

CLIMATE, ECOLOGY AND HISTORY IN NORTH AMERICA'S TALLGRASS PRAIRIE BORDERLANDS*

In 1700, Father Jacques Gravier wrote to a fellow Jesuit to report on a momentous turning point in the mission of the Immaculate Conception, the flourishing if volatile infant church in the upper Illinois Valley.¹ Founded in 1673 by Jacques Marquette, the mission had achieved great initial success as numerous Illinois-speakers, together with a handful of priests and lay brothers, created an idiosyncratic Christian practice in what was the most remote Jesuit mission in North America.² To Gravier and his partners, the Immaculate Conception had been a rare success story, allowing the priests to boast about the viability of their missionary strategies and the great potential of distant missions in the continental interior. But now, as the new century began, the mission was breaking up. Members of the largest ethnic group within the Illinois, the Kaskaskias, were moving to the south, relocating their permanent summertime villages to the region that Stephen Aron has called the American Confluence, where

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¹ Jacques Gravier, '1700', in *The Jesuit Relations and Allied Documents: Travels and Explorations of the Jesuit Missionaries in New France, 1610–1791*, ed. Reuben Gold Thwaites, 73 vols. (Cleveland, 1896–1901) [hereafter *Jesuit Relations*], lxxv, 101.

² Christopher Bilodeau, "They Honor Our Lord among Themselves in Their Own Way": Colonial Christianity and the Illinois Indians', *American Indian Quarterly*, xxv (2001); Tracy Neal Leavelle, *The Catholic Cahmet: Colonial Conversions in French and Indian North America* (2011); Robert Michael Morrissey, "'I Speak It Well': Language, Cultural Understanding, and the End of a Missionary Middle Ground in Illinois Country, 1673–1712', *Early American Studies: An Interdisciplinary Journal*, ix (2011).

the Missouri, Ohio, and Mississippi rivers flow together.³ Settling here, the Kaskaskias were joining their Cahokia kinsmen and founding the villages that would come to be known as the centre of *le pays des Illinois* in the eighteenth century. Other Illinois-speakers, most importantly the Peorias, would remain in the upper Illinois Valley, remote from the main group.⁴ Given that the upper Illinois Valley settlements had for a decade been some of the largest in all of North America, it was a consequential change, not just for the mission, but for the indigenous history of the continent more broadly (see Figure 1).

Gravier possessed a simple understanding of the Illinois's motivations for moving. As he saw it, the Kaskaskias were relocating in response to the foundation of the new French colony of Louisiana. Realizing Robert de La Salle's dream of a French imperial outpost at the mouth of the Mississippi River, the new Southern Colonies project had claimed the entire Mississippi Valley, including the confluence location to which the Kaskaskias were now moving, as a separate jurisdiction from Quebec. Jesuits like Gravier and his partner Gabriel Marest knew that the Illinois had received an invitation from Louisiana officials to put themselves into its orbit. According to one Jesuit, the Kaskaskia chief Rouensa had staked his authority on the fact that he was 'called by the great chief of the French' to move to the mid-Mississippi Valley.⁵ In addition to certain inter-ethnic conflicts that the Jesuits had long witnessed within the Illinois villages, the new Louisiana colony seemed to be the prime motivation for the Kaskaskias' consequential migration.

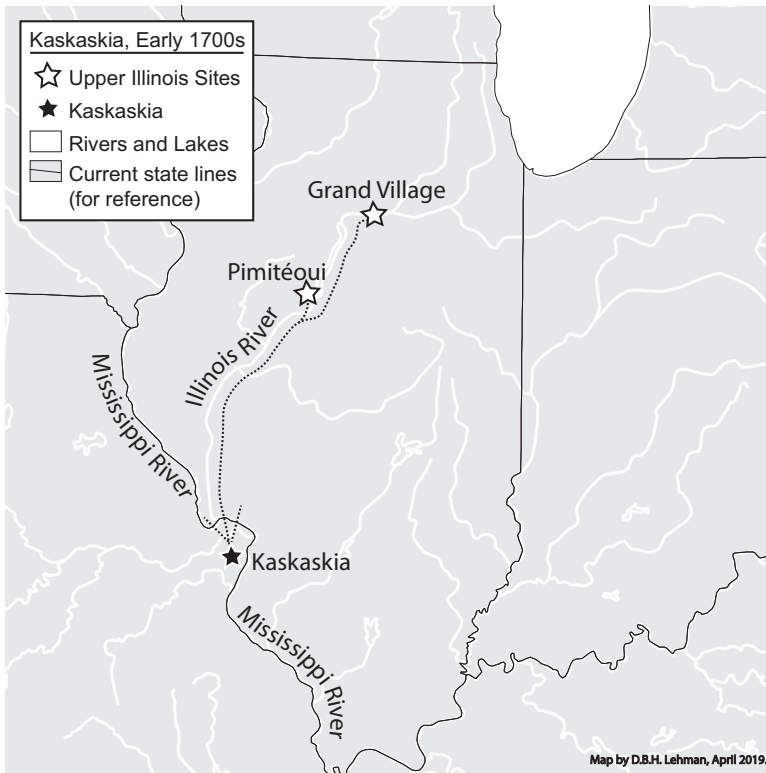
By understanding the Native Illinois's movements as essentially a response to colonial initiative, Frenchmen like the Jesuits emphasized their own importance in shaping Native geography. By the 1700s, this had become the default way for the French to explain what Indians were doing in the Illinois Valley, as when

³ Stephen Aron, *American Confluence: The Missouri Frontier from Borderland to Border State* (Bloomington, 2006).

⁴ For the most detailed history of Illinois migrations in this period, see Joseph Zitomersky, *French Americans, Native Americans in Eighteenth-Century French Colonial Louisiana: The Population Geography of the Illinois Indians, 1670s–1760s* (Lund, 1994).

⁵ Mary Borgias Palm, *The Jesuit Missions of the Illinois Country, 1673–1763* (1931), 36.

FIGURE 1



The Kaskaskia-Illinois relocated in the late 1600s, resettling in the central Mississippi Valley and leaving behind upper Illinois Valley village locations that had previously been part the largest population centre in seventeenth-century North America. Map adapted from Helen Tanner (ed.), *The Atlas of Great Lakes Indian History* (Norman: University of Oklahoma Press, 1987).

Robert de La Salle speculated that the entire population of the upper Mississippi Valley had selected their village locations in order to be close to his extremely fledgling colonial outpost, Fort Crèvecoeur. For their part, early historians of this region often followed this logic, explaining much of the Illinois's population movements in the seventeenth century — including the Kaskaskia relocation — as generally a response to French action. As in many other aspects of early Illinois history, the Illinois were cast in the role of reaction, the assumption being

that the French were the most important thing happening in the Natives' world.⁶

In recent years, however, historians have challenged and even rejected these old understandings. A new generation of historians has moved away from colonist-centred explanations to explore the Illinois's own logics and indigenous motivations. Rather than simple reaction to the French or to the Iroquois, we now understand the Illinois's migrations in part as the outgrowth of internal tensions that tore the Illinois Valley Native villages apart.⁷ We also understand the Kaskaskias' proactive strategy, the way in which their movements — both in creating their population centre in the Illinois Valley and then abandoning it — may have reflected an effort to dominate an indigenous slave trade.⁸ Thanks to recent cross-disciplinary conversations among historians and archaeologists, we also understand the migration of the Kaskaskias in light of a longer history of migration rather than a simple reaction to French policy.⁹

However, even as we have moved far beyond Gravier's one-dimensional explanation towards a more complex and native-centred account of how the Illinois chose where to settle in the precarious early colonial period, historians have often ignored another part of the story, and another actor: the environment. As it happens, the landscape in which the Illinois made their

⁶ Raymond E. Hauser, 'An Ethnohistory of the Illinois Indian Tribe, 1673–1832' (Northern Illinois Univ. Ph.D. thesis, 1973); Wayne Calhoun Temple, *Indian Villages of the Illinois Country* (Scientific Papers: vol. ii, pt 2) (Springfield, Ill., 1958). Refreshingly, Zitomersky emphasized the way Native and colonial population geography affected one another during the colonial period, rather than asserting a one-way influence. See Zitomersky, *French Americans, Native Americans in Eighteenth-Century French Colonial Louisiana*.

⁷ Robert Michael Morrissey, 'The Power of the Ecotone: Bison, Slavery, and the Rise and Fall of the Grand Village of the Kaskaskia', *Journal of American History*, cii (2015); Leavelle, *The Catholic Calumet*.

⁸ For the best treatment of indigenous slavery and the Illinois, see Brett Rushforth, *Bonds of Alliance: Indigenous and Atlantic Slaveries in New France* (Chapel Hill, 2012).

⁹ Robert Mazrim and Duane Esarey, 'Rethinking the Dawn of History: The Schedule, Signature, and Agency of European Goods in Protohistoric Illinois', *Midcontinental Journal of Archaeology*, xxxii (2007); Alan G. Shackelford, 'The Illinois Indians in the Confluence Region: Adaptation in a Changing World', in R. David Edmunds (ed.), *Enduring Nations: Native Americans in the Midwest* (Urbana, 2008); Alan G. Shackelford, 'On a Crossroads: American Indian Prehistory and History in the Confluence Region' (Indiana Univ. Ph.D. thesis, 2004). These studies join a flourishing literature in Native American population geography in the protohistoric and contact eras more broadly led most importantly by Jon Parmenter, *The Edge of the Woods: Iroquoia, 1534–1701* (East Lansing, 2010).

lives was a special one, one of the most important ecological transition zones in North America, a biome-scale division between the woodlands of the east and the grasslands of the west. At the very heart of this broad transition zone was one of North America's distinctive ecological assemblages: the tallgrass prairies. Covering large portions of the modern-day states of Illinois, Iowa, Minnesota, Wisconsin, Kansas and Missouri, the tallgrass transition zone, or 'ecotone', was a rich mosaic of vegetation communities containing species drawn from both woodlands and grasslands taxa. This distinctively biodiverse region offered its inhabitants plentiful opportunities, a kind of 'edge effect' that shaped history in important ways¹⁰ (see Figure 2).

But if the environment of the mid-continent itself was distinctive, it was also passing through an important moment of change in the late seventeenth century. While other parts of the continent and the North Atlantic were experiencing severe cold — the likely effects of the Maunder Minimum period of decreased solar irradiation in the late 1600s — the North American mid-continent experienced a curiously different, but no less powerful, episode of climate change: drought.¹¹ Recent research has established that the late seventeenth century may well have been one of the top five most significant drought events of the

¹⁰ For a good discussion of 'edge effects', the phenomenon of increased biological richness in the area where two vegetation zones or plant communities overlap, see William J. Cronon, 'Why Edge Effects?', *Edge Effects Blog* (2014), at <<http://edgeeffects.net/why-edge-effects/>>. The concept of the 'edge effect' was first made popular by Aldo Leopold.

¹¹ This paper joins flourishing recent research on the climate at the end of the seventeenth century in North America, the period of the so-called Maunder Minimum. See Sam White, "'Shewing the Difference Betweene Their Conjunction, and Our Invocation on the Name of God for Rayne": Weather, Prayer, and Magic in Early American Encounters', *The William and Mary Quarterly*, lxxii (2015); Thomas Wickman, "'Winters Embittered with Hardships": Severe Cold, Wabanaki Power, and English Adjustments, 1690–1710', *The William and Mary Quarterly*, lxxii (2015); Sam White, *A Cold Welcome: The Little Ice Age and Europe's Encounter with North America* (Cambridge, Mass., 2017). See also Katherine Grandjean, "'It's the Climate, Stupid'", *The William and Mary Quarterly*, lxxii (2015). For an overview of the new climate history: Sam White, Christian Pfister and Franz Mauelshagen, *The Palgrave Handbook of Climate History* (London, 2018). See also Mark Carey *et al.*, 'Forum: Climate Change and Environmental History', *Environmental History*, xix (2014). For background on Maunder Minimum: Thomas J. Crowley, 'Causes of Climate Change Over the Past 1000 Years', *Science*, cclxxxix (2000); P. D. Jones *et al.*, 'High-Resolution Palaeoclimatology of the Last Millennium: A Review of Current Status and Future Prospects', *The Holocene*, xix (2009).

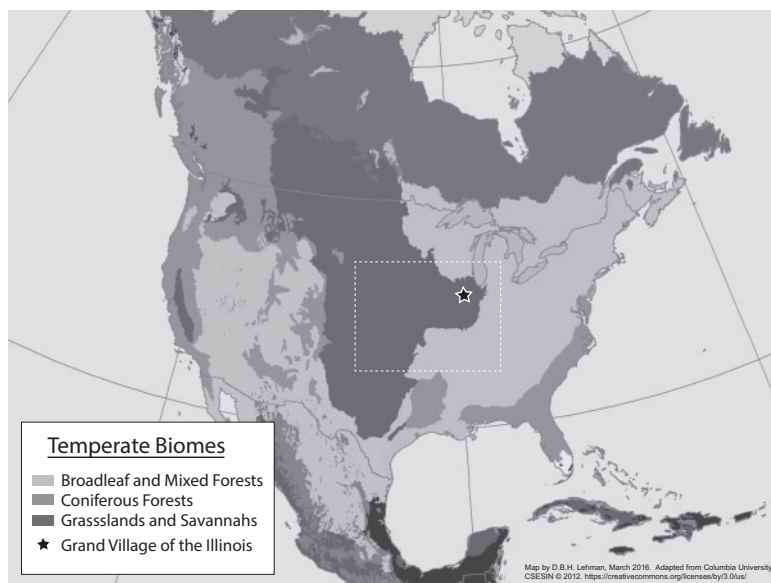
past 1,000 years over the mid-continent. Between roughly 1661 and 1705, average rainfall in the modern-day Corn Belt was lower by a significant margin, and the period witnessed three major short-term drought events, including a drought measuring -4.87 on the Palmer Hydrological Drought Index in 1698. This especially dire year was surrounded by five years of extreme drought over the Illinois Valley region from 1696 to 1699. Only three drought events over the mid-continent have been more severe in the past millennium, including the Dust Bowl and the sixteenth-century megadroughts.¹²

The premise of this article is that drought was a factor in the Native history of the Illinois Country, and a likely driver of the Illinois's population geography, including the Kaskaskias' consequential move to the confluence region in the early 1700s. Telling the story of this drought event and its impact on history is not straightforward, however. Indeed, eyewitness accounts from Illinois Country during this period hardly register a difference in the weather, even in the most severe years of the 1690s. And this was probably not just a function of their authors' ignorance or unfamiliarity with the ways that drought impacted local ecosystems. The reality is that this drought event — like so much of what we can expect from climate change in many temperate regions of the globe — did not necessarily create catastrophic or even extremely pronounced impacts.¹³ Occasionally dramatic moments of severe drought may have produced weather that made abrupt and visible change, such as failed crops; but as present-day ecological research is making clear, the more notable effects may well have been the subtle interruption of dynamic processes in the tallgrass prairie–forest edge. While it is impossible to make a direct causal argument for

¹² Michael C. Stambaugh *et al.*, 'Drought Duration and Frequency in the U.S. Corn Belt during the Last Millennium (AD 992–2004)', *Agricultural and Forest Meteorology*, cli (2011); E. R. Cook and P. J. Krusic, 'North American Drought Atlas, Lamont–Doherty Earth Observatory of Columbia University and the National Science Foundation', *North American Drought Atlas*, at <<https://iridl.ldeo.columbia.edu/SOURCES/LDEO/TRL/NADA2004/pdsi-atlas.html>>.

¹³ For current state-of-the-art interpretations of North American climate change impacts broken out by region, see 'National Climate Assessment', *National Climate Assessment* (Washington, DC, 2014). See also Donald J. Wuebbles, Katharine Hayhoe and Julia Parzen, 'Introduction: Assessing the Effects of Climate Change on Chicago and the Great Lakes', suppl. 2 to *Journal of Great Lakes Research*, xxxvi (2010).

FIGURE 2



The Illinois Country was one of the most important ecological transition zones in North America, a biome-scale ecotone featuring the division between grasslands of the west and broadleaf and conifer forests of the east.

how climate affected history, it seems likely that these disruptions had an important impact on human affairs.¹⁴

To understand this story, however, we need to take a new approach. Much indirect evidence from ecology and climate science does suggest ways that the Illinois Country was likely affected by the climate changes of the late seventeenth century. To explore how these impacts happened and why, this article embarks on a forensic journey, combining traditional ethnohistory and the new climate history together with a deep ecological history of the region. The middle of the continent, in particular the forest–prairie edge where the Illinois chose to settle,

¹⁴ For good insights on the uncertainties of this kind of work, see Dave Egan and Evelyn A. Howell (eds.), *The Historical Ecology Handbook: A Restorationist's Guide to Reference Ecosystems* (Washington, DC, 2005), 6–8 (foreword). See also Jan de Vries, 'Measuring the Impact of Climate on History: The Search for Appropriate Methodologies', *The Journal of Interdisciplinary History*, x (1980).

was especially susceptible to climate change, and for important reasons stemming from its relatively recent evolutionary history in the Holocene. When drought came, it affected dynamic succession processes underlying the shape of the region's ecological mosaic. For indigenous peoples living in the prairie region, whose lifestyle was intricately tied to the opportunities present at the ecological edges, this may well have mattered significantly. By putting Illinois history in the deepest possible context, this article adds a new dimension to our understanding of the logics of Native action at the end of the seventeenth century in Illinois. It also models the potential benefits of bringing ethnohistory, deep history, climate history and ecology together in a single cross-disciplinary narrative.¹⁵

I

ILLINOIS NEWCOMERS AND THE ECOTONE WAY OF LIFE

Arriving in the Illinois Valley in the 1670s, a generation of early French explorers and missionaries wrote the first European descriptions of the landscape and inhabitants of the mid-continent. From the moment Jacques Marquette first described the region in 1673, the Illinois Country was rarely without a French visitor, and many Frenchmen wrote voluminously about what many of them — especially in the beginning — viewed as a remarkable place and population. Thanks to their writings, we have an extensive record on which to base our study of the Illinois's culture and lifeways at contact. This archive is currently being used by scholars and cultural leaders such as Daryl Baldwin to reconstruct aspects of contact-era Illinois and Miami ethnobotany, language and culture.¹⁶ Using new insights from these projects as well as traditional

¹⁵ This article takes inspiration from well-developed historiography of climate and historical causation pioneered by Ladurie, Utterstrom and Braudel, but pushes the conversation forward by urging attention to more subtle effects of climate change on historical processes, particularly in ecological transition zones. Emmanuel Le Roy Ladurie, *Times of Feast, Times of Famine: A History of Climate since the Year 1000* (New York, 1988); Fernand Braudel, *The Mediterranean and the Mediterranean World in the Age of Philip II, Vol. I* (Berkeley, Calif., 1996); Fil. Lic. Gustaf Utterström, 'Climatic Fluctuations and Population Problems in Early Modern History', *Scandinavian Economic History Review*, iii (1955); H. H. Lamb and M. J. Ingram, 'Climate and History', *Past and Present*, no. 88 (Aug. 1980).

¹⁶ For highlights from this work, see 'Myaamia Dictionary' at <<https://myaamiadictionary.org/dictionary2015/index.php>>; 'Ilaatawaakani' at <<http://www.ilaatawaakani.org>>

(cont. on p. 47)

ethnohistorical methods, we can learn a lot about the Illinois and their distinctive lifeway and its relationship to this unusually diverse part of the continent.

A headline of many early Frenchmen's accounts about the Illinois Country is the conspicuous prosperity of its people. At a time when many other Indian groups were struggling at the end of the seventeenth century, the Illinois were quite well off.¹⁷ Referring to their health, the French commandant Pierre-Charles de Liette wrote in the 1690s that 'You can see no finer looking people'.¹⁸ Of course the French did not understand a great deal about the indigenous peoples of North America, let alone those of the Illinois Country, and they often disparaged indigenous lifeways out of prejudice. A typical French view was that the Illinois did not farm well, or that the men were lazy.¹⁹ But for all that, the French often also seemed impressed by the Illinois's economy. They wrote dissertations on the great variety of food that the Illinois harvested from wild and cultivated sources.²⁰ They wrote admiring accounts of the Illinois's hunting prowess.²¹ They observed how the Illinois lived unusually long lives. They were 'tall' and 'strong'.²² They had 'the whitest teeth imaginable'.²³

(n. 16 cont.)

ilaatawaakani.org/index.php>. See also Tim McCoy *et al.*, *Asiikkwii Neehi Kiiisikwi Myaamionki: Earth and Sky the Place of the Myaamiaki* (Oxford, Ohio, 2011).

¹⁷ An excellent collection exploring diverse conditions for North Americans in the protohistoric period is David S. Brose, C. Wesley Cowan and Robert C. Mainfort Jr, *Societies in Eclipse: Archaeology of the Eastern Woodlands Indians, AD 1400–1700* (Washington, DC, 2001).

¹⁸ Pierre de Liette, 'Memoir Concerning the Illinois Country, ca. 1693', in Theodore Calvin Pease and Raymond C. Werner (eds.), *The French Foundations* (Springfield, Ill., 1934), 327.

¹⁹ Louis Vivier, 'June 8, 1750', in *Jesuit Relations*, lxi, 147; Liette, 'Memoir Concerning the Illinois Country', 327; Louis Hennepin, *A New Discovery of a Vast Country in America, by Father Louis Hennepin. Reprinted from the Second London Issue of 1698*, ed. Reuben Gold Thwaites, 2 vols. (Chicago, 1903), i, 167; Julien Binneteau, '1699', in *Jesuit Relations*, lxxv, 73.

²⁰ Liette, 'Memoir Concerning the Illinois Country', 340–7; Nicolas Perrot, 'Memoir on the Manners, Customs, and Religion of the Savages of North America', in Emma Helen Blair (ed.), *The Indian Tribes of the Upper Mississippi Valley and Region of the Great Lakes* (Lincoln, 1996), 113–19; Claude Allouez, '1677', in *Jesuit Relations*, lx, 161.

²¹ Allouez, '1677', in *Jesuit Relations*, lx, 161–3; Binneteau, 'January 1699', in *Jesuit Relations*, lxxv, 73–5; Sébastien Rasles, 'October 12, 1723', in *Jesuit Relations*, lxxii, 171.

²² Hennepin, *New Discovery*, i, 167.

²³ Liette, 'Memoir Concerning the Illinois Country', 327.

The French were not wrong in noting the exceptional prosperity of the Illinois, and most available evidence from archaeology suggests that the Illinois enjoyed abundance in their culinary customs and traditions, and economy.²⁴ Moreover, the French were also correct in consistently linking the Natives' wealth with the special place where they lived. If Liette wrote that he had never seen 'finer looking people', he was equally impressed with the country, asserting that 'no finer landscape can be found'.²⁵ Of course the most conspicuous parts of the landscape were the tremendous prairies, which Marquette and others described as vast and endless. Crossing into the Mississippi watershed, explorers registered the scale of the landscape, as evidenced by Marquette's rather typical comment that 'the prairies extended farther than the eye can see', a description echoed by Claude Allouez a few years after.²⁶ A decade later, Louis Hennepin described the 'boundless prairies' of Illinois, and his successor Liette noted that he recognized one area of the Illinois Country because the landscape was dominated by 'nothing but prairies on either side'.²⁷ Officials in Canada also learned to use this trope in describing the prairie landscape of the mid-continent, as when Antoine Raudot described Illinois Country as having 'nothing but prairies as far as the eye can see'.²⁸

However, even as the French noted the vast prairies, they also understood that the true distinctiveness of the Illinois Valley landscape was not merely its huge expanses of grass but rather its great ecological edginess. Spend any time reading the eyewitness descriptions of the Illinois Valley in the late seventeenth and early eighteenth centuries and you will notice a ubiquitous rhetorical construction: 'on the one hand . . . and on the other'. For instance, travelling through the Illinois in the 1670s, Jesuit Claude Allouez wrote in typical fashion of the

²⁴ For a window into the diversity of species exploited in Illinois culinary traditions, see, for instance, Terrance J. Martin, 'Foodways and the Illinois: Archaeozoological Samples from Grid A', in Robert F. Mazrim *et al.* (eds.), *Protohistory at the Grand Village of the Kaskaskia: The Illinois Country on the Eve of Colony* (2015).

²⁵ Liette, 'Memoir Concerning the Illinois Country', 318.

²⁶ Jacques Marquette, '1674', in *Jesuit Relations*, lix, 103; Allouez, '1677', in *Jesuit Relations*, lx, 155.

²⁷ Liette, 'Memoir Concerning the Illinois Country', 306; Hennepin, *New Discovery*, i, 149.

²⁸ Antoine-Denis Raudot, 'Memoir Concerning the Different Indian Nations of North America', in W. Vernon Kintz (ed.), *The Indians of the Western Great Lakes, 1615-1760* (Ann Arbor, 1940), 384.

great contrasts he saw all over the landscape: 'On one side of it is a long stretch of prairie, and on the other a multitude of swamps'.²⁹ As he later assessed, the landscape of the Illinois was not homogenous, but rather was 'equally divided into prairies and forests'.³⁰ For his part, Father Claude Dablon agreed that the area around the Illinois mission settlements was sharply divided into contrasting communities of forest and grassland. He wrote, 'There are prairies three, six, ten, and twenty leagues in length, and three in width, surrounded by forests of the same extent; beyond these, the prairies begin again, so that there is as much of one sort of land as of the other'.³¹

Descriptions focused on the contrasts in the landscape between grassland, forest and wetland were almost universal in early accounts from Illinois Country. Gabriel Marest wrote that the Illinois Country was defined by these great contrasting vegetation assemblages, all in close proximity:

Sometimes we have been on prairies stretching farther than the eye could reach, intersected by brooks and rivers, without finding any path which could guide us; sometimes it has been necessary for us to open a passage through dense forests, amid thickets filled with briars and thorns; at other times we have had to go through marshes abounding in mire, in which we sometimes sank waist-deep.³²

Some years earlier, La Salle noted that Illinois Country was 'a country of boundless prairies, interspersed with forests of high trees'.³³ Marquette added oak savannahs and groves to the list of plant communities he witnessed alternating with the grasslands, writing from the Peoria village that 'one beholds on every side prairies, extending farther than the eye can see, interspersed with groves or with lofty trees'.³⁴ For Canadian official Antoine Raudot, the prairies were laced with 'patches of woods, with orchards, and with avenues of trees which it seems as if nature took pleasure in making grow in a straight line equally distant one from another'.³⁵

²⁹ Allouez, '1677', in *Jesuit Relations*, lx, 159.

³⁰ Claude Dablon, '1674', in *Jesuit Relations*, lviii, 97.

³¹ *Ibid.*, 107.

³² Gabriel Marest, '1712', in *Jesuit Relations*, lxvi, 269.

³³ Robert Cavalier, sieur de La Salle, *Relation of the Discoveries and Voyages of Cavalier De La Salle from 1679 to 1681: The Official Narrative*, trans. Melville Best Anderson (Chicago, 1901), 87.

³⁴ Marquette, '1674', in *Jesuit Relations*, lix, 103.

³⁵ Raudot, 'Memoir Concerning the Different Indian Nations of North America', 384.

As Marest's description above makes clear, the contrasts in this diverse landscape were revealed especially clearly when an eyewitness narrated the experience of travelling *through* the Illinois Valley. It is from these frequent descriptions that we get our best view into the nature of the landscape, which was hardly uniform prairie but rather contained a multitude of different ecozones. To take one more illustrative example, Liette listed five distinct plant communities — including two different forest types — which he saw in the space of just a few miles at the edge of the Illinois's village in the 1690s:

You see places on the one side that are unwooded prairies requiring only to be turned up by the plow, and on the other side valleys spreading half a league before reaching the hills, which have no trees but walnuts and oaks; and behind these, prairies like those I have just spoken of. Sometimes you travel a league, seeing all this from your boat. Afterwards you find virgin forest on both sides, consisting of tender walnuts, ash, whitewood, Norway maple, cottonwood, a few maples, and grass, taller in places than a man. More than an arpent in the woods you find marshes which in autumn and spring are full of bustards, swans, ducks, cranes, and teals. Ten steps farther on are the hills covered with wood extending about an eighth of a league, from the edge of which are seen prairies of extraordinary extent.³⁶

What all of these writers were describing was not a uniform expanse of prairie, but rather a complex mosaic, a patchy landscape that ecologists call the forest–prairie tension zone. Within a short proximity, Frenchmen saw species drawn from two biomes and several different ecozones, assembled together and clashing right at the edge. *This* was the distinguishing landscape of the Illinois Valley. And while there were mosaics and patchwork landscapes in many areas of the Native North American continent, the forest–prairie tension zone of the Illinois Valley constituted a mosaic on a massive scale.³⁷ A small patch of prairie in New England would attract whitetail deer and perhaps a few other ungulate grazers. But in Illinois, the prairie landscape contained not just deer but large herds of bison and elk. Meanwhile, the woodlands contained not just a single forest type, but richly diverse varieties of both hardwood and conifer trees and accompanying vegetation in a variety of

³⁶ Liette, 'Memoir Concerning the Illinois Country', 305. See also Vivier, 'June 8, 1750', in *Jesuit Relations*, lxix, 205.

³⁷ James R. Gosz, 'Ecotone Hierarchies', *Ecological Applications*, iii (1993); William Cronon, *Changes in the Land: Indians, Colonists, and the Ecology of New England* (New York, 1983), ch. 2.

mesic (that is, possessing moderate moisture) lowland as well as upland forests. The enormous wetlands attracted not just a small number of migrating birds, but multitudes of species travelling across the largest migration flyway on the continent. This was a mosaic on a huge scale.³⁸

The French did not know that the Illinois themselves were newcomers to this landscape who had just arrived in the 1600s. As recent archaeological discoveries have shown, the Illinois were almost certainly the creators of the so-called Danner series of pottery, which not only appears in eighteenth-century Illinois village archaeology, but is also found in a chronologically distinct succession of archaeological sites starting in Northern Ohio in the 1500s (Lake Whittlesey, Fort Meigs and Wellsburg), and advancing east to west from Madisonville (near Cincinnati), to Southwestern Michigan (Moccasin Bluff notched appliqué), to the Des Moines River Valley (Haas-Hagerman), and finally to the Illinois Valley by the mid 1600s (Zimmerman, the important location of the Grand Village of the Kaskaskias).³⁹ As archaeologists have speculated, this migration was likely an attempt to escape 'dark times' at the beginning of the 1600s in the east. But it is not hard to imagine that the meaning of this migration was not just about 'push' factors. In the forest-grassland tension zone, the Illinois gained numerous opportunities at the edge.⁴⁰

Abundant sources can be used to recreate the Illinois newcomers' way of life and its relationship to the distinctively diverse ecotonal environment of the eastern prairie peninsula. Of course reconstructing the economy and ecology of Native peoples from colonial sources is fraught with methodological difficulties and challenges. In addition to biases and prejudices already mentioned, a bigger problem is that many of the sources

³⁸ M. J. Morgan, *Land of Big Rivers: French and Indian Illinois, 1699–1778* (2010).

³⁹ Robert F. Mazrim, 'The Danner Series Pottery of the Illinois', in Robert F. Mazrim *et al.* (eds.), *Protohistory at the Grand Village of the Kaskaskia: The Illinois Country on the Eve of Colony* (2015), 29–31; Penelope B. Drooker and C. Wesley Cowan, 'Transformation of the Fort Ancient Cultures of the Central Ohio Valley', in David S. Brose, C. Wesley Cowan and Robert C. Mainfort Jr (eds.), *Societies in Eclipse: Archaeology of the Eastern Woodlands Indians, AD 1400–1700* (Washington, DC, 2001); David S. Brose, 'Penumbral Protohistory on Lake Erie's Southern Shore', in Brose *et al.*, *Societies in Eclipse*; James Brown and Robert F. Sasso, 'Prelude to History on the Eastern Prairies', in Brose *et al.*, *Societies in Eclipse*.

⁴⁰ Brown and Sasso, 'Prelude to History on the Eastern Prairies', 206–7; Brose, 'Penumbral Protohistory on Lake Erie's Southern Shore', 61.

— especially from the early period — are tainted by their authors' misunderstanding and ignorance. Early records of Illinois share many of the flaws that environmental historians of early America have encountered in archives across the continent: it is difficult and sometimes impossible to identify places, processes and species in the writings of people whose agendas and specific interests were so different from the concerns of modern environmental historians.⁴¹ For instance, consider this typical passage from a description by Jacques Marquette, who spent just a bit of time with the Illinois in the 1670s:

They raise Indian corn, which they have in great abundance, have squashes as large as those of France, and have a great many roots and fruits. There is fine hunting there of Wild Cattle, Bears, Stags, Turkeys, Ducks, Bustards, Pigeons, and Cranes.⁴²

Of course, this kind of observation, which is typical of early eyewitnesses to the Illinois, is somewhat informative, conveying the main idea that the Illinois were exploiting a diverse assemblage of domestic and non-domestic species. But it is vague and general. Fortunately, this is not all we have. For if Marquette and other early eyewitnesses were vague in their descriptions, over time French eyewitnesses in Illinois became much more sophisticated observers. Long-term residents of the region such as Liette, Gravier and Jesuit Pierre-François Pinet became intimately familiar with the place and its people after spending decades in the region. Many of our most important eyewitnesses became fluent in the Illinois language, and they quickly moved beyond the 'creative misunderstandings' that characterized early encounters between Natives and newcomers.⁴³ Indeed, dictionaries of the Illinois language created by some of these individuals are now some of the most important documents we have for reconstructing the contact-era ecology and cultural practice of this region. Within obvious limits, we have a pretty clear picture, perhaps some of the best records of the ethnobotany for a seventeenth-century North American

⁴¹ Cronon, *Changes in the Land*, 223–51. See also Michael Edmonds, 'The Pleasures and Pitfalls of Written Records', in Egan and Howell (eds.), *Historical Ecology Handbook*.

⁴² Marquette, '1677' [summarized by Claude Dablon], in *Jesuit Relations*, lix, 187.

⁴³ For this argument, see Morrissey, 'I Speak It Well'.

people.⁴⁴ And since many of these sources were produced for personal use, not public consumption, they can be read, even more than the sometimes boosterish descriptions of the landscape quoted earlier, relatively ‘straight’.

What this means is that we can reconstruct not just aspects of the seventeenth-century landscape, but also the way the Illinois used it. Mining the extant colonial archive as well as by collaborating with Miami cultural leaders, ecologist Michael Gonella has recently completed a massive study of the ethnobotany of the Miami-Illinois, identifying 93 plant species integral to the traditional way of life and ‘ancient traditions’ of these peoples.⁴⁵ Terrance Martin has also used faunal remains in archaeological deposits to supplement the written record about the Illinois’s exploitation of animals in the environment around the Grand Village as well as the American Bottom — the broad lowland region where the Mississippi River meets with the Ohio and Missouri rivers — in the seventeenth century.⁴⁶ What is clear is that the Illinois exploited the diverse resources of the transition zone in specific ways.

Reflecting how lifestyles rested on exploiting distinct plant communities in their region, the Miami-Illinois language named five distinct ecological zones:

- *miincipahki*: cornfields, or agricultural zones;
- *wiikhweehkiwi*: floodplains, including bottomland;
- *tootoomešahki/mahkiikwi*: wetlands, including marsh and swamp;
- *mahkoteewi*: prairie;
- *mihtekwaahki/mihtehki/ahtawaanahki*: forest.⁴⁷

Each of these landscape types were key to the Illinois’s economy. First were the lowland river valleys, where the Illinois located their summertime villages, or *minoonteena*, and where they

⁴⁴ Michael Paul Gonella, ‘Myaamia Ethnobotany’ (Miami Univ. Ph.D. thesis, 2007). See also Frances B. King, *Plants, People, and Paleoecology: Biotic Communities and Aboriginal Plant Usage in Illinois* (Springfield, Ill., 1984).

⁴⁵ It is important to note that Gonella’s study identified 208 *total* Miami plant traditions across time. An impressive ninety-three of these plant species have been in use since before 1846. Gonella, ‘Myaamia Ethnobotany’, 73.

⁴⁶ Martin’s work is voluminous. For a start, see the aforementioned Martin, ‘Foodways and the Illinois: Archaeozoological Samples from Grid A’.

⁴⁷ Gonella, ‘Myaamia Ethnobotany’, 29.

practised the main agricultural component of their subsistence. In the bottomlands, the Illinois raised four kinds of maize, or *miincipi*.⁴⁸ They planted *eemihkwaani*, or wild pumpkin squash, *aleciimina* (peas), *iikkihtaminki* (melon), *kocihsa* (beans), *wiipinkwamina* (huckleberries) and lima beans.⁴⁹ Raising crops in the lowlands made sense, first of all because soil moisture as well as fertility were extremely high in these areas. At the same time, clearing the land was much easier in these lowlands than it would have been in the uplands and prairies, which were not typically farmed.⁵⁰

Occupying the same lowland zone was the *wiikhwehkiwi*, or floodplain zone. Here, the Illinois took advantage of abundant wild resources, especially for food. It was in these regions that *naloomina*, or wild rice, was gathered. The Illinois and Miami also gathered *wiikoolomphsa* (elderberries) and currants.⁵¹ Certain hardwood trees were also present in the floodplains, including cottonwood, silver maple, elm and ash, all useful for technology.

More remote from the floodplain were the marsh or wetland regions where the Illinois hunted birds and gathered diverse plant resources for food and technology. It was in the wetlands that the Illinois harvested the reeds (most likely softstem bulrush, or *alansooni*) for making *apacois*, the main exterior material for Illinois cabins.⁵² Meanwhile, women scoured the wetlands for roots, in particular the *mahkohpina* (macopine or white water lily).⁵³ French observers were astounded at the abundant resources that the Illinois gathered from the wetlands, as when Liette described the harvesting of what was probably hollow root.⁵⁴ Also at the edge of wetlands were 'bear's root' or Indian turnip (*Arisema tripyllum*), and several other species of edible plants, including berries such as *makiinkweemina* (blackberries), *napaleeteemina* (raspberries), *meenkaalakiinkweemiša*

⁴⁸ For a linguistic analysis of 'corn' in the Illinois language, see Michael McCafferty, 'Illinois Voices: Observations of the Illinois-Miami Language', in Robert F. Mazrim *et al.* (eds.), *Protohistory at the Grand Village of the Kaskaskia: The Illinois Country on the Eve of Colony* (2015), 127. See also Gonella, 'Myaamia Ethnobotany', 113–17.

⁴⁹ Gonella, 'Myaamia Ethnobotany', 19–20.

⁵⁰ *Ibid.*, 86.

⁵¹ *Ibid.*, 20.

⁵² Liette, 'Memoir Concerning the Illinois Country', 340. Gonella, 'Myaamia Ethnobotany', 20.

⁵³ Liette, 'Memoir Concerning the Illinois Country', 345; Gonella, 'Myaamia Ethnobotany', 48.

⁵⁴ Liette, 'Memoir Concerning the Illinois Country', 346.

(dewberries) and *mihtekwaapimiši* (mulberries).⁵⁵ Importantly, the wetlands had a high density of useful plants per area of land cover.⁵⁶ They were also the source of a great number of fowl, including cranes, herons, 'swans, bustards, wild geese, and ducks of all kinds', which the Illinois hunted.⁵⁷

Like the wetlands, prairies also had a high density of useful plant species per area of land cover. According to Liette, Illinois hunting parties could support themselves from day to day simply by gathering plants as they traversed the prairies.⁵⁸ As he put it, the prairie contained an 'abundance of all things'.⁵⁹ Prairie plants gathered for food included *waapinkopakahki* (goosefoot), plantain, dock and dandelion.⁶⁰ Illinois women also gathered *oonsaapeehkateeki* (Jerusalem artichokes), wild onions, and other food plants in the prairie.⁶¹ The prairies were also the source for milkweed (*Asclepias syriaca*), which was an important plant for both food and cordage.⁶² Of course the primary use of the prairies was as a huge game reserve. Arriving in the 1600s, the Illinois became a bison culture, hunting the animals on foot and killing around 2,000 'wild cattle' every year. Burning the prairies annually or semi-annually, the Illinois enhanced the grazing ability of the grasslands and also used fire as an important technology for hunting. The prairies were clearly the second most important ecozone in the Illinois way of life.

However, it was the upland forests, the *mihtekwaahki/mihtehki/ahtawaanahki*, that were the most significant ecozone for many of the Illinois's customs and traditions. The upland forests contained by far the greatest number of useful plant resources for the Illinois, including large numbers of food species (mostly fruit and nut trees, and some forest-dwelling tubers such as groundnut), technological and medicinal plants, as well as habitat for significant numbers of woodland game species,

⁵⁵ See Perrot's description of prairie and wetland plant exploitation: Perrot, 'Memoir on the Manners, Customs, and Religion of the Savages of North America', 113–19.

⁵⁶ Gonella, 'Myaamia Ethnobotany', 31.

⁵⁷ Perrot, 'Memoir on the Manners, Customs, and Religion of the Savages of North America', 113. See also Morgan, *Land of Big Rivers*, 45–68.

⁵⁸ Gonella, 'Myaamia Ethnobotany', 21.

⁵⁹ Liette, 'Memoir Concerning the Illinois Country', 347.

⁶⁰ Gonella, 'Myaamia Ethnobotany', 19.

⁶¹ Liette, 'Memoir Concerning the Illinois Country', 347.

⁶² See Mike Gonella's fascinating case study of milkweed cultivation and harvesting. Gonella, 'Myaamia Ethnobotany'.

which were important to Illinois diet and technology.⁶³ Importantly, in contrast to ecozones such as the prairie and wetland, the density of useful species in the forest was relatively low; here useful species were more spread out, requiring a large amount of forest land cover to supply the Illinois with all their needs. Although many of the Illinois's well-tested ecological traditions were based in the forest, the landscape of Illinois Country was relatively scarce in this particular ecozone.⁶⁴ As we will see, this could pose a problem.

Importantly, the Illinois were not just inheritors of a wild landscape when they arrived in the Illinois Valley. Rather, they shaped and altered much of this region as an anthropogenic creation. Like many other indigenous groups in North America, their most important tool was fire. Burning the prairies, they made the grasses hospitable for grazers, and managed prairie as a game reserve to maximize productivity. At the woodland edges, they burned back forest undergrowth to encourage the park-like savannahs that eyewitnesses like Liette recognized as planful landscapes. Removing beavers from lowland pools, they converted creek bottoms into mesic forest — characterized by a moderate degree of moisture — in order to encourage hardwood species such as maples. As Sam Muñoz has argued, it was through these active processes of 'niche construction' that Native groups like the Illinois altered and shaped their landscapes at scales from the local to the regional.⁶⁵

Yet even as they shaped the landscape and helped to foster this mosaic of woodland, prairie, marsh and lowlands, there were limits to how thoroughly indigenous peoples of the Illinois Valley could control their landscape. As a result, village location was a crucial factor in allowing the Illinois to take advantage of the diverse components of their ecological system. Seventeenth-

⁶³ Liette, 'Memoir Concerning the Illinois Country', 320.

⁶⁴ Gonella, 'Myaamia Ethnobotany', 31.

⁶⁵ Samuel E. Munoz *et al.*, 'Defining the Spatial Patterns of Historical Land Use Associated with the Indigenous Societies of Eastern North America', *Journal of Biogeography*, xli (2014). For inspiring studies of Native American landscape use and creation, see M. Kat Anderson, *Tending the Wild: Native American Knowledge and the Management of California's Natural Resources* (Berkeley, Calif., 2005); Thomas C. Blackburn and Kat Anderson (eds.), *Before the Wilderness: Environmental Management by Native Californians* (Menlo Park, Calif., 1993); Omer C. Stewart, *Forgotten Fires: Native Americans and the Transient Wilderness*, ed. Henry T. Lewis and M. Kat Anderson (Norman, 2009). See also James C. Scott, *Against the Grain: A Deep History of the Earliest States* (New Haven, 2017), 70–1.

century village locales in the upper Illinois Valley, such as the Grand Village of the Kaskaskia, as well as the Peoria Village (or Haas-Hagerman site) in the Des Moines River Valley, conspicuously put the Illinois in close reach of all five important ecozones mentioned earlier. And although indigenous evidence about the intentions behind Illinois village locations is rare, place names in Illinois Country suggest the role that the ecological situation of villages played in their selection. Take for instance the Illinois Valley village site of Pimitéoui, occupied by the Illinois beginning around 1690. As Michael McCafferty has recently shown in a brilliant piece of detective work, the name for this important village — which probably translates literally to ‘it burns past’ — spoke directly to the presence of upland forests in this location, and their imperviousness to prairie fire, in contrast to villages further to the north.⁶⁶ As this name suggests — and not surprisingly — the Illinois paid especially close attention to the availability of forest cover in the places where they chose to settle. Using landcover data from 1800 as a rough proxy for pre-contact vegetation zones, it is possible to visualize how Illinois village locations like the Grand Village and Pimitéoui kept the Illinois within reach of the quintet of ecozones upon which their lifestyle depended (see Figure 3).

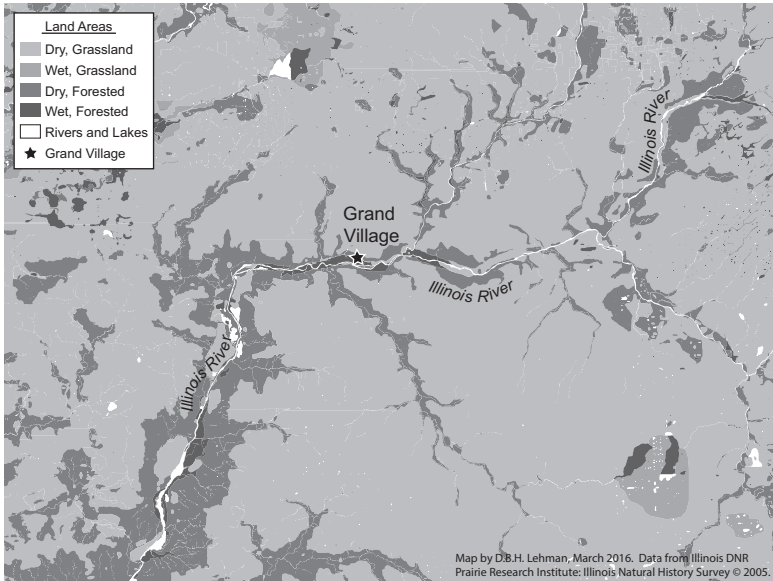
In many respects, the patterns described above made the Illinois similar to other indigenous peoples in seventeenth-century North America. It was not so unusual for indigenous peoples after 1000 CE to practise a diverse economy based on agriculture and secondary hunting and gathering food cycles, nor was it unique that the Illinois exploited distinct zones by moving across the landscape and settling close to multiple resources. The great variety of ecozones available to the Illinois at the forest–prairie tension zone was exceptional in its scale, but it was not qualitatively unique.⁶⁷

However, there were aspects of this human ecology that were definitely distinctive, and which play into our exploration of the impact of climate on Illinois history. To understand why, we need to take a step back. The Illinois Country was an especially diverse ecoregion, and that made it special in ways that even outsiders like

⁶⁶ Michael McCafferty, ‘The Illinois Place Name “Pimitéoui”’, *Journal of the Illinois State Historical Society*, cii (2009).

⁶⁷ Cronon, *Changes in the Land*, ch. 2.

FIGURE 3



Location of Grand Village of the Kaskaskia (modern-day Starved Rock, Illinois), c.1680s. In the seventeenth century, the Illinois located their villages within close range of all four ecozones important to their ways of life — woodlands (mesic and dry-mesic), prairies, wetlands and floodplains. Land-cover data taken from the early 1800s as a rough proxy. See <<https://clearinghouse.isgs.illinois.edu/data/landcover/illinois-landcover-early-1800s>>.

the French could see. But perhaps its most distinctive ecological feature was completely invisible: its dynamic history. So far we have seen how the Illinois exploited diverse resources in what ecologists categorize as a transition zone. But the word ‘transition’ applies to Illinois Country ecology in more ways than one. Turning our attention to less conventional historical archives — such as those comprised of pollen and charcoal sedimented on lake bottoms — it is time to put the history of the Illinois in the context of deep ecological history. As scientists have learned over the past generations, a central distinguishing characteristic of the tallgrass prairie was that it was a recently established and unstable landscape, *in transition*.

As we have seen, the Illinois were newcomers to this region. But they were not the only ones.⁶⁸

II THE DEEP HISTORY OF THE TALLGRASS PRAIRIE ECOTONE

It is interesting to note that the first generation of professional ecologists in North America spent a great deal of time studying the tallgrass ecotone. It was in studying this region and its distinctive edge habitats that scientists like Frederic Clements first hammered out the theory of plant succession in the first half of the twentieth century. As is well known, scientific pioneers such as Clements and Henry Cowles, among others, believed strongly in the concept of climax ecology, the idea that vegetation tended towards an equilibrium after advancing through predetermined and regular stages of evolution. Plant communities — as early twentieth-century ecologists called them — had a certain built-in telos. Darwin had illustrated the idea of biological species engaged in webs of competition; the task of ecology was to explain vegetation zones by virtue of the contentious (and sometimes harmonious) interrelationships among species present in the community. The local environment was an organism in its own right.⁶⁹

These early theories fit well with the notion that the prairies were an almost timeless landscape. The climax theory meant that particular prairie plants were destined to be there, balanced in the exact relationships in which they were found on what Clements and others considered ‘pristine’, ‘true prairies’.⁷⁰ Meanwhile natural historians echoed this notion, admiring the relic prairies of the Midwest which gave a sense of how the landscape should have looked in its ‘primeval’ state before the landscape became ‘the product of human manipulation’.⁷¹ Many early twentieth-

⁶⁸ Henry Allan Gleason, ‘The Vegetational History of the Middle West’, *Annals of the Association of American Geographers*, xii (1922), 41.

⁶⁹ James Claude Malin, ‘Plant Ecology’, in *The Grassland of North America: Prolegomena to Its History* (Lawrence, Kan., 1947), ch. 2; Ronald C. Tobey, *Saving the Prairies: The Life Cycle of the Founding School of American Plant Ecology, 1895–1955* (Berkeley, Calif., 1981).

⁷⁰ Malin, *Grassland of North America*, 7.

⁷¹ Betty Flanders Thomson, *The Shaping of America’s Heartland: The Landscape of the Middle West* (Boston, 1977), 180–2.

century researchers thought that the prairies, like much of the vegetation cover of North America, were ancient. Studying the original formation of the prairie, scientists theorized many explanations ranging from soil types to geological factors to precipitation patterns, and authorities like Clements agreed that the formation of the prairie stemmed from factors that dated millions of years into the past.⁷² Many even believed the prairies to be older than most other vegetation zones on the continent, dating to the Miocene, 25–5 million years before present.

However, recent research has told a different story. First of all, ecologists discarded the notion of steady-state climax equilibrium, and they acknowledged that plant communities like the tallgrass prairie changed over time, not according to preordained laws of succession.⁷³ More importantly, advances in the science of vegetation history rewrote the understanding of the origin of the prairie. It was not the Rocky Mountains or soil types that created the eastern prairies, but rather a combination of drought, wildfire, anthropogenic fire, glacial endowments and precipitation patterns. Moreover, this happened a relatively short time ago, within the Holocene. The new consensus is that the tallgrass landscape — and particularly its eastern extent — was relatively recently formed, indeed one of the newest biotic communities on the continent.⁷⁴

Paleoecology research shows us why.⁷⁵ For instance, much recent research in pollen records demonstrates the vegetation

⁷² Daniel I. Axelrod, 'Rise of the Grassland Biome, Central North America', *Botanical Review*, li (1985), 166; M. K. Elias, 'Tertiary Grasses and Other Prairie Vegetation from High Plains of North America.', *American Journal of Science*, xxix (1935); Frederic E. Clements, 'Nature and Structure of the Climax', *Journal of Ecology*, xxiv (1936).

⁷³ For a useful synthesis, Daniel B. Botkin, *Discordant Harmonies: A New Ecology for the Twenty-First Century* (New York, 1990); Donald Worster, *Nature's Economy: A History of Ecological Ideas* (Cambridge, 1994).

⁷⁴ Axelrod, 'Rise of the Grassland Biome, Central North America', 167; James Ellis, 'Understanding Prairie in the Prairie State', in Nature Conservancy (U.S.) *et al.* (eds.), *Illinois Master Naturalist Curriculum Guide* (Urbana, 2008); Roger C. Anderson, 'Evolution and Origin of the Central Grassland of North America: Climate, Fire, and Mammalian Grazers', *The Journal of the Torrey Botanical Society*, cxxxiii (2006); Stanley A. Changnon, Kenneth E. Kunkel and Derek Winstanley, 'Climate Factors That Caused the Unique Tall Grass Prairie in the Central United States', *Physical Geography*, xxiii (2002); John H. McAndrews, 'Postglacial History of Prairie, Savanna, and Forest in Northwestern Minnesota', *Memoirs of the Torrey Botanical Club*, xxii (1966).

⁷⁵ Owen K. Davis, 'Palynology: An Important Tool for Discovering Historic Ecosystems', in Dave Egan and Evelyn A. Howell (eds.), *The Historical Ecology*
(cont. on p. 61)

history of the mid-continent.⁷⁶ First of all, and contrary to the old consensus, prior to the late Pleistocene ice ages, the landscape of the tallgrass region was defined by forests. Upending theories that held that the central shaper of the prairie was aridity caused by the 55-million-year-old Rocky Mountain rain shadow, scientists discovered that this region received much more rainfall in periods before the Holocene, and was dominated by elm, maple and other hardwood taxa as recently as the late Pleistocene.⁷⁷

If this is true, it follows that the tallgrass prairie was formed quite recently. While different studies show varying chronologies, the recent consensus among palynologists is that the prairie–forest transition zone was established on top of glacial till 9,000 years before present, and pushed east rapidly in a period of exceptional aridity.⁷⁸ At the eastern edge of the zone, a marked spike in non-arboreal pollen (grass and forbs) accompanied a rise in mid-Holocene aridity around 6,000 years before present in Chatsworth Bog, in central Illinois.⁷⁹ Grasses, of course, are much more resistant to drought and aridity than trees, mostly because of the C₄ carbon pathway that they use in photosynthesis.

However, it was not just aridity that drove the prairies eastward and northward. As Edgar Transeau established in the 1930s, much of the prairie peninsula region received plenty of annual rainfall to support trees, even during years of drought.⁸⁰ Thus another factor helped to form the eastern prairies: fire. Recent charcoal studies confirm that a rise in fire frequency accompanied the rise of the grassland ecotone and its eastern push.

(n. 75 cont.)

Handbook: A Restorationist's Guide to Reference Ecosystems (Washington, DC, 2005); Neil Roberts, *The Holocene: An Environmental History* (Oxford, 1998).

⁷⁶ Anthony M. Davis, 'The Prairie-Deciduous Forest Ecotone in the Upper Middle West', *Annals of the Association of American Geographers*, lxvii (1977).

⁷⁷ Axelrod, 'Rise of the Grassland Biome, Central North America', 168–70.

⁷⁸ Roger C. Anderson, 'The Eastern Prairie–Forest Transition: An Overview', in *Proceedings of the Eighth North American Prairie Conference* (1983); David M. Nelson *et al.*, 'The Influence of Aridity and Fire on Holocene Prairie Communities in the Eastern Prairie Peninsula', *Ecology*, lxxxvii (2006); John W. Williams, Bryan Shuman and Patrick J. Bartlein, 'Rapid Responses of the Prairie-Forest Ecotone to Early Holocene Aridity in Mid-Continental North America', *Global and Planetary Change*, lxxvi (2009); Joseph J. Williams *et al.*, 'Ecosystem Development Following Deglaciation: A New Sedimentary Record from Devils Lake, Wisconsin, USA', *Quaternary Science Reviews*, cxxv (2015).

⁷⁹ Nelson *et al.*, 'Influence of Aridity and Fire on Holocene Prairie Communities in the Eastern Prairie Peninsula'.

⁸⁰ Edgar Nelson Transeau, 'The Prairie Peninsula', *Ecology*, xvi (1935).

Importantly, many scholars agree that this increased fire frequency was almost certainly anthropogenic, the mark of Archaic period peoples on the landscape.⁸¹ The eastern push of the prairies happened recently, and probably in large part at the hands of people.

If fire history and pollen make it clear how and why the prairies formed just a relatively short time ago, there is one other recent discovery that proves the ‘newness’ of the tallgrass prairie in ecological terms: species composition. The tallgrass prairies were dominated by certain distinctive species — grasses like big bluestem as well as many flowering forbs. But among the most characteristic species of the tallgrass, none of them is what ecologists would call endemic, that is, present in tallgrass ecosystems but not typically present in other ecosystems. Indeed, unlike most other sub-biomes in North America, the tallgrass has precious few ‘endemic’ species. This suggests most tallgrass species did not evolve in tallgrass: they were all, in a certain biological sense, *newcomers*, assembled together in a new configuration relatively recently by filling new niches after the Ice Age.⁸²

All of this matters. Given the relative recentness and the complexity of its formation, the landscape of the tallgrass prairie was especially unstable, and particularly at the northern and eastern edges. This is what modern restoration ecologists mean when they lament of the prairie that it was ‘last evolved, first dissolved’.⁸³ Isopoll maps from late twentieth-century vegetation histories make clear how the forest–prairie edge moved rapidly across the landscape in the Holocene in response to changing conditions.⁸⁴ But if prairie pushed east rapidly in

⁸¹ Roger C. Anderson, ‘The Historic Role of Fire in the North American Grassland’, in Scott L. Collins and Linda L. Wallace (eds.), *Fire in North American Tallgrass Prairies* (1990); Stewart, *Forgotten Fires*; Anderson, *Tending the Wild*; Matthew S. Allen and Michael W. Palmer, ‘Fire History of a Prairie/Forest Boundary: More than 250 Years of Frequent Fire in a North American Tallgrass Prairie’, *Journal of Vegetation Science*, xxii (2011); Stephen J. Pyne, *Fire: A Brief History* (2011). A classic pioneer in this field is Henry Allan Gleason, ‘The Relation of Forest Distribution and Prairie Fires in the Middle West’, *Torreya*, xiii (1913).

⁸² Ellis, ‘Understanding Prairie in the Prairie State’; Axelrod, ‘Rise of the Grassland Biome, Central North America’.

⁸³ See Ken Robertson, ‘The Tallgrass Prairie in Illinois,’ at <<http://wwn.inhs.illinois.edu/~kenr/tallgrass.html>>. Quotation taken from the chapter ‘Settlement’ at <<http://wwn.inhs.illinois.edu/~kenr/prairiesettlement.html>>.

⁸⁴ Williams *et al.*, ‘Rapid Responses of the Prairie–Forest Ecotone to Early Holocene Aridity in Mid-Continental North America’; J. W. Williams *et al.*, ‘Late-Quaternary Vegetation Dynamics in North America: Scaling from Taxa to Biomes’.

response to factors like aridity and fire, the forest edge also could push back.⁸⁵ Indeed, the rapid movement of woody plant species at the forest–prairie tension zone is probably one reason that scholars like Henry Cowles and Frederic Clements developed their early theories of plant succession while working in the eastern prairies and related ecosystems — it was here in the prairie–forest ecotone that they witnessed the ecosystem changing remarkably quickly. At the grassland–forest edge, people like Cowles and Clements witnessed a grassland *tending towards forest*, constantly in flux.⁸⁶ One way of thinking about the tallgrass then is as a mosaic made by various assemblages of species in transition, even as people, fire, grazers and climate halted, held back, or sometimes hastened that transition (or in ecological terms, succession) in spatially and temporally diverse ways. Natural historians E. C. Pielou and Tim Flannery have recently written the ecological history of North America as a story about immigration and invasion.⁸⁷ The tallgrass ecotone was the ultimate landscape of newcomers and migrants — westerners moving to the east, and easterners pushing back.

If this is true for vegetation, it is also true for fauna. A good example is bison. Long overlooked in the human history of the region, a recent generation of historians has renewed a focus on this important creature and its significance in the mid-continent's history.⁸⁸ Of course, the importance of 'boeuf sauvage' was never lost on French eyewitnesses, whose accounts are full of sensational descriptions of the way the Illinois shaped their lives around these animals as pedestrian bison hunters. As the French noted, the Illinois used the bison as a secondary food cycle, killing up to 2,000 animals in a year, amounting to many thousands of pounds of meat. Historians are re-writing the history of the

⁸⁵ John Madson, *Where The Sky Began: Land of the Tallgrass Prairie* (Iowa City, 2004), 35–8.

⁸⁶ Egan and Howell, *The Historical Ecology Handbook* (editors' intro.). Davis, 'Palynology: An Important Tool', 247–52.

⁸⁷ Tim Flannery, *The Eternal Frontier: An Ecological History of North America and Its Peoples* (New York, 2001); E. C. Pielou, *After the Ice Age: The Return of Life to Glaciated North America* (Chicago, 1991).

⁸⁸ Shackelford, 'The Illinois Indians in the Confluence Region'; R. Bruce McMillan (ed.), *Records of Early Bison in Illinois* (Springfield, Ill., 2006); Chris Widga and John White, 'An Ecological History of Bison in Illinois over the Last 9000 Years' (Chicago, 2015); Robert Michael Morrissey, 'Bison Algonquians: Cycles of Violence and Exploitation in the Mississippi Valley Borderlands', *Early American Studies: An Interdisciplinary Journal*, xiii (2015).

Illinois and their neighbours to include the important place of bison in the story. Meanwhile, archaeologists and prairie restorationists are also renewing their focus on bison in the archaeology and natural history of the region.⁸⁹

However, it turns out that the story of bison in the tallgrass is not a simple one. Reflecting larger patterns in the tallgrass region, the bison were newcomers too.⁹⁰ Recent research shows a substantial increase in the presence of bison in the archaeology of Illinois starting after 1000 CE. Evidence suggests that an increasing percentage of these archaeological deposits comprise locally hunted animals, not trade animals. Indeed, data amassed by paleontologist Chris Widga and ecologist John White constitutes evidence of what Elinor Melville has called an 'ungulate irruption', a sudden upsurge in the numbers of bison in the region, and especially in the Illinois Valley, during this period.⁹¹

Importantly, this was not just a matter of 'arrival' or 'immigration', but something more complex. First of all, it is worth noting that bison were not endemic to tallgrass. Indeed, the high cellulose content of most grasses in the eastern prairies was suboptimal for bison grazing, especially in late summer, and especially without a highly planful human fire regime designed purposefully to enhance the grazing ability of the landscape.⁹² Certainly bison were present in small numbers in temperate regions, but recent studies of bison in eastern ecosystems make it clear that they had adapted an entirely different habit as

⁸⁹ McMillan, *Records of Early Bison in Illinois*. In 2014, a herd of bison was brought to Nachusa Prairie, a tallgrass prairie preserve in Northern Illinois. Since then, herds of bison have been established also at Midewin National Tallgrass Prairie and at Fermilab. These herds represent the first bison in the state of Illinois since the early 1800s.

⁹⁰ John White, *A Review of the American Bison in Illinois with an Emphasis on Historical Accounts* (Urbana, 1996); McMillan, *Records of Early Bison in Illinois*; Kenneth B. Tankersley, 'Bison and Subsistence Change: The Protohistoric Ohio Valley and Illinois Valley Connection', in Dale Croes, Rebecca Hawkins and Barry Isaac (eds.), *Long-Term Subsistence Change in Prehistoric North America* (1992).

⁹¹ Widga and White, 'Ecological History of Bison in Illinois over the Last 9000 Years'; Elinor G. K. Melville, *A Plague of Sheep: Environmental Consequences of the Conquest of Mexico* (Cambridge, 1994).

⁹² Alan K. Knapp *et al.*, 'Keystone Role of Bison in North American Tallgrass Prairie', *BioScience*, xlix (1999); Anderson, 'Evolution and Origin of the Central Grassland of North America'; S. D. Fuhlendorf and D. M. Engle, 'Application of the Fire-Grazing Interaction to Restore a Shifting Mosaic on Tallgrass Prairie', *Journal of Applied Ecology*, xli (2004).

browsers, not as grazers. As Widga has shown, bison bones from eastern archaeological deposits in the mid-Holocene contained the signature of a woody browse diet (C_3 carbon pathway), rather than the signature of grassland grazers (C_4). For instance, the bison subfossils unearthed at Big Bone Lick in Kentucky were dominated by C_3 carbon pathway and characteristic patterns of tooth enamel wear, reflecting a woody diet.⁹³

Small numbers of bison, mostly exhibiting this browsing habit, were present in almost all present-day states east of the Mississippi in the Holocene. But their numbers were low, since their small herd size, sex distribution, and unusual migration patterns limited population relative to western bison. They were not a significant resource in the diets and lifestyles of humans east of the Mississippi.

So what happened in the Illinois Country in the period after 1000 CE? Why did bison numbers grow suddenly and extensively? The mechanism is not entirely clear. It may well have been a result of the decline of Cahokia, which lowered the human population in the area of the Illinois Valley, clearing the way for bison occupation. Another theory is that Oneota migrants from the West, ancestors of Siouan-speaking Winnebagos and others, brought a western fire regime, enhancing the attraction of the tallgrass for bison.⁹⁴ Another factor may well have been climate change. Climatologists including Edward Cook have established that the period after the fall of Cahokia was characterized by extended droughts in the tallgrass peninsula.⁹⁵ Moreover, pollen records from the lower Illinois Valley show a spike in non-arboreal (grass and forbs) pollen in the same period, 1300–1500, hinting at a quite speedy extension of prairie in the region, perhaps as a function of increased drought.⁹⁶

⁹³ Chris Widga, 'Niche Variability in Late Holocene Bison: A Perspective from Big Bone Lick, KY', *Journal of Archaeological Science*, xxxiii (2006); Widga and White, 'Ecological History of Bison in Illinois over the Last 9000 Years'.

⁹⁴ White, *Review of the American Bison in Illinois with an Emphasis on Historical Accounts*; John A. Jakle, 'The American Bison and the Human Occupance of the Ohio Valley', *Proceedings of the American Philosophical Society*, cxii (1968).

⁹⁵ Edward R. Cook *et al.*, 'North American Drought: Reconstructions, Causes, and Consequences', *Earth-Science Reviews*, lxxxi (2007); Stambaugh *et al.*, 'Drought Duration and Frequency in the U.S. Corn Belt during the Last Millennium'.

⁹⁶ Amy Lynn Ollendorf, 'Changing Landscapes in the American Bottom (United States of America): An Interdisciplinary Investigation with an Emphasis on the Late-Prehistoric and Early-Historic Periods' (Univ. of Minnesota Ph.D. thesis, 1993).

It may be a combination of these factors that encouraged the sudden rise in bison population after Cahokia. One interesting and quite mysterious fact is that many bison bones from this period of Illinois archaeology show the C_4 carbon pathway typical of grazers, not the C_3 pathway typical of browsers. The sudden arrival of bison was connected with a sudden shift in the habit of bison — these seem to be the first *grazing* bison east of the Mississippi!⁹⁷

It is perhaps not necessary for our purposes to pinpoint precisely why bison numbers increased in the Illinois Valley after 1000. What is important to note is that they did increase, and like other components of the prairie ecosystem, they pushed east into a region that was a novel habitat for them. The bison are a perfect reflection of the instability and flux in the prairie landscape, where species were constantly moving and changing in response to sometimes uncertain factors, just as the isopoll maps show for vegetation communities. This was a landscape of newcomers.

However, the most important flux in the region was certainly the prairie–forest vegetation boundary, where newcomer prairie species competed with forest and wetland taxa vying to extend their own range.⁹⁸ What seems clear is that the great potential energy in the tension zone was the tendency *towards forest*. Indeed, part of the reason for the great interest in the vegetational history of the tallgrass prairie has always been the mismatch between the region's plant cover and underlying climate conditions, which do not seem to predict prairie, but rather forest. As many have observed, the prairie peninsula is the only large grassland ecosystem on the planet in such a humid environment.⁹⁹ Much evidence suggests that it was trending towards forest over time.¹⁰⁰ The question for most ecologists is not so much what caused prairie in the Midwest, but rather what *prevented* forest succession? And the answer has recently focused especially around human history. Without contingencies such as poorly

⁹⁷ Widga and White, 'Ecological History of Bison in Illinois over the Last 9000 Years'.

⁹⁸ Madson refers to this phenomenon as a 'battleground of floristic groups'. Madson, *Where The Sky Began*, 35.

⁹⁹ Changnon, Kunkel and Winstanley, 'Climate Factors That Caused the Unique Tall Grass Prairie in the Central United States', 260.

¹⁰⁰ Transeau, 'Prairie Peninsula'.

understood patterns of anthropogenic fire, or the even more mysterious agency of bison grazers of the period after 1000, the forest surely would have advanced and overtaken the unstable newcomer grassland.¹⁰¹

In this light, the ecological situation of the *human* newcomers in Illinois takes on new meaning. Migrating into the edge in the 1600s, the Illinois did not occupy a mosaic of static vegetation types, timelessly rooted in a climax formation. Rather, they entered a relatively young and dynamic ecoregion where several vegetation communities competed against one another in an unstable process of transition. Interestingly, non-human factors of climate, soil and precipitation seemed to favour one vegetation community — the woodlands — rather clearly over the others. If this is true, then the Native peoples of the prairie most likely played a special role in this drama, by selecting the prairie against the woodlands. In spatial terms, what the protohistoric Illinois did — in a sense — was to locate themselves in the midst of migrating plant communities. Exercising their agency, they used fire and other tools to halt and shape these ecological migrations, prioritizing a diverse mix of vegetation and preventing woodlands from crowding out the other formations. Like fishermen who position their boats for trawling right at the edge of cold and warm ocean currents, the Illinois most likely knew that they could stay put in this dynamic tension zone and let the diverse zones of the ecotone *come to them*, albeit in very slow motion.¹⁰² Like fishermen, they could then select what they wanted.¹⁰³

However, this strategy — and the Illinois's access to the five vegetation zones that defined their way of life — depended on the constant and consistent process of forest succession. Of course, this was not guaranteed, and especially not in moments of significant climate change. Having explored the special instability

¹⁰¹ Knapp *et al.*, 'Keystone Role of Bison in North American Tallgrass Prairie'; John M. Briggs and Alan K. Knapp, 'Interannual Variability in Primary Production in Tallgrass Prairie: Climate, Soil Moisture, Topographic Position, and Fire as Determinants of Aboveground Biomass', *American Journal of Botany*, lxxxii (1995); David C. Hartnett, Karen R. Hickman and Laura E. Fischer Walter, 'Effects of Bison Grazing, Fire, and Topography on Floristic Diversity in Tall-Grass Prairie', *Journal of Range Management*, xlix (1996); Fuhlendorf and Engle, 'Application of the Fire-Grazing Interaction to Restore a Shifting Mosaic on Tallgrass Prairie'.

¹⁰² Mark Kurlansky, *Cod: A Biography of the Fish That Changed the World* (New York, 1998), 43.

¹⁰³ For another example of this kind of strategy, see Scott, *Against the Grain*, 52.

of the Illinois's location, we now take the final step in this forensic journey to examine how the specific stresses of the late seventeenth-century drought over the mid-continent might have impacted these processes. Anthropologists 'upstream' from modern-day cultural patterns to try to understand past human culture.¹⁰⁴ In what follows, I use modern-day ecological research in a similar way to speculate about the effects that would have resulted from the climate change conditions we now know took place in the second half of the seventeenth century.¹⁰⁵

III ECOLOGY AND THE UPSHOT

It is not hard to understand why climate change has not featured in most accounts of the history of the mid-continent in the early colonial period. For while eyewitness accounts are plentiful and detailed, they contain almost no data about changing weather. French explorers at the end of the seventeenth century certainly did discuss the climate in Illinois, but primarily to distinguish the region's mild weather from the intense cold of Quebec. The tiniest shreds of evidence suggest that the severe winters that affected New England in these years may have had some corollary in the mid-continent, for example Liette complained of 'cold spells in May as severe as those of winter'.¹⁰⁶ Of course, these reports are far less frequent than positive reflections on the warmth of Illinois, or Marquette's typical report that 'winter is only known there by the rains'.¹⁰⁷ As for drought, there is almost no mention whatsoever in the French sources.

However, if we expand our source base — this time to include ecological data and especially tree rings — new information makes it certain that Illinois Country faced an extraordinary period of drought at the end of the seventeenth century. Tree-ring records for the corn belt, based on regional data including several stands of oak trees from just south of the Illinois Valley, give good insight into the changing climate of the mid-continent

¹⁰⁴ William N. Fenton, 'Ethnohistory and Its Problems', *Ethnohistory*, ix (1962).

¹⁰⁵ For thoughts on this methodology, see Neil Roberts, 'Reconstructing Holocene Environments', in *The Holocene: An Environmental History* (Oxford, 1998).

¹⁰⁶ Liette, 'Memoir Concerning the Illinois Country', 339.

¹⁰⁷ Dablon, '1674', in *Jesuit Relations*, lxiii, 99.

over a thousand years.¹⁰⁸ Of course, there are complexities in these archives that are worth discussing. The first and most important caveat for historians venturing into tree-ring science is understanding what these methods of climate reconstruction cannot tell us. The biggest limitation of dendroclimatology methods is that they only ever give us information about two things: annual rainfall, and average summertime temperature. Extremely cutting-edge work can reveal patterns in the early and late growth of tree rings to distinguish seasonal temperature and precipitation, but this requires excellent data. It is probably hopeless in the case of the Midwest of North America, for reasons that relate to another limitation of dendroclimatology research.

The greatest challenge of tree-ring research is ‘detrending’ — the process of isolating that portion of the variation in a tree’s annual growth pattern that was likely driven by differential rates of rainfall or temperature.¹⁰⁹ Importantly, this detrending is easiest to do when the tree in question grew at the extreme edge of its species’ range in terms of either temperature or precipitation. For this reason, the highest resolution tree-ring studies often happen in alpine regions where temperature or precipitation patterns are most likely to be the primary limiter of growth for many tree species in any given year. This is simply not true of the oak trees of the Midwest, however, which are solidly in the middle of their range. For these trees, many other environmental factors besides rainfall and temperature may be responsible for variations in growth patterns.¹¹⁰

For all these reasons, our picture of paleoclimate change in the Midwest has been a long-term challenge, and still remains difficult. Apart from models, we do not have a high-resolution annual temperature series specific to the American Midwest. But

¹⁰⁸ V. Trouet *et al.*, ‘A 1500-Year Reconstruction of Annual Mean Temperature for Temperate North America on Decadal-to-Multidecadal Time Scales’, *Environmental Research Letters*, viii (2013).

¹⁰⁹ Kurt Kipfmüller and Thomas Swetnam, ‘Using Dendrochronology to Reconstruct the History of Forest and Woodland Ecosystems’, in Dave Egan and Evelyn A. Howell (eds.), *The Historical Ecology Handbook: A Restorationist’s Guide to Reference Ecosystems* (Washington, DC, 2005). See also Raymond S. Bradley, *Paleoclimatology: Reconstructing Climates of the Quaternary* (Amsterdam, 2015) esp. ch. 13.

¹¹⁰ Kipfmüller and Swetnam, ‘Using Dendrochronology to Reconstruct the History of Forest and Woodland Ecosystems’.

we do have a clearer picture of historical drought. In a paper published in 2011, researchers including Michael Stambaugh, with the collaboration of Edward Cook and the Lamont–Doherty Earth Observatory at Columbia University, released a new paper estimating drought history in the corn belt from 992–2004.¹¹¹ Synthesizing a series of tree-ring studies collected from streams in east-central Iowa, their findings pinpointed the most severe drought episodes in the region during this period, and fleshed out a growing consensus around modelling the region's drought history.¹¹² As Stambaugh *et al.* showed, starting in 1651, the mid-continent entered the fourth worst multi-year drought in the last thousand years, a drought that lasted until 1705. Reflecting the severity of the period, 1698 was not just an extremely bad year of drought for this series, it was the ninth worst year of drought in the region for the whole of the last millennium.¹¹³ Overall, Stambaugh *et al.* argued, the half century of drought in the Midwest in the seventeenth century compares favourably in its intensity with droughts like the Dust Bowl of the 1930s. It was a tremendous climate event.

So although the French sources do not make much mention of changing weather in this period, environmental history should not ignore the story the tree rings tell. The challenge of course is figuring out whether and how this prolonged drought may have impacted events on the ground in Illinois. Happily, we have a flourishing body of research about how tallgrass prairie ecosystems and prairie–forest edges interact with changing moisture conditions in modern times. Over the past thirty years, researchers have produced a vibrant literature on climate and ecotones, including much literature on the forest–prairie edge in the American Midwest (and particularly Minnesota).¹¹⁴

¹¹¹ Stambaugh *et al.*, 'Drought Duration and Frequency in the U.S. Corn Belt during the Last Millennium'.

¹¹² Cook *et al.*, 'North American Drought'; David W. Stahle *et al.*, 'Tree-Ring Reconstructed Megadroughts over North America since AD 1300', *Climatic Change*, lxxxiii (2007).

¹¹³ Stambaugh *et al.*, 'Drought Duration and Frequency', 158.

¹¹⁴ Williams, Shuman and Bartlein, 'Rapid Responses of the Prairie–Forest Ecotone to Early Holocene Aridity in Mid-Continental North America'; Charles E. Umbanhowar Jr *et al.*, 'Asymmetric Vegetation Responses to Mid-Holocene Aridity at the Prairie–Forest Ecotone in South-Central Minnesota', *Quaternary Research*, lxxvi (2006); Richard G. Baker *et al.*, 'Patterns of Holocene Environmental Change in the Midwestern United States', *Quaternary Research*, xxxvii (1992); David M. Nelson and Feng Sheng Hu, 'Patterns and Drivers of Holocene Vegetational Change near the

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Meanwhile, since 1971, Konza Prairie in the Flint Hills of Kansas has been a centre for research on tallgrass prairie ecology, focusing on questions of plant communities, grazing and fire, and more recently, climate change.¹¹⁵ Considered in the context of history, literature from these related lines of research suggests several phenomena that may well have operated in the eastern prairies during the extreme drought conditions of the late seventeenth century. Most importantly, it suggests the likelihood that drought slowed forest succession in the tallgrass mosaic, leading to an extension of prairie plants further to the north and east into the forest tension zone. Although this is the most tentative part of my forensic journey, much of the current research about climate in tallgrass prairie makes the link between drought and an extension of prairie into the forest–prairie border.

For instance, several studies of ecotone response to climate change show important changes in species composition as a clear impact. One suggestive study in Minnesota examined data about the relationship between vegetation and climatic moisture availability across the grassland–forest biome boundary. Focusing in particular on the variable of precipitation *minus* the potential evaporation (a good standardized measure of moisture across time and space), researchers found a high response to relatively modest changes in moisture, especially in a sharp ecological boundary region.¹¹⁶ At Konza Prairie, researchers found a predictable dieback of oak seedlings at the forest–prairie ecotone in response to climate change–related drought.¹¹⁷ In New

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Prairie–Forest Ecotone in Minnesota: Revisiting McAndrews’ Transect’, *New Phytologist*, clxxix (2008); Paolo D’Odorico *et al.*, ‘Vegetation–Microclimate Feedbacks in Woodland–Grassland Ecotones’, *Global Ecology and Biogeography*, xxii (2013); Nelson *et al.*, ‘Influence of Aridity and Fire on Holocene Prairie Communities’; Fuhlendorf and Engle, ‘Application of the Fire–Grazing Interaction to Restore a Shifting Mosaic on Tallgrass Prairie’.

¹¹⁵ Alan K. Knapp (ed.), *Grassland Dynamics: Long-Term Ecological Research in Tallgrass Prairie* (New York, 1998).

¹¹⁶ Nicholas P. Danz *et al.*, ‘Do Vegetation Boundaries Display Smooth or Abrupt Spatial Transitions along Environmental Gradients? Evidence from the Prairie–Forest Biome Boundary of Historic Minnesota, USA’, *Journal of Vegetation Science*, xxiv (2013).

¹¹⁷ Peter H. Wyckoff and Rachel Bowers, ‘Response of the Prairie–Forest Border to Climate Change: Impacts of Increasing Drought May Be Mitigated by Increasing CO₂’, *Journal of Ecology*, xcvi (2009); Brett T. Danner and Alan K. Knapp, ‘Growth Dynamics of Oak Seedlings (*Quercus Macrocarpa* Michx. and *Quercus*

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Mexico, an influential study found significant forest dieback and fragmentation in response to a regional drought in the 1950s at a forest–woodland ecotone.¹¹⁸ A study of forest regeneration dynamics under drought conditions found that ash forests in the northeast of the United States were one of just seven forest types to experience a failure of species regeneration in response to decreased moisture, giving way to shrubland.¹¹⁹

If research on the modern day suggests these responses, more general research on ecotone responses to climate change in the distant past is perhaps even more suggestive. For instance, Feng Sheng Hu and others have shown recently that drought, much more than fire, was responsible for pronounced advances of the prairie (and forest diebacks) at the forest tension zone in the mid-Holocene.¹²⁰ Examining another forest tension zone, researchers have documented a rapid response in species composition in Michigan as a reaction to climate events including drought.¹²¹ Speleothem evidence backs up these findings of rapid fluctuations in species composition as a function of moisture availability in the past.¹²²

Perhaps most suggestively, recent research examining stark changes in tree species' range in response to climate change has suggested a surprisingly rapid reaction by many deciduous tree species to changes in moisture availability over the past three decades. Noting a marked yet small increase in total annual

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Muhlenbergii Engelm.) from Gallery Forests: Implications for Forest Expansion into Grasslands', *Trees*, xv (2001).

¹¹⁸ Craig D. Allen and David D. Breshears, 'Drought-Induced Shift of a Forest–Woodland Ecotone: Rapid Landscape Response to Climate Variation', *Proceedings of the National Academy of Sciences of the United States of America*, xcv (1998).

¹¹⁹ Jordi Martínez-Vilalta and Francisco Lloret, 'Drought-Induced Vegetation Shifts in Terrestrial Ecosystems: The Key Role of Regeneration Dynamics', *Global and Planetary Change*, cxliv (2016).

¹²⁰ Baker *et al.*, 'Patterns of Holocene Environmental Change in the Midwestern United States'; Nelson and Hu, 'Patterns and Drivers of Holocene Vegetational Change near the Prairie–Forest Ecotone in Minnesota'; Nelson *et al.*, 'Influence of Aridity and Fire on Holocene Prairie Communities in the Eastern Prairie Peninsula'; David M. Nelson *et al.*, 'Response of C₃ and C₄ Plants to Middle-Holocene Climatic Variation near the Prairie–Forest Ecotone of Minnesota', *Proceedings of the National Academy of Sciences of the United States of America*, ci (2004).

¹²¹ Christina M. Hupy and Catherine H. Yansa, 'Late Holocene Vegetation History of the Forest Tension Zone in Central Lower Michigan, USA', *Physical Geography*, xxx (2009).

¹²² R. F. Denniston *et al.*, 'Speleothem Evidence for Holocene Fluctuations of the Prairie-Forest Ecotone, North-Central USA', *The Holocene*, ix (1999).

precipitation in the middle of the North American continent during that period, scientists have observed a related westward shift in the range of many deciduous tree species as saplings and succession processes respond to wetter conditions. For species centred in the forest–prairie transition zone, the median species had a westward shift of 30.0 km per decade in response to an average increase of between 100 and 150 mm of annual precipitation! And if scientists are correct that this westward migration of tree species is in response to small increases in moisture availability, then one might infer that the drought conditions of the seventeenth century may have produced the opposite effect: interrupted succession and *eastward* movement of the forest–prairie edge.¹²³

Of course, neither early Holocene nor modern-day conditions tell us precisely about what happened in the seventeenth century. And since available pollen data does not allow for a high-resolution reconstruction of vegetation history at a local scale in Illinois, these proxies are the best sources we have. Still, inferring from these studies might be instructive. Taken together, they point to the possibility that the drought events of the late seventeenth century may have halted the long-term trends towards reforestation in the eastern prairies, slowing down and even reversing forest succession in some places. In these conditions, forests also would have been more susceptible to fires (indeed, the exacerbating effect of drought on forest fire regimes is well established).¹²⁴ Wetlands might have dried out in some years.¹²⁵ The whole ecotone could have shifted to the east.

There is no smoking-gun evidence that this happened, but consider: in the 1690s, precisely during the driest years of the late seventeenth-century drought, all of the Illinois speakers, including the Peorias and Kaskaskias, relocated from the region around Starved Rock (the so-called Grand Village of the Kaskaskias) to a new location near modern-day Peoria. Describing their motivation, commandant Liette explained that

¹²³ Songlin Fei *et al.*, ‘Divergence of Species Responses to Climate Change’, *Science Advances*, iii (2017), 2; Robinson Meyer, ‘American Trees Are Moving West, and No One Knows Why’, *The Atlantic* (2017).

¹²⁴ Jeremy S. Littell *et al.*, ‘A Review of the Relationships between Drought and Forest Fire in the United States’, *Global Change Biology*, xxii (2016).

¹²⁵ Intriguingly, Raudot commented on dried-out wetlands in the Illinois Country in his writings from the early 1700s. Raudot, ‘Memoir Concerning the Different Indian Nations of North America’, 386.

the previous village location was inconveniently located relative to water sources, and that it had grown unsustainable because ‘their firewood was so remote’.¹²⁶ Their new location was the village previously mentioned as Pimitéoui. As we have already seen, the literal meaning of this word was ‘it burns past’ or ‘fire passes through’, a reference to the fact that here was a place where forests had not been burned by prairie.¹²⁷

Considered in the context of the Illinois’s history and ecological setting, this idea of a forest not destroyed by fire seems especially significant. Could it be that in the 1690s — the height of the late seventeenth-century drought in the Illinois Valley — the Illinois had in fact destroyed much of the forest of their previous locations, not only by collecting firewood, but by setting prairie fires? As speculated above, the Illinois’s primary ecological strategy in Illinois involved waiting at the forest edge, encouraging biodiverse edges by using fire essentially to interrupt the consistent processes of forest succession that were underway since the mid-Holocene in their region. By doing this, they had access to marsh, prairie, lowland and upland woods, often within small distances from their villages.

And yet what happened if forest succession paused or even stopped? The woods were by far the smallest component of the ecoregion of the upper Illinois Valley, as a cursory examination of vegetation maps makes clear. Moreover, as Gonella showed, in comparison with all the other ecozones the Illinois utilized in their way of life, forests had the lowest resource density, meaning that the Illinois needed large patches of forest to ensure access to important plants and animals. Meanwhile, some of the most important medicine, food and technological plants were forest-based.

Settling in the midst of the prairie edge, the Illinois may well have been relying on continuing forest succession, the constant east-to-west migration of woodlands species into the forest–prairie tension zone. But drought may have ended this process, or halted it. When the Illinois moved to Pimitéoui — the place where ‘fire burns past’ but did not destroy the forest, they may not have just been looking for fuel, as Liette thought. They may have been trying to preserve their ecotone lifestyle in the face of drought-induced change.

¹²⁶ Liette, ‘Memoir Concerning the Illinois Country’, 326.

¹²⁷ McCafferty, ‘The Illinois Place Name “Pimitéoui”’.

If all of this is plausible, then it may provide a new context for understanding the relocation by the Kaskaskias to the lower Illinois Valley at the start of the eighteenth century. The upper Illinois Valley was a prosperous landscape, and offered several advantages. But when and if woody species stopped invading the ecological edge as a result of drought, and when forest resources receded to the east, the Illinois may have looked to a place with more reliable hardwood forest cover, particularly the oak-ash-hickory that was the most important forest of their ancestral homelands. Importantly, the American Bottom region in the lower Illinois Valley had substantially more rainfall, considering its nearer proximity to the Gulf of Mexico, the source of most precipitation in the mid-continent.¹²⁸ It also had huge oak-ash-hickory forests, both in the floodplains and bottomlands, as well as in the uplands. Although sources give no direct access to the Illinois's motivations, it seems plausible that availability of forest resources — in addition to other factors — played a role in shaping the Illinois's population geography at the end of the seventeenth century.

IV CONCLUSION: NEWCOMERS

Like other Native peoples in North America, the Illinois viewed relationships with plants in a different ontological frame. Positing no hierarchy of species, the Illinois viewed humans and other-than-human persons as occupying a shared world with reciprocal obligations to one another. Words for many plants and animals in the Miami-Illinois language reflect this as they are often formed with the stem *aweem-*, literally translated as 'related to' or 'relative'.¹²⁹ In short, the Illinois's relationship to the natural world was both a spiritual and a material relationship.¹³⁰

Moving to the Illinois Country in the seventeenth century, the Illinois created many new such relationships. They exploited a

¹²⁸ Stanley A. Changnon *et al.*, *Climate Atlas of Illinois* (Champaign, 2004).

¹²⁹ Gonella, 'Myaamia Ethnobotany', 9.

¹³⁰ Robin Wall Kimmerer, *Braiding Sweetgrass: Indigenous Wisdom, Scientific Knowledge and the Teachings of Plants* (2013); Robin Wall Kimmerer, 'Native Knowledge for Native Ecosystems', *Journal of Forestry*, xcvi (2000); Robert L. Hall, *An Archaeology of the Soul: North American Indian Belief and Ritual* (Urbana, 1997).

rich ecological mosaic in the prairie–forest tension zone, taking advantage of five different ecozones — marsh, lowland, agricultural fields, prairie and forest. In many ways, this new mosaic offered great opportunities and innovations. The Illinois became bison Algonquians. At the same time, the Illinois preserved long-standing traditions from their past in the woodlands landscape.

Although we cannot be totally certain, it seems reasonable and consistent with all evidence that village locations were chosen to maximize access to the diverse ecosystems on which the Illinois's way of life rested. But importantly, these resources were not part of a static system. As we have seen, the deep history of the tallgrass region reveals that the prairie–forest ecotone was in constant flux. In the area that the Illinois settled at the eastern edge, a continual process of forest succession allowed the Illinois to construct a niche that balanced the five ecozones and allowed a prosperous lifestyle. Even in the midst of an unstable region — indeed precisely because of the instability in a landscape of newcomer species — the Illinois thrived.

However, climate change may well have affected these basic realities. Recent research in ecotones and tallgrass ecology suggests the ways in which drought may have affected the succession processes — the invasion of woody species — that constituted the central dynamism of the forest–prairie ecotone in the protohistoric and early colonial period. We now know that the droughts of the late seventeenth century were long and severe enough to trigger effects like those described in much research about tallgrass prairies in particular and ecotones in general. The most severe of these drought years, 1698, was right on the eve of the Illinois's migration to the American Bottom. It seems reasonable that these important changes may well have been connected.

Of course there is no smoking gun. But even if not neatly definitive as a causal explanation, a forensic journey like this reveals the important and long misunderstood natural and human history of the North American mid-continent. Not only was this one of the more important cultural and ecological borderlands in North America, it was a landscape of newcomers passing through an important moment of change. Historians have too often told its story as a simple matter of

homogenous prairies and reactionary Native peoples. A look at the natural history of the ecotone, together with the emerging new climate history, provides a whole new perspective.

*University of Illinois at Urbana-
Champaign*

Robert Michael Morrissey