The Prefixes of Forestation

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“Forest—field—plow—desert—that is the cycle of the hills under most plow agricultures—a cycle not limited to China. China has a deadly expanse of it, but so have Syria, Greece, Italy, Guatemala, and the United States. Indeed we Americans, though new upon our land, are destroying soil by field wash faster than any people that ever lived—ancient or modern, savage, civilized, or barbarian. We have the machines to help us to destroy as well as to create. The merciless and unthinking way in which we tear up the earth suggests that our chief objective may be to make an end of it.”
— J. Russell Smith, *Tree Crops: A Permanent Agriculture* (1929)

Scientific forestry relies on the entrenched techniques of planting or clearing woody plants through deforestation, afforestation, agroforestation—and reforestation. In this rotation economy, operations of addition and subtraction necessitate that plants be transformed into units, securing continual expansion and economy. The tree is no longer valued for its diversity, biology, beauty, or affiliated customs, but for its presence or absence alone. This tendency entangles environmental and political economy by reducing living organisms to extractable units. Despite this entanglement, the operations of scientific forestry are grafted onto environmental debates and make their way into spatial practices that designate tree planting as an ecological necessity. The passage by J. Russell Smith suggests that this technique of transforming biomes is a naturalized sequence—forest to field to desert, in order to progress from desert to field and back to forest.[1] Each “fix” partitions the landscape for the sake of de-, re-, af-, or agro-incentives.[2] Why have plant units become a conceit of greening initiatives? Why do we celebrate units planted, rather than value temporality in survival rates? When did planting trees become more about numbers than about livability? The design professions are complicit in repeating an exhausted association with forestation. Without attention to the encounters, dependencies, and relationships that plant units depend upon and create, we risk continuing along the path of “merciless” tearing up.

Forestation evolved as a self-sanctioned procedure, as foresters exploited a repetitious pattern that continues to convert biomes from desert to forest and from forest back to field. In this way, tree planting has become the common operation that fuels both the ambitions of industrial forestation and the defining feature of environmentalism: treeless deserts beg to be afforested, depleted fields require reseeding to regenerate, and commercial logging practices are committed to both deforestation and agroforestation strategies. Each prefix territorializes photosynthesis, amassing resources, creating carbon-offsetting markets, and hiding behind do-goodism projects that reward and count individual tree units. Without critical inquiry, the most important considerations of planting a tree, such as species selection, age, water, demands, mycorrhizal relationships, and context, are given over to “science,” such that no one dares to ask how long the seedling might live, who might be planting it, what water source it is drawing from, and under what conditions it is being nurtured. The contradictory fictions of endless research, testing, and control continue to contour the decisions that are implicit to Smith’s quote: planting trees is not a solution to ravaging the soil, nor can forestry fix large-scale erosion, urbanization, or drought. At the most basic level, large-scale forestation postures as a globally sanctioned environmental solution to soil degradation, despite the spectrum of industrial gains and ecological losses.

De—forestation is the ancient practice of felling trees, which recognizes our debt to wood as the foundation upon which societies are built. Pliny the Elder, the great Roman natural historian, devoted whole books of his *Naturalis historia* (77 CE) to the virtues of trees and the importance of wood to building civilization. The success of deforestation and the subsequent global cycles of scarcity have triggered major colonialization struggles, political exploits, and technological revolution. Deforestation techniques include slash-and-burn, clear-cutting, selective logging, and the more nuanced exploits of forest management. Despite thousands of years of practice, significant global legislation, and a collection of known ecological consequences, the current motivation for clearing forest is no longer to amass wood resources but to convert land to a more profitable, nonforest use.

Af—forestation is the deliberate planting of trees in an otherwise treeless environment. Another dictum could be the deliberate insertion of a forest into a grassland or desert biome. The first image that comes to mind is the tree itself—the aboveground form represented by an umbellate silhouette, so recognizable as a celebrated icon of nature. Inserting trees, activating a social network of planters, and petitioning for international recognition unfolds as a scalable sequence. The act of replacing biomes is no longer an act of exploitation in the sense of imposed expansion or industrial agriculture. Instead, the plant is reduced to the outline of a tree form—a logo and a representation of nature that neutralizes the plant. Moreover, afforestation is fundamentally a modification of the landscape that replaces deep mats of rhizomatic fiber with shallow, woody rhizomes. Visible form is favored over concealed formation, just as forest is privileged over nonforest.

Agro—forestation is a tree-planting strategy that advocates for planting trees within pastoral and agricultural acreage. The tree unit is manifest as a row, shelterbelt, or copse, or as separate individuals in grazing parcels. Generally, ecological deceit emerges within the operations embedded in other fixes. For instance, if deforestation were more selectively designed, or predicated on ecological rather than financial gain, then mature trees could remain intact above and below the ground in order to provide substantial local benefits. But this would necessitate less industrial and scientific models of reductionism, including tree planting. Scientific forestry first gained agricultural prominence under the Great Plains Shelterbelt Program, a significantly successful means to gain control of private land in the United States following the devastation of the Dust Bowl. The more recent vision of agroforestry is finding traction in the sub-Sahel as an evolution of control toward nomadic practices. Applying a universal vision of agriculture insists that water-dependent crops can succeed in the face of cyclical drought.

Re—forestation is the restocking of land that was formerly forested by planting trees. Traditionally, the first organized or state-led reforestation scheme is attributed to John Evelyn’s *Sylva, or A Discourse of Forest-Trees and the Propagation of Timber in His Majesties Dominions* (1664), an impassioned report on the state of England’s forest resources and a plea for reforestation. Organized tree planting by private markets has now largely replaced state-run initiatives, as trees are injected into the land or aerially seeded to advance financial gains that only masquerade as environmental fixes. Consequently, slow reforestation measures are largely undone by the ease of quick-fix deforestation.

OPENING SPREAD
Daniel Kovalovszky, *Birch Trees in Spring*, from the Green Silence series, near Bugac, Hungary, 2013.

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Dorothea Lange, *Tractored Out, Childress County, Texas,* 1938.

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The railroad line near Benjing (between Wuhai and Jilantai), China, which is one of the last sections of track in the Gobi that still uses steam locomotives. The train carries cargo and passengers to Jilantai through a large corridor of dunes. The dunes flanking the track have been stabilized by thrusting a grid of straw into the sands in a checkerboard pattern, a method that was pioneered by the Institute for Desert Research in Shapotou. Dunes from the Gobi would constantly bury the tracks and cause accidents until 1956, when scientists at the institute developed the technique of installing one-meter grids of straw along the tracks. This labor-intensive technique has stabilized the dunes and encouraged the growth of groundcover.

Tree planting is especially reliant on the exploits of plant domestication. Thus, it is possible to tune into the spatial exploits of forestry by exploring a single species, as the description of a plant can offer cultural, social, historical, and geographic evidence. As humans are an entirely plant-dependent species, plants continue to index human settlement and offer both a basic unit of study and a method for surveying forestation fixes. For instance, *Populus* spp., or poplar, is a globally distributed woody plant found in the temperate regions of the Northern hemisphere, covering a range of landscapes from Greenland to Mongolia, Japan to North America. Its wide range is due to its adaptability and ease of self-propagation. Its current range only structures a reading of extant plants, whereas the pollen record tells us that various ancient forms have appeared and disappeared since the Pleistocene, driven by severe climate events.[3]

Extents so vast and mutable reveal a significant evolutionary process of natural hybridization, a reproductive capacity that enables *Populus* spp. to persist when faced with new habitats or novel conditions. Hybrids can be artificially produced when humans, creating a deliberate cross, dust pollen from one plant onto another. A hybrid is simply a cross between species that can conceivably lead to the formation of new species. In this way, desirable traits can be selectively bred. Natural hybridization occurs when plants decide to breed. This fluid hybridity between plant and human and human and plant is an evolutionary feature that has enabled *Populus* spp. to expand and adapt to continental ranges and vastly differentiated biomes. Such a unique combination of features from its vast range and diversified reproduction has made *Populus* spp. the industry standard for botanists, silviculturalists, geneticists, and foresters alike.

Growing Genotypes

Populus spp. is the first woody plant to have its genome fully sequenced. Subsequently, in 2006, the US Department of Energy selected popular as a model organism.[4] Once the draft genome assembly of *Populus trichocarpa*, or black cottonwood, was sequenced, the decoded poplar genome was released, distributed, and published in a paper coauthored by 109 scientists from 39 international institutions and agencies.[5] Poplar is now considered the foundational plant in the study of woody perennials, leveraged to make sense of plant biology more broadly.[6] Poplar was selected because it has a relatively compact genome sequence, which offers a simplified infrastructure of growth.[7] Its rather simple organization also explains why poplar is one of the fastest-growing woody plant species, commonly planted to provide fast cover on cultivated land and for quick turnaround cycles in the wood-pulp industry, growing up to 30 feet in five years under the right conditions—a trade-off between progress and survival.

Remarkably, the genetic sequence created a complete proxy of the plant since the entire genome was extracted. Here, scientific achievement even overcomes the plant as a tool of forestation and dissolves its material order into a replicable formula. Such a proxy does not mimic the plant's formal structure; it is the code to its morphology, the strategic calibration between growth and development. Prior to the full sequencing, only portions of this complicated biological code could be extracted, which reinforced an edited version of the plant as choice attributes were isolated in order to convey important properties to humans. Consequently, traits and features that misbehave or become difficult to contain are removed or subtracted from the code—in this case, the clonal growth and hybridity that confirm the endurance of *Populus* spp. These designer trees cannot produce the fluffy seed coats that blanket the forest floor and give cottonwood its name, nor can they clone endlessly through their root vigor, giving rise to millions of identical plantlets. In 2006, when the genome assembly of *Populus trichocarpa* was fully sequenced, an entirely novel species was created: *Populus trichocarpa* version 1.1. Augmented through the biological expression of raw data, the plant is no longer referred to as a "species" but a "genotype"—a set of genes that describes a sterile version of the plant.

Genotypes make their way into the field once a biome has either been abused or pacified by forestation operations, emerging as a fix to "stressed," "heavily eroded," or "unfertile" environments. Often, this replanting agenda is led by foresters and achieved by simplifying and streamlining the effort required to actually establish a forest.[8] Backed by scientific evidence, tree planting is positioned as the standard protocol for all value relations without exploring the more significant consequences of why the land is in need of repair in the first place. In this way, scientific forestry obscures environmental predicaments that are often brought on by their own procedures. Here, fixes require prefixes. Thus, with tree planting as the protocol, *Populus* spp. becomes the tree technology, at once an opportunity for ordered rows of pulpwood and a unit of calculation in greening projects. Can forestation succeed without pacifying and industrializing plant life? Has planting been entirely overcome by procedural statistics?

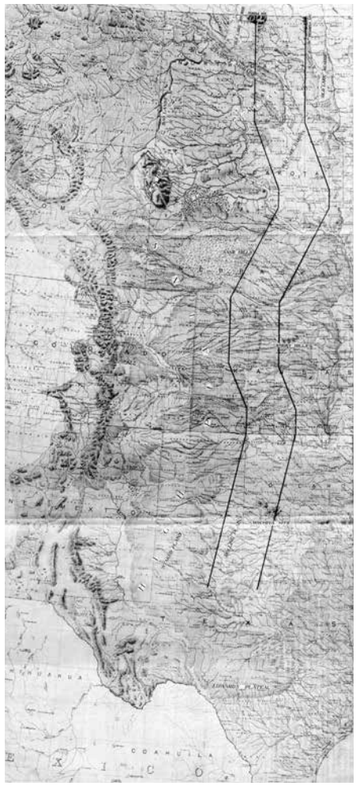
The symmetrical competition between growth and yield, or materializing and extracting, calculates carbon credits through additive operations and timber volume in deductive increments. We are led to believe that "billion tree" campaigns and "great green" walls are pronouncing progress, but growth statistics and depletion metrics are isolated from accountability and context. The flip-side tactics of forestry benefit from quick rotations that leverage tree planting as a means to elevate control through yield in a world troubled by ongoing crisis. For instance, the seemingly incongruent marketing terms of "profit" and "diversity" are both deployed to sanction more tree planting in agroforestry systems.[9] Aggregating units transforms the plant—or the tree—into a measure of progress, converting ecosystems and biomes into legible acreage. Therefore, the history of knowing trees is a scientific account of forestation, whereby statistics create ecological authority.

Planting Politics

Foresters use their authority to selectively determine value, often neglecting the less visible attributes of forests, including individual plant behavior, symbiotic relationships, and the concealed roots and rhizomes that form and deform the soil upon which biomes are produced. Because of aboveground visibility, development budgets, and technical encouragement, projects that eagerly plant trees under the rubric of forestation continue to garner international funds and approval, despite the haunting conspiracy of replacing biomes and commercializing plant life. Forestation implicitly assumes that tree cover offers the most "productive" land use and eagerly replaces grassland biomes with greening initiatives.[10] The prowess

TOP
Relief map of the Great Plains Shelterbelt with zone boundaries superimposed, including the Great Plain States of North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas, 1934.

BOTTOM
Populus alba, excavating the rhizosphere for study, Arnold Arboretum, Boston, 2015.



of progress that celebrates biome conversion creates as it destroys, a central tenant of forestry. For instance, recognizing the rhizography of plant life acknowledges the spatial discrepancies of some of the most recognizable ecosystems in the world.

Rhizography is the delicate and tough geography of the ground that emphasizes the root zone of plants. It attends to the concealed formation of forests and to a more credible form of forestry. It builds confidence through association, coproduction, and collaboration, rather than authority, procedure, and profit. Here, an inter-dependent biological world can be appreciated, such that contributions are widely accepted between species. It counters the ambition of planting as a simple procedure of "fixing" in place, whether it is a tree, a garden, or a biome, since this fixity ignores interspecies behavior found so eloquently in the rhizosphere of plants. Until such time, as we pay closer attention to the whole plant organism, our practices will only repeat the same oversights of the past. The ongoing perception of environmental decline has helped mainstream catastrophic evidence, deploying plants as tools by endorsing tree planting as the link between culture and nature. The categorization is complete once the tree is perceived as an object, a unit, or a genotype, sanctioning tree planting in any biome, anywhere on Earth, even at the expense of existing ecosystems and social orders.

While plants are the basis of any forest undertaking, they are often treated as banal by-products of the environment. Trees, on the other hand, are imbued with myths, desires, and capital. In the popular imagination, plants are ornamental and trees are useful. But a tree is actually a perennial plant. Typically, a tree is a plant whose stem is elongated, but this is not always the case. Trees delight the imagination and have helped link humans to their land—have helped build nations. In 1907, President Theodore Roosevelt memorably claimed, "A people without children would face a hopeless future; a country without trees is almost as hopeless."[11] Nearly 20 years later, the tradition of regionally scaled planting began in the United States during President Franklin D. Roosevelt's New Deal initiative. The creation of the Great Plains Shelterbelt Program (also known as the Prairie States Forestry Project) was both an extremely controversial and highly effective socioeconomic and geopolitical initiative, responsible for planting millions of trees and successfully altering the land forever. The project was sustained only from 1935 to 1942 yet is still responsible for half the trees ever planted on US soil.[12] In a country built and conditioned by wood, trees became a symbol of genuine democracy, and planting represented a collective measure in nation building.

The Shelterbelt Program deployed significant political and biotic mechanisms to regain control of the landscape, which leaned heavily on Roosevelt's own penchant for a federal land ethic. The project was made possible by transferring the anxiety caused by the twin extremes of the Great Depression and the Dust Bowl into a catastrophe outside of political jurisdiction. The urban interpretation of the rural grasslands was built by fabricating ecological principles, dramatized by the notion of soil failure. In fact, Congress had conceived of the move toward agriculture in response to growing food crises in cities, effectively funding the transformation of millions of hectares in productive grassland prairie into exposed cultivated fields. New Deal politics converted a flawed political initiative into a successful environmental campaign. For the first time, soil itself caught the nation's attention, as the Soil Conservation Service and the Civilian Conservation Corps (CCC) were created to defend the overwhelmed soil from further exploit. Effectively fighting fire with fire, or nature with nature, New Deal trees were drafted into service and sent nationwide to farmers who were paid to plant them, supported by the efforts of federally subsidized teams of young men. In creating the CCC, Roosevelt effectively democratized conservation through social action. Environmentalism in the United States' New Deal era is an exemplary scheme for describing how trees have crept their way into politics.

Trees gain entry into any situation; they find themselves the topic of international debate and blur political borders. In particular, tree-planting fixations have become a political and industrial act rather than an environmental necessity, exploiting the plant using persuasion, aggression, and control. This is not a projection; this is one of the world's most rehearsed spatial practices.

Tabula Rasa

At the end of the 19th century, US geographic thought was elevated by the work of J. Russell Smith, who raised salient arguments between the scale of soil erosion and the procedures of forestry. In *Tree Crops* he advocates for what he calls "mountain agriculture," a careful description of how agriculture can be adapted to the physical conditions of the landscape.[13] In particular, he outlines how deforestation and reforestation abuse the soil, which could otherwise provide a lasting resource for fuel and food production. Essentially, Smith maps out the pretentions that underlie land use. He also fundamentally problematizes the abuse of soil in scientific forestry. While he acknowledges the need for "flat land agriculture," he advocates for "tiered systems" and confronts mechanized and totalizing procedures with succinct language: "this book is primarily an attack upon the gully."[14] A gully is a landform, mostly created by water sharply eroding and cutting into the soil. Gullies reduce productivity by limiting growth because they produce sediment, exacerbated by tree-removal operations and industrial plowing. Water moves quickly along the subsurface of gullies, directing precious rainwater away from the roots and depths of the substrate where it is so needed. Advocating for tree crops, Smith also contradicts the prefixes of forestation that insist upon partitioning the landscape for the sake of yield metrics. In reference to his book being filed under "forestry," Smith expands on the character of professionalization: "There was no good philosophic reason for putting it under forestry. It should have gone to horticulture, not forestry. By professional occupation, the forester bears the same relation to a horticulturist that a butcher does to a dairyman. The dairyman pets a cow, gives her what she needs for years, that she may give him a continuous harvest. In an hour, the butcher cuts her throat, skins her, and sells her carcass. . . . By every act of his professional life, the forester is foreign to the tree-crops idea."[15]

Thus, at a time when railroads were expanding, population and housing were flourishing, and food security emerged as a crisis, the exhaustions that expert foresters created were dismissed both domestically and abroad. Instead, they were celebrated for their conservation and restoration efforts despite industrialized landscapes, fungal triumphs, monocultures, and suppressed or accelerated growth modulations. In this way, forestation continues to advance globally by claiming itself as a profession of nature. While it has done so by profiting off of the most discernible attributes of the forest, it proliferates by inventing an expertise that treats plants as a unit or a hindrance—certainly not through the care of continuous harvest. It is a destructive practice that has so effectively neglected both the physical properties of the land and any interspecies associations, that any attempt to revitalize these topics is deemed "unscientific." Moreover, it invests heavily in the most obvious species that are cultivated, hybridized, and released for pure gain.

As a plant-dependent species, our livelihoods and health are determined by the achievement of plants. Acknowledging the whole plant requires that particular attention be paid to its longevity and temporality, as well as to its social rhizosphere, which plays out in the delicate horizons of the Earth. Plants live in the ground, and soil manufactures the nutrients for plant health—a cycle that is implicit to Smith's articulation, which is precisely an attack on the procedures of forestation that create gullies by design and that clear in order to replant. The assumption that every tree is natural or that tree planting is always beneficial reflects the prefix—the linear order of one thing before another. The fiction of endlessly fixing and exploiting is subsiding, since land is now worth more as pasture than as forest. In the same twist of fate, trees are usually worth more dead than alive. While the regimes of de-, re-, agro-, and afforestation have coerced us into believing that plants are simple, fixed units, a change in our behavior may only arise in a consideration of working without the prefixes of forestation. Perhaps the interplay of temporal and lively meanings can help us resist singular resource management and precipitate other, more equitable arrangements.

[1] J. Russell Smith was an educator and geographer, largely known for the application of geographic principles to the fields of economics and business. J. Russell Smith, *Tree Crops: A Permanent Agriculture* (New York: Harcourt, Brace, 1929), 4.
[2] The term "fix" cannot be disassociated from the seminal work of geographer David Harvey. His suggestion of "spatial fix" is developed through his interest in re-engaging theory with space, or "in relation to nature." While the term suggests a simple relationship to land-use patterns, Harvey unpacks the notion of how time is prioritized over space qualitatively, especially as it relates to different forms of labor. See David Harvey, "Globalization and the 'Spatial Fix,'" *geographische revue* 2 (2001): 23–30.
[3] For an early paleobotanical perspective, see Edward Wilber Berry, "Notes on the History of the Willows and Poplars," *Plant World* 20 (1917): 16–28.
[4] "Poplar was chosen as the first tree DNA sequence decoded because of its relatively compact genetic complement, some 50 times smaller than the genome of pine, making the poplar an ideal model system for trees." See the Department of Energy's Joint Genome Institute, Phytozome 12, "Populus trichocarpa v3.0 (Poplar)," https://phytozome.jgi.doe.gov/pz/portal.html#!info?alias=Org_Ptrichocarpa.
[5] Gerald A. Tuskan et al., "The Genome of Black Cottonwood, *Populus trichocarpa* (Torr. & Gray)," *Science* 313, no. 5793 (September 2006): 1,596–1,694.
[6] The Joint Genome Institute has a public portal that shares 48,000 poplar-derived genes available for use to apply sequencing technology to other more complex organisms.
[7] For instance, its genetic complement is 50 times smaller than the genome of *Pinus*/pine. See Tuskan et al., "The Genome of Black Cottonwood," 1,596–1,694.
[8] The term "simplification" as it applies to forestry projects is refined in James C. Scott's description of the "stripped-down forest," which explains how order and regulation made the old-growth forest more legible. See James C. Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven, CT: Yale University Press, 1998).
[9] The definition of agroforestry offers substantial clues to this popular myth: a land-use management system in which trees or shrubs are grown around or among crops or pastureland. It combines shrubs and trees in agricultural and forestry technologies to create more diverse, productive, profitable, healthy, ecologically sound, and sustainable land-use systems. See Wikipedia, "Agroforestry," last modified February 1, 2018, https://en.wikipedia.org/wiki/Agroforestry.
[10] For a longer account of greening initiatives, see Rosetta S. Elkin, "Cultivating Green Wall Infrastructure," in Revising Green Infrastructure: Concepts Between Nature and Design, eds. Daniel Czechowski, Thomas Hauck, and Georg Hausladen (Boca Raton, FL: CRC Press, 2014).
[11] US President Theodore Roosevelt, letter to US schoolchildren for Arbor Day, April 15, 1907.
[12] For a comprehensive review of the project, see Neil M. Maher, *Nature's New Deal: The Civilian Conservation Corps and the Roots of the American Environmental Movement* (New York: Oxford University Press, 2008).
[13] Smith, Tree Crops, 375–79.
[14] Ibid., 32.
[15] Ibid., 378.

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