Building Common Ground
Ecological Art Practices and Human-Nonhuman Knowledges
Edited by Emiliano Guaraldo

Uprooting Silicon Prairie

Matthew Darmour-Paul
Researcher and designer

Abstract The American Midwest is undergoing a major renovation. A landscape known for facilitating the farming and distribution of crops and animal products is transforming to enable the proliferation of digital platforms, retrofitting infrastructure like buildings, mines, factories and fields in the service of producing hardware and software that create a platform for other actors to conduct their own business. A new economic framework called the Silicon Prairie has declared Iowa, Missouri, Kansas and Nebraska as a mecca of data production. While there has been increased scholarship on the effects of the platform economy in urban areas, drawing mostly from the study of gig work, smart cities and governance optimisation, there is a noticeable gap in researching how the infrastructure of platform capitalism materialises within rural environments and smaller urban settlements. This essay presents three speculative design interventions in a project called Digital Permaculture.

Keywords Re-worlding. Multispecies. Architecture. Platforms. Regionalism. Permaculture.

1 Introduction

With around 5 billion people online today, the total energy footprint of the information and communication technology ecosystem is on par with that of air travel.[1] An article by The Guardian Environment Network (2017) estimates that by 2025, the production, circulation and storage of data is scheduled to use a fifth of the world's energy, a small fraction of which would be considered 'clean'. According to research done by Greenpeace, a single Google search, perhaps the one that led you to this essay, can use anywhere from 0.4-7.0 grams of carbon, or the equivalent of driving a car 16 metres. Just having a Gmail account open for one year consumes 1,200 kilograms of carbon. A single email without attachments can use four grams of carbon,

1 For an energy forecast of digital infrastructure, see Jones 2018.

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knowledge which might make us think twice about all of the meaningless subscriptions filling our inboxes.[2]

In early twentieth century Britain, getting 'on-the-line' became a popular expression to describe settlements connected to the material goods supplied by a railroad. Connection was quite literally referred to as the manifestation of lines materialised first on paper, in the telegraph wires, the railroad tracks of an expanded territory and later in the light speed travel of fibre optic cables. Settler industrialists, corporations, individuals and groups who had access to these powerful networks came to be associated with the economic benefits of a progressive, technological society. Today, the term 'online' is reserved for individuals who are 'active' or ready-at-hand to participate in digital communication, omitting what was historically considered a social continuum of material flows.[3]

There is not a clearer example of the ascension of on-the-line infrastructure than in the Great Plains of the American Midwest. In order to feed the growing capitalist centres of Chicago, Minneapolis and St. Louis, these settlements were established by railroad speculators in the nineteenth century to expand a burgeoning railnet and penetrate new markets, while causing irreparable damage to non-commercial forms of life and indigenous world making projects. The patterning of these developments have come to be known as 'tracks and elevator towns' as railroad companies frequently commissioned grain elevators as the first buildings from which the towns' urban form was generated. In states like North Dakota, railroad speculators and their developer confidants drew town plats in symmetrical, orthogonal, centre and square templates before arriving at the reliable 'T' layout, with a Main Street running perpendicular to the train station **[fig. 1]**. In thousands of hectares across the Midwest, T-towns were built every 10 miles, as far as a farmer could reasonably carry grain in a day's journey.[4] An architecture of storage and circulation punctuated these hinterlands, as larger and larger monocultures and the associated ruins of disease, oppression, and built obsolescence moved westward and northward. Meanwhile, the Robber Barons of American cities, whose railroads were often represented in popular media as tendrils of an evil octopus, reaped enormous profits.

The capillary networks that moved early twentieth century commodities like timber, wheat and soy, established the routes of data circulation, transfer and power supply seen today. State, municipal and corporate actors splay reels of fibre cables, centralised and edge data centres, colocation hubs, transfer stations, 'fiberhoods', 5G small cells, cell towers, power stations, wind farms and solar panel fields, big box stores, underground and open pit mines, wifi routers and charging points. All were laid across the extractive networks of yesterday. An observer of the Midwest would be forgiven for not knowing the difference between a data centre and a Walmart, a semiconductor manufactory and a Bass Pro Shop. The large, anonymous

2 A collection of energy statistics from eight different organisations have been collated here: https://www.custommade.com/blog/carbon-footprint-of-internet/.

3 For a material and social overview of online history, see Banks 2015. In the Midwest, rivers often preceded the lines, as French aristocratic families traded fur along river routes, displacing indigenous Americans or forcing their gradual reliance on mercantilism. River networks provided less friction than the land and were powerful orienting features for traders.

4 For more on the lasting geography of rail networks see Hudson 1985..

Figure 1 A typical 'on-the-line' settlement, organised along a railroad and grain silo. 2019. Accessed from Google Earth, Kansas

buildings that inhabit the plains, keeping a large part of the country online, expand and expand as they recede from popular consciousness.

Enter *The Silicon Prairie*: a comprehensive economic campaign that views Iowa, Missouri, Kansas and Nebraska as the new mecca of digital investment and opportunity.[5] As just one of many Silicon Valley spinoffs (Silicon Beach, Silicon Mesa, Silicon Rainforest, etc. have all been boosted in the United States), the Silicon Prairie is increasingly synonymous with the benefits and shortcomings of platform capitalism.[6] For rural communities – historically the last to receive new technologies – access to greater digital equity means the retention of young family businesses and the ability to participate remotely in urban economic flows. The disadvantages of increased digital uptake include increased dependence on corporate monopolies like Facebook and Microsoft, the devolution of family business into precarious

5 See `https://siliconprairienews.com/about/`.

6 According to Nick Srnicek, platform capitalism is the production of hardware and software that create foundations, or platforms, for other actors to conduct their own business (Srnicek 2017).

workers (Weigel 2023), and increasing levels of energy use and rare earth extraction necessary to provide the hardware, software and power to new digital infrastructures.

These forces converge in the latest big-box and underground building typology on the plains: the rural data centre. Within the rural data centre we begin to see the prevailing tech hierarchy attempting to remake the planet as a kind of digital plantation, where the basic underlying components of profiteering can be replicated (or unearthed) endlessly, at scale, and without resistance.

2 Digital Permaculture

The Midwest is no stranger to the failures of plantations and monocultural farms, in particular their ecological and social impacts. The model of concentrated, intensive farming, whether in the realm of corn, soy or wheat, leaves the region vulnerable to overabundance, exhausted soils and environmental ruin. It becomes necessary to consider an alternative approach based on more environmentally holistic principles.

I use the term Digital Permaculture to explore a set of multispecies practices that might be suitable for the exhausted soils and spaces of American hinterlands while also facilitating Internet connectivity. In the mid 1970s, Tasmanian based environmental designer Bill Mollison and David Holmgren produced a comprehensive collection of technical documents to productively modify human and non-human relationships which culminated in *Permaculture. A Designer's Manual*. This far ranging document illustrates how to construct "the harmonious integration of landscape and people providing their food, energy, shelter, and other material and non-material needs in a sustainable way" (Mollison 1988, IX). It addresses topics as diverse as 'Plant themes for drylands' to 'An Ideal Demographic Profile of a Steady-State Nation'. The style of the text reveals numerous anxieties typical of the era: acid rain, pesticides in tap water, peak oil, etc. In many ways, Holmgren and Mollison were building on radical environmental criticism of the 1970s in Australia and North America, providing alternatives to the deleterious effects of monoculture farming.

Permaculture is not without its problems. Those working in Food Sovereignty movements remind us that David Holmgren and Bill Mollison sought to create their practice using knowledge taken unwillingly from indigenous people. In Australia especially, where permaculture was first articulated, ecological commitments often have an undercurrent of ethnonationalism (Gaynor 2012). Often practitioners of permaculture are those with the land, money, and time to experiment. In some cases, registered permaculture practitioners take on free labour in the form of burnt out millennials who need reprieve from the city and 'woofers' who work in exchange for food and lodging. Most recently, the COVID-19 pandemic has caused a schism in the movement around the role of the state and the legitimacy of vaccine mandates (Leahy 2022).

As Kezia Barker shows in her work on food security and alternative food futures, permaculturists are often both ecological activists and apocalypse preppers. What they share, besides a vision beyond an ecocidal neoliberal present and a desire to repair society and soil, is an ethos towards objects and their functions in the pursuit of survival (Barker 2020). Objects

are seen as a site of flexibility and potentiality: a single object deployed in a self-sufficient farm might have multiple uses, some that transcend their original conception. For example, a permaculturalist might see a large, exposed boulder in the mountains and think how best to harvest the water that would fall across its surface should it rain. Similarly, they might view a discarded aluminium section as a good way to temporarily store water or firewood. This ability to see the potential in objects strikes me as a necessary skill for navigating an ecologically compromised future, whether it be in the service of Internet access or lower impact farming practices.

Moving forward with a permacultural ethos of object adaptability and scepticism toward the ecological practices of the state, the following three sections each highlight a speculative design intervention into the Silicon Prairie. They possess the kernel of an alternative and more sustainable IT network. There are questions that have guided the exercise: what does the land want? What already exists? What cannot we afford to lose? Digital Permaculture is characterised by a desire to analyse the many layers of our current energy-intensive relationship to the Internet, and remake them through just, rational, and ecologically sensitive means.

If the Internet is built upon the monocultural models of the past, then Digital Permaculture focuses on the production, storage and circulation of data as interlinked with specific ecological conditions that benefit from holistic and long term imaginings.

1.1 On Earth, Something is Always Burning: Production

The suppression of fire, as a form of land management and communication, has been central to the project of settler colonialism (Pyne 1997). Fire is integral to the ecological health of the tallgrass prairie, which must experience routine burning and grazing to thrive. Burning removes dead plants, recycling nutrients and suppressing invasive woody plants that would otherwise prevent the grasses from the sun. After fire burns off dead matter, large herbivores like bison graze new vegetative shoots, eventually moving on to new food sources, leaving plenty of fuel behind for the next fire. The imbrication of fire and grazing gives the prairie its unique heterogeneous appearance, creating a mosaic of diverse lifeforms. Prescribed burns in prairie conservation zones happen at predetermined intervals along natural buffers formed by watersheds. The United States Geological Station (USGS) outlines hydrologic unit codes (HUCs) on the basis of watershed morphology, boundaries that could become more valuable in a new fire regime, where designated fire wardens and data technicians become the focal point of a social economy of terrestrial energy.

According to pyrogeographers Nigel Clark and Kathryn Yusoff, a typical day on earth is punctuated by 400 trillion tiny explosions, used in the machines that propel humans between places (Clark, Yusoff 2014). Almost all of this combustion has been removed from sight, happening inside of the internal combustion engines of endless vehicles and agricultural machines. If digital production is to replace large-scale farming, then we must reclaim the diminishing tallgrass prairie ecology, and the enormous biodiversity and carbon sequestration it affords. Knowing that the grasses need to burn for the soils to thrive, how can we create opportunities between the combustion required for digital production, and harness it toward the

Figure 2 In 2014 Light Edge Solutions opened a digital co-location centre inside of a former limestone quarry in Kansas City, Missouri. Photograph by the Author

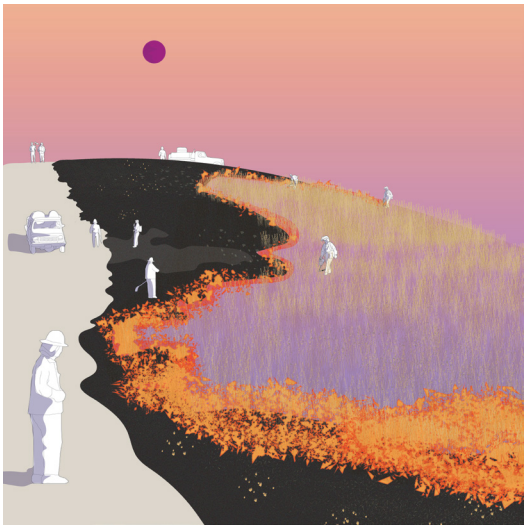

Figure 3 Matthew Darmour-Paul, *Burning Regime in Practice*. 2019

ongoing land care practices of the prairie? How can the fire that one practice generates, be transferred to the fire that an ecology needs?

In Missouri, there are nearly a thousand active mines that could halt their extraction of lead, zinc and limestone in order to mine data. Some have already changed over **[fig. 2]**.[7] Limestone quarries create the ideal house for data servers. The heat generated from the data mines lowers the combustion rate of the air in the winter, making for ideal prairie burning testing grounds. Considering the co-location of data mining and prairie ecological conservation offers opportunities for regeneration **[fig. 3]**. In dry summers, when the risk of wildfires are high, access to data production ceases, in order to keep heat out of the atmosphere.

1.2 Networks Follow Networks: Storage

Because the Internet rides on the back of landline telephone networks, the landlines on the back of the railroad, the railroad on the back of telegraph lines, etc., then might the intentional practice of restoring the prairie be planned on the back of the Internet? The midwest is structured along a clearly defined grid of grain silos equally spaced across the landscape, and connected by railroads. This grid is imagined as a new unit of distance for the storage and distribution of data, made possible through the repurposing of this grain storage infrastructure.

In 2008, a South African homing pigeon was found to have moved 50 Gb of data faster than the predominant ADSL connection by the nation's largest

7 See "Geography of Underground Co-Location Data Centers", https://panethos.wordpress.com/2022/04/27/geography-of-underground-co-location-data-centers/.

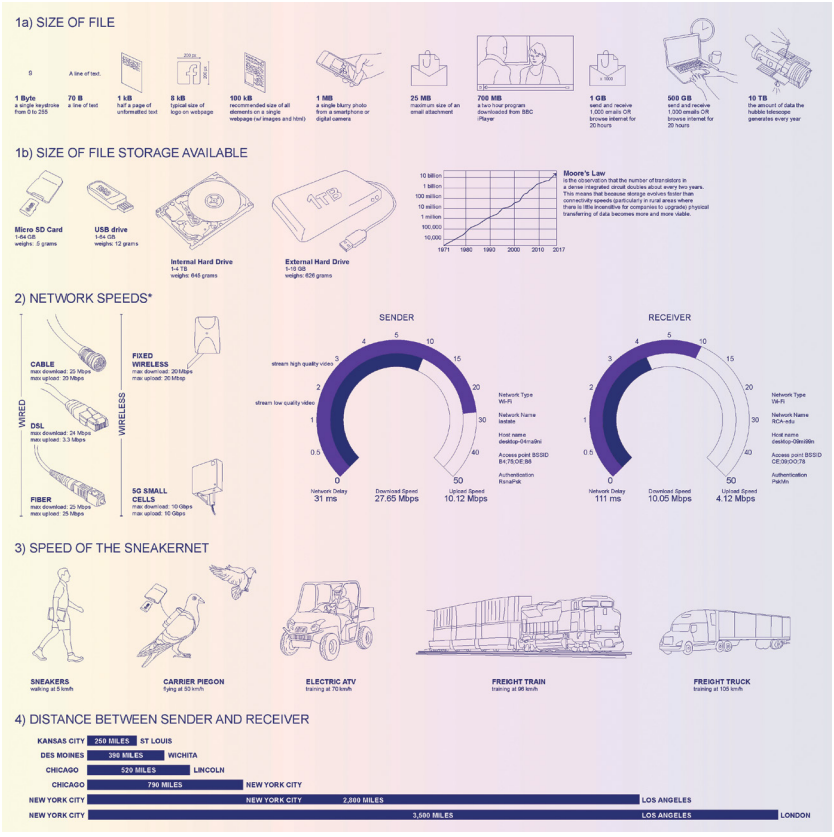

Figure 4 Matthew Darmour-Paul, *Sneakernet Efficacy Diagramme*. 2019

Internet service provider, Telkom (Reuters 2009). Similarly, in 2010, A pigeon in Yorkshire with a micro-SD card was found to transfer a Youtube video faster than the slower, more predominant rural Internet could (Fae 2010).

Experiments in moving data physically began in the 1990s and were called *sneakernets*, a reference to moving storage units with someone in sneakers between two locations. Because storage capacity evolves at a much faster rate than Internet connectivity, the movement of objects or subjects across existing physical infrastructures might be the most effective way to move data in rural America. Sneakernets are often tested against the Internet, using an analysis that depends on five factors: the size of the digital file being transferred; the size of the storage media; the speed of the Internet connection; the speed of the sneakernet; and the distance between sender and receiver **[fig. 4]**.

The grain silo is emblematic of the Midwest's agricultural history, and the project re-considers the future of these monumental vertical halls as sites for storing data, with working spaces in elevated distribution areas. On-line settlements in Kansas and Nebraska become the sites of data storage and harvesting. Medium scale compliant hosting, data protection, and collocation services install their servers in the silos, which also work to warm homing pigeons outfitted with micro SD backpacks for local data exchange **[fig. 5]**.

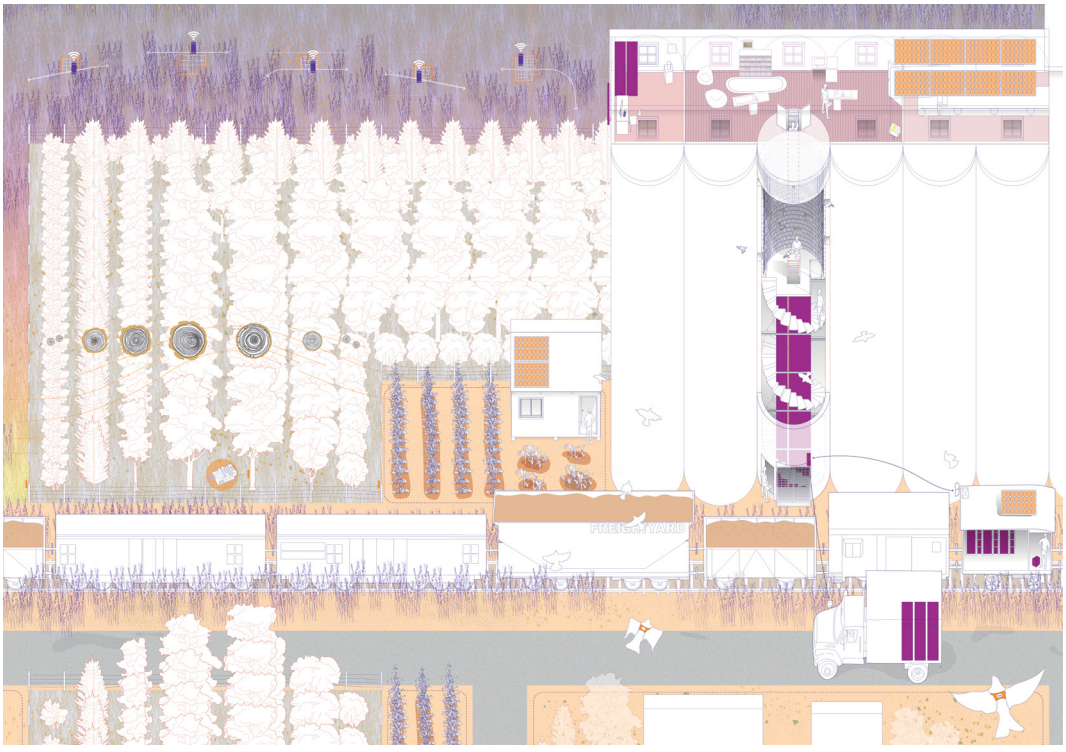

Figure 5 Matthew Darmour-Paul, *Dovecote Data Hall*. 2019

1.3 Water is Life

The circular pivot irrigation pump was invented in 1940 by a Colorado farmhand named Frank Zybach, to increase the even distribution of water across field crops. The invention struggled to perform until after World War II, when gas-powered water pumps and high-tech irrigation systems came together, turning the Central Plains into the world's breadbasket and meat market. However, because the pump draws nonrenewable fossil water from the Ogallala aquifer, which has been storing water for millennia without being drawn out, there is a legitimate fear that the well will run dry by the end of the twenty-first century – a situation that would take 6,000 years to reverse (Ashworth 2007).

One characteristic of plains ecosystems is their absence of trees which have co-evolved with bison. Bison rub up against the bases of trees to help them shed their coats. This action can often remove an entire layer of bark, killing the tree, thus ensuring that low level grasses can thrive for the bison to eat. In the early nineteenth century, telegraph lines were found as sites of intense bison contestation, as each fought over these ideal scratching posts. Trees, large boulders, telephone poles; nothing was safe from a good rub. The intensive irrigation and depletion of the aquifer must halt, which offers an opportunity to consider re-use of the now redundant irrigation icon. A new scratching post from the obsolete irrigation rigs is coupled with electric powered wifi signal boosters, forming a bi-fi scratching post that can move small volumes of data between disparate regions **[fig. 6]**.

Figure 6 Matthew Darmour-Paul, *Bi-fi Scratching Post* – an Internet signal booster and scratching post fashioned out of disused circular irrigation pumps. 2019

3 Conclusion: Platform Capitalism on Main Street

In 1920, the author Sinclair Lewis masterfully criticised the banality of Midwestern life in his novel, *Main Street*. The book describes the life of an earnest yet cultured city-goer who moves to a generic tracks and elevator town in the deep prairie of rural Minnesota. These towns were promoted as the next boom towns, with endless opportunities for wealth creation. Despite the persistence of the novel's protagonist, the town and the sociality that the Main Street produces overwhelms her plans for reform. The generic midwestern town, according to Lewis, produces a particular kind of human: one that is resistant to meaningful change.

The tracks and elevator towns saw their populations peak in the years Lewis was satirising their inhabitants, at a time between intense railroad use and the adoption of the private automobile.[8] Population data suggests that marketing new towns as the booming centres of tomorrow succeeded only in their becoming reliable back-of-house operations for other,

8 For more on this analysis, see Curtis White 2008.

larger settlements such as Chicago and Minneapolis, the homes of their various stakeholders. These towns have been declining over the last hundred years, and this project considers what opportunities there might be for their continuation.

The Midwest is the factory floor of the United States, one that is undergoing a major renovation from farming crops to farming data. Where there were once ribbons of green soybeans and corn stalks, today there are anonymous logistics buildings so large that they begin to merge with the horizon. Data centres and fulfilment centres are entangled in a libidinal economy, where 'binge on' has become the new unspoken creed. Farmers who had become accustomed to working in relative isolation with technical machinery in the fields are moving indoors to tend to the whirring lights of server racks, cyber attacks and storage failures.

From within this eco-social context, Digital Permaculture is a suite of speculative design proposals intended to re-purpose the ecologically damaging technologies of farming in the Midwest toward the Internet economy. Using the repetition of these farming types, the project manifests at a number of scales that can be repeated with a long view toward an ecologically just Silicon Prairie, uprooting the homogenous, stultifying and damaging monocultural Internet in the process. Practising digital permaculture requires identifying linkages between what the land wants and the tools society has at its disposal. It imagines low tech, asynchronous communication networks to serve the digitally divided plains alongside a set of guiding ecological patterns, unique to the prairie, that are suitable for de-industrial data usage.

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