

# The loss of wetland agricultural value in north-eastern North America, 1800 to 1840

by Chelsea Teale

## *Abstract*

Many of the surviving wetlands in north-eastern North America should be considered to be relict agro-ecosystems as a result of their widespread use for hay production and pasture during the colonial era. Open land in the heavily forested North East was frequently confined to areas with high water tables and colonists relied on graminoid-dominated wetlands to provide livestock fodder. To ensure a more consistent and palatable crop of this native hay, as well as allow mowers, wagons, and animals safe passage on wetlands, farmers manipulated water tables and tidal influences. This manipulation intensified in the early nineteenth century, to the extent that many wetlands ceased to be wet, which allowed the introduction of new crops such as upland forage species. The motivation for these changes were fears of a hay shortage as human and livestock populations increased in response to the emerging market economy that moved farmers away from mixed husbandry to livestock and forage specialization. From this perspective, the low value placed on wetlands in the United States is partially due to their inability to provide the quality and quantity of hay and pasture required by a new agricultural system.

In the early nineteenth century, much of the north-eastern United States and Canada began to make the transition from a subsistence-based agrarian society to a market economy emphasizing specialization and mechanization. One result of this change was a shift away from mixed husbandry to a focus on livestock and fodder crops, a shift enabled by an increasingly scientific perspective on crop production. European advances were shared with North American farmers and home-grown American and Canadian ‘improvers’ emerged who published their own works. Decreasing soil fertility and persisting pest infestations of grain crops partially influenced the switch, but the opening of the Erie Canal in 1825 – which gave eastern markets access to grain and flour from western New York and beyond – especially motivated north-eastern farmers to focus on the production of perishable goods such as meat and dairy products for growing urban populations.<sup>1</sup> To raise the marketable surplus required

<sup>1</sup> M. Bruegel, *Farm, shop, landing: The rise of a market society in the Hudson Valley, 1780–1860* (2002); C. Merchant, *Ecological revolutions: Nature, gender, and science in New England* (1989); C. Sellers, *The market revolution: Jacksonian America, 1815–1860* (1991); T. Steinberg, *Nature incorporated: Industrialization and the waters of New England* (1991); For information on fungal and insect infestations that reduced wheat production in nineteenth-century New England, see George S. J. Hill, *Essay on the hessian fly, wheat midge, and other insects injurious to the wheat crops* (1858); Cheese and butter were the most important products in eastern cities in the 1840s, see *Trans. State of New York Agricultural Soc., for the Year MDCCCXLI*, I, (1842).

a reliable source of fodder, and by 1860 New York was the nation's leader in hay production, followed closely by the New England states.<sup>2</sup>

Developing and maintaining sources of fodder was initially problematic, because for some time after European settlement grassy areas in the North East were limited to areas with high water tables, poor soils, or where indigenous people had cleared land. The South's milder climate allowed year-round grazing in forests but the North East lacked sufficient native flora suitable for over-winter provisioning apart from grasses, sedges, rushes, ferns, horsetails, composites, and other non-woody plants collected from wetlands. Wetlands supporting this herbaceous vegetation were called *meadows* in New England, *prairies* in New France, and *vlys* in New Netherland, and they were managed to a greater or lesser extent in order to maintain or improve yields of native hay.<sup>3</sup>

As human and livestock populations grew and north-eastern economies became dependent on forage (either in crop rotations or as the primary crop), wetlands in the region were put under increasing pressure to provide adequate hay and pasture. One solution was to 'improve' wetlands so that they would be more consistently productive, and in an early example from 1753, the pioneering American agriculturalist Jared Eliot recorded a vision of wetland improvement that encouraged his readers to clear, ditch, drain, burn, and otherwise manage wetlands for different purposes:

Take a view of a swamp in its original estate, full of bogs, overgrown with flags, brakes, poisonous weeds and vines, with other useful product, the genuine offspring of stagnant waters. Its miry bottom, and harbour to turtles, toads, efts, snakes, and other creeping verm'n. The baleful thickets of brambles, and the dreary shades of larger growth; the dwelling-place of the owl and the bittern; a portion of foxes, and a cage of every unclean and hateful bird. Now take another survey of the same place, after the labour of clearing, ditching, dreining, burning, and other needful culture has passed upon it. Behold it now clothed with sweet verdant grass, adorned with the lofty wide spreading well-set Indian-corn; the yellow barley; the silver coloured flax; the ramping hemp, beautified with fine ranges of cabbage; the delicious melon, and the best of turnips, all pleasing to the eye, and many, agreeable to the taste; a wonderful change this! And all brought about in such a short time; a resemblance of creation, as much as well, impotent beings, can attain to, the happy product of skill and industry.<sup>4</sup>

Eliot's enthusiasm reached a large number of educated, well-to-do New Englanders and New Yorkers, but although he strove to write in a manner to reach everyday farmers, his success in encouraging wetland improvement – and other agricultural advancements coming out

<sup>2</sup> J. H. French, *Gazetteer of the state of New York* (1860).

<sup>3</sup> V. D. Anderson, *Creatures of empire: how domestic animals transformed early America* (2004); J. S. Bleakney, *Sod, soil, and spades: The Acadians at Grand Pre and their dykeland legacy* (2004); B. Donahue, *The great meadow: Farmers and the land in colonial Concord* (2004); M. G. Hatvany,

*Marshlands: Four centuries of environmental change on the shores of the St. Lawrence* (2003); C. Teale, 'Wetlands of New Netherland', *Hudson River Valley Rev.* 33 (2016), pp. 62–77.

<sup>4</sup> H. J. Carman, R. G. Tugwell, and R. H. True (eds), *Essays upon field husbandry in New England and other papers, 1748–1762, by Jared Eliot* (1934), pp. 96–7.

of Europe – was limited.<sup>5</sup> Eliot's work enjoyed a resurgence in the greater North East after the Revolution when his treatises were republished and excerpts printed by the emerging agricultural press. It took nearly a century in many parts of the North East for Eliot's vision to be achieved during the transition to a market economy, but ultimately the change might be called an 'ecological revolution' because the value, use, and management of many natural resources were dramatically altered.<sup>6</sup> Brian Donahue noted this change in his 1989 paper tracing a half-century of conflict between local farmers, the emerging market economy, and nascent industrialization on Massachusetts' Sudbury River. The extreme example offered by the flooding of that river's meadows by a mill-dam, and consequent degradation and loss of forage, can be generalized to many resources across the North East whose value decreased as new production priorities forced farmers to accept new management techniques and alternative crops.<sup>7</sup>

Environmental historians have developed a narrative explaining how the low value placed on wetlands in the nineteenth century was based on their association with disease and a perspective which viewed them as wastelands, inspired in part by musings of improvers like Jared Eliot.<sup>8</sup> It is more revealing to frame wetlands in terms of their changing agricultural value. Although agricultural historians have acknowledged the importance of wetland forage production for some time, only a few authors have addressed it in depth and most notably with regard to salt marshes, particularly in the French territories of Canada; an example is Matthew Hatvany's 2003 study of the St Lawrence River.<sup>9</sup> A notable exception is Brian Donahue's 2004 examination of land use in English-settled Concord, Massachusetts, a study that explicitly considered the same freshwater marshes on the Sudbury River that he had first written about in 1989.<sup>10</sup> Another is this author's dissertation on the value, use, and management of New Netherland wetlands.<sup>11</sup> The present study uses the emerging agricultural

<sup>5</sup> C. Grosso, 'The experimental philosophy of farming: Jared Eliot and the cultivation of Connecticut', *William and Mary Q.* 50 (1993), pp. 502–28.

<sup>6</sup> Merchant, *Ecological revolutions*; Sellers, *Market revolution*; Steinberg, *Nature incorporated*.

<sup>7</sup> B. Donahue, "Dammed at both ends and cursed in the middle": the "flowage" of the Concord river meadows, 1798–1862', *Environmental Rev.* 13 (1989), pp. 46–67.

<sup>8</sup> H. Prince, *Wetlands of the American Midwest: A historical geography of changing attitudes*, (1997); C. B. Valencius, *The health of the country: How American settlers understood themselves and their land* (2002); A. Vileisis, *Discovering the unknown landscape: A history of America's wetlands* (1997).

<sup>9</sup> W. R. Baron and A. E. Bridges, 'Making hay in northern New England: Maine as a case study, 1800–1850', *Agricultural Hist.*, 57 (1983), pp. 165–80; K. W. Butzer, 'French wetland agriculture in Atlantic Canada and its European roots: Different avenues to historical diffusion', *Annals of the Association of American Geographers* 92 (2002), pp. 451–70; A. H. Clark,

*Acadia: The geography of early Nova Scotia to 1760* (1968); R. Cunningham and J. B. Prince, *Tamped clay and saltmarsh hay (Artifacts of New Brunswick)* (1976); M. G. Hatvany, "Wedded to the marshes": salt marshes and socio-economic differentiation in early Prince Edward Island', *Acadiensis* 30 (2001), pp. 40–55; Hatvany, *Marshlands*; D. Muir, *Reflections in Bullough's Pond: Economy and ecosystem in New England* (2002); D. Smith and A. Bridges, 'Salt marsh dykes as a factor in eastern Maine agriculture', *Maine Historical Soc. Q.* 21 (1982), pp. 219–26; D. C. Smith, V. Konrad, H. Koulour, E. Hawes and H. W. Borns, Jun., 'Salt marshes as a factor in the agriculture of northeastern North America', *Agricultural Hist.* 63 (1989), pp. 270–84.

<sup>10</sup> Donahue, *Great Meadow*.

<sup>11</sup> C. Teale, 'Informing environmental history with historical ecology: Agricultural wetlands in New Netherland, 1620–1820' (unpublished PhD Dissertation, Pennsylvania State University, 2013); ead., 'Agricultural wetland use and management in the

press to examine the processes that drove the devaluation of wetlands as an agricultural resource across the North East from colonial-era agricultural necessity to nineteenth-century liability.

# I

To understand early changes in the value of wetlands in North America agriculture, we will focus on the North East (where hay was most important among the colonies) and consult agricultural publications from 1800 to 1840 when they focused on that region and began sharing information from Europe and other parts of North America.<sup>12</sup> Agricultural journals largely used each other's articles and excerpts from books (often verbatim), aside from some publication-specific editorials and reader submissions, and many early issues also reprinted material from mid- to late eighteenth-century essays. The result was dissemination of nearly identical material across a wide area, making agricultural journals a good source of information on regional-scale change.

The first true agricultural journals in the United States were the *Agricultural Museum* of Washington, DC (1810–12), the *Massachusetts Agricultural Journal* (1813–32), and Baltimore's *The American Farmer* (1819–34). This last publication was intended to be national in scope but was perceived as a more southern publication; its northern counterpart was Albany's *Plough Boy* (1819–23). The *New England Farmer* (1822–46) was the first widely circulated agricultural journal in the North East. The *New-York Farmer and Horticultural Repository* (1828–39) was relatively expensive and didn't have the circulation of the *New England Farmer*, but was its sole regional competitor for several years. The most widely circulated agricultural journal in the country was Albany's *Cultivator* (1834–39) that eventually merged with the Rochester-based *Genesee Farmer*; it continued under the name of *Cultivator*, then as the *Country Gentleman*.

*The Cultivator* had nearly 7000 subscribers in New York State by 1837 when it first reported figures, followed by Virginia (964) and Connecticut (835).<sup>13</sup> Every state had subscribers that year and several hundred also lived in Upper Canada (Ontario), Lower Canada (Québec), New Brunswick, and Nova Scotia; it was mailed as far afield as Scotland. Despite being an Albany-based publication, the journal's main areas of subscription aligned with 'New England extended': New England proper, the Erie Canal corridor, and lower Great Lakes region.<sup>14</sup>

The agricultural press came to Lower Canada in the early 1820s when the Earl of Dalhousie encouraged farmers in Québec and Montréal to subscribe to the Albany-based *Plough Boy*. John Young, of Nova Scotia, was simultaneously publishing *The letters of Agricola on the*

Note 11 *continued*

Dutch-settled Northeast, 1620–1800', *New York Hist.* 98 (2017), pp. 177–204.

<sup>12</sup> A. L. Demaree, 'The farm journals, their editors, and their public, 1830–1860', *Agricultural Hist.* 15 (1941), pp. 182–8; D. B. Marti, 'Agricultural journalism and the diffusion of knowledge: the first half-century in America', *Agricultural Hist.* 54 (1980), pp. 28–37;

S. C. Stuntz, *List of the agricultural periodicals of the United States and Canada published during the Century July 1810–July 1910* (US Department of Agriculture, Miscellaneous Publication 398, 1941).

<sup>13</sup> *The Cultivator* 4, Mar. 1837, p. 5.

<sup>14</sup> J. Fisher, 'Improving the soil and mind: the geography of *The Cultivator*' (unpub. Master's thesis, Pennsylvania State University, 2008).

*principles of vegetation and tillage*, a collection of letters previously carried by the *Acadian Reporter* beginning in 1818. Other publications emerged in 1836 with the *Journal d'agriculture* (Montréal) and the *Farmer's Advocate* (Sherbrooke); most other eastern Canadian publications only started in mid-century.<sup>15</sup> *The Cultivator* greatly increased its circulation in Canada after 1838 and agricultural journals for the mid-western states appeared in the 1840s. Although regional publications like the *American Farmer* served the South by the 1820s, that region was also not well represented for another two decades.

## II

Haying and pasturing practices in the seventeenth- and eighteenth-century North East were similar to those in England a century before, in that they took place wherever possible: in wetlands, on the aftermath of crop fields, in forests, and anywhere that was not fenced in.<sup>16</sup> The French, English, and Dutch used and managed wetlands ('natural meadows') in similar ways from Nova Scotia to New Jersey, typically mowing some for hay in the late summer and using others as pasture. Some wetlands were grazed after being mowed. Depending on size, wetlands were either independently owned or divided into parcels; some larger wetlands (like salt marshes) were managed in common. Early surveys often allocated separate house, garden, woodland, and meadow lots. Tax rolls sometimes distinguish between 'meadowland' and 'upland'.<sup>17</sup> Despite the importance of wetlands in the production of natural hay, early American farmers were aware of the low quality of natural forage found in wetlands. As early as 1637, for example, a New Englander wrote that hay from low-lying areas was:

inferior in goodness to our reed and sedge in England, for it is so devoid of nutritive vertue, that our beasts grow lousy with feeding upon it, and are much out of heart and liking; besides, it breeds among them sundry diseases which we know not how to cure.<sup>18</sup>

A 1655 report from neighbouring New Netherland indicated that cattle also tended to be small in part because of malnourishment and often became ill by 'feeding on sweet pastures or sweet hay' ('sweet' often referred to freshwater plants, as opposed to those growing on salt marshes; as a remedy, afflicted animals were fed salty or brackish water and/or salt hay).<sup>19</sup> One possible cause of malnutrition and illness is that some native wetland plants, mainly

<sup>15</sup> 'Agriculture in Canada', *The Cultivator* 7, Dec. 1840, p. 183; S. Southwick, 'To the Patrons of *The Plough Boy*', *The Plough Boy* 3, 20 Apr. 1822, pp. 46–7.

<sup>16</sup> C. Lane, 'The development of pastures and meadows during the sixteenth and seventeenth centuries', *AgHR* 28 (1980), pp. 18–30.

<sup>17</sup> P. W. Bidwell and J. I. Falconer, *History of agriculture in the northern United States, 1620–1860*, I, *Agriculture in the earliest settlements* (1925); Hatvany, *Marshlands*; H. Russell, *A long, deep furrow: Three centuries of farming in New England* (1976); G. Whitney, *From coastal wilderness to fruited plain: A history of environmental change in temperate North America from*

*1500 to the present* (1994); Smith *et al.* 'Salt marshes'; Teale, 'Wetland use and management'.

<sup>18</sup> This comment is interesting because English reed and sedge were themselves not highly valued at the time; T. Hutchinson, *The history of the colony of Massachusetts's Bay, from the first settlement thereof in 1628, until its incorporation with the colony of Plimouth, province of Main, &c. by the charter of King William and Queen Mary in 1691* (sec. edn, 1765), p. 483.

<sup>19</sup> D. W. Goedhuys (trans.), C. T. Gehring and W. A. Starna (eds), *A description of New Netherland written by Adriaen van der Donck in 1655* (2008), p. 44.

broadleaf species, are toxic to livestock unless additional processing is done. In some cases (like knotweed, *Polygonum amphibium*) this means simple cutting and curing, but in other cases the process required to neutralize toxins would be either unknown to farmers or cost- and time-prohibitive (such as the steaming and drying needed to make bracken fern, *Pteridium aquilinum*, edible). Not all plants are equally harmful, however, because animals select and tolerate forage species differently.<sup>20</sup>

Another influence on the nutrient content of wetland forage may be the timing of the hay harvest, which at least in New Netherland appears to be concentrated in the late summer, possibly when the ground was dry enough to support mowers and wagons. Haying may also have been pushed late in the summer and fall in order to accommodate the harvest of food crops. As the season progresses, however, there is an increasingly inverse relationship between yield and nutritional value and digestibility because plants grow more fibrous, making it difficult for farmers to perfect the timing of the harvest. For example, some species like cattail (*Typha* spp.) should be cut very early in spring while others like slough sedge (*Carex atherodes*) are best after setting seed in the summer.<sup>21</sup> When considering the diversity of species present in any given wetland, such inconsistencies undoubtedly led to hay of variable quality. A separate issue is the unpalatability of many wetland plants such as those listed by the naturalist Henry David Thoreau on the Sudbury River marshes including cattail, sedges (Cyperaceae), and arrowhead (*Sagittaria* spp.). Cattle may have favoured ‘pipes’ (or horsetails, *Equisetum* spp.) and a meadow full of them was valuable, though too many can poison horses.<sup>22</sup> The diversity of plants found in many non-tidal wetlands is illustrated by the cattails, sedges, forbs, and small shrubs in the Vermont wetland shown in Figure 1, which was owned by the Revolutionary War hero Ethan Allen. Ironically, Allen died in 1789 while transporting a borrowed load of hay back to his homestead after he failed to harvest enough of his own despite having access to both ‘swales and rich upland meadow’.<sup>23</sup>

The issue of low-quality forage was not limited to wetlands, as the visiting Swedish botanist Peter Kalm noted on his journey through Pennsylvania, New Jersey, New York, and Québec in 1749. He wrote that livestock that grazed on upland grasses in western New Jersey were small in size and hungry, saying:

most grasses here are annuals, and do not for several years in succession shoot up from the same root as our Swedish grasses. They must sow themselves every year, because the last year’s plant dies away every autumn. The great numbers of cattle hinder this sowing, as the

<sup>20</sup> D. E. Hubbard *Using your wetland for forage* (US Fish and Wildlife Service, FS 853, 1988); C. Menard, P. Duncan, G. Fleurance, J.-Y. Georges, and M. Lila, ‘Comparative foraging and nutrition of horses and cattle in European wetlands’, *J. Applied Ecology* 39 (2002), pp. 120–33; J. Vetter, ‘Toxicological and medicinal aspects of the most frequent fern species, *Pteridium aquilinum* (L.) Kuhn’, H. Fernández, A. Kumar, and M. A. Revilla (eds), *Working with Ferns: Issues and complications* (2011), ch. 25.

<sup>21</sup> See, for example, Hubbard, *Using your wetland*

*for forage*.

<sup>22</sup> Donahue, “‘Dammed at both ends’”; D. Foster, *Thoreau’s country: Journey through a transformed landscape* (1999), p. 55; R. J. Hill and D. Foland, ‘Equisetum’, *Poisonous Plants of Pennsylvania* (1986), pp. 67–8; A. S. Hudson, *The history of Sudbury, Massachusetts 1638–1889* (1889), p. 635.

<sup>23</sup> David Blow, ‘Ethan Allen’s Burlington Home, 1787–1789’, [www.ethanallenhomestead.org/ethan-allens-burlington-home-1787-1789.html](http://www.ethanallenhomestead.org/ethan-allens-burlington-home-1787-1789.html), accessed 20 Mar. 2018.

grass is eaten before it can produce flowers and seed. We need not therefore wonder that the grass is so thin on fields, hills and pastures in these provinces.<sup>24</sup>

Kalm was mistaken, in one respect. Native grasses north of Pennsylvania are most likely to be perennials. His error may have stemmed from an unfamiliarity with warm-season grasses, which are not common in Europe but comprise three-quarters of the native grasses in areas he travelled through in North America.<sup>25</sup> He may have believed grasses died away each year because, in contrast to cool-season grasses, they are active only during the warm months (primarily June through mid-September). In contrast, cool-season grasses grow in spring and fall and the absence of grasses Kalm observed later in the year may have been interpreted as death.

Kalm was correct in another regard though. The timing of grazing may have degraded warm-season grasses in the North East because farmers let their animals outside once they ran out of fodder, in some cases while snow was still on the ground. One farmer in eastern New York, for example, had run out of fodder by 1 March 1660 and his horses were forced to 'look for food under the snow'.<sup>26</sup> Over 125 years later, another farmer in the same area observed colts that were left outside all winter where they subsisted:

chiefly on the roots of the grass which they paw up, though under two feet of snow. This cold and famine, stunt their growth so, that when the Spring comes, their ribs are as bare of fat, as the fields they fed off of are of verdure, there being no root of good grass left.<sup>27</sup>

Rules were eventually put in place to prevent farmers from letting their stock run at large too early in the year, but repeated early grazing could have led to a diminished capacity to set seed.<sup>28</sup>

Temporary solutions were to supplement livestock diet (typically with corn and other grains, cornstalks, straw, and/or leaves) and increase the amount of natural hay. Due to increases in population, however, accessing new meadows quickly became problematic. In some areas, and within a few decades of settlement, farmers were compelled to obtain wetlands far from their farms in order to feed their animals. The allotment of wetlands to farmers became increasingly strict, and conflicts between settlers were not uncommon in court records.<sup>29</sup> In 1686 the city charter for Albany, New York included rights to meadowland 35 miles to the west, in the

<sup>24</sup> A. B. Benson (ed.), *Peter Kalm's travels in North America: The English version of 1770* (1937), pp. 180–1.

<sup>25</sup> J. Dickerson, D. Burgdorf, T. Bush, C. Miller, B. Wark, R. Maher, and B. Poole, *Vegetating with native grasses in northeastern North America* (1997); USDA, NRCS, *The PLANTS Database*, plants.usda.gov, accessed 28 July 2016.

<sup>26</sup> A. J. F. van Laer (trans., ed.), *Correspondence of Jeremias van Rensselaer, 1651–1674* (1932), p. 229.

<sup>27</sup> A. Coventry, *Memoirs of an emigrant: The journal of Alexander Coventry, M.D. in Scotland, the United States, and Canada during the period 1788–1831* (1978), p. 123.

<sup>28</sup> It is unlikely that burning was a contributor to

pasture degradation because fuel and climate studies indicate that wildfire would have occurred in the North East in fall and spring even without anthropogenic ignition. Native Americans were also known to have set fires in late fall and in spring, and early European settlers did the same. However, it is possible that burning slowed the establishment of introduced cool season grasses because those taxa evolved in the absence of fire. R. L. Bushman, *From Puritan to Yankee: Character and the social order in Connecticut, 1690–1765* (1967).

<sup>29</sup> See, for example, Teale, 'Agricultural wetland use and management'.



FIGURE 1. Wetland on the Ethan Allen Homestead, Burlington, Vermont. Photo by author, 2012.

1750s Jared Eliot noted that farmers from New Haven, Connecticut had to travel ten miles to gather ‘sedge-grass’ from the marshes around the town, and in the 1820s many farmers in New Bedford, Massachusetts owned salt marsh several miles from their homes.<sup>30</sup>

Toward the late eighteenth century some writers began expressing concern about the insufficient quantity of hay. In 1749 Jared Eliot described this scarcity as

gradually increasing upon us for sundry years past. It is evident that the necessary stock of the country hath out-grown the meadows, so that there is not hay for such a stock as the present increased number of people really need: such a high price of hay, takes off much from the profit of raising and keeping stocks.<sup>31</sup>

The following year he wrote that people were still feeding corn to their animals instead of eating it themselves. Nearly two decades later the future President George Washington remarked that the availability of wetland forage and cornstalks was limiting the number of cattle raised in the new country, attributing this to the fact that ‘very few persons have attended to growing grasses, and connecting cattle with their crops’.<sup>32</sup> Closing the nutrient cycle between crop extraction, livestock consumption, and re-deposition through manure has been a focus of many agricultural histories, but as logical as the process seems, north-eastern manuring practices were inconsistent in the Colonial era and early Republic.<sup>33</sup> Eliot wrote in

<sup>30</sup> Carman *et al.*, *Essays*, p. 27; *New England Farmer* IV (5 May 1826), p. 325; J. Munsell (ed.), ‘State of the claim of the Corporation of Albany to the lands in Tryon County, called lower Mohawk Castle or Tion-onderoga, Oct. 5, 1779’, *Collections on the history of Albany*, I, (1865), p. 300.

<sup>31</sup> Carman *et al.*, *Essays*, p. 27.

<sup>32</sup> U. P. Hedrick, *A history of agriculture in the state of New York* (1933), p. 74.

<sup>33</sup> Donahue, *Great meadow*; S. Stoll, *Larding the lean earth: Soil and society in nineteenth-century America* (2002).

1748 that dung ‘cannot be had for Love nor Money’ but noted that other manures were available (such as clay, sand, and creek mud).<sup>34</sup> Dung from eastern New York farms was dumped into the Hudson River into the late eighteenth century, as witnessed by a visitor in the 1760s and another in the 1780s; one described the difference between Dutch and English farming in the Mid-Hudson Valley in this way:

[The Dutch raise] large crops of wheat, plowing sometimes 200 acres, using no manure, which, until of late they rode out to the river, in the winter, so that it might go off in the spring, with the ice. The quantity of land plowed, makes up for the present poverty of the soil, which, however, after frequent plowing, becomes incapable of producing more. This obliges them to move, and they not being compelled to raise their own bread must sell. Often the purchaser is a New England man, who being used to employ every known art to make his native, barren soil produce a good subsistence, generally gets rich, lives well, and even his hogs have more pleasure in the appetite than the former Dutch family on the same farm.<sup>35</sup>

Another contemporary also reported that manure was not used in New York in the 1780s, saying ‘Manure is rarely made use of; but what little is collected is given to the maize, which requires every support that can be bestowed on it’. The editor of *The Cultivator* wrote in 1834 that crop rotation and manuring had only recently become widely accepted, the tradition being to acquire a new field when the old one wore out.<sup>36</sup> In contrast, wetlands seemed inexhaustible due to deposition of new soils with daily tides or annual spring freshets. The amount of accumulated organic matter was believed to be sufficient for long-term use or as manure itself.<sup>37</sup> Although today it seems obvious that livestock fed on natural hay would essentially transfer nutrients from wetlands to uplands in their dung, the clearest statement in the agricultural press connecting the two came as late as 1831 when a Bostonian wrote to the *New England Farmer* that

When salt marsh or fresh meadow is attached to a farm, it enriches the farm; these want no manure and they help to manure the upland. If there are the same number of acres of marsh that there are of upland, more than double the quantity of stock can be kept, which will more than double the manure, all of which will be for the benefit of the upland.<sup>38</sup>

Improvers like Eliot did not typically specify an increase in manure as a positive side effect of wetland reclamation, but did advocate increasing their capacity to produce forage crops. In particular, Eliot suggested that ‘clearing and dreining swamps, cran-berry and bog Meadows’

<sup>34</sup> Carman *et al.*, *Essays*, p. 17; a comprehensive list can be found throughout Russell, *Long, deep furrow*.

<sup>35</sup> Coventry, *Memoirs of an emigrant*, p. 123; A. M. Grant, *Memoirs of an American lady with sketches of manners and scenery in America, as they existed previous to the Revolution* (1836), p. 105.

<sup>36</sup> J. Buel, ‘On improved farming’, *The Cultivator* 1, Apr. 1834, p. 20; J. Buel, *The Cultivator* 2, Oct. 1835, p. 116.

<sup>37</sup> J. Buel, ‘Miscellaneous Manures’, *The Cultivator* 1, Nov. 1834, p. 139; J. Buel, ‘Peat earth and peat ashes’, *The*

*Cultivator* 4, Dec. 1837, pp. 157–8; S. W. Johnson, *Peat and its uses: as fertilizer and fuel* (1866); H. Murphy (trans., ed.), *Journal of a voyage to New York and a tour in several of the American Colonies in 1679–1680, by Jaspar Dankers and Peter Sluyter of Wiewerd in Friesland* (1867), p. 315; *New England Farmer* 4, 5 May 1826; 5, 26 Jan. 1827; 9, 28 Jan. 1831; 4 Feb. 1831; 16 Mar. 1831; ‘The draining of marshes’, *The Plough Boy* 2, 2 Dec. 1820, pp. 210–13; ‘An address’, 3 (8 Mar. 1822), pp. 321–3.

<sup>38</sup> Donahue, *Great Meadow*; *New England Farmer* 9, 28 Jan. 1831, p. 220.

would provide a lasting solution to the scarcity of hay.<sup>39</sup> Widespread acknowledgement of a need to increase forage *and* manure production would not come until well into the nineteenth century. As late as 1835 a geologist from just north of Albany, New York wrote to *The Cultivator* to express his frustration with the slow pace of meadow improvement, saying:

Perhaps no kind of land has been more eagerly sought for, or more highly prized as an appendage to the farm, by the most of our farmers, than what is usually termed 'natural meadow,' and yet probably no part of the farm is so unprofitable. The object is to secure a crop of hay, which it seldom fails to produce; but, it should be remembered, that the quantity is always much less than what might be produced from the same quantity of land by cultivation; its quality is vastly inferior, and the land is totally lost to the production of any other crop. I have frequently counted ten and twelve different species of grass within the compass of few rods square, and no more than one or two of them that has ever been noticed as furnishing food suitable for the sustenance of stock, to say nothing of the great variety of ferns, rushes and mosses growing upon the same spot, which every farmer would be pleased to have annihilated. Every farmer should calculate upon the cultivation of his grass, as he does upon that of his grain; he will then be sure always to have a supply, that of a quality agreeable to his choice, while the system, if properly pursued, will have the effect to increase the quantity and quality of all his other crops to a degree, that those who are not acquainted with the acts, can hardly believe. The question has often been asked, What shall we do with the field? it is too wet to plough. The answer is, drain it. I have seldom seen a field of this description but what might be drained for a sum considerably less than what the first crop would amount to, and the effects of draining, if properly executed, is permanent.<sup>40</sup>

By the time that column was written, journals had been advocating new wetland management practices and crops for over a decade; again, however, adoption was slow.

### III

Nineteenth-century wetland management involved colonial-era techniques but also drew from contemporary European examples. The agricultural press reported on methods ranging from simple ditching to complex sequences of improvement: in 1823, for example, the editor of the *New England Farmer* recommended drainage of a shrubby wetland followed first by burning and then by winter flooding.<sup>41</sup> At their most basic, however, the options for wetland reclamation were burning, irrigation, ditching and draining, and diking. A simultaneous improvement was the cultivation of imported forage plants, usually from western Eurasia.

#### (a) *Burning*

Paring and burning were common in Scotland and Ireland by the 1830s and not uncommon on American uplands. The surface sod was shaved away, burned, and ashes spread on the ground as fertilizer. This method was also recommended for wetlands, including by the *Plough*

<sup>39</sup> Carman *et al.*, *Essays*, p. 41.

p. 142.

<sup>40</sup> Steele, 'Pine Plains', *The Cultivator* 2, Nov. 1835,

<sup>41</sup> *New England Farmer* 2, 9 Aug. 1823, p. 2.

*Boy* in 1819, which described the practice and noted its popularity in Ireland and Holland. Taking cues from Jared Eliot and a later improver Samuel Deane, the *New England Farmer* also recommended burning drained wetlands to encourage the growth of grass, particularly if the ground was mossy. Paring and burning of peat meadows supposedly resulted in good hay crops because ashes were a fertilizer, though the *Plough Boy* reported that the amount of ashes did not replace the organic matter lost. Nevertheless, at a later date that journal still recommended burning wetlands after drainage. *The Cultivator* also recommended burning 'bushes and bogs' to fertilize the soil and noted that grasses would appear 'spontaneously' after doing so. The *New England Farmer* reported that fire was used in at least one New England diked marsh to eliminate weeds before planting grass.<sup>42</sup>

#### (b) Irrigation

Both wetlands and uplands were irrigated, a process inspired by the idea that water was a natural manure. The *Agricultural Museum* ran an article in 1811 outlining methods of irrigating meadows to promote soil moisture, fertilization, and 'the growth of grass by its warmth'. Eight years later John Armstrong's *Treatise on agriculture* described methods of temporary and permanent irrigation (where water was pooled behind a dam to control release) and total submersion (where the reservoir was maintained until decomposition occurred). Journal contributors continued to differ on methods and offered advice either for allowing water to sit on one area at a time or simply allowing it to 'pass over, and not remain on' the land. All agreed that the water speed must be slow to prevent erosion.<sup>43</sup> Frederick Butler's *Farmer's manual* recommended irrigation with dammed streams as well as running the 'wash' from highways onto adjacent mowing grounds. Trenches could be dug throughout sloping fields to allow water to run over them and the method was cheap and profitable: 'No manuring will give such profits upon mowing grounds as irrigation, and the expense, generally, may be considered cheaper than plaster'. Animals were to be kept off these 'watered meadows'.<sup>44</sup>

Over the following decades irrigation was recommended by the wider agricultural press. To protect and produce grass the *New England Farmer* and *The Cultivator* recommended that water sit on fields during winter and then flow over them before they were dressed with ashes or lime. Water was still thought to contain 'manure' and irrigation was a cheaper and easier way to lay it on a meadow than carting and spreading solid material. The goal was to 'make use of water as a carrier, to convey certain substances to the soil, which may have a tendency to enrich it'. Naturally flooded swales benefited from this process and farmers were given instructions to try it with upland fields, particularly in spring by using runoff from muddy streams or roads. Clayey and calcareous soils required less watering, as did northerly areas,

<sup>42</sup> 'Ashes for Manure', *The Plough Boy* 3, 16 Mar. 1822, p. 331; *The Cultivator* 1, Sept. 1834, pp. 106–7; H. Davy, 'Original formation of soils', *The Plough Boy* 1, 26 Feb. 1820, p. 308; *New England Farmer* 2, 16 Aug. 1823; *New England Farmer* 5, 2 Feb. 1827, p. 28; *New England Farmer* 9, 4 Feb. 1831, p. 29; *The Plough Boy* 1, 30 Oct. 1819, pp. 172–3; *The Plough Boy* 4, 10 Sept 1822, p. 120.

<sup>43</sup> 'Irrigation, &c.', *The Agricultural Museum* 2, July 1811, pp. 1–6; *New England Farmer* 2, 16 Aug. 1823, p. 3; 29 Nov. 1823, p. 129; 3 Apr. 1824, p. 36.

<sup>44</sup> F. Butler, *The Farmer's manual; being a plain practical treatise on the art of husbandry, designed to promote an acquaintance with the modern improvements in agriculture, together with remarks on gardening, and a treatise on the management of bees* (1819), p. 51.

and muddy water was particularly valued as natural fertilizer. Channels leading from ponds and windmills drawing on ground water could also be used.<sup>45</sup>

The *Plough Boy* recommended irrigating meadows in May. Stephen van Rensselaer, an improver in New York's Hudson Valley, advocated flooding meadows for three or four weeks twice a year: once in October and again in the spring. In 1822 another eastern New Yorker wrote to the *Catskill Recorder* that irrigation was commonly used in Europe and elsewhere to stabilize moisture conditions and should be used in the Hudson Valley because precipitation had recently been unpredictable. He noted that flooded meadows along the Connecticut River produced three cuttings per year, flooding swamps eliminated 'bogs and bushes', and winter inundation protected grass from frost. The highest yield reported for an irrigated meadow reported by the *New England Farmer* was two to three tons of native hay on a winter-flooded meadow.<sup>46</sup>

Systems of comparable 'water meadows' had covered over 100,000 acres in England by the nineteenth century, but fell out of favour as a result of agricultural recession and cheaper alternatives.<sup>47</sup> In North America the popularity of irrigation simultaneously declined, but for other reasons. In 1836, for example, *The Cultivator* reported that it was no longer a frequent topic for publication because it was not recommended for the north-eastern climate, was too expensive, produced 'coarse and innutritious herbage' that included rushes and other hydrophytes, and caused disease in both humans and livestock. In contrast to Peter Kalm's admiration of Pennsylvania's irrigated meadows a century before, the journal now reported that 'watered meadows' near Philadelphia produced less hay per acre than new upland meadows managed in the alternating system. The journal concluded that removal of water was far more important than its addition.<sup>48</sup>

### (c) Drainage

In 1791 the vice-president of New York's Society for the Promotion of Agriculture, Arts, and Manufactures wrote that he had seen grass, turnips, and other vegetables growing in drained wetlands, but that same year the president explained that drainage was not pursued in America owing to the abundance of cheap land and lack of capital.<sup>49</sup> In 1822 when the editor of *The Cultivator* addressed the Albany County Agricultural Society he noted that a 'point of primary importance in good farming, but in which our county is defective, is the draining of wet and marshy grounds'. He believed such lands were useless and unhealthy and farmers should spend a few days after the annual harvest to ditching and removing brush. The editor of the

<sup>45</sup> *The Cultivator* 1, Mar. 1834, p. 1; *New England Farmer* 1, 9 Nov. 1822, p. 15; 2, 22 Nov 1823; *New England Farmer* 2, 3 Apr. 1824, p. 286; *New England Farmer* 3, 14 Jan. 1825, p. 25, 29 Apr. 1825, p. 40, 20 May 1825, p. 43; J. Pierce, 'On irrigation', *The Plough Boy* 4, 6 Aug. 1822, pp. 76-7.

<sup>46</sup> *New England Farmer* 9, 28 Jan. 1831, p. 219; Pierce, 'On irrigation'; *The Plough Boy*, 4, 20 May 1823, pp. 333-4.

<sup>47</sup> English Heritage, *Introduction to heritage assets: water meadows* (2013), p. 3.

<sup>48</sup> Benson (ed.), *Peter Kalm's Travels*; J. Buel, 'Irrigation', *The Cultivator* 2, Jan. 1836, p. 166; 'Irrigation', *The Cultivator* 3, Apr. 1836, pp. 17-18.

<sup>49</sup> E. L'Hommedieu, 'Communications made to the Society, relative to manures', *Trans. of the Society, instituted in the state of New-York, for the promotion of agriculture, arts, and manufactures*, pt I (1792), pp. 63-76; R. Livingston, 'Address to the Society, in consequence of their request, during the absence of Mr. Justice Hobart, who had been appointed to deliver the annual oration', *ibid.*, pp. 47-63.

*New England Farmer* likewise wrote in 1823 that drainage was ‘an operation of great importance in agriculture, though comparatively speaking, it has not so strong claims to attention in the United States, where labor is dear, and land is cheap’. Moreover, until the benefits of drainage were better known, farmers didn’t want to stop working their other lands to improve wet areas. A decade later *The Cultivator* published another speech that again declared drainage to be ‘a branch of labor which has had a very limited practice among us’. At the same time, that journal’s editor commented that drainage (along with paring and burning) had become common in both Scotland and Ireland.<sup>50</sup>

Despite the reluctance of farmers to undertake drainage projects, journals continued to make recommendations on the proper way to drain. The editor of the *New England Farmer* wrote that the soil should first be evaluated: if clayey it would make a good soil after topping with black soil or mud, but if gravelly or sandy the surface layer must be very deep. Mossy ‘swamps’ might be damaged by too much drainage so the water level should be maintained three feet or less from surface and periodically flooded. To drain a wetland, an outlet should first be created, enlarged, or cleared before the basin was ditched around its circumference to intercept runoff. If no surface outlet is available a deep, stone-filled hole could be made to accept ditch effluent.<sup>51</sup> Ditches, also called drains in New England, could be dug with ox-drawn scrapers or shovels although by 1834 a special spade was developed for digging by hand; a suggestion was also made in *The Cultivator* that money be raised to fund a premium to whoever invented the best ‘drain-plough’.<sup>52</sup>

Ditches were of two types: open or surface drains were better in fields with standing water, and closed or underdrains were suited to fields with lower water tables. Open ditches were also recommended by *The Cultivator* for use in ‘bogs or moss’. According to the *New England Farmer* and *The Cultivator* their surface width should generally be three times that of the base. *The Cultivator* recommended main drains between six and twenty feet wide at the surface tapered down to between two and eight feet fed by secondary drains not less than four feet wide. Another suggestion called for drains three feet wide at the top, eight to twenty inches at the bottom, and two feet deep. The ditch should be angled so water flowed fast enough to prevent stagnation but not enough to cause erosion. Ordinary farmers could design these systems successfully because the primary strategy was simply to discover the water source and intercept it (Figure 2). A variation on the open ditch was the creation of ‘water furrows’ or ‘furrow-drains,’ which were shallow troughs ploughed into fields to collect water. ‘Cross-drains’ or ‘water gaas’ were created by digging a main ditch fed by perpendicular drains.<sup>53</sup>

According to Samuel Deane and repeated in the *New England Farmer*, closed ditches were more often used in Europe at the time because they didn’t waste soil, there was no need for cleaning, and ploughs and vehicles could travel over them. Contributors to *The Cultivator*

<sup>50</sup> *The Cultivator* 1, Mar. 1834, p. 1; Sept. 1834, pp. 106–07; Jan. 1835, p. 11; ‘An Address’, *The Plough Boy* 3, 16 Mar. 1822, pp. 332–3; *New England Farmer* 2, 9 Aug. 1823, pp. 9–10.

<sup>51</sup> *New England Farmer* 2, 9 Aug. 1823, p. 9; 17 Jan 1824, p. 25.

<sup>52</sup> *New England Farmer* 2, 9 Aug 1823; *The Cultivator*

1, Mar. 1834, p. 1; May 1834, p. 3.

<sup>53</sup> ‘On under-ground draining’, *The Cultivator* 1, Jan 1835, p. 11; J. Buel, *The Cultivator* 2, Mar. 1835, pp. 1–3; D. Low, ‘Draining’, Mar 1835, pp. 8–10; Apr. 1835, pp. 26–8; G. Stephens, ‘Draining’, *The Cultivator* 4, Dec. 1837, pp. 167–70; Jan. 1838, pp. 186–8.

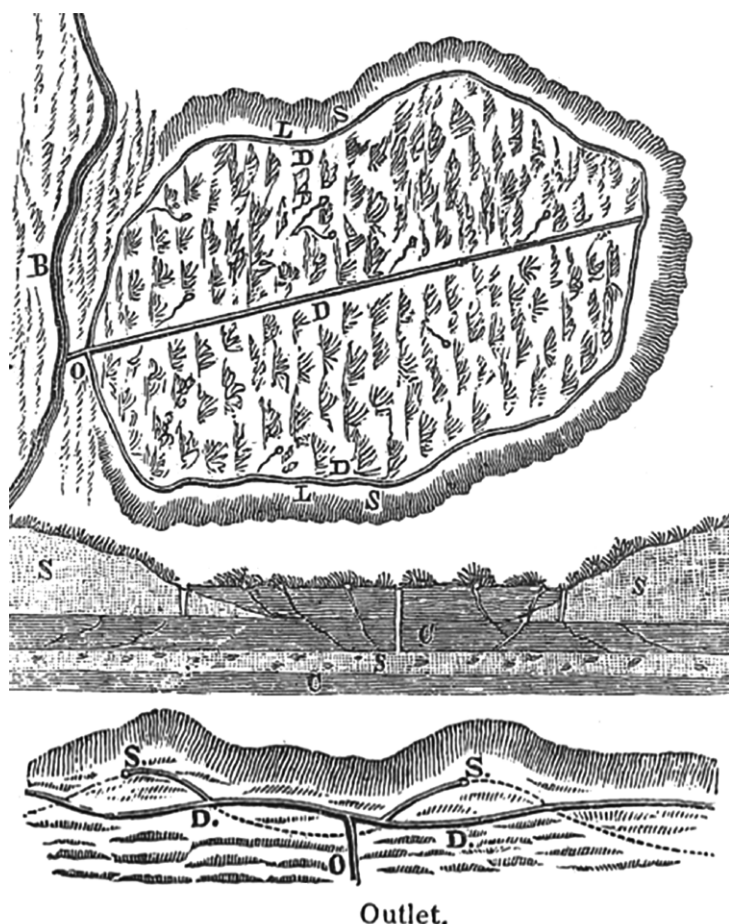


FIGURE 2. Three views of the drainage plans; B is a sand ridge; O is outlet; S is sand; D is drain; C is clay; L is unknown (illustrated in *The Cultivator* 4, Dec. 1837, p. 167).

added that they were cheaper in the long run, were not unsightly, and did not cave in. These were usually two and a half to three feet wide at top, half a foot at bottom, and three feet deep according to the *New England Farmer*; *The Cultivator* published recommendations of four to five feet deep. Some suggested dimensions from New York farmers included drains fourteen inches wide and two feet deep; three feet wide at top, less than one foot wide at the bottom, and three feet deep; and two feet wide and three and a half feet deep. Small stones or bundles of long sticks should line the bottom length-wise and the entire ditch covered with straw, leaves, twigs, and topped with soil (Figure 3 illustrates possible types of drains and fillings). They could also be topped with flat stones or turf. The soil removed while excavating ditches should be spread on the surface to make it level and act as a manure, and if the hardpan was reached during excavation it should be broken through and also spread on top.<sup>54</sup>

<sup>54</sup> J. Buel, *The Cultivator* 2, Mar. 1835, pp. 1-3; D. Low, 'Draining', *The Cultivator* 2, Apr. 1835; L. Chandler, 'Systematic Farming - under draining - ruta бага', 3, Jan 1837, pp. 153-4; J. Ryder, 'Under-Drains - Wheat - Clover', *The Cultivator* 1, Jun. 1835, p. 56; G. Willet, 'Letter to the editor', *The Cultivator*, Sept. 1834, p. 110; G. Stephens, 'Draining', *The Cultivator* 4, Jan. 1838, pp. 186-8; *New England Farmer* 2, 9 Aug. 1823; *The Cultivator* 1, Mar. 1834; May 1834; Sept. 1834, pp. 106-07, 110.

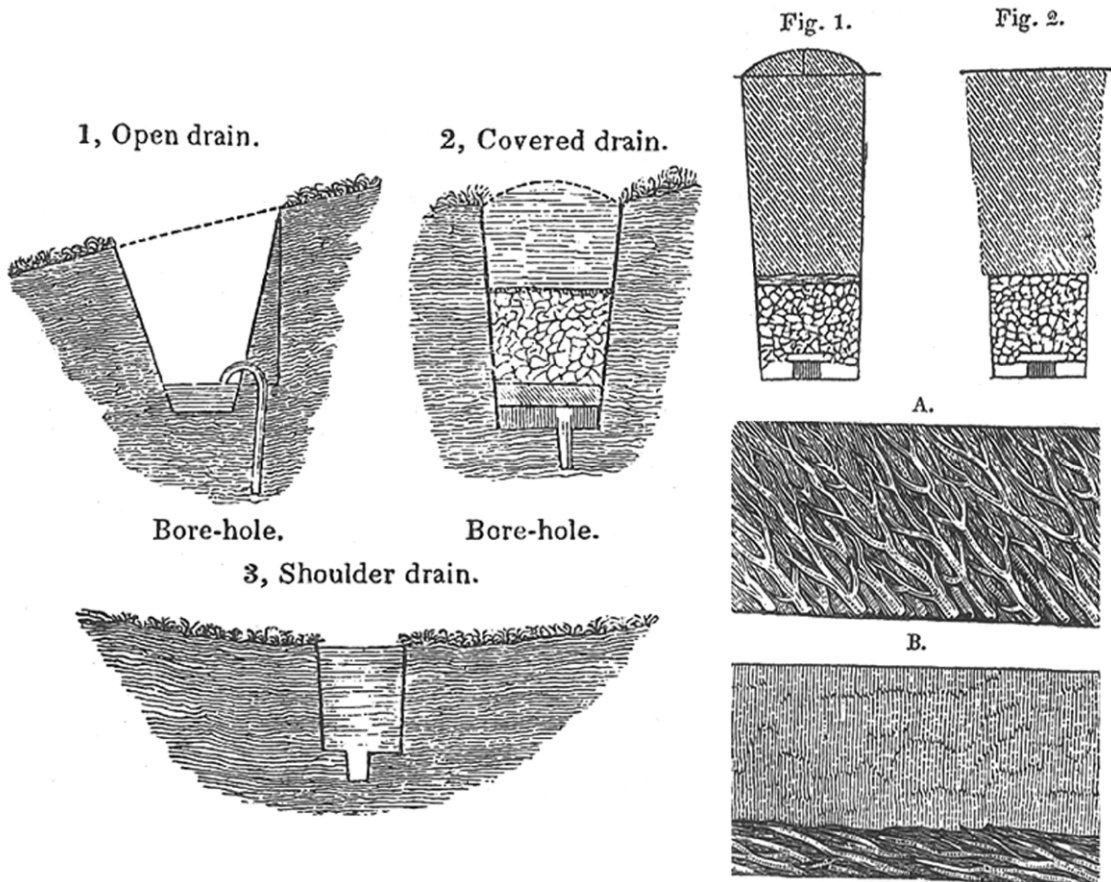


FIGURE 3. Three types of field drains: 1) open with borehole, 2) covered with borehole, and 3) shoulder (illustrated in *The Cultivator*, 4, Dec. 1837, p. 167).

Field drain backfilled with stone and soil: Fig. 1) before and Fig. 2) after soil compression. Orientation of sticks or straw in a drain where stone is unavailable: A) top-down view of the fill orientation and B) side-view with soil placed on top (illustration from *The Cultivator* 2, Apr. 1835, pp. 26, 28).

The *New England Farmer* advocated ploughing drained wetlands in spring before planting with fallow crops like potatoes and turnips. 'Bogging' was the act of turning over peat with a plough or hoe after drainage; a bogged wetland was then typically 'rolled' for compaction, covered with loam and compost, then sown with grass seed. Gravel or sand was added to some drained tidal and palustrine wetlands to make them firmer and discourage native vegetation, though results were mixed and the cost could be prohibitive. *The Cultivator* recommended adding manure, sand, or lime to wetlands to help the peat decompose. Also following Samuel Deane, the *New England Farmer* recommended letting wetland vegetation and peat rot after drainage, either by allowing the site to lie fallow during the summer after drainage or flooding throughout the winter and emptied in spring. *The Cultivator* recommended drainage in order to decompose peat so that crops could access the released material. One man from Plymouth

County, Massachusetts had success growing potatoes, corn, oats, and grass on a wetland he had modified by creating 30-foot-wide beds, separated by ditches, with the excavated soil used to dome the beds to prevent water accumulation.<sup>55</sup> Tidal wetlands were also made more productive by ditching to straighten creeks and drain ponds because it allowed upland grasses to become established.<sup>56</sup>

It wasn't until tiling was developed in England in the early nineteenth century, and popularized in western New York in the 1830s, that North American drainage efforts moved beyond simple ditching. The editor of *The Cultivator* was inspired by Scottish estates that had installed subsurface drains and in 1835 the journal ran an article by an Edinburgh specialist in underdraining who said the process required professional consultation because of soil variation. He said drains filled with stones or other debris ('rubble drains') inhibited drainage and the depth should be limited to an inch lining the bottom; ideally, flat stones or tiles should be used to line the ditch. In 1834 a resident of Ballston, New York wrote to *The Cultivator* saying that he had installed stone-lined underdrains. Tiles were introduced to North America that year by a Geneva, New York farmer and were first advertised in *The Cultivator* in 1837. Albany-manufactured tiles were one foot long, four inches square, and cost \$15 per thousand. Mechanized ditch digging was similarly pioneered by a farmer from Canandaigua, New York in 1854 but it would take until the 1860s for increasing demand for agricultural products, mechanized ditching machines, and mass-production of clay tiles to make this mode of sub-surface drainage financially feasible for most American farmers.<sup>57</sup>

Some journals touted the benefit of drainage to public health but the primary goal was to increase access to arable land; by 1840 it was called the 'mother of all other improvements in land' and there were at least four books published by north-easterners on the subject between 1860 and 1900.<sup>58</sup>

#### (d) Diking

Nineteenth-century north-eastern diking varied little from the colonial-era techniques adopted directly from England, France, and the Netherlands, with the exception of a few design modifications in New England. The agricultural press published rationales for and against this type of reclamation, but the general recommendation was to adopt the practice. In 1820 an article in the *Plough Boy* advocated draining and diking 'salt marshes, pacosons, and swamps' because it would eliminate their 'noxious exhalations' and open their 'inexhaustible' soils for

<sup>55</sup> H. Davy, 'Original Formation of Soils', *The Plough Boy* 1, 26 Feb. 1820, p. 308; *The Cultivator* 1, Sept. 1834, pp. 97–9; *The Cultivator* 1, Sept. 1834, pp. 106–7; *New England Farmer*, 2, 16 Aug. 1823; 17 Jan. 1824; 5, 2 Feb. 1827; 9, 4 Feb. 1831, pp. 225–7.

<sup>56</sup> *New England Farmer* 5, 26 Jan. 1827; 9, 28 Jan. 1831.

<sup>57</sup> J. Buel, 'Draining tile', *The Cultivator* 4, Dec. 1837, p. 159; *The Cultivator* 1, Mar. 1834, p. 5; 'On underground draining', *The Cultivator*, Jan. 1835, p. 171; H. W. Delavan, in *The Cultivator* 1, Mar. 1834, pp. 8–9; Prince, *Wetlands*; Whitney, *From wilderness to fruited plain*.

<sup>58</sup> J. Buel, 'Draining', *The Cultivator* 3, Sept. 1836, p. 92; W. I. Chamberlain, *Tile drainage, or, why, where, when, and how to drain land with tiles: a practical book for practical farmers* (1891); H. F. French, *Farm drainage: the principles, processes, and effects of draining land with stones, wood, plows, and open ditches, and especially with tiles* (1860); M. Miles, *Land draining: a handbook for farmers on the principles and practice of farm draining* (1892); G. Stephens, 'Draining', *The Cultivator* 4, Nov. 1837, p. 151; G. E. Waring, *Draining for profit and draining for health* (1867).

cultivation.<sup>59</sup> The author referenced British and Dutch marshes reclaimed in this way. Three years later the editor of the *New England Farmer* wrote that:

The practicality and economy of embanking and draining lands which are usually over flowed by tide water has been evinced by many successful experiments. Holland consists mostly of land reclaimed from the sea; and in England, many hundreds of thousands of acres have been acquired by means of embanking. There is no doubt but valuable tracts might in the same manner be reclaimed along the sea coast of Massachusetts and other maritime parts of the United States. In the Southern states draining and embanking have been successfully undertaken; and the Messrs. Swartwout's and their associates of New York, have distinguished themselves by a similar enterprise in the vicinity of that city.<sup>60</sup>

The Swartwout brothers purchased tidal wetlands between the Passaic and Hackensack rivers in New Jersey in 1813 and began diking soon thereafter. In 1819 they asked New York City for financing to finish the project and the following year the editor of the *Plough Boy* reported that the New Jersey Salt Marsh Company had been incorporated by the state legislature to reclaim and cultivate the marshes in Bergen County. The Swartwouts were members and by the end of the decade they had diked 2000 acres with a five-foot-tall embankment 5½ miles long and sixteen feet wide at the base. By 1883, however, these marshes were once again producing salt hay and the failure was apparent almost immediately after reclamation. In 1827 the *New England Farmer* reported that the land only produced good crops of grain and 'English hay' for one or two years after reclamation before:

the soil becomes loose and light, so that it scarcely produces weeds to conceal its barren surface. Public opinion is here certainly strong against the feasibility of rendering such marshes either fit for cultivation or valuable for grass.<sup>61</sup>

Shrinkage of the peat was the likely cause of the Swartwout failure because dried and mineralized peats and mucks have a lower volume than their original waterlogged and un-decomposed state, making crop maintenance difficult on the compact, organic-depleted soil. Some tidal marsh surfaces subsided to below sea level once diked, leading to problems with flooding; this continues to be a problem for marsh restoration, which can require the addition of fill to bring diked marsh surfaces back to sea level.

Articles were published in the *New England Farmer* during the 1820s and 1830s highlighting other drawbacks inherent in maintaining agricultural salt marshes, including the distance between marshes and their owners, the cost and time involved in harvesting and boating, the vagaries of sea and sun, the low price of salt hay, and the reduced milk production of cows fed on it. Still, submissions in favour of diking listed the increased reliability and value of produce even if the meadows were left in grass; in particular, using improved marshes to fatten beef cattle could make New England more self-sufficient.<sup>62</sup>

<sup>59</sup> 'The draining of marshes', *The Plough Boy* 2, 2 Dec. 1820, pp. 210–13.

<sup>60</sup> *New England Farmer* 1, 1 Mar. 1823, p. 243.

<sup>61</sup> 'City and Suburban News', *New York Times*, 6

Aug. 1883; J. Welles, 'Reclaimed Marshes No. II', *New England Farmer* 5, 2 Feb. 1827, pp. 217–18.

<sup>62</sup> *New England Farmer* 4, 5 May 1826, p. 325; 2 May 1827; 9, 9 Feb. 1831.

Dike dimensions depended on marsh orientation and sediment type but the *New England Farmer* recommended berms at least two feet higher than the high-tide level constructed of turf, with a 'backcut' ditch running along the landward side and faced with stone or planks on the seaward side. The dike should otherwise be pinned and sown with grass or surfaced with brush, gravel, small stones, broken brick, etc. Sluices should be like the *aboideaux* of French settlers in the Canadian Maritime Provinces (Acadia) – designed to exclude seawater but allow the exit of freshwater – but the design often differed. 'Tide trunks', for example, were a new invention in 1820 and recommended for use in tidal marshes from the Chesapeake to New England over the following decades; these gates were made of long, wooden boxes with a floating plug.<sup>63</sup>

Because the success of a diked meadow is based on the integrity of adjacent dikes, in some instances joint stock companies were incorporated by the State of Massachusetts to organize dike construction and maintenance, employing the pooled funds of neighbouring landowners. Stakeholders owned as much stock as their lots had value and the assumption was that all lots would ultimately be uniform following completion of the project. Such cooperation theoretically cut costs because mowing and grazing could be done by fewer people but with the same, or greater, output. For example, at Dartmouth and Westport, Massachusetts, marshes were divided into stake-marked lots of one to twenty acres in 1826; all owners agreed on a harvest time so that everyone was cutting the grass simultaneously. Diked marshes in the Delaware River and tributaries were also managed cooperatively. Generally, however, the small size of so many private holdings in north-eastern tidal marshes made cooperative maintenance difficult or even impossible.<sup>64</sup>

Only one diking-related article was published in *The Cultivator* between 1834 and 1840: a letter to the editor by a resident of Nova Scotia who inquired about the best ways to ditch, manure, and cultivate a 400-acre marsh. The new editor responded by saying he 'had no experience in the reclamation of salt marshes' and solicited input from readers. The editor's inability to provide advice is not surprising, considering that aside from the Swartwout's failed attempt, diking had never been an improvement of consequence in New Netherland or New York. It does not appear to have been common anywhere in the North East outside of Acadia or the banks of the Delaware River, and an 1885 coastal survey remarked that tidal marsh reclamation was too maintenance-intensive and costly in a country that was still opening new, cheap lands for settlement.<sup>65</sup>

<sup>63</sup> *New England Farmer* 1, 1 Mar. 1823; 2, 6 Mar 1824; 10 July 1824; 'Draining of Marshes', *The Plough Boy*, 2, 2 Dec. 1820, pp. 210–13.

<sup>64</sup> D. M. Nesbit, *Tide Marshes of the United States* (Department of Agriculture, Miscellaneous Special Report 7, 1885); *New England Farmer* 4, 23 June 1826;

K. R. Sebold, *Marsh to farm: the landscape transformation of coastal New Jersey* (1992).

<sup>65</sup> S. G. Fairbanks, 'Letter from Nova Scotia', *The Cultivator* 7, Nov. 1840, p. 178; Nesbit, *Tide marshes*; Teale, 'Agricultural wetland use and management'.

## IV

The practice of intentionally sowing grasses and legumes for hay and pasture was not firmly and widely established across Europe at the time of North American colonization, though it was present. Instructions to sow 'hay dust or seeds' circulated in England by 1610 and seeds of several new legume species were available in London by the 1680s, including many generally called 'clover' (such as crimson, red, and white clover as well as hop trefoil [*Trifolium incarnatum*, *T. pratense*, *T. repens*, and *T. campestre*]). Other legumes included lucerne (or alfalfa, *Medicago sativa*), hopclover (or black medic, *M. lupulina*), sweet clovers (*Melilotus* spp.), sainfoin (*Onobrychis viciifolia*), and bird's foot trefoil (*Lotus corniculatus*).<sup>66</sup> Clovers were known in Germany from an early date whilst Dutch farmers may have been the first to follow regular crop rotations that included the legume; France's agricultural revolution was relatively late and clover was not widely planted until after 1700 even in northern areas.<sup>67</sup> Grasses like ryegrass (*Lolium perenne*), timothy (*Phleum pratense*), and cocksfoot (or orchard grass, *Dactylis glomerata*) were also cultivated in England by the mid-eighteenth century.<sup>68</sup>

The widespread adoption of forage plants in North America lagged behind Europe by perhaps a century, but as farmers sought more abundant and reliable sources of hay and pasture, the same species of grass and legumes were introduced and established.<sup>69</sup> With the improvement of wetlands 'meadow' gradually came to refer to both wetland and upland hayland. Meadows were divided according to vegetation, being 'either natural or artificial: the former, containing only plants of spontaneous growth; the latter, those selected, sown and cultivated by man'.<sup>70</sup> Likewise, introduced forage species were commonly termed 'artificial grasses'.

In 1749 Peter Kalm had remarked that 'foresighted farmers have procured seeds of perennial grasses from England and other European states, and sowed them in their meadows, where they seem to thrive exceedingly well'. However, in 1820 the *Plough Boy* reported that 'grass and root crops ... are just beginning to become the subject of conversation' and with regard to grass culture 'It is in this branch of husbandry more than in any other, that our present practice is unskillful and defective'.<sup>71</sup> The slowness of the process was in part due to seed supply, which began as individual efforts like those of Jared Eliot to acquire and test new plants. Editorial offices of journals gradually became distribution centres for exotic seeds collected and sent from around the world.<sup>72</sup> Seeds, and sometimes cuttings, were given to American farmers willing and able to experiment with their cultivation and report back to

<sup>66</sup> Lane, 'Development of pastures and meadows'.

<sup>67</sup> P. M. Jones, 'Agricultural modernization and the French Revolution', *J. Historical Geography* 16 (1990), pp. 38–50; Lane, 'Development of pastures and meadows'; A. C. Zeven, 'Four hundred years of cultivation of Dutch white clover landraces', *Euphytica* 54 (1991), pp. 93–9.

<sup>68</sup> A. R. Beddows, 'A history of the introduction of timothy and cocksfoot into alternative husbandry in Britain, I, The year 1763 and its significance', *Grass and*

*Forage Science* 23 (1968), pp. 317–21; II, 'The impact of timothy on ley farming', *ibid.*, 24 (1969), pp. 40–3.

<sup>69</sup> H. Kerr, 'Introduction of forage plants into antebellum United States', *Agricultural Hist.* 38 (1964), pp. 87–95.

<sup>70</sup> Armstrong, *Treatise on agriculture*, p. 284.

<sup>71</sup> Benson (ed.), *Peter Kalm's Travels*, pp. 180–1; 'Superior Live Stock', *The Plough Boy* I, 13 May 1820, p. 399.

<sup>72</sup> Demaree, 'Farm journals', pp. 56–7.

the office with methods and results. A letter to the editor of the *American Farmer* (reprinted in the *Plough Boy*) expressed approval of the journal's format and mission to provide native seeds to 'our distant neighbors' and:

collect, preserve and diffuse useful information: to bring into general notice and use the best agricultural implements and machinery; and to introduce valuable seeds and plants not hitherto cultivated among us, and the best kinds of those that have been.<sup>73</sup>

Forage species were not only transferred from Europe but from elsewhere in North America. In 1835, for example, *The Cultivator* reported that grasses from the American Midwest would probably prove useful and seeds had been obtained from Illinois.<sup>74</sup>

European species were increasingly introduced and established in Pennsylvania and the North East after 1750 but 'English grasses' were rare south of Virginia at that time.<sup>75</sup> The introduction record is less clear in former French territories though some species were present by 1820.<sup>76</sup> The *Plough Boy* reported that only four species were cultivated from seed in the United States in 1822: red clover, white clover, timothy, and redtop (or one of many other names, *Agrostis* spp.). In 1835 *The Cultivator* reported that the 'most respectable seed shops' had added just three additional species: lucerne/alfalfa, cocksfoot/orchard grass, and tall oat grass (*Arrhenatherum elatius*). Two years later the editor of *The Cultivator* told a farmer that he didn't know where many seeds could be obtained, but that lucerne at least could be bought in Albany and others could be purchased in New York City.<sup>77</sup> By the end of the nineteenth century, however, approximately 70 exotic legumes and grasses were mentioned in the agricultural press as possible forage species for North America, of which perhaps 15 grasses and six legumes were the earliest to be established successfully in the North East (Table 1). The vast majority of grasses were perennial, upland, cool-season grasses; legumes were a mix of upland annuals and perennials.<sup>78</sup>

Clover was perhaps the most important crop, being known throughout the North East in the seventeenth century. It was present in Massachusetts as early as 1650 when William Pynchon sold 'Flanders grass seed', but it may have been known even earlier in New Netherland owing to the Dutch settlers there. In 1634, for example, the colony's director requested clover seed directly from the Netherlands.<sup>79</sup> Clover was ultimately paired with another early introduction – timothy – and the combination was the most common for hay and pasture by the 1820s. By

<sup>73</sup> 'From the American Farmer', *The Plough Boy* 38, 19 Feb. 1820, p. 301.

<sup>74</sup> 'Remarks of the Conductor', *The Cultivator* 2, Aug. 1835, p. 88.

<sup>75</sup> Carman *et al.*, *Essays*.

<sup>76</sup> Carman *et al.*, *Essays*; Young, *The letters of Agricola*.

<sup>77</sup> 'Remarks of the Conductor', *The Cultivator* 2, Aug. 1835, p. 88; J. Finch, 'Meadow and pasture grasses', *The Cultivator* 4, May 1837, p. 51; 'Grasses', *The Plough Boy* 3, 25 May 1822, p. 410.

<sup>78</sup> For a complete list with descriptions, see Appendix C in Teale, 'Informing environmental history'; United

States Department of Agriculture Natural Resources Conservation Service, *The PLANTS Database*, available online at [plants.usda.gov](http://plants.usda.gov); R. W. Lichvar, D. L. Banks, W. N. Kirchner, and N. C. Melvin, 'The national wetland plant list: 2016 wetland ratings', *Phytoneuron* 30 (2016), pp. 1–17.

<sup>79</sup> Though, ironically, the person he requested seed from procured his own supply from Italy because seed was hard to come by that year; Carman *et al.*, *Essays*; A. J. F. van Laer (trans., ed.), *Van Rensselaer Bowier manuscripts* (1908), pp. 283–4; Zeven, 'Four hundred years'.

TABLE 1. List of legumes and grasses introduced and established prior to 1840 in the north-eastern United States and Canada.

| Legumes                                |                                                                                                                                                                                                                                                                                                     |                          |
|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| <i>Medicago lupulina</i> L.            | Wolf clover, black medick, black medic, hop clover, hop medic, nonesuch, yellow trefoil                                                                                                                                                                                                             | Eurasia; northern Africa |
| <i>Medicago sativa</i> L.              | Chili clover, alfalfa, lucerne, lucern                                                                                                                                                                                                                                                              | Eurasia; Middle East     |
| <i>Onobrychis</i> spp. Mill.           | Lupinella, St Foin, sainfoin, sanfoin                                                                                                                                                                                                                                                               | Eurasia; Middle East     |
| <i>Trifolium aureum</i> Pollich        | Hop clover, palmate hop clover, golden clover                                                                                                                                                                                                                                                       | Eurasia                  |
| <i>Trifolium pratense</i> L.           | Red clover                                                                                                                                                                                                                                                                                          | Eurasia; northern Africa |
| <i>Trifolium repens</i> L.             | White clover, Dutch clover, ladino clover, white Dutch clover, creeping clover                                                                                                                                                                                                                      | Europe                   |
| Grasses                                |                                                                                                                                                                                                                                                                                                     |                          |
| <i>Agrostis capillaris</i> L.          | Herd's grass, redtop, colonial bentgrass, white-top, foul/fowl meadow grass, duck grass, swamp wire grass, Rhode Island bent, fine bent, browntop, Waipu bent, English bent, furzetop, Prince Edward Island bent, dew grass, Astoria bent, spire grass?, burden grass?, Burden's grass?, blue bent? | Europe                   |
| <i>Agrostis gigantea</i> Roth          | Herd's grass, redtop, fiorin grass, foul/fowl meadow grass, black bent, water bentgrass, creeping bent, carpet bent, seaside bent, whitetop, English bent, southern bent, marsh bent, couch grass, Rhode Island grass, marsh bent grass, redtop                                                     | Eurasia                  |
| <i>Alopecurus pratensis</i> L.         | Meadow foxtail, foxtail                                                                                                                                                                                                                                                                             | Europe; Britain          |
| <i>Anthoxanthum odoratum</i> L.        | Sweet vernal grass, sweet-scented vernal grass                                                                                                                                                                                                                                                      | Eurasia                  |
| <i>Dactylis glomerata</i> L.           | Orchard grass, cocksfoot, swamp cock's foot, rough cock's foot?                                                                                                                                                                                                                                     | Europe<br>Britain        |
| <i>Festuca ovina</i> L.                | Sheep fescue                                                                                                                                                                                                                                                                                        | Europe; Britain          |
| <i>Glyceria fluitans</i> (L.) R. Br.   | Floating fescue grass, water mannagrass                                                                                                                                                                                                                                                             | Eurasia                  |
| <i>Glyceria maxima</i> (Hartm.) Holmb. | Reed meadow grass, water meadow grass, reed mannagrass, reed sweet grass                                                                                                                                                                                                                            | Eurasia                  |
| <i>Holcus lanatus</i> L.               | Velvet grass, meadow soft grass, woolly soft grass, Yorkshire white, Salem grass, white timothy, velvet lawn grass, velvet mesquite grass, Yorkshire fog, feather grass, white cap                                                                                                                  | Europe                   |
| <i>Lolium perenne</i> L.               | Ray grass, rye grass, perennial ryegrass, Italian rye grass, darnel, Italian lolch, Pacy's grass?                                                                                                                                                                                                   | Europe; Britain          |
| <i>Phleum pratense</i> L.              | Timothy, herd/Herd's grass, meadow cat's tail, catstail                                                                                                                                                                                                                                             | Europe; Britain          |
| <i>Poa annua</i> L.                    | Speargrass                                                                                                                                                                                                                                                                                          | Europe                   |
| <i>Poa compressa</i> L.                | Wire grass, blue grass, Canada bluegrass, flat-stalked meadow grass, Dutch grass?, couch grass?                                                                                                                                                                                                     | Europe                   |
| <i>Poa palustris</i> L.                | Fowl meadow-grass, fowl bluegrass, fowl meadow grass, false red top, duck grass, swamp wire grass                                                                                                                                                                                                   | Eurasia                  |
| <i>Poa pratensis</i> L.                | Fescue grass, green grass, spear grass, Kentucky bluegrass, smooth stalked meadow grass, great meadow grass, June grass, English grass, redtop                                                                                                                                                      | Eurasia; Britain         |

Note: Current scientific names are taken from the United States Department of Agriculture; common names from the agricultural press.

then timothy was the 'chief constituent ... of "English grass"' in the United States and the most common hay species in the North East.<sup>80</sup>

The results of grass and legume cultivation were promising, though journals did not report many direct, specific comparisons with natural wetland hay. To attempt this would be difficult in any case, however, because of the diversity of species as well as the different types of wetlands themselves. The hay output of two Massachusetts tidal marshes did triple after reclamation (following diking: one ton of salt hay per acre to three of upland hay; following drainage: thirty-three tons per fifty acres to one hundred tons for the same area).<sup>81</sup> Values for palustrine meadows were less dramatic but those with native hay tended to produce two to three tons per acre and those with upland hay produced around four.<sup>82</sup> Irrigated meadows produced less than cultivated uplands but probably more than unmanaged wetlands.<sup>83</sup>

## V

North-eastern farmers did not immediately and consistently devalue wetlands after the turn of the nineteenth century despite the availability of reclamation advice, introduction of artificial grasses, and the characterization of wetland forage as 'bad hay'.<sup>84</sup> In spite of the promotion of artificial grasses by the emerging agricultural press, contributors still referred to 'meadow hay' and 'natural meadows' in 1835. The diversity of plants in these meadows, so reviled by *The Cultivator* that year, was still valued by some farmers twenty years later. Thoreau himself opined in 1858 that, owing to the diversity of wetland plants, 'If meadow-hay is of less worth in the market, it is more interesting to the poet'. Even as new fodder crops were adopted, including root vegetables and early types of silage, some farmers mixed chopped straw and 'coarse marsh or meadow hay' with grain.<sup>85</sup>

Grass yields on wet soils were known to exceed those of dry soils so many wetlands continued to produce hay even after the species composition changed from natural to artificial.<sup>86</sup> Timothy grass was found in a New Hampshire wetland and *The Cultivator* reported on another grass discovered in that state with great promise as hay and pasture in 'wet boggy grounds' (ribbon grass, *Phalaris caroliniana*, native to the southern states). This grass was later described to have provided two cuttings of hay from a bog in Connecticut and made that wetland firm enough for pasture.<sup>87</sup> The commonly cultivated 'fowl meadow grass' (referencing one or more species of *Agrostis* or *Poa*) was traditionally claimed to have

<sup>80</sup> Beddows, 'History of the introduction of timothy and cocksfoot'; S. Deane, *The New England farmer; or georgical dictionary. Containing a compendious account of the ways and methods in which the important art of husbandry, in all its various branches, is, or may be, practised, to the greatest advantage, in this country* (third edn, 1822).

<sup>81</sup> Deane, *New England farmer; New England Farmer* 9, 28 Jan. 1831, p. 220.

<sup>82</sup> *The Cultivator* 1, Mar. 1834, p. 6; Oct. 1834; *New England Farmer* 2, 16 Aug. 1823, pp. 17–8; 17 Jan. 1824, p. 197; 6 Mar. 1824, pp. 252–3.

<sup>83</sup> *The Cultivator* 3, Apr. 1836, pp. 17–18; Jun 1836, pp. 49–50; *New England Farmer* 9, 28 Jan. 1831, p. 219.

<sup>84</sup> Carman *et al.*, *Essays*, p. 8.

<sup>85</sup> L. F. Allen, 'Farm buildings and the consumption of fodder', *The Cultivator* 2, Jan. 1836, pp. 166–9; Foster, *Thoreau's Country*, p. 55; Steele, 'Pine Plains'.

<sup>86</sup> *New England Farmer* 1, 14 Dec. 1822; 2, 27 Dec. 1823.

<sup>87</sup> A. Harris, *The Cultivator* 1, Oct 1834; T. Pickering 'Letter to the editor', *The Plough Boy*, 1, 26 Feb. 1820; *The Cultivator* 1, Aug. 1834, p. 81.

been brought to meadows on the Neponset River at Dedham, Massachusetts by a flock of wild birds and to meadows at Hartford, Connecticut by floods.<sup>88</sup> In 1836 *The Cultivator* published a list of artificial grasses that included the wetland obligate floating fescue grass (or water mannagrass, *Glyceria fluitans*) and water meadow grass (or reed meadow grass, *G. maxima*). These were only sporadically present in America at that time, but recommended for cultivation in wet soils; *G. fluitans* has since become problematic in some wetlands as an invasive weed.<sup>89</sup>

Some salt marshes continued to be used for hay into the late nineteenth and twentieth centuries. A resident of New Bedford, Massachusetts commented in 1823 that many farmers kept their marshes in a natural state because they believed they should have 'a little salt hay'.<sup>90</sup> Sixty years later, one engineer lamented the failure of New Englanders to dike their salt marshes but he also acknowledged that at least for older, established families in Norfolk County, Massachusetts, 'salt haying is a feature of their life. They would neither sell the marsh at any price nor reclaim it'.<sup>91</sup> The same held true for some freshwater marshes, such as those along the Sudbury River in Massachusetts where there was 'no pause between the English [upland] and meadow haying' in the 1850s.<sup>92</sup>

The value of un-reclaimed tidal marshes was frequently stated in agricultural journals and included reader-submitted accounts of the labour and cost of diking, and the time that elapsed before results were shown. Furthermore, in some areas, salt marshes were more valuable than uplands and they were still in demand in the 1830s because they could produce almost as much hay as uplands, particularly in times of drought. Their productivity had already been greatly improved by some draining, they did not require manuring or much fencing, and other products were available like seaweed, muck, and peat. Some farmers believed cows fed salt hay produce better-flavoured milk.<sup>93</sup> A man from Plymouth, Massachusetts added that the majority of livestock at nearby Duxbury over-wintered on salt hay and more than half the cash earned by farmers there came from salt hay. It was easier to transport and store than upland or fresh meadow hay because it could be left on marshes for up to a week after harvest. Salt marshes were also less affected by extremes in temperature or precipitation and the hay crop was more uniform.

Although some wetlands retained their identity as hayfields and pastures, and others were valued for their rich soils, wetland improvement and the introduction of European forage species ultimately reorganized the north-eastern landscape and economy. By 1790 the price of upland hay on Staten Island was double the price per hundredweight of salt hay (8s. against 4s.). Between 1810 and 1831 the value of 'salt meadow hay' in a town just south of Boston fell more than 50 per cent, 'owing principally to the better cultivation of the uplands'. Likewise, a resident of Babylon, New York noted that although some Long Island marshes continued to be hayed in 1882, their value had decreased owing to greater 'attention to the growing of

<sup>88</sup> Carman *et al.*, *Essays*; Russell, *Long, deep furrow*; 'On Grasses, No. II', *New England Farmer* IV, 9 June 1826, pp. 361–2.

<sup>89</sup> J. Buel, 'An essay on grasses', *The Cultivator* 3, May 1836, pp. 34–6.

<sup>90</sup> *New England Farmer* 4, 5 May 1826, p. 325.

<sup>91</sup> Nesbit, *Tide marshes*, p. 124.

<sup>92</sup> Foster, *Thoreau's country*, p. 53.

<sup>93</sup> *New England Farmer* 4, 5 May 1826; 5, 26 Jan. 1827; 9, 28 Jan 1831; 9, 4 Feb 1831, 16 Mar 1831.

domestic grasses' and the price of salt hay in some areas was dependent on the output of upland hay.<sup>94</sup>

Close study of the scant pre-1800 agricultural literature, and the abundant publications of the North East-focused agricultural press to 1840, shows that much of the shift in wetland valuation came not from worry over disease but from the inability of wetlands to supply farmers with enough hay and pasture to support the transition to a new farming economy based on livestock. Even when the forage demand became undeniable, many farmers disagreed with expert opinion on the value and best use of their wetlands. The process was slow and not geographically uniform due to farmers' exposure to new ideas, their willingness and ability to accept them, and the type of wetlands owned. Ultimately, however, approximately 67 per cent of wetland acres across New York and New England were lost between the 1780s and 1980s.<sup>95</sup> Fortunately, what remains is now valued for provision of ecosystem services such as wildlife habitat, water filtration, nutrient sequestration, and buffers against storm surge, among other positive attributes like aesthetics.<sup>96</sup> Perhaps greater awareness of their historical importance will inspire additional efforts to protect and restore wetlands that undoubtedly influenced today's landscape through lingering settlement patterns and roadways.

<sup>94</sup> Richard Mather Bayles, *History of Richmond County (Staten Island), New York from its discovery to the present* (1887); Samuel Deane, *History of Scituate, Massachusetts: from its first settlement to 1831* (1831); J. B. Cooper, in *History of Suffolk County, New York, with Illustrations, Portraits, & Sketches of Prominent*

*Families and Individuals* (1882), p. 83.

<sup>95</sup> Thomas E. Dahl, *Wetlands losses in the United States, 1780's to 1980's* (1990).

<sup>96</sup> Ralph Tiner, *Wetlands of the United States: Current status and recent trends* (1984).