Journal of Rural Studies 47 (2016) 231–241

Contents lists available at ScienceDirect

Journal of Rural Studies

journal homepage: www.elsevier.com/locate/jrurstud

The history of oats in western Washington and the evolution of regionality in agriculture

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ARTICLE INFO

Article history:
Received 1 January 2016
Received in revised form
31 July 2016
Accepted 4 August 2016
Available online 30 August 2016

Keywords:
Regional agriculture
Agricultural industrialization
Sustainability
Oats
Western Washington

ABSTRACT

Concern is expressed in the literature that as agriculture industrializes, regionality is lost; and with it, social, economic and environmental benefits. The example of oats in western Washington provides an opportunity to examine forces driving agricultural evolution during the twentieth century and to reflect on whether and to what degree they reveal changes in the extent and nature of regionality in agriculture over time. Research based on historic literature explores five themes which highlight different ways in which the disappearance of the oat crop from western Washington was associated with the decline of regionality in its agriculture. Whereas regionally grown oats as horse feed were once an important energy source for transport and machinery in western Washington, they have been superseded by fossil fuels following mechanization. Oats were eclipsed in importance as livestock and poultry feed by corn and soy, preferred by a professionalized animal feed production industry and better supported by agricultural policy and research. Regional milling operations for food oats have also given way to industrial scale production in national centers. Increased need for farmers to participate in the monetized economy drove them away from the small grains, whose market value has declined as their commoditization progressed. Lastly, the role of oats as an agronomic tool for weed and disease control was undermined by crop protection chemicals. Oats thus exemplify evolution away from regional self sufficiency and towards greater integration with national and global markets by western Washington farmers. While the process was in part compelled by wider developments in agriculture and industry, it was also self-driven: regional farmers and agriculture sector leaders embraced opportunities to grow cash crops and participate in national and global markets from an early stage of western Washington's agricultural history. In a more recent phase of agricultural evolution, social interest in and consumer demand for local and regional agriculture are growing. This phase represents deliberate choice of regionality in the knowledge that it is neither necessary for farmers nor the cheapest possible option for consumers. Reinvented roles for oats are becoming possible in the present context and demonstrate a new and more purposeful approach to regionality which leverages technology and the market.

1. Introduction

Regionality is a concept that has emerged in the debate about how society organizes and relates to its food and agricultural systems. The potential benefits and extent of regionality in modern food systems of the US are widely discussed in the literature (for example Born et al., 2012; Urban Food Link, 2012; Delaware Valley Regional Planning Commission, 2010; Columbia University Urban Design Research Seminar, 2011). A question which has received less attention is what factors permit the development of regional or local agro-food networks, and what factors impel regions towards greater integration with the global economy. Where a historical perspective is taken, food and agricultural systems tend to be described as having evolved from greater to less regional self-sufficiency, from "craft production to mass production" (Lyson, 2012, p. 30). Herrin and Gussow (1989) found that this had occurred in Montana, and used their research into historic crop production to "examine the feasibility of encouraging the adoption of more localized seasonal diets." The present study revisits the question of how regionality in agriculture has changed over time,

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http://dx.doi.org/10.1016/j.jrurstud.2016.08.003

with a focus on understanding those factors which constrain or enable it. We take the approach of examining the regional history of a single crop – the oat (*Avena sativa* L.) in western Washington.

Social and academic interest in agricultural regionality reflects the importance of scale as a defining feature of twentieth century change in agro-food networks. Increasing concentration of agricultural resource ownership and geographic integration of operators are identified in the literature with negative impacts including environmental degradation, monopolization of genetic and physical resources and deterioration of rural communities (Welsh, 1996). Expansion of scale is viewed by some as threatening to food security and food system resilience because of the vulnerability of populations reliant on a decreasing number of food production centers (Griffin et al., 2015). 'Regional' and 'local' are foremost among the "spatially referenced concepts" (Feagan, 2001) around which opposition to such change has been built. They have become important words in the lexicon of what Jarosz (2007) calls "alternative food networks", a collective of efforts such as farmers' markets, food hubs, farm-to-school and community-supported agriculture schemes aiming to integrate social, environmental and economic goals in the structuring of agro-food networks. Consensus around the meaning of 'regional' and 'local' has so far been precluded by the broad spectrum of approaches, processes and locations embodied by alternative food networks: Kneafsey (2010) notes that the term 'region' has been variously used to indicate an area within a nation, an entire nation or even a group of nations, and the 'regional' overlaps considerably with the 'local', whose definition is no less elusive. Where agreement exists, it is around the idea that whereas profit motive and productivism define food and agriculture in the globalized capitalist framework, more spatially confined alternatives can provide a better context to manifest "the values of care for others, environmental sustainability, health and well-being" which are important to proponents of alternative food networks (Kneafsey, 2010).

Thus, while mainstream food and agriculture is typified by Hart's (2003) "tripartite macro-geography" dividing the US into just three agricultural regions – the Midwestern cash-grain region, the livestock region surrounding it, and coastal states which supply fruit, vegetables and cotton – the alternative food movement understands the 'regional' or 'local' as having a smaller spatial scale which can 'short-circuit' lengthy industrial food chains and restore the relationship of consumers to the provenance of their food (Renting et al., 2003).

Food and agriculture systems involves the physical movement of goods through production, processing and retail networks; economic relationships within those networks; and ideas communicated between producers and consumers. Hance et al. (2006) propose that agricultural development strategies based on the region should "seek to capitalize on competitive advantages derived from potentially reduced input and transportation costs; increased and more refined information flows between producers and purchasers/consumers; and market development based on product differentiation and branding products in terms of place or locale, freshness, or other characteristics distinctive to a region". Clancy and Ruhf (2010) write that in the "ideal" regional food system, "as much food as possible to meet the population's food needs is produced, processed, distributed, and purchased at multiple levels and scales within the region, resulting in maximum resilience, minimum importation, and significant economic and social return to all stakeholders in the region". In such approaches, regional agriculture privileges local production-consumption cycles, the active promotion of regional identity in the marketplace, and the nurturing of human and cultural values in agriculture including personal connections to food production.

Drawing on these ideas, the present study defines the extent of regionality in agriculture firstly by the importance of local production-consumption cycles, including processing activities, relative to the reliance on external markets. Secondly, regionality is thought of as the existence of regional identity in the food system and its active promotion in the marketplace. In reflecting critically on the role of regionality over time, we also acknowledge the social and political origins of the concept as it is used in the literature today, whereby it is envisioned as a conduit to democratization of agro-food networks and revitalization of rural communities.

Western Washington was chosen for the present study as a region with clear geographical identity, demarcated by the Cascade mountain range to the east and the Pacific Ocean to the west. Several previous studies of regional food and agriculture have taken western Washington as their study area, building up an understanding of the region's physical and social characteristics (Born et al., 2012; Hills et al., 2013; Urban Food Link, 2012; Jarosz, 2007).

Western Washington's nineteen counties fall within the Oceanic (*Csb*) climate classification of the Köppen Geiger system (Kottek et al., 2006). Its characteristic wet winters and warm, dry summers make western Washington particularly well suited for cultivation of oat because the oat plant has a higher water requirement by unit of biomass than any other small grain except rice (Brouwer and Flood, 1995) and performs exceptionally well in other similarly temperate, high-precipitation environments such as the UK and Ireland (FAOSTAT, n.d. a). Oats traditionally have had multiple roles in cropping systems as animal feed, human food and agronomic tools. Despite the crop's value, oat production declined worldwide during the twentieth century, falling from an average of 50.5 million metric tons per year between 1966 and 1970 (FAOSTAT, n.d. b) to 28.1 million metric tons between 1996 and 2000 (FAOSTAT, n.d. c). The decline has been even more precipitous in the US; and nowhere was this trend more dramatically manifested than in western Washington.

The agricultural community of western Washington originally capitalized successfully on the natural adaptedness of the oat crop but has virtually abandoned it within the last few generations. Similar disappearances have occurred in other places and at other times in history such as the loss of flax from cropping systems in Scandinavia (Viklund, 2011) or that of quinoa from Inca territories after the Spanish conquest (González and Eisa, 2015). The loss of oats from western Washington's cropping systems provides us with an example from recent history which took place during a time when regionality is held to have decreased in agricultural systems worldwide, particularly in developed countries including the United States. The present study uses the historic literature to develop explanations for the loss of oats in western Washington and considers the extent to which these explanations are connected to changes in agricultural regionality. By doing so, it aims to deepen our understanding both of *how* regionality in agriculture has changed over time, and of *why*. The study aims to illuminate specific factors which have constrained or enabled agricultural regionality in the past, contrasting them with those which constrain or enable it in the present. Implications of these enabling or constraining factors for regions elsewhere are considered.

2. Methods

The study region was defined as nineteen Washington State counties lying west of the Cascade Mountains: Clallam, Clark, Cowlitz, Grays Harbor, Island, Jefferson, King, Kitsap, Lewis, Mason, Pacific, Pierce, San Juan, Skagit, Skamania, Snohomish, Thurston, Wahkiakum and Whatcom (Fig. 1).

Historical research for the present study was conducted through a literature review of a wide range of historical and contemporary sources including federal and state government reports, technical

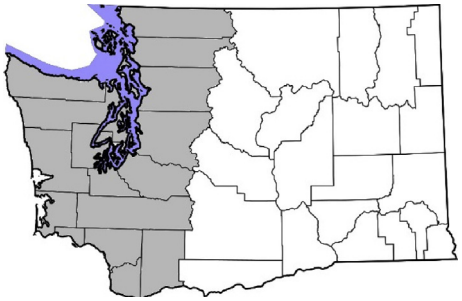

Fig. 1. Washington State map with the 19 counties of western Washington highlighted in grey.

guidance for agriculturists published by Washington State University (the state's Land Grant university, responsible for communicating scientific research in agriculture to stakeholders in the industry), popular press archives, trade journals and social and economic histories. Five themes in particular, identified from initial findings in the literature, were explored in depth for their potential to explain the loss of oats from western Washington. 1. Replacement of horses with mechanized farm power and transport; 2. Restructuring of livestock farming and professionalization of feed manufacture; 3. Loss of regional processing infrastructure; 4. Expanding marketization of agriculture and deflating market value of small grains; 5. Introduction of agro-chemicals. Findings are organized according to these themes.

Explanations for the loss of oats from western Washington were considered in the light of changes in agricultural regionality over time. Data enabling the quantification of agricultural regionality are not readily available. For example, there is no dataset recording the proportion of regionally grown crops that are locally consumed, or the proportion of consumption that is regionally grown. This lack represents an obstacle to the precise quantification of food system regionality. We therefore focused on developing an impressionistic understanding of the extent of regionality in western Washington agriculture over time by using several existing studies of the region's food system in addition to agricultural census and survey data collected by the US Department of Agriculture and other narrative reports about regional food and farming activities.

3. Early agricultural development in western Washington State

Western Washington, situated in the far northwest of the United States of America between the Cascade mountain range and the Pacific Ocean, was once a landscape of dense conifer forests and tidal mudflats (Graves, 1916). Native American tribes had populated the region and lived from the land by hunting, gathering and shifting cultivation (Thrush, n.d.). European settlers were attracted by rich timber resources, coal, metal ores, fisheries and the prospect of highly productive farmland, and their arrival marked the start of more intensive agricultural development (Evans and Meany, 1893, pp. 83–98).

Fur trade companies such as the Hudson's Bay Company cultivated some areas of western Washington during the early 19th century in order to establish self-sufficient supply outposts along trapping and trade routes, and to produce agricultural commodities for export (Scheuerman and MacGregor, 2013). Development gathered pace in the 1860s and 1870s after the Oregon Treaty transferred jurisdiction over territories including Washington Territory from Great Britain to the US, leading to an influx of independent American settlers. Population centers initially grew in the southwestern corner of the region (present-day Lewis County) and spread along the coast of Puget Sound, providing a local market for agricultural output, while territories east of the Cascade Mountains were populated later (Anonymous, 1989).

By the late 19th century, the productive potential of western Washington's lands was becoming clear. Farms had little choice but to be self-sufficient and most undertook activities including meat-raising, egg production, vegetable production and the maintenance of draft animals (Anonymous, 1989). The region developed a population of small mixed farms, successfully cultivating a wide range of different crop types. Potatoes were one of the first crops to sustain the incoming population, and were used as currency in some areas before coins and banknotes became readily available (Interstate Publishing Company, 1906). Cereal crops were also grown: wheat, oats and barley. The hops of western Washington gained renown, as did its abundant hay crops. Hay and forage production supported the growth of dairying around the major population centers. Western Washington farms reported 14,171 dairy cows in the agricultural census of 1880 and close to 114,000 in 1910.

Commerce became important to western Washington's agriculture at an early stage, thanks in part to multiple routes through which the region is connected to other markets. The Great Northern Railway arrived in 1890, connecting the city of Bellingham with Midwestern and Eastern states. A history written shortly afterwards states that fruits and vegetables of the region are marketed "throughout the cities of the [US] northwest" (Hestwood, 1893). The sheltered waterways of Puget Sound offered passage to steamships carrying grain and other produce from the region's rural production areas to cities such as Seattle and Tacoma (Newell, 1969). Beyond the Sound, the Pacific Ocean provided access to ports further south along the US west coast and in the Asia Pacific. Western Washington's connectedness was important not only for the marketing of its own agricultural production, but also to supply its expanding population. For example, in the late nineteenth century, before the expansion in its dairy sector, western Washington relied on imports of butter and cheese from Kansas and Nebraska; and on imports of meat, dairy and poultry from other Pacific states and as far as the Mississippi Valley (Giles, 1912).

Emerging from this overview of western Washington's early agricultural development are clear signs that there was both the need for regionality, because farms were required to be relatively self-sufficient, and the potential for it to grow, because of a highly productive natural environment and the close coexistence of population centers and agricultural lands. At the same time, farmers and community leaders were clearly interested in markets beyond the region's borders. The oat crop provides an organizing theme for examining economic, technological and social changes which help us interpret gain or loss of regionality in agricultural systems over time.

4. Oat production dynamics from Euro-American settlement to present

Among the crop types most valuable to early generations of settlers was the oat crop, providing both animal feed and human food. In Skagit County, at the northern reaches of the Puget Sound, prolific oat and barley crops of the 1860s are said to have financed costly construction of the dike network (Interstate Publishing Company, 1906). Throughout the region, oats are referred to as a "staple" of agriculture in the late 19th century (Interstate Publishing Company, 1906; Rudene, 1908). A 1916 report of the Washington State Department of Agriculture describes oats as "an important contributor to the sum total of the output of Washington farms," and the western region as being responsible for most of that contribution (Graves, 1916). Whereas wheat was dominant in the

east of the state, oats were clearly the dominant grain in the west (Fig. 2).

Western Washington demonstrated unique potential for the production of oats because of its wet winters, cool springs and warm, dry summers. Several farmers in 1876 obtained oat yields so high that they published them with a legal oath as to their veracity (Interstate Publishing Company, 1906). Their reported yields lay in the region of 89 bushels per acre, or 3168 kg per hectare (a bushel of oat grain consists of 32 pounds, or 14.5 kg). Early 20th century data indicates that 100 bushel acre-yields were usual (Evans and Meany, 1893, p. 102). These figures are most likely for unirrigated oat crops and compare favorably with relatively recent yields achieved in US states in the heartlands of oat grain production; 1997 non-irrigated yields in Minnesota, for example, were 54.5 bushels per acre and in Wisconsin, 59 bushels per acre (USDA National Agricultural Statistics Service, 1999). The United States Commissioner of Agriculture reported in 1882 that, "Washington Territory heads the list of oats producing States" in terms of yield (Loring, 1882). Washington State sustained its top rank in the Census of 1900. As late as 1961, F.A. Coffman's authoritative account of the oat crop states that "One of the areas of highest acre yields in North America is in the Puget Sound region [of Western Washington], where cool, moist weather usually prevails" (Coffman, 1961).

The historic literature documents a number of different roles for oats in western Washington. One role was as horse feed. In addition to draft horses on farms (Fig. 3), western Washington sustained a population of heavily-worked horses in numerous logging camps throughout the region and transport horses in growing urban centers of Olympia, Seattle and Tacoma. In the Census of 1910, western Washington's on-farm horse population was 46,388 and its off-farm population 23,377. Oats have traditionally been known as the optimum source of nutrition for horses (Meinken, 1953). It was common practice at the time also to feed oat grain to dairy cattle, so the successful regional dairy industry is likely also to have supported a market for oat grain (Murray, 1916; Hoffman and Livezey, 1987). Agricultural census data from western Washington also show that the region's oats have been used for forage, usually just under half the total acreage. Moreover, oats had become a fashionable breakfast food in the late nineteenth century, and western Washington boasted several mills producing food oat products for the human market. Oatmeal milling was described as "a great industry" in Graves' (1916) account of Washington agriculture to the State Governor. Graves concludes that the oat farmer is "assured a ready market and a profitable price for his product." Supported by the diversity of market outlets for the crop, oats were reliably in demand in Western Washington.

For several decades of the late nineteenth and early twentieth centuries, oats were the dominant small grain crop and a substantial contributor of agricultural value overall in western Washington, but their success faltered in the mid-twentieth century. County level data from the Census of Agriculture show that the grain oat harvest peaked during the first two decades of the twentieth century, exceeding 4.7 million bushels (almost 70,000 metric tons) in the census of 1920 (Fig. 4). It then entered a decline towards the middle of the twentieth century during which oat acreage, oat grain production and the number of farms reporting oats all decreased steadily. In 1997, the last census of the 20th century, western Washington produced less than 150,000 bushels (around 2170 metric tons) of oat grain. The US Department of Agriculture's regional survey dataset for western Washington ceased altogether to record oats in 2009, because the total output of oat has been considered too low for reporting since that time.

4.1. Mechanization replaces horses in farm power and transportation

One of the original success factors of the oat crop in western Washington was a local horse-feed market by which oats were required in high volume, with no equivalent substitute. Fig. 4 displays changes in the region's oat production together with changes in its horse population. Western Washington's on-farm horse population declined from 46,866 in the 1920 agricultural census to 6790 in 1969, as draft and transport horses were replaced by motorized vehicles and equipment. The provision of power by horses fed with local oats made western Washington's agricultural system regionally self-sufficient for power. The replacement of horses by diesel- or petrol-powered motors removed this aspect of regionality.

Western Washington later saw a certain recovery of its horse population, up to 25,021 by the 1997 census. These horses, however, were leisure horses rather than work horses, and therefore were not associated with any re-regionalization of power supply.

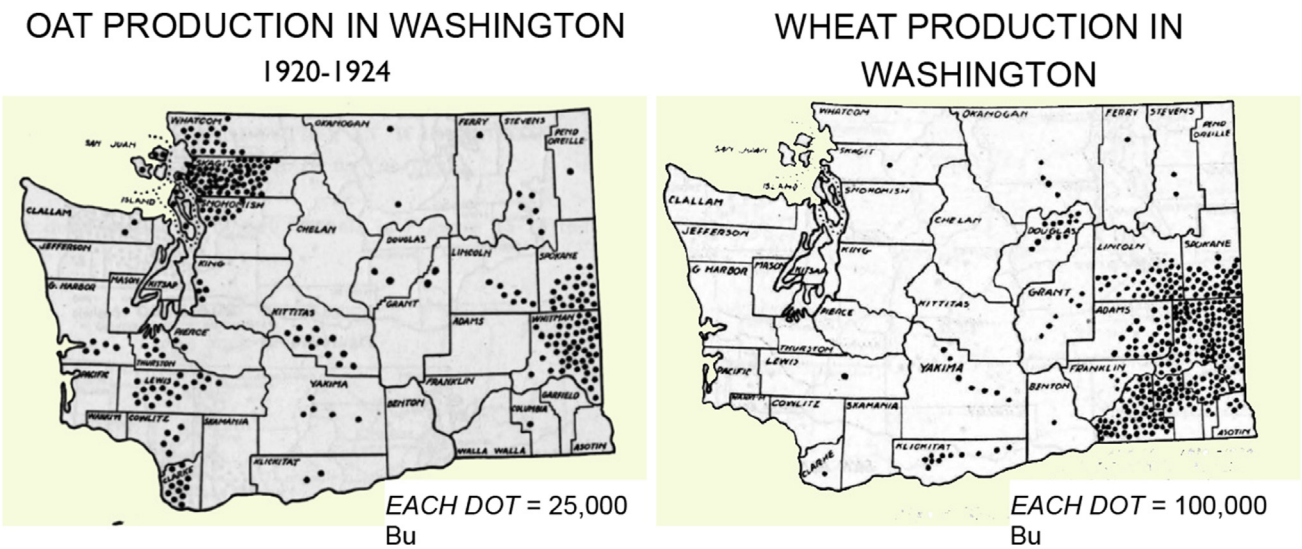

Fig. 2. Early 20th Century distribution and scale of oat (left) and wheat (right) production in Washington, showing the concentration of oats to the west of the Cascades and of wheat to the east (State College of Washington (1926). Washington State Extension Bulletin No. 134, Washington Agriculture Part 4: Cereal Crops.).

Fig. 3. Farmers binding oats on Lopez Island, Washington, early 20th century. Reproduced with the kind permission of Lopez Island Historical Society.

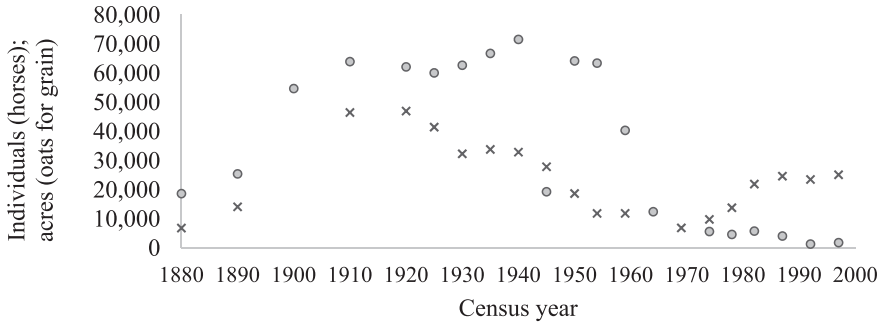

Fig. 4. Oat acreage (circles) and number of horses (crosses) in western Washington, 1880–1997. Data from US Census of Agriculture, various years (no data available for horses in 1900).

Fig. 4 also shows that the arrival of leisure horses was not accompanied by any recovery of oat production. By this time, farmers had shifted their attention to other crops, and any demand for horse-feed oats had to be met with imported grain.

The decline of the horse population is often cited to explain the loss of the oat crop from twentieth century agricultural landscapes worldwide. In western Washington, however, oat acreage and horse population dynamics were imperfectly aligned. This suggests the existence of additional factors, the first of which to be considered is other livestock markets.

4.2. Specialization of farms and the rise of the corn/soybean production system

Washington State University Extension literature from the early twentieth century recommends oats for cattle and poultry (McNatt, 1921), while also emphasizing to farmers the importance of using "home-grown" rather than purchased feeds for all kinds of livestock because "Transportation adds to feed cost" (Turner and Miller, 1924). However, the willingness to use oats in livestock markets other than the horse feed market decreased considerably over the twentieth century. During this time, the organization of livestock production in the US underwent substantial change, namely specialization, consolidation and expansion of operations, separating crops from animal production and professionalizing the manufacturing of feeds (Macdonald et al., 2013).

These changes are reflected in the agricultural census data from Washington State. In the Census of 1910, 76.3 percent of farms in Washington State reported cattle, 41 percent pigs and 70.5 percent poultry (USDA, 1913). In the census of 1997, 40 percent of farms reported cattle, 3 percent hogs, 5 percent laying hens and 1 percent broiler chickens (USDA National Agricultural Statistics Service, 1999). While statewide population size for all these types of animal increased in Washington, the number of flocks and herds decreased, i.e. the production scale was raised. The average size of a Washington dairy herd was six cows in 1910, whereas it was 190 in 1997. Further, the 1910 census states that only half of farmers reported any expenditure for livestock feed, showing that they were able to meet most or all feed requirements from crops grown on-farm.

The same Extension Bulletin mentioned above that advised the use of locally-grown oats in dairy feed rations also introduced the suggestion of using corn (maize) meal, soy meal and coconut meal as supplements (McNatt, 1921), all of which would necessarily have been imports as the climate conditions of western Washington are not suited to their production. McNatt's suggestion presages the shift to professionally-manufactured, high-efficiency feeds which swept across the US during the twentieth century (see for example Gardner, 2002; Hart, 2003). The primary ingredients of such feeds are corn and soy. By the 1960s, US corn production represented one-fourth of total crop production, i.e. more than the combined production of fruits, nuts, vegetables and sugar crops (DuRost, 1960). Oat grain has higher concentrations of lipid and protein than maize or any other cereal, and studies attest to its value as feed for poultry (Cave et al., 1989), pigs (Boggess et al., 2008) and cattle (Tommervik and Waldern, 1969). The question therefore arises of why oat was so thoroughly eclipsed in importance by corn and soy. The history and politics of corn and soy are complex and multi-faceted; here, we attempt to identify a few of the key points with greatest relevance to our inquiry.

Corn is long-established as a feed grain in the US (Hudson, 1994). It is a remarkably adaptable crop which grows in a wide

range of climates, and was being grown throughout the nation by the turn of the twentieth century. Its abundance has made it cheap and available, and therefore a logical choice as a carbohydrate source for large livestock operations interested in economy and scale (Newman, 2013). With a large number of farmers invested in corn, the crop became a target for research dollars (Frey, 1996). It benefited directly from some government subsidy initiatives (price supports, direct payments) and indirectly from others (industrial subsidies supporting use of corn-based ethanol, for example) (Gardner, 2002).

While corn is a carbohydrate source in animal feeds, soy is a protein source. Soybean only began to attract serious attention from the U.S. agricultural sector after major production shortfalls in the cotton crop during the early twentieth century. Cottonseed meal had been an important source of protein and energy in livestock feeds, used domestically and exported. Replacement of cottonseed meal by soy products in overseas markets stimulated efforts to adopt it into the US agricultural system (Newman, 2013). The protein content and quality of the soybean impressed American farmers, and while oats have disappeared, soybean production has expanded from almost nothing in 1925 to 14 percent of total national crop output in 1995 (Gardner, 2002).

A report by Frey (1996) on plant breeding research resources allocated to different crop types found that field corn received 545 scientist years, soybean 156, wheat 130 and oat just 18. Reflecting the allocation of research resources, the yield advantage of oat over wheat on a nationwide basis reduced from 2.21 in 1949–51 to 1.65 in 1969–72 (Ryan and Abel, 1973). In addition to improving crop genetics and production practices, research investment can expand the range of applications for a crop, supporting its market value. Research investment has refined the utilization of corn in livestock production and developed other, more unexpected, end-uses such as bioplastics, sweeteners, biofuels and many others (Gardner, 2002). Meanwhile, the reconceptualization of soy as a human food was partly assisted by Henry Ford's million-dollar research initiative, launched during the Great Depression to develop manufacturing uses for American agricultural products (Newman, 2013). Owing to their large-scale use in the animal feed markets and wide range of alternative applications, returns earned from corn and soy were far higher than those earned from oats towards the end of the twentieth century. US Department of Agriculture Survey data from 1990 to 99 show that across the US, corn earned an annual average per hectare of US$713.60, soy, $532.94, and oat, just $195.66.

While western Washington's livestock farmers continued to produce much of their own forage throughout the twentieth century (the 1997 Census of Agriculture reported almost 24 percent of total agricultural land being used for this purpose), the transition to corn- and soy-based manufactured feeds meant the elimination of feed grain production from the region. By 1969, livestock feed concentrates (grain based or compound feeds as opposed to roughages) were no longer produced in the Puget Sound agricultural area (Hopp et al., 1974). Today, direct contact with local farmers and feed mills in addition to evidence in the popular press (for example Tuttle, 2014) suggest that livestock feeding practices in western Washington, in common with other regions, now depend almost wholly on corn, soy, wheat and other grains, and professionally manufactured feeds are much more likely to be utilized. These data may explain why oat production was not sustained in the region despite the maintenance of dairy herds comprising over 116,000 cows throughout the century.

4.3. Consolidation and concentration of the grain sector

Another important aspect of the context in which oat was lost from western Washington is the disappearance of regional food grain processing capacity. The historic literature offers evidence of at least five oatmeal mills in western Washington during the late nineteenth and early twentieth centuries: the Cascade Oat Meal Mill in Tacoma (Hestwood, 1893), p. 15; J.M. Moore's mills outside Anacortes (Bourasaw, n.d.) and on San Juan Island (Anonymous, 1895); the Mount Vernon Milling Company's mill and warehouse in Mount Vernon (Anonymous, 1917); and Milne's oatmeal mill in La Conner (Anonymous, 1881).

Oatmeal was “found on almost every gentleman's breakfast table” in western Washington by 1878, according to a local newspaper (Anonymous, 1878), suggesting that mills in the region had a local demand for their output. Today, oats remain a commonly eaten food in Washington State, but none of the mills mentioned by historic sources survives. Farmers in western Washington interested in growing oats for the human food market are faced with lack of access to processing equipment. If they wish to supply to the milling industry, their closest options are mills in Eugene, Oregon or Bancroft, Idaho, and they might be challenged to do so at a profit.

The disappearance of western Washington's oatmeal mills is part of a nationwide trend towards consolidation of the food oat milling industry which has resulted in the region's demand for food oats being supplied entirely from external sources. US oat milling has traditionally been centered in the Midwest, drawing on crop production in Iowa, Wisconsin, Minnesota, Illinois and the Dakotas. As early as 1891, the Quaker Oats Company sent a freight train loaded from Cedar Rapids, Iowa to Portland, Oregon to introduce its oat products to the Pacific Northwest (Marquette, 1967, p. 63). The experiment was part of a successful endeavor to develop markets throughout North America. Together with Quaker (acquired by PepsiCo in 2001), five companies, each with a small number of mills, now process the majority of North American food oats and have well-established national and international distribution networks. A similar process of consolidation has occurred in the US flour milling industry (Kim et al., 2001; Heffernan et al., 1999), contributing to the withdrawal of flour mills from western Washington.

Along with its oatmeal mills, western Washington has lost its flour mills (only one, Fairhaven Flour Mill, is operational in the region at the time of writing) and processing capacity in the fruit, vegetable and meat sectors; the resulting impact on the agricultural landscape is large (Puget Sound Food Project, 2008; Urban Food Link, 2012). Dairy processing capacity is reported to have largely moved from western to eastern Washington where land values are lower to enable lower-cost, larger-scale business models (Anonymous, 2012). The regulatory environment poses further obstacles to within-region food production and distribution (Puget Sound Food Project, 2008). In this way, oats and other components of a regionally self-sufficient food and farming system in western Washington were victims of the process of macro-geographical specialization described by Hart (2003) and noted by Clark et al. (2010) to be associated with the declining availability of support infrastructure – both upstream, such as crop inputs or cultivation equipment, and downstream, such as processing capacity – for all but the most dominant commodities.

4.4. Declining market value of oats, pressure for farmers to increase revenue

The loss of regional market outlets for the small grains, including oat, likely exacerbated rapid decline in their market value as commoditization of grains proceeded during the twentieth century. Improved efficiency of production and transport has allowed most of the US to rely on centralized grain production in the macro-region stretching between Ohio and Nebraska, Hart

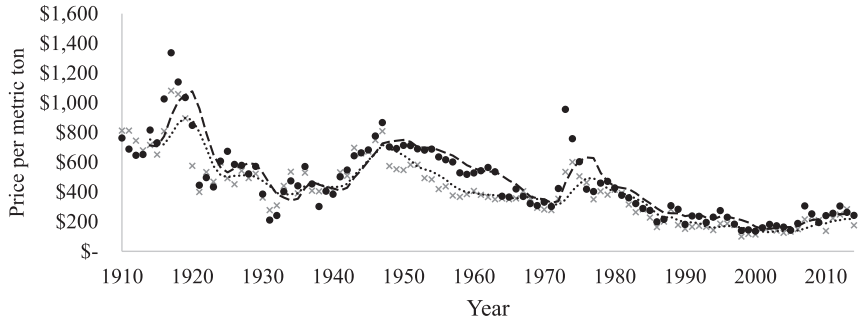

Fig. 5. Changing market value of oat (gray crosses and dotted line) and wheat (black circles and dashed line) in Washington State, 1910–2012. Prices are corrected for inflation to 2014 value (USD).

(2003) "Midwestern core" or DuRost (1960) "north-central regions". Over the course of the twentieth century, a decline in the real price of oats (2014 dollar values) has been observed in Washington State from a ten-year average of US$803.21 per metric ton between 1910 and 1920 to $152.31 between 1990 and 2000 (USDA National Agricultural Statistics Service, Various years; Fig. 5). This was part of a pattern of rising productivity and falling commodity prices across developed-world agriculture as a whole (Gardner, 2002, p. 153), though the small grains have been affected particularly and are today viewed as a comparatively low-return crop.

Deflation of small grain prices significantly affected twentieth century farmers' cropping decisions because they were faced with a greater need for cash than their predecessors. Gardner (2002, p. 13) points out that the mechanization of agriculture increased the market-dependency of farms by necessitating the purchase of off-farm inputs, repair services, chemicals and equipment. Washington State's farmers now use "the services of utilities, farm machinery and equipment dealers, aerial sprayers, helicopter drying services, veterinary services, bankers, accountants, computing experts, insurance companies and suppliers of fertilizers, herbicides, insecticides and biological controls for insects and diseases" (O'Rourke, 2008). Increased taxes further contribute to their financial burden and the need to generate financial income (Saloutos, 1982). Such changes represent a process of marketization which is part of the industrialization of agriculture. Mayhew (1972) describes farmers as having transitioned as a result from being opportunistic users of the market to being dependent upon it.

Pressure to generate cash revenue was especially intense for farmers of western Washington because of the economics of their land base. Western Washington experienced rapid expansion of urban areas during the decades following WWII, at the same time as productivity and efficiency gains brought down farm prices (Canty et al., 2012). This caused a 63 percent reduction of available farmland between 1945 and 1997, and an increase in land values. Value per acre (2014 dollars) of agricultural land in western Washington ranged between US$29 and $987 in 1900, whereas it ranged between $438 and $27,260 in 2012 (United States Census Office, 1902; USDA NASS, 2012). Farmers have therefore been required to intensify the acre value of their farms in order to survive. In the 1997 agricultural census, the average farmed acre in Western Washington earned 3.49 times the average acre in the state's east, where population density and pressure on land values are lower (USDA National Agricultural Statistics Service, 1999).

Supported or compelled by technological and market developments, the farms of western Washington became more specialized and more valuable. The agricultural census shows the number of farms in western Washington decreased from 23,189 in 1910 to 10,888 in 1997. The average value of farm property at 2014 dollar values increased from US$176,082 in 1910 to $545,385 in 1997.[1] Another indicative metric is farm expenditure on hired labor. Washington State farm-average labor expenditure increased from $7030 in 1910 to $58,348 in 1997 (2014 dollar values). These data reflect evolution in the agricultural landscape from a patchwork of small, mixed farms with integrated crops and livestock, owner-operated and reliant on family labor, to larger, specialist business operations. The direction of this evolution is in step with that observed in US agriculture nationally (Dimitri et al., 2005).

Western Washington's oat acreage dropped from approximately 60,000 in agricultural censuses between 1920 and 1930 to 1743 in the Census of Agriculture of 1997, and wheat acreage from over 17,000 to 5928. Agricultural sectors which expanded to replace them during the second half of the twentieth century were dairy, berries, potatoes and vegetable seed. Berries are reported to be marketed both within and outside the region (Hopp et al., 1974; Born et al., 2012). Dairy experienced an export-oriented phase in the middle of the century but now appears to serve primarily regional markets. Potatoes declined through the first half of the twentieth century but have recently gained popularity as a specialty crop with the introduction of new varieties; today, nine out of ten potatoes grown in Washington are marketed outside the state (Tozer et al., 2013). Western Washington's unique climate characteristics are suited to small-seeded, cool-season vegetable seed production, and the region became a significant or dominant contributor to US and world supplies of spinach, table beet, Brussels sprout and cauliflower seed (Thomas and Schreiber, 1997).

4.5. Diminished agronomic roles for oats in production systems

At the same time as their markets contracted, the introduction of chemical herbicides and fertilizers undermined the agronomic role of small grains including oat in western Washington. The ability of oats as a rotational crop grown to control weeds and pathogens of more valuable cash crops is well documented, and the practice of using oats in this way was common in US agriculture through the first half of the twentieth century (Hoffman and Ash, 1989). Chemical herbicides and fertilizers became available during the 1950s, and permitted farmers to shift from agronomic self-reliance to the use of purchased inputs for crop nutrition and pest control. The Census of Agriculture reported of Washington State in 1910 that "about three out of every hundred [farmers] purchase fertilizer," whereas it would be difficult in the present day to find three in one hundred who did not. Instead of rotating a variety of crops through their fields, some of which might have had limited or

[1] The Census of Agriculture records "value of all property" in 1910 but "value of land and buildings" in 1997; these categories are considered roughly comparable for the purpose of this discussion.

no market value, farmers could now focus on cash crops. As the market value of oats diminished relative to that of other crops, their use as a rotational tool was associated with a higher opportunity cost, explaining why agrichemicals are associated with the decline of the oat crop not only in western Washington but at a national level (Hoffman and Ash, 1989).

Because the agricultural chemicals on which most farmers now rely are sourced from outside the region, the agronomic self-sufficiency of western Washington can be regarded as having declined. In this sense, the disappearance of oats from the region is clearly associated with the rise of twentieth century models of agriculture characterized by national or international product flows.

5. The "loss" of regionality: a welcome change?

In the framework of the present study, regionality in agriculture is defined by the practical aspect of how production-consumption cycles, including processing, are organized, and the cultural aspect of the existence and importance of regional identity in agricultural marketplaces.

The fate of the oat crop in western Washington, together with other data, suggests that self-reliance in food, feed and even fuel have been eroded between the late nineteenth century and the end of the twentieth century, and aspects of agricultural regionality have been lost. Farmers have been required to marketize and professionalize their operations, increasing their acre returns at a time when commoditization and expanding scale of competition in grain markets deflated the market value of oat grain. A trans-regional supply network for fertilizer and other agrichemicals has made oat and other small-grain crops redundant as agronomic tools, while their role in the feed market has been undermined by the professionalization of concentrate manufacturing and the dominance of corn and soy. These changes represent the erosion of previously existing local production-consumption cycles.

With respect to other aspects of regionality such as the active promotion of regional identity in the marketplace and the nurturing of human and cultural values in agriculture (Hance et al., 2006), the character of change may not be so straightforward. It is interesting to note that the regionality that once existed in western Washington seems to have been a matter not of choice but of necessity. The historic literature conveys the sense that agricultural operators and decision makers were far less keen to foster regionality than they were to embrace the prospects offered by extra-regional markets and the perceived prestige associated with serving them. The following passage from an 1893 history of the state emphasizes how far western Washington's nascent agricultural community set its sights:

> *[The Puget Sound country] exports, annually, grain by the shipload, hops by the million pounds, and eventually will ship pears and other fruits by the hundred carloads to the harsher climates of the East, besides supplying a large and ever-increasing home market"* (Hestwood, 1893).

The evident sense of accomplishment is echoed in modern descriptions of the state's farming, such as the following extract from a Washington State Department of Agriculture document:

> *[T]he Washington wheat industry was among the leaders in the 1950s and 1960s in identifying how rising incomes in traditional rice-eating countries like Japan, South Korea and Taiwan would trigger demand for consumption of alternative wheat-based foods. The Washington apple industry, through its pioneering marketing efforts for fresh apples, helped open up many developing country markets for other Washington agricultural products such as pears, sweet cherries and fruit juices"* (O'Rourke, 2008).

Marketization and commercialization with an orientation towards export began early in western Washington's agricultural history and were supported by the state's Extension Service as part of national-level agricultural policy. Roth (2002) notes that the US Extension Service, born of the Smith-Lever Act in 1914, was heavily influenced by politicians who believed specifically that "scientific agriculture," which to them meant the promotion of industrial approaches, was necessary to produce a sufficiently reliable and abundant food supply to feed growing urban populations cheaply. Glenna (2003) argues the existence of a link between such beliefs and the increasing presence and power of agribusiness in US agriculture, resulting in orientation towards the commodity production model. In Washington State, the Commissioner of Agriculture wrote in 1916 that the "unceasing [government] campaign" to transmit "scientific principles" to dairymen had succeeded in transforming the industry from "haphazard" to "a highly organized business of its own," suggesting that a shift from small-scale informal to specialist large scale was taking place. Giles' Extension Service publication of 1912 has a section entitled, "The Cow a Factory." The history of the Washington Cooperative Farmers Association shows that the egg and broiler production industry professionalized rapidly in the first two decades of the twentieth century. This included becoming reliant on purchased feed, and the Washington Co-Op began its own feed imports from Iowa just after World War I (Bell and Buchanan, 1956, p. 35). In 1922, the Co-Op joined an affiliation that successfully marketed western Washington eggs as far east as New York. In 1916, western Washington's berry crops were mostly sold into regional population centers, but processed berries were already sold into other states.

6. Contemporary perspectives: a new regionality and a new role for oats?

Today, western Washington is experiencing growing consumer interest in regional agriculture and food. Farmers' markets quintupled in Washington State between 1991 and 2012, the majority of them located in the west (Ostrom and Donovan, 2013). Growth has been documented not only in the number of farmers' markets but also Community Supported Agriculture programs, food hubs and direct sales to restaurants by farms in the Central Puget Sound (Sonntag, 2010). Regional markets exist for all types of food, and operators are developing independent production and marketing channels which can exploit direct connection to consumers and which emphasize values such as artisanal, fresh and local.

This interest extends to locally grown grain, supplied through channels alternative to the commodity mainstream. Similar movements are already advanced in other areas of the US, represented, for example, by the Northern Grain Growers association of Vermont and the Community Grains group of California (Northern Grain Growers Association, 2015; Community Grains, 2015). While such activities are less developed in western Washington, research exists to show that the region's bakers have an interest in using locally grown grains (Hills et al., 2013). Markets for barley exist in malting and brewing, supported by a rapidly growing craft beer industry (Food Processing Center, 2001). In western Washington, both barley and wheat are also sold into locally-grown livestock feed markets and are used as rotation crops for their agronomic benefits. After plummeting at the end of the nineteenth century, the acreage of grains in the region is climbing, and exceeded 15,000 in 2012 (Born et al., 2012).

The reintroduction of oats to western Washington would allow

farmers to exploit their high productive potential under local climate conditions and its low input requirements, as well as further diversifying the cereal component of rotations and enhancing agro-biodiversity. Oat grain has demonstrated nutritional value in human (Ranhotra and Gelroth, 1995) and animal (Cuddeford, 1995) diets. A further advantage of shorter supply chains is the flexibility to experiment with novel crop characteristics not accommodated within the commodity mainstream. The health value of oat grain is related to its high protein content in comparison with wheat and barley, and presence of the soluble dietary fiber beta glucan (Welch, 2011). There are varieties of oat with elevated content of protein and beta glucan which could confer health benefits not currently marketable within the commodity system, and other unique characteristics could potentially be identified and developed.

Provision of a locally grown and processed food oat product would require substantial investment to overcome infrastructural challenges. Oat grain is high in oil and vulnerable to rancidity (Lehtinen et al., 2003). The grain can be stabilized by heat treatment, but this is energy intensive and requires appropriate equipment. Hulled oat varieties can be stored for longer in a stable condition than hulless varieties, but the hull is difficult to separate from the grain and also requires equipment. At present, machinery for oat processing is difficult for small- or mid-scale operators to obtain.

Nonetheless, evidence exists to suggest that such challenges can be overcome. Craft malting companies in several regions of the US have devised complex machinery to achieve small-scale processing of barley for the craft brewing industry, including a company in western Washington (Stayton, 2014). In other regions of the US, small- or mid-scale operators have found creative ways to overcome the challenges of processing oat (for example Lazor, 2014; Maine Grains, n.d.).

With respect to the regional feed value of oats, consumer demand for local agricultural products provides incentive to livestock producers to use locally grown feed ingredients, and there are successful feed formulators in western Washington who advertise their commitment to sourcing locally (see for example Scratch and Peck Feeds, n.d.). Direct contact with producers of pastured poultry indicates that prices of imported feed grains are climbing, creating additional opportunity for nutritious and locally grown alternatives. There is especially strong consumer interest in foods and feeds that can be certified free of genetically modified ingredients. Because no genetically modified varieties of oat exist, it has an easily certifiable status, which may contribute to its value for producers and end-users.

Regardless of the application chosen for oat in western Washington, there are likely to be higher costs associated with regional sourcing than with sourcing from the commodity market—at least as long as transport remains cheap. Therefore, the decision to source locally would necessarily be a values-based decision that ascribes importance to non-cost factors discussed above including supply chain flexibility, traceability and freshness in addition to food democracy. The contribution of a value-added grain product to the overall sustainability of the agricultural system may also be a consideration. The privileging of such factors over cost represents a movement towards what Kloppenburg et al. (1996) have described as a foodshed system, where an increased level of local and intra-regional food production, processing, and distribution helps to retain economic value and jobs in the community. It would also require organization, technical skills, motivation and financial investment, with implications for the type of region in which regional agriculture and food systems could succeed, discussed below.

7. Conclusion and reflection on wider implications for regional agriculture

Production of oats in western Washington made sense at a time when undeveloped transport infrastructure was a barrier to the fluid movement of commodities, national scale supply chains had not yet been established and technological development had not yet made fossil fuels and agrichemicals a necessity in every region. It was also a time at which the dominance of corn and soy had not yet become established, broadening the range of applications for which oat grain was considered desirable. The history of oats in western Washington and its wider agricultural context help to demonstrate that agriculture did follow a trajectory away from regionality with respect to local production-consumption cycles, and that this trajectory was probably both strategic at the political level and also welcomed by many participants in the system. Such evidence challenges the assumption sometimes implicit in literature comparing historic with modern farming systems that actors in historic systems perceived the same advantages in regionality that are perceived by its proponents today. For previous eras, success seems instead to have been associated with the departure from regionality.

The former manifestation of regionality, associated with constraints such as less developed markets, transport infrastructure and technology, is being replaced by a new regionality, intermediated by the market, taking advantage of consumer demand and social support for local and regional produce and leveraging the additional benefits available outside the commodity system. Efforts being undertaken in the present day to deliberately nurture regional agro-food networks as an alternative to the industrial/corporate model arguably represent a new phase with new potential. This finding echoes Kneafsey's (2010) suggestion that "it is difficult to talk of a 'return' to regionalization because the concept of a 'region' is not always highly meaningful […] in terms of discussing the historic organization of food production." The modern era may represent the first opportunity in history to deliberately build regionality into the agricultural system and to nurture it, based on the recognition of economic, environmental and social advantages it offers. In this sense, it appears to be more accurately thought of as *de novo* rather than *re*-regionalization (Kneafsey, 2010).

It is also notable that the cultivation of regionality is to some extent reliant on western Washington's well-organized and well-funded alternative food movement. Modern western Washington has several metropolitan areas with high enough average incomes to support a market for more expensive local, value-added foods; a high average level of education, supporting the emergence of organizations to identify and overcome obstacles to development of alternative food systems; and a culture characterized as progressive with a strong interest in food provenance and environmentally friendly farming, such that people have an interest in both advocating for and purchasing from alternative food networks. As Jarosz (2007) showed in her study of regional food systems serving the Seattle area, "Urbanization contributes both economically and politically to the development and emergence of AFNs [alternative food networks]". Thus, western Washington is highly conducive to the development of regional agriculture in its present-day manifestation.

Other regions without the same combination of characteristics might face greater challenges. In particular, 'food deserts' in the rural US are often also associated with lower population density, average income and education (Blanchard and Matthews, 2007). Rural food deserts are often situated in agricultural areas. While local or regional agriculture networks might seem an obvious solution to meet the food needs of such communities, the resources

required to build alternative food networks may not exist within them. Also, the producer targeting a small population may face greater challenges selling a large enough quantity to sustain his or her business, necessitating a more complex mix of near- and long-distance marketing. Thus, the potential of regional agriculture as a tool for democratization and community revitalization in the present day is constrained in certain circumstances.

Recent changes to agricultural subsidy structures in the US have the potential to positively impact regional agriculture. Evidence from the present study suggests that federal investment of crop subsidies and research funds in a limited range of major commodities, particularly corn and soy, was an influential factor in the disappearance of oat from western Washington and the decline of regionality. Subsidy structures have likewise been implicated in declining crop diversity throughout the US (Aguilar et al., 2015). Increased emphasis on crop insurance over direct payments in recent versions of the Farm Bill (the legislation at the core of US food and agriculture policy) has somewhat lessened the strength of incentive for farmers to confine themselves to major commodities; more significantly, however, the introduction of Whole Farm Revenue Protection in the 2014 Farm Bill is likely to allow farmers greater freedom in their cropping decisions, thereby potentially enhancing regional diversity of cropping systems nationwide (NSAC, 2015).

The economics and landscapes of agriculture in regions such as western Washington continue to evolve. Agriculture of the twentieth century has been largely defined by its ability to transcend regional boundaries and develop global marketing networks. Reinforcement of regionality in the future will depend on efforts in communities and in the marketplace to differentiate regional versions of products, like oats, otherwise available from the mainstream system. Evidence suggests that regions with enough consumer interest and the skills for innovation can succeed with such efforts.

Funding

This work was supported by a fellowship from the Seed Matters Initiative. The funders had no role in the research or writing processes.

Acknowledgements

The authors gratefully acknowledge Jessica Goldberger, Brook Brouwer, Lucas Patzek, Cark Maunsell, Richard Scheuerman, anonymous reviewers and the journal editor for helpful comments which improved the quality of this article.

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