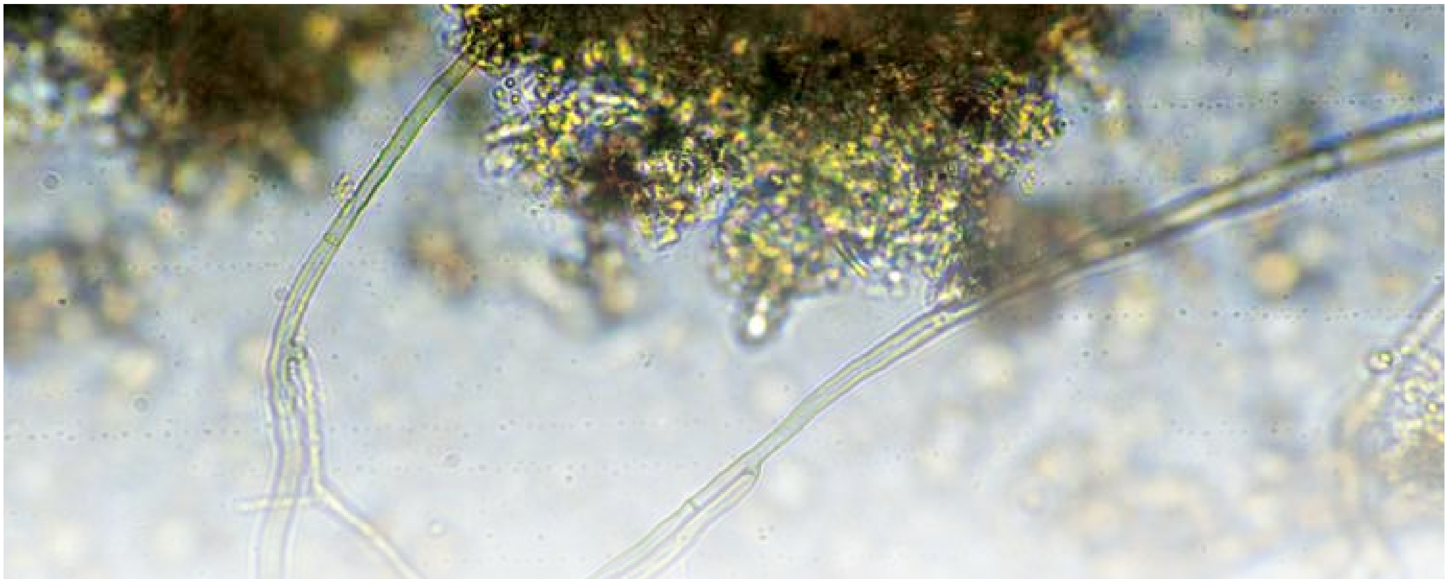

Rewilding the Planet!
And the importance of biotrophic fungi

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Abstract This essay introduces the global rewilding movement and examines five major models shaping its practice today. Through examples ranging from American Prairie's grassland connectivity work to European trophic rewilding, closed-system herbivore experiments, continental wildlife corridors, and Indigenous-led restoration, it explores how different cultures and landscapes interpret the idea of returning ecological processes to self-willed function. It also considers the often-overlooked role of fungi in rewilding, showing how mycorrhizal networks, decomposers, and fungal ecologists contribute to ecological recovery. Together, these models reveal the diversity, ambition, and evolving philosophy of rewilding in a rapidly changing world.

What is rewilding?

Rewilding has emerged over the past three decades as one of the most imaginative and ambitious movements in global conservation. At its core lies a radical but intuitive idea: ecosystems can regain their vitality, complexity, and self-direction if the processes that once shaped them are restored. Rather than focusing solely on protecting individual species, rewilding seeks to revive relationships—migration, predation, grazing, disturbance, succession—that allow landscapes to function as dynamic, resilient systems. It is a shift from managing nature to enabling it, from preservation to regeneration, from static reserves to living, evolving worlds.

Although the term "rewilding" is relatively new, the impulse behind it is ancient, echoing Indigenous stewardship traditions that understood landscapes as reciprocal, relational, and alive. Today, rewilding has become a global conversation, taking different forms in different places, shaped by local histories, ecologies, and cultural values. Across continents, five broad models have emerged, each offering a distinct vision of how to restore the wild.

1. Prairie-scale connectivity: American Prairie

The first model is the prairie-scale connectivity approach exemplified by American Prairie in north-central Montana. Their work is rooted in the recognition that the Great Plains were once a vast, continuous grassland shaped by the movements of bison, pronghorn, elk, and predators across immense distances. Fences—barbed wire strung across the plains over the past century—fractured that continuity, blocking migration and fragmenting habitat.

American Prairie's strategy is to reverse that fragmentation by assembling a large, connected reserve through land acquisition, partnerships, and the systematic removal or modification of fencing. Their efforts have already eliminated more than a hundred miles of obsolete wire, reopening ancient pathways for wildlife. Unlike many rewilding projects, American Prairie is not focused primarily on species reintroduction; instead, it aims to restore the ecological choreography of the grasslands themselves. Bison function as landscape architects, shaping vegetation patterns, creating habitat mosaics, and driving nutrient cycles. The project's ambition—an eventual reserve of roughly three million acres—places it among the largest conservation visions in the world. What makes it especially distinctive is its integration with working ranchlands and its emphasis on coexistence rather than exclusion. In this model, rewilding is not a fenced-off experiment but a living, permeable landscape where wildlife and human livelihoods interweave.

A local return: Bison and Indigenous stewardship in the Prairie State

A recent event in northern Illinois offers a vivid, contemporary example of how rewilding models can overlap and reinforce one another. Just twenty-three miles from my home, a small herd of American bison was released onto the restored grasslands of Burlington Prairie, marking the first time in more than two centuries that bison have set hoof on this landscape. The project is unusual not only for its ecological ambition but for its governance: the animals are owned by the American Indian Center of Chicago, and their release and longterm care are being carried out in partnership with local Native communities.

In this sense, the Illinois herd embodies (see box below) the connectivity ethos of American Prairie—restoring the ecological work of large herbivores—and the relational, sovereignty-centered framework of Indigenous-led rewilding. Even at a small scale, the presence of bison begins to reanimate prairie processes: grazing patterns that create habitat mosaics, nutrient redistribution through dung and movement, disturbance patches that open niches for plants, insects, and fungi. Their return also restores a cultural relationship that predates the state itself, reaffirming that rewilding is not only about ecological function but about the renewal of human–land connections. In Illinois, as in many places, the future of rewilding may lie in these hybrid models—where ecological restoration and Indigenous stewardship converge to bring back both species and the stories that shaped them.

2. Trophic rewilding: Europe's functional revival

A second model, most visible in Europe, is trophic rewilding. Here the focus is on restoring ecological roles by reintroducing or protecting key species—especially large herbivores, carnivores, and ecosystem engineers—rather than assembling large tracts of land. Rewilding Europe, a network of projects across nine major regions, has championed this approach by bringing back European bison, wild horses, lynx, wolves, brown bears, and beavers, species whose behaviors once shaped the continent's forests, rivers, and floodplains.

Because Europe is densely populated and heavily parceled, the emphasis is less on creating vast contiguous reserves and more on reestablishing ecological functions within existing landscapes. Grazing by semi-wild herbivores maintains open meadows and prevents forest overgrowth; predators help regulate herbivore populations and restore trophic balance; and beavers transform waterways by building dams that slow floods, create wetlands, and increase biodiversity. This model is pragmatic, adaptive, and often opportunistic, working with the landscapes that exist rather than trying to recreate those that have been lost. It is also deeply cultural, engaging local communities, tourism economies, and shifting public attitudes toward wildlife.

3. Closed-system herbivore experiments: Oostvaardersplassen

A third model is the closed-system herbivore experiment, best known through the example of Oostvaardersplassen in the Netherlands. Conceived as a bold ecological experiment, Oostvaardersplassen introduced large herbivores—konik horses, red deer, and cattle—into a fenced reserve to mimic Pleistocene grazing dynamics. Without predators and without the ability to migrate, herbivore populations rose and fell dramatically, leading to winter starvation events that sparked public controversy.

The project became a global touchstone for debates about what "wildness" means in a human-bounded world. In contrast to American Prairie's antifence ethos, Oostvaardersplassen is defined by its fences, and by the ecological consequences of containing large animals within a closed system. While the experiment revealed important insights into herbivore-driven ecosystems, it also highlighted the ethical and ecological challenges of rewilding in constrained landscapes. This model underscores the tension between ecological authenticity and human control, and the difficulty of recreating ancient processes in modern, fragmented environments.

4. Continental-scale connectivity: Yellowstone to Yukon

A fourth model is the continental-scale connectivity approach exemplified by the Yellowstone-to-Yukon (Y2Y) initiative. Rather than building a single reserve, Y2Y works to restore wildlife movement across a 2,000-mile corridor stretching from Wyoming to the Canadian Arctic. The focus is on predators and wide-ranging species—wolves, grizzlies, wolverines, elk—whose survival depends on the ability to move across vast distances.

Y2Y does not acquire land; instead, it builds partnerships with governments, tribes, private landowners, and conservation groups to create a network of protected areas, wildlife crossings, and habitat linkages. Where American Prairie is assembling a contiguous grassland ecosystem, Y2Y is stitching together a continental tapestry of connected habitats. This model reflects a growing recognition that ecological resilience depends not only on the quality of habitat but on the permeability of landscapes. Movement is life, and connectivity is the infrastructure of evolution.

5. Indigenous-led rewilding: sovereignty and reciprocity

The fifth model is Indigenous-led rewilding, which reframes the entire conversation by centering sovereignty, cultural landscapes, and reciprocal stewardship. Examples include the Tla-o-qui-aht Tribal Parks on Vancouver Island, Māori restoration projects in Aotearoa, and numerous tribal bison programs across the Great Plains. These initiatives do not treat rewilding as a return to some prehuman baseline; instead, they emphasize the restoration of relationships—between people and land, species and stories, ceremony and ecology.

Cultural keystone species such as salmon, bison, or kiwi are restored not only for their ecological roles but for their significance in Indigenous cosmologies and governance systems. In this model, rewilding is inseparable from justice, sovereignty, and the renewal of cultural lifeways. While American Prairie collaborates with tribes, it is not Indigenous-governed; Indigenous-led projects offer a different paradigm, one in which ecological restoration is braided with cultural resurgence.

Rewilding adjacent: Miyawaki forests

Miyawaki forests occupy an intriguing borderland between ecological restoration and rewilding. Developed for highly degraded or urban sites where natural regeneration is no longer possible, the Miyawaki method uses dense plantings of locally appropriate species to jumpstart forest succession. Although these miniature forests are curated and intensively managed in their early years, they are designed to become self-organizing systems—multilayered, biodiverse, and increasingly autonomous. In this sense, they echo the rewilding ethos of restoring processes rather than simply planting trees, especially in landscapes where historical baselines have been erased.

Yet Miyawaki forests also highlight the limits of rewilding in constrained environments. They lack the trophic interactions, disturbance regimes, and landscape permeability that define most rewilding models. Instead, they function as accelerated ecological catalysts—small, intentional interventions that create pockets of complexity within human-dominated spaces. As such, they align most closely with the European model of functional rewilding, where ecological roles are revived within fragmented landscapes, and with Indigenous-led approaches when used to restore culturally significant species. Miyawaki forests may not be rewilding in the strict sense, but they offer a compelling example of how humans can initiate processes that, over time, begin to take on a life of their own.

How do fungi fit in?

Fungi are not just beneficiaries of rewilding but among its quiet architects. Nearly every ecological process that rewilding seeks to restore—nutrient cycling, soil formation, plant establishment, decomposition, disturbance recovery—is either powered or mediated by fungi. When landscapes are fragmented, overgrazed, simplified, or chemically stressed, fungal communities collapse or shift into impoverished states. Rewilding reverses many of those pressures.

More diverse plant communities create more diverse mycorrhizal partnerships. Deadwood accumulation supports saprotrophs and wood decay specialists. Large herbivores create disturbance mosaics that open niches for fungal succession. Predators indirectly shape fungal communities by influencing herbivore behavior and nutrient flows. Even the simple act of removing fences, as in American Prairie, allows bison and elk to redistribute nutrients across the landscape, feeding soil fungi in ways that fenced pastures cannot replicate.

Fungi are not passive recipients of these changes; they are engines of ecological recovery. They rebuild soil structure after disturbance, mediate plant establishment in degraded areas, decompose the biomass that fuels nutrient cycles, and form the underground architecture that allows plant communities to reorganize. Mycorrhizal networks buffer plants against drought and pathogens, accelerating the return of functional ecosystems. Wood decay fungi open cavities for wildlife and create the coarse woody debris that anchors forest regeneration. Even fungal pathogens help maintain diversity by preventing any one species from dominating. If rewilding is about restoring processes, fungi are among the most important process-makers.

This is where mycologists can play a transformative role. They can map fungal baselines in rewilding sites, revealing whether soil communities are recovering or stagnating. They can identify keystone fungal guilds whose presence signals ecological resilience. They can guide restoration plantings by matching species with their appropriate mycorrhizal partners. They can monitor fungal succession after herbivore reintroduction. They can advise on deadwood management, fire regimes, and grazing patterns that support fungal diversity. They can help design fungal corridors—the subterranean analog to wildlife corridors—by restoring soil structure and organic matter. Mycologists can also bring cultural and narrative depth to rewilding, offering a language of networks, reciprocity, decay, and renewal that resonates with the philosophical core of the movement.

Conclusion

Taken together, these five models—and the fungal dimension that underlies them—reveal the diversity and adaptability of the rewilding movement. Each arises from its own ecological and cultural context, yet all share a commitment to restoring the processes that make landscapes vibrant and self-willed. American Prairie stands out for its scale, its focus on grassland migration, and its unusual emphasis on fence removal as a primary ecological tool. European trophic rewilding demonstrates how ecological functions can be revived even in densely settled regions. Oostvaardersplassen shows both the promise and the pitfalls of experimental rewilding in constrained spaces. Y2Y illustrates the power of connectivity across political and ecological boundaries. Indigenous-led rewilding reminds us that restoration is not only ecological but relational. And fungi—so often overlooked—anchor the entire enterprise, providing the metabolic, structural, and relational foundations that allow rewilded landscapes to regain their resilience and begin, once again, to shape themselves.

Over the horizon: rewilding microbiomes?

You and I, indeed all organisms, have a genome—an organism's total genetic makeup. It follows that there is a proteome, transcriptome, etc. (scientists are studying all of these for many organisms right now). And there is a microbiome. A recent edition of *Science* (378: 599–560) featured an excellent essay by Raaijmakers and Kiers that focused on a clever use of fungi and other microbes. They discuss recent research over the past decade, showing that microorganisms living on and inside eukaryotes—the microbiota—are drivers of host health, enhancing immunity, nutrient acquisition, and tolerance to environmental stresses. From this has emerged a "microbiome rewilding hypothesis" that posits plant and animal health can be improved by reinstating key members of the diverse (ancestral) microbiota that were lost through domestication and industrialization processes, including changes in diet, plant and animal breeding, and the (over) use of antibiotics, pesticides, and fertilizers.

A central question is whether the microbiomes of crop ancestors can be used to "rewild" microbiomes of current crops. They argue that rewilding plant microbiomes is similar to restoring diversity lost from the human gut: wild plant ancestors carry microbial partners and functions that modern crops have largely lost. But we still don't know which microbes disappeared during domestication or how much rewilding could improve crop health. As in animal systems, the effectiveness of microbiome rewilding is debated.

Domestication has dramatically reshaped plants—larger seeds, predictable growth, reduced bitterness—and expanded them into new habitats, but at the cost of increased dependence on fertilizers, pesticides, and irrigation. Naturally, the transition of plants from their native habitats to new ones led to changes in microbiome composition of those plants. For example, the authors note that the domestication of legumes, combined with long-term nitrogen fertilization, has been linked to the evolution of less mutualistic rhizobia (nitrogen-fixing soil bacteria that form nodules in the roots of legumes), and legume varieties that are less able to discriminate between rhizobia that provide nitrogen to the plant versus those that do not. And changes in plant microbiomes are not limited to bacteria, fungi are also affected. Disruption of the symbiotic interaction between plants and their mycorrhizal fungi has also been documented, with domesticated crops showing lower colonization and a decreased growth response to fungal symbionts, especially in fertilized soils.

Rewilding involves reinstating key ancestral microbes in agricultural soils or planting materials, and/or breeding modern crops with specific traits that support ancestral microbiota colonization. Identifying differences in the microbiomes between crop plants and their wild progenitors—and the mechanisms mediating these differences—is straightforward in theory, but difficult in practice. To unravel plant microbiome interactions, analyses of native soils in a crop's center of origin are needed to interpret shifts in plant microbiome composition along the domestication path. Next, all possible microbes are tested on wild and cultivar plants. Considering that the effects of plant genotype on microbiome composition may be relatively small, exposure of crops to a suite of different stresses can help amplify the differential recruitment of specific ancestral microbiota. Once the ancestral forms of microbes are found (and "biobanked" for future use), it's time to do the rewilding—that is, to put them back into the environment.

Does all this sound like "woo-woo" or pseudoscience? So did human fecal transplants just a few years ago … until they were tried. And they worked! Analogous to fecal microbiota transplantation to redirect the dysbiotic composition of human microbiomes, transferring complex microbial communities from root or shoot tissue of wild crop relatives onto seeds or planting material of their domesticated counterparts can initially be used to identify specific microbiome-associated plant phenotypes. If beneficial effects of wild microbiome transplants on crop cultivars are confirmed, approaches to minimize microbiome complexity through dilution to extinction or the design of synthetic microbial communities may help identify the key microbial genera associated with particular plant phenotypes. The performance of modern crop varieties may also be improved through artificial selection on the native microbiome. Again, exposing plants to specific stresses, such as drought or nutrient deprivation, can expedite the search for specific subsets of ancestral beneficial consortia. This can be followed with the identification of specific plant root exudates (or other control mechanisms) in wild relatives that are responsible for the recruitment of these consortia. Existing domesticated crop varieties can then be selected for those particular control mechanisms and used as hosts compatible with the ancestral consortia.

Raaijmakers and Kiers conclude by saying that rewilding approaches can offer a new avenue to harness the benefits of ancestral microbiota, and do not preclude the use of domesticated crop cultivars or agricultural management practices, such as fertilizer. As rewilding research moves between the field and the lab, its value and integration in breeding programs for a new generation of "microbiome-assisted" crops await critical assessment in different agroecologies.