1 - Juan Barte. *Grasses of Val Taleggio,* 2017. (Image courtesy of artist)

GRASS, FOOD, AND CLIMATE IN A TIME OF UNCERTAINTY

by Colin Sage*

THE GLOBAL CHALLENGE

At a time when we are confronted by a global crisis of planetary heating and biodiversity loss, this essay provocatively suggests that **'grasses and pastures' may be presenting one of our most challenging and contested plant communities.** Today, half of the world's habitable land is occupied by agriculture and 77 percent of this is used by livestock as pasture for grazing or for the growing of feed crops (Ritchie and Roser 2020). The expansion of agricultural land around the world is a consequence not only of a growth in human numbers but also a

change in dietary patterns. This 'nutrition transition', as it is called, is characterized above all by increasing consumption of meat and dairy which has resulted in a huge growth in the numbers of animals reared –and slaughtered (an estimated 80 billion annually) - for their products. Increasingly, the question is being asked: if we are to restore some equilibrium with the planet, should we change our diet by replacing the large quantities of meat and dairy eaten by many in rich and middle-income countries, with more plant-based foods? **If we were to do so, what would be the implications for farmers engaged in small to medium-scale livestock production and for the grasslands and pastures on which they depend?**

Most intensive livestock production systems which have spread around the world are characterized by their scale in numbers of animals reared and their output volumes of meat, milk, and eggs. Known also as confined animal feeding operations (CAFOs) where most animals spend the majority of their lives indoors, pigs, poultry and a growing number of dairy cattle are fed a diet of protein-rich feedstuffs, such as soy, in order to speed growth to market weight and enhance yield, **and are thus largely disconnected from their local resource base.** However, most ruminants – cattle, sheep and goats – still spend at least part of their time feeding on grass or other browsing vegetation, though its composition, location, growth and role in animal nutrition varies very widely indeed around the world.

2 - Lucrezia Costa. *Air Breathing Us*, 2023. (Images courtesy of G. De Santis)

One of the key issues to emerge from recent research on the contribution of the global food system to climate breakdown is the disproportionate impact of cattle with regard to the release of methane, a key short-lived greenhouse gas, eighty-five times more powerful than carbon dioxide (CO_2) in retaining atmospheric heat over a 20-year span (Costa et al. 2021). While beef and dairy production score badly across a range of environmental variables per kg of output – including land and

freshwater use, eutrophication, ammonia pollution etc. - their role in the generation of anthropogenic methane (i.e. arising from human activity, not natural sources) has fallen under the spotlight, particularly in countries where intensive cattle (and, to a lesser extent, sheep) are commercially significant. In the Republic of Ireland, for example, agriculture contributes 37 percent of the country's greenhouse gas emissions (the EU average for the sector is ten percent), most of which can be attributed to a national herd of 7.3 million dairy and beef cattle. Proponents of this agricultural strategy place emphasis on the grass-fed basis of the system, **proclaiming its intrinsically 'green' and sustainable character given the 'naturalness' of grass.** Critics, on the other hand, deploy a wide range of arguments that, while highlighting the climate burden of ruminants, also point to **the wider costs of growing grass and extending pasture into uplands that would be more ecologically-suited to the restoration of native woodlands.**

Grasses and pastures, then, are not without controversy – for example, there is a heated scientific debate about their relative capacity to sequester atmospheric carbon compared to woodlands - and can also be caught up in passionate discussions around the appearance of 'cultural landscapes' once forested now rendered as spaces for livestock grazing. Large scale habitat restoration is regarded by many terrestrial ecologists as an urgent strategy if we are to slow biodiversity loss. Indeed, there is a growing lobby that argues for the removal of agriculture from upland environments which should then undergo a process of 'rewilding' to enable not only the recovery of forests able to sequester carbon, but also endangered plant communities and even apex predators such as wolves. **Such arguments present striking alternative scenarios that challenge and potentially threaten the existing basis of upland farming and herding communities such as those of the Alpine valleys.**

3 - An analog for a bio-inspired process. One of a kind copy on photographic paper. Juan Barte. *Truth, fulsome*, 2017. (Images courtesy of artist)

In order that we make more space for nature it is likely that it is the less intensively farmed regions of the world where the focus of land use change will fall. Yet such marginal regions, even in rich countries, support - often precariously - the livelihoods of millions of people with most dependent upon livestock to transform vegetation into commercial products. Indeed, so successful have these upland farmers been in carefully managing their resources and developing a body of tacit knowledge and skills passed down through generations that their production has even given rise to some iconic foods – particularly cheeses – highly regarded by connoisseurs. How might we reconcile, then, the urgent need to save space for nature, its biodiversity and service to all living organisms, without compromising food output for a world of people, while supporting the livelihoods and cultures of upland human communities whose economies are closely tied to grasses and pasture?

GRASS IN THE FOOD SYSTEM

Grasses are probably one of the least appreciated plant communities in popular imagination. Ubiquitous in comprising such diverse surfaces such as suburban lawns, carefully manicured sports pitches (especially golf and bowling greens), to fields, meadows, rangelands and mountain pastures, **grass exists as a backdrop to human and animal activity.** For those of us with little botanical expertise, it is educational to learn of the enormous variety of grasses that are not only identified and catalogued, but which co-exist in plant communities on a spectrum reflecting their purpose and degree of human and animal intervention. Acknowledging that the first fields created for food production were reclaimed from woodlands, the opening up of space enabled light-loving grasses and herbs to flourish. **Yet a landscape of herbaceous vegetation evolves, reflecting environmental conditions (climate, soil, topography) and its use.** Early colonizing plants can gradually be suppressed by invasive trees and shrubs unless their emergence is controlled for example by grazing or fire.

As agricultural science, and especially livestock husbandry, developed in Europe starting in the 17th century, greater attention was placed on different varieties of grasses to improve the diets of grazing animals, but also to restore nitrogen and organic matter to the soil. The inclusion of a grass ley, including clover and lucerne,

as part of a crop rotation became a vital means to restore fertility – at least until the age of agricultural chemistry became ascendant in the late 19th century with its promotion of industrial amendments to the soil. The 20th century thus gradually saw the disappearance of a mixed farming model involving arable crops and livestock,

4 - Grasses and pastures of the Italian Alps before the second cut, 2021. (Images courtesy of S. Invernizzi)

where each farm produced multiple products within a largely circular economy of nutrient recycling which produced less environmental damage than modern intensive systems. Yet the pursuit of agricultural productivism as measured by output has been enshrined within the policy directives set by the European Union and national governments, and has led to specialization and intensification of single agricultural commodities which has become the norm at farm level. Together with the major

power brokers of the food system, operating in corporate boardrooms far removed from the land, the key imperative has been to drive down costs in order to produce food as cheaply as possible – irrespective of its nutritional benefits, health consequences or of the wider environmental externalities of production[1].

For the farming community the pressure to scale up has been intense as a consequence of declining margins under a cost-price squeeze. For dairy farmers this has invariably required them to increase the size of their herds. More cows – often substantially more - has huge implications for feeding and milking practices: does the farm have sufficient land on which to graze (and feed from cut hay or silage) its animals? Or must it purchase additional fodder and concentrates requiring greater financial expenditure? Milking technology, too, must adapt to reflect not only greater numbers of animals but the labour demands of undertaking this task once or twice per day. The installation of robotic milking or feeding systems – as witnessed on one Val Taleggio farm – may reduce labour inputs and cut the availability of jobs in the area, but requires huge investment ordinarily secured through bank loans, and leaves farms at risk of financial indebtedness if problems (animal disease or other unexpected hazards) should arise. It is not widely appreciated that rates of suicide amongst farmers are way above any other occupational category - 3.5 times that of the general population in the United States – and while there may be a complex social pathology underpinning such personal and domestic tragedies, indebtedness is invariably the single most common factor. So while the agri-technology corporations promote their labour-saving innovations, we also recognise the capacity and determination of powerful interests to extract value from land without themselves being directly responsible for production.

When a visitor to a farm also observes large stacks of dextrose monohydrate – used as a sweetener to improve the palatability of a ‘total mixed ration’ – then the question arises as to the role of grasses and pasture in the feeding of animals producing milk for cheese. Although farms may be in scenic locations surrounded by grassy hillsides, we should not assume these continue to provide the sole means of sustenance for intensively farmed animals selectively bred for their high milk output. In this regard appearances can be deceptive and we may need to be far more

[1] For further elaboration of this argument see Sage 2022.

attentive to actual farming activities rather than to assume current practitioners are continuing an unbroken tradition of using grass.

It is understandable if we fall prey to such a delusion given that, in a European context, there is an incredibly rich cultural history around the agronomic management of pasture. From early medieval times farmers selected and sowed grass seeds that were designed to provide food for their animals both as fresh grazing but also as hay. From Pieter Bruegel ('The haymaking, 1565) through John Constable (The Hay Wain, 1821) to Camille Pissarro (Haymaking, Éragny, 1887) and beyond, European artists have captured the vital moment of 'saving the hay', constructing vernacular stooks and stacks, and ensuring that their animals would survive over the winter in a temperate, even hostile, climate. The often communal nature of this task, when neighbors would work for each other within a spirit of reciprocity and conviviality, was vital to their own survival as a community dependent upon stored roots, coarse grains and, of course, fresh, seasonal, and fermented milk products.

5 - The storage of hay during the mountain pasture season: Alpe Sella in Val Taleggio (BG), 2021. (Images courtesy of S. Invernizzi)

Grasses and pasture, then, have long played a critical role in farming communities with their importance rising with altitude and latitude. While pastoralism displays many different forms reflecting complex geographies, the movement of animals in accordance with seasons has, like haymaking, a rich cultural history across Europe. The practice of transhumance to make use of mountain pastures during the summer months has enabled livestock owners to produce a “gold of the uplands” in Grasseni’s words - cheeses that capture the floristic diversity, aroma and taste of these mountain meadows. The absence of animals from lowland villages also allowed those more intensively grazed fields time to recover and to yield a crop or two of hay before the flocks and herds returned. The practice of *alpeggio* has been an important ritual throughout the Alpine region demonstrating how rural communities secured their food through ecological adaptation and social cooperation. That they also produced foods of distinction has enabled many to flourish given a wider gastronomic interest in their products.

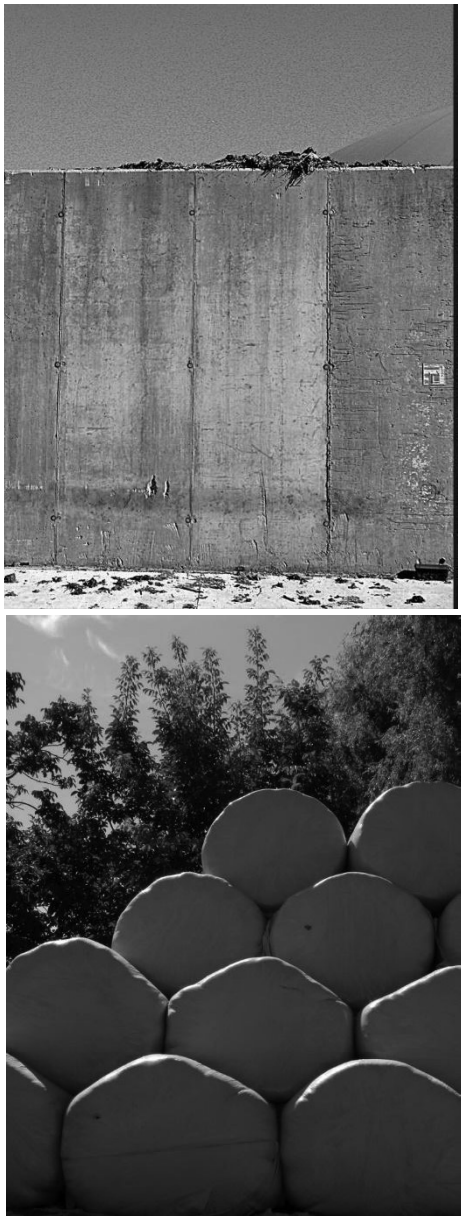
Yet this is an uncertain time for such a production system, dependent as it is on the continued support of consumers willing to pay premium prices for

geographically designated products while the urgency of action on climate is creating a powerful narrative around plant-based alternatives. It is increasingly apparent that dietary change is an indispensable tool in a complex portfolio of civil society responses to climate breakdown, and the development of alternative proteins including from 'precision fermentation' technology may well 'eat into' (pun intended) the market for livestock products. Indeed, many of the major meat processing companies have already rebranded themselves as leaders of the new 'protein industry' thereby repositioning themselves as 'planetary saviors'. Plant-based milks, too, have grown their market share and increasing numbers of eaters – especially younger generations – identify as vegan or vegetarian.

6 - Pasture practice at 1700 meters above sea level at Piani di Artavaggio, Orobie Prealps, 2020. (Image courtesy of S. Invernizzi)

For livestock farmers such developments might be disregarded as a transient fickleness of the market. Yet amongst policy-makers willing to listen to the science, regulations are beginning to take shape that will inevitably, and arguably belatedly,

require reductions in methane emissions from ruminant animals. How will such restrictions be applied? For intensive sheep and cattle farms in lowland environments, options in arable production may be available and ought to be encouraged where practicable in order to produce more plant-based food. For upland farmers, however, with smaller herds/flocks practicing traditional and more ecologically suitable forms of production, effort must be made to ensure a ‘just transition’ whereby their livelihoods can be ensured with the help of wider social and economic networks of support that value their continued existence.



7 - Semi-intensive farming in the Lodi area (Po Valley): the grasses disappear behind the plastic, the manure behind reinforced concrete walls, 2020. (Photograph courtesy of S. Invernizzi)

GRASSES AND PASTURE IN THE CLIMATE TRANSITION

Cheap, highly processed food has become the hallmark of our era. It is the product of a deeply flawed logic that has come to regard food as a source of profit and wealth accumulation rather than as the foundation of human well-being, social vitality and cultural significance. For most of us as eaters in rich and middle-income countries, we are presented with the greatest range of products requiring the smallest expenditure of household income in history. Yet the paradox of the contemporary food system is that around one billion people are chronically food insecure, almost two billion are overweight or obese and at least 11 million people die every year from specifically diet-related illnesses (GLOPAN 2020). Simply regarded as 'consumers', the food system with its ubiquitous availability of processed products has infantilized and disempowered a general population lulled into a narrative of convenience and low price. In short, the contemporary food system has become decoupled from parameters such as the numbers of people fed healthily and sustainably.

However, over approximately the past three decades, increasing numbers of people have sought to engage with a different vision of food, one that is more localized, preferably organic, and potentially healthier. This emerging coalition of diverse actors concerned about their food and how it is produced now constitutes an important bloc in civil society that arguably has moved beyond the mere purchase of 'better products'. Rather, significant numbers of people are expressing opposition to

the status quo, demonstrating that alternatives are not only practically feasible, but also deliver a host of other co-benefits, including ecological regeneration, community

8 - Ancient water mill in Lirone, Italian Alps, 2019 (Image courtesy of S. Invernizzi).

building and improved well-being (Sage et al. 2021). The unfolding climate catastrophes of recent years are beginning to sharpen public attention even while political leaders are distracted by maintaining economic growth at all costs. While there are disparate and discordant voices within civil society, there is evidence to suggest the foundations for an agenda of social change is emerging. Some of its key features are being articulated most forcefully by a younger generation ('Millennials', 'Gen Z') many of whom comprehend the devastating consequences of continuing to pursue 'business as usual'. The challenge now is to harness this energy and courage with the tools that we know provide for an effective alternative pathway of transition capable of delivering food security, social justice, better human health and planetary ecological equilibrium.

Arguably, the single biggest problem that we must overcome is to move away from the atomized model of consumption and towards a more aggregated and

collective response. The market works best by individualizing us as consumers despite the needs and aspirations we have in common. Recognizing the ways in which food opens up spaces for conviviality – through growing, purchasing, cooking and eating – creates opportunities for redesigning many conventional practices at the neighborhood level. The proliferation of community gardens, the expansion of solidarity purchase schemes (e.g., GAS in Italy) and a growing consciousness around a range of ethical considerations (animal welfare, the rights of nature, climate breakdown), demonstrates the existence and growth potential of this emerging movement. [2]

There are, however, several important considerations before we can embark upon a program of change. First, we have to recognize that we now live in a world where silo thinking is not only redundant, it is dangerous to the complexities of our age. We have to be able to address multiple policy fields simultaneously, synergistically, and where there can be little room for trading off one issue (economic growth) for another (social justice). Secondly, we can no longer afford short-term thinking allowing events to unfold as they will ('trust in the market') without some coherent vision in place to guide us. Scenario planning is thus a vital tool in the repertoire, not only in establishing a road map, but in ensuring the widest possible consultation in its preparation. This leads into a third indispensable element: that of building collaborative initiatives to reshape production and consumption norms. When we consider the extraordinary abundance of ingenuity and expertise which exists in our societies, it is simply unfathomable to comprehend how we are in this current predicament. **Yet we have created disciplinary walls between academics, whose knowledge is set apart from most of civil society that in turn is disregarded by business (except in their role as customers).** Consequently, we have to find new arrangements capable of bringing together a diverse selection of professionals, activists, business-people and artists capable of initiating new

[2] Indeed, one might argue that food has become increasingly politicized not only on the global stage, where grain shipments represent life or death for the poorest and most food insecure regions, but at sub-national level in rich countries where citizens seek to achieve alternative visions for more localised food systems. Often experimental in design many projects fail, but those that persist can significantly revitalize thinking around food, not only calling into question current arrangements - how food is produced, by whom and at what cost to the environment – but through devising collective responses including efforts to enrol and mobilise local political authorities. The growth of food policy councils is one such development, while solidarity purchase schemes (GAS in Italy) have proven a highly successful mechanism for (re-)connecting consumers and producers. For more see Sage et al. (2021), Giambartolomei et al. (2021).

conversations around the food system as well as its wider place in the world. **The question, then, is how might such initiatives have any connection with farmers managing grasses and pastures in upland environments?**

9 - Beth Robertson. *Fraggio*, 2023 (Image courtesy of artist)

If we are to have any hope of addressing the existential threat posed by climate breakdown, then ensuring a just transition will be vital. That is to say, the wholesale imposition of strict regulations on a sector – indeed on a way of life such as livestock farming – is unlikely to be successful if this results in the demonizing of certain foods. Yet 'business as usual' is also not an option. Farmers will be required to change, to accommodate to new targets that might require a level of destocking, that might involve alterations to existing land use such as afforestation (for carbon capture, for habitat regeneration), and they will need to be compensated for such changes. Clearly, there is considerable scope here for innovative financial instruments overseen by public policy that better valorize ecological services and the stewardship of farmers. But it also opens up opportunities for new partnerships and collaborations: with outsiders who validate, encourage and support their efforts and perhaps can add value to the measures that farmers undertake. While this might involve ensuring a market for existing products – through solidarity purchase or community supported agriculture – the portfolio of products themselves might change as farmers and producers develop more agro-ecological measures for which premiums may apply. In this respect, building a more specifically territorial and

landscape approach could become a central tool to ensuring that farm livelihoods are ensured even while production volumes may decline. The key here being that designations of quality, in an increasingly differentiated market, wins over output by volume of singular brands. This represents something of a paradigm change to the existing food system where 'piling it high and selling it cheap' has generally prevailed. Can upland farming communities that have created livelihoods for many generations by managing grasses and pasture and their grazing livestock adapt to these new circumstances and lead on this necessary transition?

CONCLUSION

This essay has presented a critical perspective on the current food system, one where neither upstream producers or downstream 'consumers' are the major beneficiaries. 'Taking back the middle' has become a refrain in certain circles, where the scale of corporate concentration and the drive of productivism is seen as a major obstacle to ensuring that the entire world eats well and within planetary boundaries. Dietary change in the rich and in many middle-income countries will be necessary if we are to meet those goals. The human and environmental health burden of intensive livestock production is simply unsustainable and threatens to overwhelm ever-narrowing carbon budgets and health services. Planetary saviors promoting alternative proteins may suggest that death-free meat eating can continue, while others extol confined animal feeding operations utilizing rations that might comprise a diminishing proportion of grass in favor of concentrates and methane-reducing seaweed. **If the food industry continues along this high-tech path of AI, robotics and cellular**

10 - Danica Liongson. *Research process*, 2022 (Image courtesy NAHR archive)

agriculture then we look toward a future that not only excludes eaters as stakeholders, but likely renders grasses and pasture as an archaic, analog form of animal feeding to be eliminated. This is the vision that proponents of precision fermentation offer: large-scale industrial manufacturing of protein that renders livestock as entirely superfluous to food supply and thereby releasing land for rewilding, species recovery and carbon sequestration.

11 - Ming Lin and Heidi Maribut. *Radio for Rural Futurities*, 2019. (Courtesy of the artists)

On the other hand, a broad constituency of consumer citizens concerned not only about the quality of their food, but how it is produced, by whom and where, and working to ensure that production systems are transparent and demonstrate high ethical standards could transform food systems worldwide. The key here is to insist that consumer citizens take greater responsibility for their food purchases, not simply by their shopping choices or reducing kitchen waste, but by reaching out to others including those back up the food chain. Building strong and durable alliances with farmers is critical here, but will require patience and tenacity given the fierce independence that the agricultural community traditionally demonstrates. While it may be reluctant to relinquish complete control over its own affairs, farmers should be encouraged to appreciate the opportunities - and potential rewards - that democratizing the food system presents. Building closer relationships with the consumers of their products provides a social validation of their work, and creates sources of income that do not pass through the hands of intermediaries.

Reterritorializing food systems is a first step in the new agri-food transition, in which natural geographical boundaries may define a regional foodshed. Without

imposing fixed spatial parameters – each region will emerge reflecting its own historical, socio-cultural, and ecological circumstances; an initial task is to appreciate the particular agricultural and production characteristics of various territories. This is not to create autarchic regions engaged in the pursuit of self-sufficiency, but to better understand what can be provided to ensure the basis of a healthy, sustainable and culturally appropriate diet in the region. The current food system is extractive and linear with produce being transported over long distances; reterritorializing food supply provides an opportunity for more circular, closed-loop arrangements, reducing waste and other inefficiencies and valuing foods, ecological services, labor and other resources, including grasses and pastures.

In this respect the husbandry of animals on natural vegetation at stocking levels that do not exceed clear agro-ecological parameters – and not just regrowth of pasture but methane emissions that are balanced by sequestration in soils and plants – can form a vital part of sustainable food systems. Meat and dairy products therefore have a future, although at substantially reduced volumes of consumption in rich countries. The prospect that alternative proteins will displace animal tissue is unclear at this stage; Alternative protein products may simply provide an additional rather than substitute source of protein. For the dairy sector there are challenges too, although the fractionation of liquid milk into a wide range of food and industrial products (including infant and child formula, sports nutrition, the beverage sector) makes this food sector less immediately threatened by plant-based alternatives. For both mainstream milk and dairy, cutting costs in pursuit of profit may well have consequences for animal feeding regimes with implications for pasture. But for quality cheese makers and their milk suppliers, the role of well-managed and diverse grasslands will remain critical to their business. **Nevertheless, in the interests of remaining vigilant about the future, we should probably learn to appreciate more the formidable roles played by grasses and pastures, especially their wider social, cultural, and ecological dimensions.**

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REVIEWER/AUTHOR: NOTES/COMMENTS

(For internal logistics)

ADD HEADSHOT

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3 takeaways:

1. We should probably learn to appreciate more the formidable roles played by grasses and pastures, especially their wider social, cultural and ecological dimensions.

2. Grasses and pastures, then, are not without controversy (…) and can also be caught up in passionate discussions around the appearance of 'cultural landscapes' once forested now rendered as spaces for livestock grazing.

3. Reterritorializing food supply provides an opportunity for more circular, closed loop arrangements, reducing waste and other inefficiencies and valuing foods, ecological services, labour and other resources, including grasses and pastures.

 # key words: Food system; rewilding; farmers; cultural landscapes; challenging and contested plant communities; productivism; social, cultural and ecological dimensions