Land Management Tribes: a New Species of Symbiotic Architectures for The Great Plains

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BACKGROUND

Agriculturally converted grasslands represent a major source of food, fuel, and fiber for our cities and civilizations. However, both the host ecologies and the techniques to farm these regions are approaching critical limits because of stresses incurred by increased productivity demands and ecosystem failures. Rethinking how grasslands are farmed is unavoidable if we are to continue using these regions for agriculture.[1]

The American Great Plains is an ideal candidate to explore alternate grassland occupations and farming techniques, as the region represents both one of the most ecologically threatened biomes and most innovative agricultural meccas on the planet. The continuing advances in automated farming and a shrinking population have created an extreme condition of fewer people to manage more land, recent depopulation has plummeted to such severe lows that many counties are returning back to their "frontier" designation (fewer than six residents per square mile).[2] Machine technologies that now work in the stead of the absent land managers have created a land use of paradoxical character; that of a "productive frontier." While the technologies developed on the American prairies have been traditionally seen as a negative impact from both an environmental and sociological perspective it is the "productive frontier" that their application has produced that we argue should be explored as a new territory of design—a territory of design that must include other species and their ecosystem services as part of wits scope.

POSITION AND PIECES

The position of this work is to envision a landscape future for the Great Plains that finds new design opportunity in intelligent automation to farm ecologically challenged grasslands. The project intervenes on the very technology already being developed and deployed in the region: robotic farming systems. But, rather than looking at production efficiency, the designs

consider the spatial, symbiotic, and experiential potentials such technology might offer in this context. As a result, these designed alternate land-management machines are less engineering-like and more specie-like as they mediate between ecosystem rehabilitation, productive farming, and new human experiences. The tribal deployment of these machines is to reintroduce ecosystem services from other species as an alternate agricultural enterprise. The interaction between those species, their territory, and human visitors becomes the territory for design.

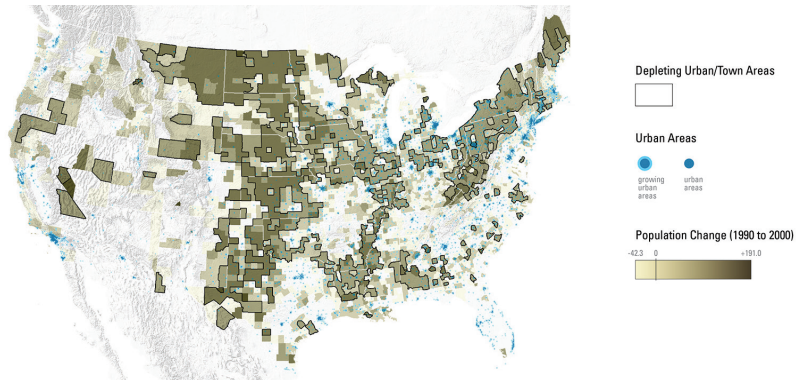
The "hoofed-wheel," an autonomous hyper-sensory mono-wheel is the base component of a modular equipment library that effectively becomes the new tractor for the grasslands. The porous wheel design is inspired by the soil-stimulating impact of ungulate hooves, which in combination with lighter, continuously operating, intelligent, and more numerous machines, mimics herds of animals rather than the soil-depressing fleets of today's farm equipment. The "hoofed-wheel" can be combined with both implement (mobile) and stationary equipment from the library, making the resulting machines capable of scaling between tasks and conditions.

TRIBAL CONDITION: "CROWD-SOURCED ECOLOGIES"

One combination the "hoofed-wheel" can make with implements is the "bison herder" machines. Bison behavior (observed from the studies of Dr. Temple Grandin)[3] is the inspiration for designing implements that make it possible for large herds of bison to roam the grasses again since the Plains were "broken" and settled. Tribes of "bison herders" crowd-source several herds, distributing both their ecological services (soil aeration, fertilization, and micro-climate creation) with their management services (grass mowing) over an area. While providing benefits to perennial polyculture-based farms[4] these machines also protect bison by legally escorting the "wildlife" between conservation areas, feeding grounds, and wintering havens.

TRIBAL CONDITION: "PRINTING AUGMENTED WETLANDS"

Another "hoofed-wheel" combination includes recycled pivot irrigator modules, retrofitted to become "wetland printers." Across the Great Plains thousands of seasonal wetlands or lakes, dubbed "prairie potholes"/"playas" have almost completely disappeared, filled in by their land owners who saw them as impediments to maximum crop coverage.[5] The result has been the reduction of bird migration stop-overs, regional flood management deterioration, and the loss of water holes shared by both mega-fauna and aquatic micro-ecologies. The "wetland printers" seek to restore the wetlands and their regional ecosystem services, but also augment their traditional ecology by strategically scanning dormant lake-beds and planting high-cellulosic plant species that can be harvested for their bio-fuel energy at the end of a season, behaving much like a large scan-jet printer. A combination of competing factors results in different "print" patterns from year to year, as these new landscape-architectures are capable of attracting different clusters of species for different services, including humans (who can traverse their elevated walkways to view the species that converge on these grassland oases).



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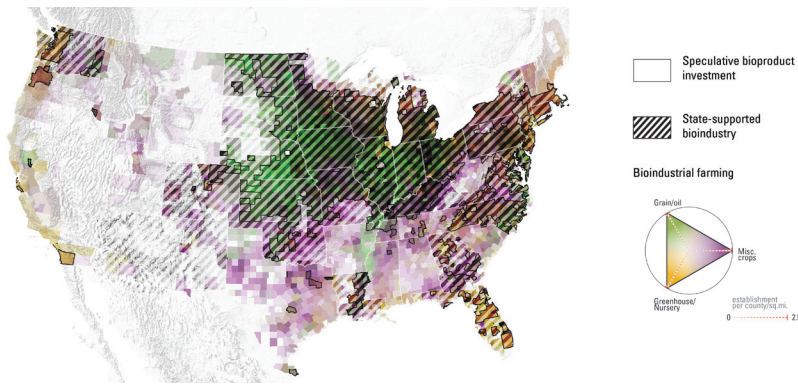

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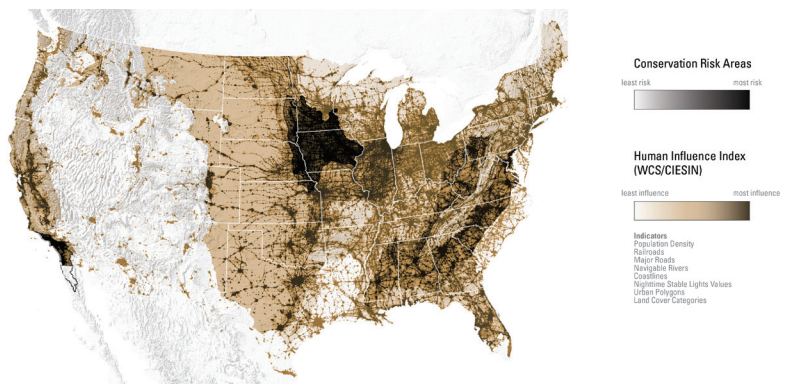

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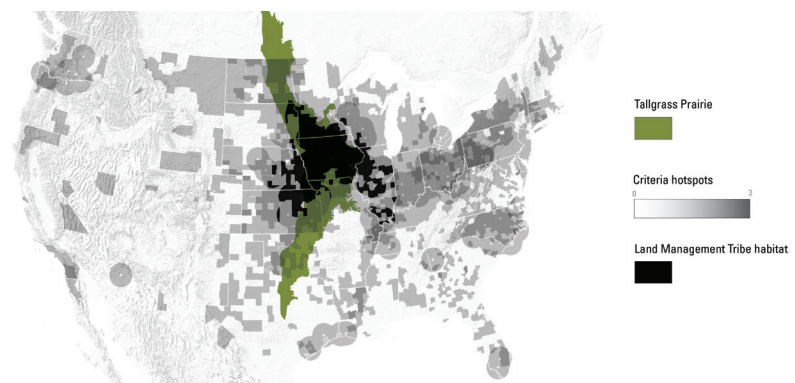

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Figure 1: "Mass Exodus," thematic map of the United States illustrating counties experiencing high levels of depopulation.

Figure 2: "Agri-Speculation," thematic map of the United States illustrating counties and states that are receiving high levels of investment toward agricultural and bio-product development.

Figure 3: "Eco-Strain," thematic map of the United States illustrating regions that have multiple levels of human-influence factors that are impeding eco-system services and functions.

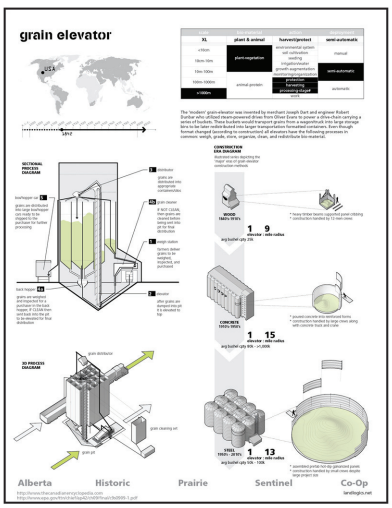
Figure 4: "Tribal Habitat," an area of concentrated challenges and opportunities emerges with the overlap of the previous maps. This regional site is the ideal candidate for developing a landscape future.

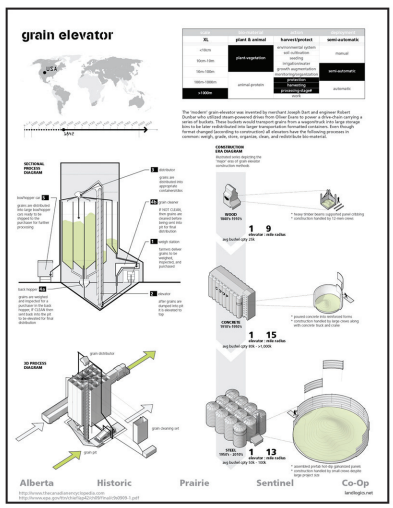
TRIBAL CONDITION: "MIGRATING MICROCLIMATE"

One final example of a "hoofed-wheel" machine is the "migrating-microclimate." This tribe of "hoofed-wheels" are outfitted with large hydrogen-filled (from organic compost) wind turbines, modeled after the buoyant rotor-kite developed by MAGENN Company.[6] Draped between many rotor-kites are light-weight solar-collecting fabrics capable of producing artificial cloud cover on extremely hot days to protect ground cover. This collection of machines migrates to drought-prone areas guided by a network of aerial drones (equipped with ambient-sensory technology). Energy collected from the "kites" and "clouds" is stored to feed the machine tribes.

CONCLUSION

Together the machine-tribes and the species they interact with build a symbiotic relationship with the regional ecology, on the basis of shared machine-to-machine data that they sense and harvest across the grasslands. As a result of working with their surroundings the distinction between the machine activities becomes blurred; farming, wildlife conservation, soil remediation, and many other functions all become one land management task as they (like the other species on the prairie) roam the grasses.◆





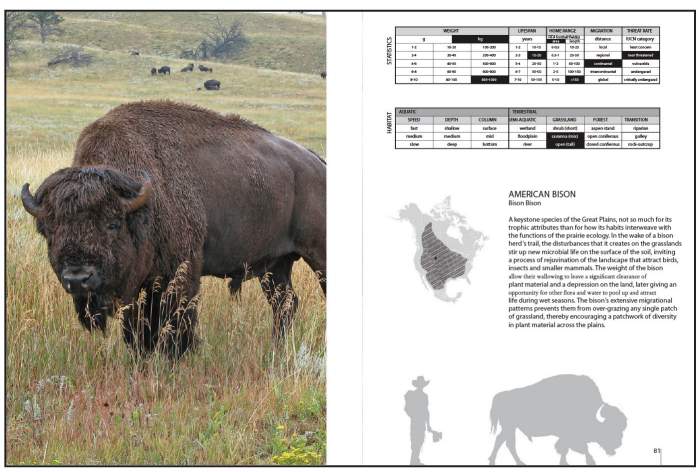


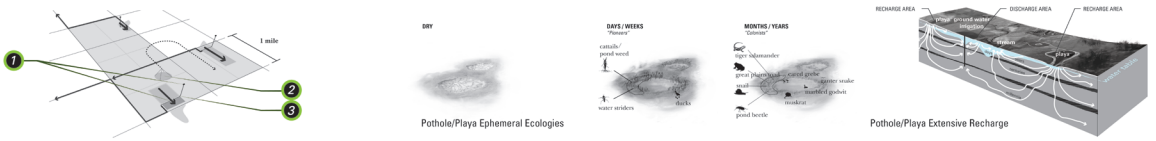
Figure 5: Series of studies exploring the indigenous species of the Plains, which we now argue includes the various agricultural equipment modifying the terrain and ecologies. The functional aspects of these "species" were examined as precedents for the land-management tribes.


1
2
3


1
2
3
1 mile
Domesticated Cattle "Lounging" Behaviour
Bison Grazing Behaviour

06


1
2
3


1
2
3
1 mile
DRY
DAYS / WEEKS
"Pioneers"
MONTHS / YEARS
"Colonists"
RECHARGE AREA
DISCHARGE AREA
RECHARGE AREA
Pothole/Playa Ephemeral Ecologies
Pothole/Playa Extensive Recharge

07

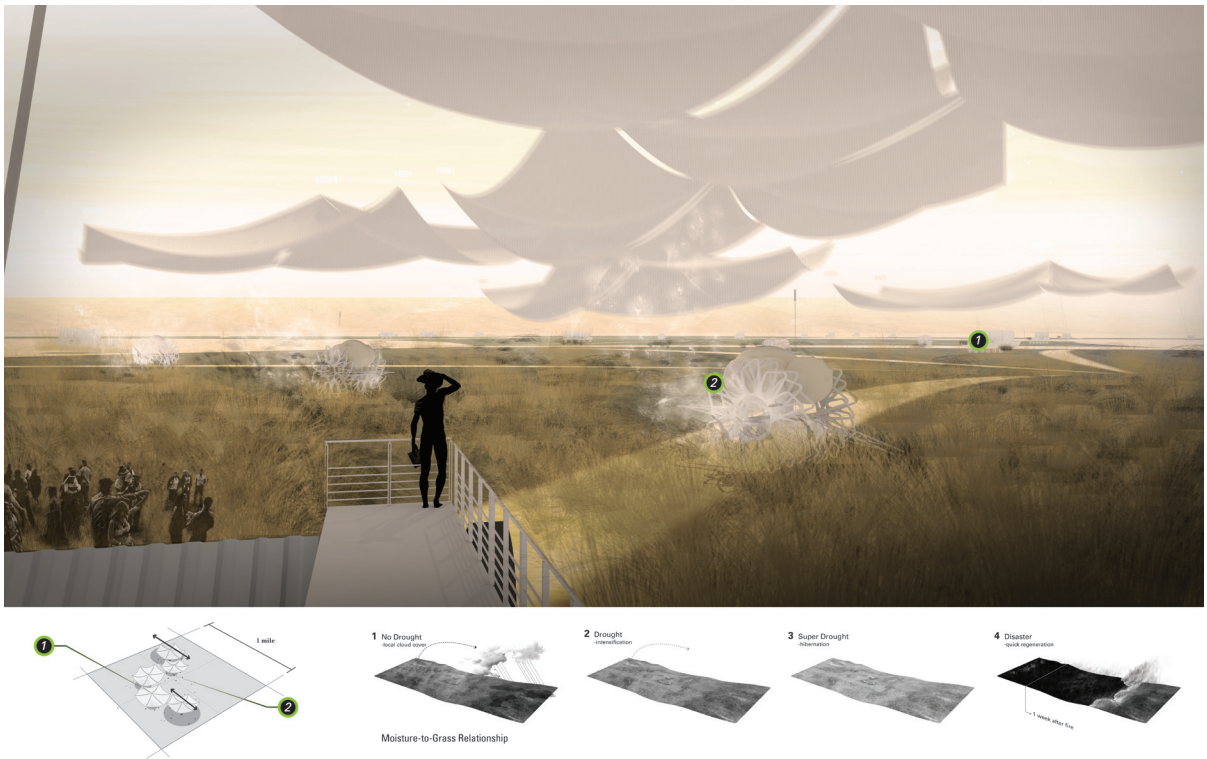


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Figure 6: TOP: View from a bison-herder tribe unit, corralling the herd to and from water resources during the start of the warmer spring/summer. BOTTOM: Diagrammatic view of the tribe-machines interacting with the ecology. Comparative analysis between cattle and bison and their net behavioral effects on grassland ecology.

Figure 7: TOP: View from a former crop-dusting airplane observing a flock of aerial-drones collecting ambient data and guiding a series of both wetland printers and bison herder tribes. BOTTOM: Diagrammatic view of the tribe-machines interacting with the ecology. Analysis of successive phases of prairie-pothole wetland ecology and aquifer recharge

Figure 8: TOP: View from a 'mobile micro-climate' tribal-unit observing a series of misting units near an outdoor agro-tourism market amidst the tallgrass. BOTTOM: Diagrammatic view of the tribe-machines interacting with the ecology. Analysis of successive phases of drought-like conditions and the effect it has on deep-rooted perennial grasslands.

ENDNOTES

1. Kimbrell, Andrew. *Fatal Harvest: The Tragedy of Industrial Agriculture*. Washington: Published by the Foundation for Deep Ecology in arrangement with Island, 2002.
2. "United States - Free GIS Data - GIS Data Depot." United States - Free GIS Data - GIS Data Depot. N.p., n.d. Web. 04 Sept. 2011. <http://data.geocomm.com/catalog/US>.
3. Grandin, Temple. *Livestock Handling and Transport*. Wallingford: CABI Publishing, 2000.
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5. "Prairie Potholes." Home. N.p., n.d. Web. 05 Sept. 2011.<http://water.epa.gov/type/wetlands/potholes.cfm>.
6. "MAGENN AIR ROTOR SYSTEM (MARS)." Magenn Power Inc. N.p., n.d.Web. 10 Sept. 2011. <http://magenn.com/about.php>.