter *externalities* inflicted by private and corporate activities – amongst them pollution and loss of biodiversity. Taxes raise objections from affected parties; subsidies are costly; tradeable permits may introduce markets for externalities that may decrease costs to polluters; regulations are blunt and inefficient; voluntary agreements have limited capacity unless there is the threat of regulation; education that internalizes environmental values among the population is effective but limited in scope. For all these reasons, payments for environmental services became the preferred government intervention, *e.g.*, in agri-environment schemes, until the Trump administration abdicated any responsibility and scrapped them all.

Dean Ansell and colleagues at the Australian National University consider *Developments in agri-environment schemes in Australia* in the context of abject failure of conservation policies implemented over the last two or three decades, and a scramble to shift the cost of any action to the private sector. Following the financial if not environmental success of carbon-offset schemes, biodiversity is being linked in the statutory Australian Carbon Credit Unit (ACCU) scheme that registers carbon-offset projects for tradeable credits that are supposed to represent real and additional abatement of greenhouse gas emissions. This offers an opportunity for income diversification and the long shot of agricultural exports being able to claim both carbon and biodiversity neutrality. In the Australian Government's Carbon+biodiversity pilot, landowners can contract environmental planting of 5-200ha either to restore the pre-clearing vegetation or with simple mixed-native planting. Participants receive initial payments to cover their costs for the first 2-3 years and receive credits for the carbon sequestered over 25 years which they can sell in the carbon market. Regional biodiversity benefit scores also contribute to payment offers that should achieve a prescribed internal rate of return. But, the complexity of arrangements and their contract length are unattractive and the risk is greater than in traditional agri-environment schemes, operation of the market being left mainly to the private sector.

The fourth section of the book covers *rewilding* of ecosystems from human dependency to some degree of self-sustaining autonomy. In *Restoring peatlands in European landscapes*, Rudy van Diggeren and colleagues from the Low Countries note that vast, undisturbed peatlands are no more in densely populated parts of Europe; the isolated remnants have lost many of their characteristic species, most of the survivors are endangered, and recolonisation by typical species is unlikely because of short-lived seed banks and the distance from source populations. Restoration to wilderness would need a lot of space and regional re-engineering of the hydrology; but semi-natural wetland or productive functional landscapes are achieved through closure of drainage ditches, cessation of fertilization, and suppression of competitive plants by mowing or grazing. There is also a need for wet-agriculture buffer zones for sites of higher biodiversity value; several crops are being tested, economic models developed. The search is on for sustainable systems in which multiple ecosystem services can be restored or conserved on degraded peatlands still under cultivation.

Worldwide, grasslands and rangelands have been the main target for takeover by farmers. *Rewilding grasslands and rangelands* by Thomas Jones of USDA Forest and Range Research discusses the ecological principles that drive grassland and rangeland function, the diversity of best practices, and emerging technologies. Grasslands are disturbance-driven ecosystems: walking away rarely restores anything like the original vegetation. Abandoned land commonly reverts to scrub: active restoration by reseeding, controlled grazing, mowing and/or burning may be required; even so, sustainability has been elusive. Long-term field experiments are invaluable for informing seed-mix design and management; and native-seed industries have developed to meet the demand.

A case study of sagebrush steppe rangelands in Utah reports encroachment of woodland from less than 3million ha pre-European settlement to 50million ha today. The Utah Watershed Initiative in 2006 covered some million ha with state-assisted community projects combining herbicide and drill seeding, chaining or harrowing and drill seeding, or aerial seeding followed up by shredding with a toothed drum, and controlled burning. Recovery of herbaceous perennials has been greater on seeded sites but, in the case of sagebrush, establishment may be limited by the infrequency of regeneration episodes, dry spring weather, grazing by big game, and competition from seeded herbaceous perennials. Rewilding is challenged by climate change but diversion of marginal agricultural land is opportune for many urban populations. Three things are necessary: ecological monitoring, plant materials that are more effective in modified environments, and reliable demand to support seed production. The big challenge is to apply science in the face of economic and political realities.

David Lindenmeyer and colleagues from the Australian National University draw *Lessons from reforestation of agricultural landscapes in SE Australia.* Twenty-four years of empirical data on restoration projects on some 800 sites on more than 300 farms reveal that biodiversity depends on a hierarchy of factors from individual features like paddock trees, fallen logs, mistletoe, rocky outcrops, and farm dams; to the site level – topography, shape and size, connectivity with other plantings or remnants; to the farm level – the variety of assets across the farm and the amount of native woody vegetation; to the landscape level – the amount of native woodland and the climate. Each and every feature is important and everything is connected to everything else. Larger plantings are better than smaller; blocks better than strips; plantings connected to others or near to others or remnants are better than isolation; those around streams, paddock trees, rocks and logs are better than those without them

– *e.g.,* scattered paddock trees can be stepping stones for bird movements in agricultural landscapes and foraging sites for other animals. Greater diversity on farms and in landscapes with higher levels of native trees is likely to be related to greater connectivity. Restoration is most popular where there are multiple benefits; *e.g.,* restoration of a farm dam might entail controlling livestock by fencing, creating vegetation cover across the catchment to filter animal waste and runoff, establishing trees to shade the water body, and encouraging vegetation cover at the margins of the dam and in the water. The cost can soon be recouped through improved livestock weight gain as a result of better drinking water; at the same time, methane emissions are halved and there is a biodiversity dividend from water quality.

Animal rewilding is generally believed to be incompatible with farming but *The future of animal rewilding in agricultural landscapes* by Kiarrah Smith and colleagues, also from ANU, places it between wilderness and conventional intensive agriculture, within the land-sharing part of the spectrum. There are trade-offs between the ecosystem services and disservices of wild animals but, within heterogenous landscapes, there are opportunities from hunting, shooting and fishing to flood control; wildlife habitat within croplands is increasingly appreciated for pollination, pest and weed control, soil and water conservation; and money can be made by running traditional native livestock breeds or species best suited to local conditions, including the threat of natural predators. Ecosystem engineering by beavers and re-introduction of top predators takes an order of magnitude more adjustment but *co-existence conservation*, originally proposed for managing predation of threatened species by invasive predators may be transferred to animal rewilding in agricultural landscapes. In the conservation context, the vulnerable organism is a threatened rare plant or animal: in the agricultural context it is crops or livestock that are at risk and predation (*i.e.,* consumption) rather than the predator (consumer, herbivore or carnivore) becomes the focus of management strategies.

The mobility of animals makes rewilding a landscape-scale venture. Heterogenous landscapes that might include intensive agriculture for land sparing provide a diversity of habitats, support greater animal diversity, and may benefit from complementary species that may reduce the disservices of otherwise beneficial herbivores. Our authors conclude with an optimistic case study of kangaroos and dingoes worthy of David Attenborough.

Both climate science and biodiversity science have drawn lines in the sand. History has already washed away the climatic +1.5°C sandcastle and, in *Looking ahead*, Nick Reid surveys the sand lines of the UN Convention on Biodiversity [7]: cease transforming natural areas, restore at least 30% of degraded ecosystems by 2030, conserve and manage for biodiversity conservation at least 30% of the world's lands, coastal areas and oceans by 2030 – noting that only 17% of land and 8% of marine areas were so managed in 2022. In 2025, the issue becomes 'How best to restore habitats in agricultural regions so that at least 30% of the land is managed for biodiversity conservation?' Bottom-up, we have farmers' own initiatives. Top-down, we have statutory and policy interventions that prohibit, encourage or require farmers to undertake specified management actions, extension and training programs, market incentives, reversal of pest-animal policies to permit the return of wild animals, government purchase of land with high potential for restoration of high conservation-value species and ecosystems, and outlawing conversion of natural habitats.

Nick Reid highlights regional-scales issues in two case studies. Despite extensive clearance, Mount Lofty in South Australia is one of the continent's biodiversity hotspots, reflecting its isolation and the impending collapse of biodiversity. Since there is a time lag between initial clearance of vegetation and extinctions; the critical requirement is to put back substantial plots of appropriate habitat, especially on better soils. The competing claims on the waters of the Murray-Darling Basin have already featured on these pages [8]. The 30,000 wetlands, 16 of them Ramsar listed, are priceless flood-related habitats: but the basin also sources almost 40% of national farm output and water supply for more than 3 million people. Prior to abstraction for irrigation, an average of 12,500 GL per annum flowed to the sea, although with dramatic variations. By the turn of the millennium, more than 13,000 GL per annum was abstracted and, during the Millennium drought, the Murray mouth was kept open only by continuous dredging. The best-available science suggested that between 3,000 and 7,600 GL should be returned to the environment to secure the health of the various ecosystems, the lower figure offering little chance of success. The Water Act was promulgated in 2007 to drive water reform, including buying back over-allocated water from irrigators, and the 2012 Murray-Darling Basin Plan undertook to return a modest 2,750 GL annually by 2024. Politics, rival claims of riverine states, has prevented this, which suggests that the much more ambitious UN targets are unreachable.

If indeed the big challenge is to apply science in the face of economic and political realities, how much more factual or persuasive must researchers be before society listens?

References

[1] Alfred the Great, c890, *Prefatory letter to Alfred's translation of Gregory's Pastoral Care,* (Cambridge: University of Cambridge Digital Library).

[2] Leopold, A., 1953, *Round River. The Journals of Aldo Leopold*. (Oxford : Oxford University Press).

[3] Rittel, H., & Webber, M., 1973, Dilemmas in a general theory of planning. *Policy Sciences* **4**(2)155-169. https://doi.org/10.1007/BF01405730

[4] Ostrom, E. 2009, A general framework for analysing sustainability of social-ecological systems. *Science* **325** (5939) 419-422. https://doi.org/10.1126/science.1172133

[5] Sellar, W.C., & Yeatman, R.J., 1930, *1066 and all that.* (London: Methuen).

[6] Allan, A., & Dent, D., 2021, The cost of food: Consequences of not valuing soil and water and the people who manage them. In D. Dent and B. Boincean (Eds) *Regenerative Agriculture,* (Cham: Springer), pp. 3-19.

[7] Convention on Biological Diversity, 2022, *Decision adopted by the conference of o parties to the Convention on Biological Diversity 15/4. Kunming-Montreal global biodiversity framework.* https://www.cbd.int/doc/decisions.cop-dec04-en.pdf

[8] Dent, D., 2021, Review, Dead in the water. A very angry book about our greatest environmental catastrophe…the death of the Murray-Darling Basin. *International Journal of Environmental Studies* **79** (4) 765-767. https://doi.org/10.1080/00207233.2021.1941679

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