16 Planting the Desert
Cultivating Green Wall Infrastructure

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CONTENTS

16.1 INTRODUCTION

The global challenge of rapidly declining vegetative cover is being addressed by massive replanting projects that cross territorial, political, and cultural boundaries. By considering two contemporary examples in different stages of cultivation—"The Great Green Wall" in the Sub-Sahara Africa and the "3 North Shelterbelt Program" in China—a perspective is offered that highlights the tension between engineering infrastructure and cultivating healthy ecosystems. Considered together, these projects aim to replant more than 170 million hectares of land that is classified as semiarid, arid, or hyperarid. The tradition of planting deserted land is an ancient practice, most often initiated as a response to local climatic variation. The contemporary tradition tends to attribute the need to plant as a consequence of human activities. Although the global concerns surrounding the threat of desertification act as the impetus for both megaprojects, desertification is not offered as the framework for this discussion as it is often misused and confused with drought (Thomas 1993). Instead, both initiatives are presented as a form of planted infrastructure, most often specified within the prevalent framework of "green infrastructure," a dominant theme within current policy making. These projects represent the largest horticultural projects the world has ever considered, which categorically of green removes them from the discourse of green infrastructure and opens a discussion of territorial geopolitics. In both cases, a principal species acts as the foundation for planting an entire region and structures

the associated conditions of each site (Figures 16.1 and 16.2). Therefore, the varying frameworks that allow new plant cover to be introduced will be studied to form a perspective of each project, exploring the role of plants from innovative seed mechanics to regional bionetworks. Rather than desertification, the biological and ecological processes themselves are offered as the basis for understanding the goal of each project. In other words, the political frameworks that enable processes (such as desertification) to become permanent are revealed when addressing projects at this scale. Subsequently, this category of infrastructure is exposed as a totalizing system rather than framed as a series of projects. The speculative argument offered here is that planting deployed at a local scale considers micro-conditions and species suitability more prudently than the agencies that describe and articulate the complications to a wider audience across territorial scales.

Afforestation refers to the deliberate conversion of non-forest land to forestland, which does not involve re-establishment (replanting)—including the deliberate transformation of agricultural land back to forest—but rather, afforestation mobilizes tree planting through environmental authority and value statistics; planting one tree is fine, but planting millions is better. This classification confirms that the undertaking is not rooted in renewal or local conditions, nor in intensifying existing

FIGURE 16.1 *Populus Simonii var. fastigiata* planted as a traditional shelterbelt. (Image by Frank Nicholas Meyer; reproduced with permission from Harvard Arnold Arboretum Library.)

FIGURE 16.2 The agency of species. (a) Poplar in China. (b) Acacia in Africa. Each species displays adaptive virtues that are exploited in order to accomplish the coverage across an entire region. (Image courtesy of author.)

processes, but as a specifically human-induced incentive—an instrument of urbanism and a prime example of green infrastructure. Infrastructure offers a framework when referring to public works projects that are created in support of an industrial economy (Bélanger 2010). It also has historic significance as a military procedure and tends to be used in contemporary design discourse to describe any substructure that supports development. Finally, soil erosion is offered as the opponent, and infrastructure is offered as a means to arrest decline and amend the land in preparation for food production or to shelter the surrounding communities from airborne particulate. In the case of planted infrastructure, scale can be measured at the level of the farmstead, the province, and as a result of increasing water scarcity, the continent. Although there is seductiveness to suggesting a unifying theory, the process of

desertification is often misunderstood when it is reduced to such a totalizing order. Additionally, projects that are introduced through large-scale planning measures do not encourage the required sensitivity between various arid and semiarid conditions and the associated vegetal dynamics. The supplementary protection strategies are often misaligned with local needs, plant-soil requirements, and their mutual dependence. If design professions aim to have impact on the scale of the territory by taking into consideration the principles of an entire system as a series of long-term processes, then how can we contribute as designers in the face of global environmental policy on planting trees in grasslands?

16.2 CONDITIONS

The United Nations Convention to Combat Desertification retains authority over the definition of desertification: "land degraded in arid, semi-arid and dry sub-humid areas resulting from various factors, including climate variation and human activities" (UNCCD 1995). This characterization of the land as something to combat or contest is intrinsic to the objectives outlined by the definition. In fact, most academic discussions of the topic position desertification as a threat to the "natural" environment and tend to characterize the issue using similar military terminology (Figure 16.3). The main battle presented is the tension between unproductive land encroaching upon productive land. The notion that the land is actually non-static is recognized, but it is not described through the lens of biological evolution or ecological succession. Instead, the definition offered by the UNCCD outlines a specifically human-induced condition that insinuates

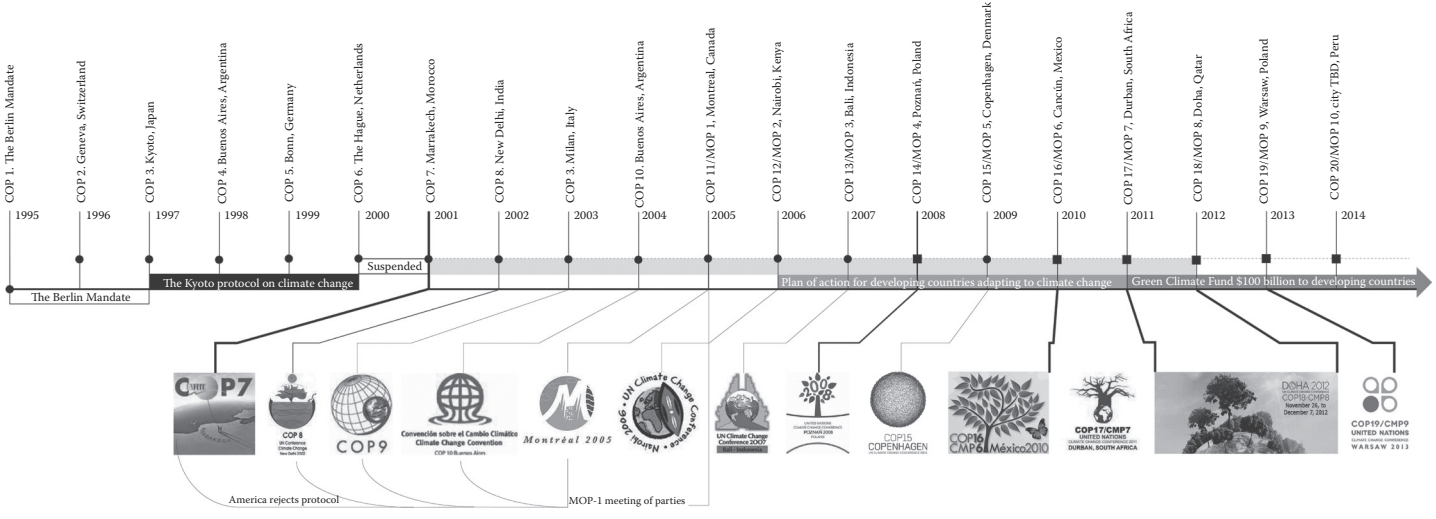
FIGURE 16.3 Aridity index adapted from United Nations "Map of Desertification" (1977). The first official map that positions desertification as a risk. (Image courtesy of author.)

a disobedience of nature and highlights a potential conflict. The link between population growth and environmental degradation has theoretically existed since the origins of technology, and so it is safe to assume that erosion and development are symbiotic. Further, this is supported by the global migration from agrarian to industrial production (Odum 2007, 54). Is desertification the result of a bond between attrition and progress, or is it an urban hypothesis offered in support of expanding economies? The term desertification was first popularized in 1949 by the French ecologist André Aubreville in his book *Climats, Forêts et Désertification de L'Afrique Tropicale* (1949), in which he specifically linked the impact of man to the undesirable loss of cover:

> It is the process of deterioration in these ecosystems that can be measured by reduced productivity of desirable plants, undesirable alterations in the biomass and the diversity of the micro and macro fauna and flora, accelerated soil deterioration and increased hazards for human occupancy. (33)

According to Helmut Geist in *The Causes and Progression of Desertification*, there are over a hundred existing definitions of the term (2005). This observation offers us an immediate perspective regarding the historical complexity of the issue and the complications of a single authority when discussing dynamic ecosystems. Therefore, the term desertification is not always appropriately applied as few definitions explicitly refer to whether it is actually a permanent state or if it is artificially exaggerated as a metropolitan construct as opposed to an ecological condition characterized by drought. Although desertification may be the consequence of exploitative human practices, it is also a complex process that proceeds to varying degrees across climatic regions and diverse locations. Aubreville's contribution is critical as it goes on to refer not only to process, but also to event and cyclical patterns. This is based on his perspective as a botanist and his expertise in tropical rainforests. Aubreville's research was in Subtropical forests, where colonial silviculture was denuding the land, exposing rich topsoil to the elements. The capacity for destructive forestry practices to generate soil scarcity is at the root of his descriptions and the impetus for crafting such an authoritative term. It was also effectively linked to improvement strategies and logistics that supported the spread of colonization. However, "green wall" infrastructure (afforestation) is not replenishing cover in degraded land but is being introduced into grasslands and prairies that experience drought as an environmental and biological imperative. The term desertification seems to now have contemporary associations, which have falsely elevated it to the status of other exhausted semantics such as "sustainability" or "biodiversity." It would appear that as soon as the United Nations (UNEP, UNCCD) declares an issue within the scope of conservation, the subject itself becomes obscured by the agencies that were created to represent it (Figure 16.4). In other words, it is the regional geomorphology rather than the agent that expresses the loss that is critical to addressing the subject and, further, to proposing explanations.

The more arid the environment, the more likely it is that vegetation under distress will not recover through natural succession (Gurevitch and Scheiner 2002). Therefore the bond between vegetated and non-vegetated surfaces frames the topic in arid regions; and the relationship between species and establishment



1 Black, Richard (November 18, 2006). "Climate talks a tricky business". BBC News.

FIGURE 16.4 The evolution of an ideology from the planetary to the terrestrial. The United Nations Climate Change Conferences offer a formal setting for the Conference of Parties (COP). The COP meets to review and assess the most recent scientific, technical, and socioeconomic information produced worldwide in order to understand the advancements made internationally on climate change. The COP does not conduct any research, nor does it monitor climate-related data or parameters. Since 2001, these meetings have been fashioned with a logo in order to generate a comprehensive image of the major issues. This chart illustrates the evolution of the brand from the framework of an interconnected global issue represented by the planet to the idea of potential local resolution, represented by the symbolic tree. This shift in ideology occurred following the COP-12, the first conference held in Africa. (Image courtesy of author.)

technique is of critical importance. From a planning perspective, the realization of large-scale replanting is hinged on the capacity for the technique to be implemented without skill while attaining a high rate of survival (Guo et al. 1989). Therefore, the methodology rarely considers the species itself, its development over time and space, and, further, its botanic associations. The tree species are merely selected based on a compromise between their adaptability and resistance to drought, and it is widely acknowledged that restoring vegetative cover is the most effective technique for slowing erosive states and securing productive soil. The species being deployed grow rapidly and adapt to difficult conditions easily, these characteristics do not contribute to a slower and more systemic ecology that would increase soil stability over time. Instead, trees are established as tools, an infrastructure that is directly associated with industrial economies albeit offered under the rubric of environmental protection.

Plants are the most successful agents when weighing the challenges of economy and restoration of degraded soils, since they are inexpensive and offer an alternative to vacancy. However, the specific manner in which dryland vegetation can recover from drought is in marked contrast to how it responds to degradation (Thomas 1993). Drought is actually a meteorological term, which is attendant to rainfall, and degradation is a specifically soil-based disturbance, defined through measures in organic composition. Degradation often occurs through human (grazing) or natural (wind) disturbances that have clear denuding effects on the land. Therefore, the articulation of local conditions is crucial to applying the appropriate replanting technique, and a definition of micro-condition will define species suitability. Although this appears instinctive, the sheer scale of regional planting projects does not support the prospect of acting in a precise and targeted manner. These projects are not being framed through the experiences of industrial infrastructure simply because live matter (trees) are the ingredient of defense—packaged with the added benefits of carbon offset, environmental amendment, tax incentive, and a sense of common good. Quantities of trees are not analogous to quantities of concrete within the current cultural domain. The positivist qualities of a tree distract criticism and reproach from the true authorities that are practicing afforestation. An infrastructure that it is sold as an absolute system—be it biotic or abiotic—cannot consider a gradation of influences or a sequence of ranges.

16.3 NEW DEAL SHELTERBELT

The practice of shelterbelt planting has roots in the American Midwest as part of Franklin D. Roosevelt's soil conservation initiative to conquer the effect of the dust bowl in the American Great Plains. The stated goals of the project were clear, defining a territory that was imagined as a defensive "green wall" to suppress airborne particles, prohibiting agriculture and framed as a local measure that could simultaneously protect the stable urban regions from erratic rural erosion. In the first U.S. Forest Services report, the design was proposed as "… shelterbelts one hundred feet wide and not more than one mile apart, in a 100-mile wide belt from the Canadian border to the Gulf of Mexico" (LSF 1935). FDR's shelterbelt project remains the most comprehensive planting project ever attempted and was

implemented to varying degrees of success. It also represents half the trees ever planted in America, a fact that does not account for the number of trees that remain nor the quality of that stock (Maher 2008). Its accomplishment was clearly not botanic; rather, it was social as it effectively unified thousands of unemployed urbanites in collaboration with thousands of rural farmers, mobilizing an industrial infrastructure of tree planting in grasslands—promoted through the lens of conservation. The Civilian Conservation Corps (CCC) was initially proposed as a temporary New Deal Agency, which would support local farmers in the struggle to conserve precious topsoil. Tree planting and land management represents the nexus of interactions between society and the environment as thousands of men enlisted and were sent across the country. The work of the CCC represents the largest federally funded transformation of the land in history, and although much of the work spanned the coasts, the critical tree-planting efforts were deployed in the Prairie states—the American grasslands (Figure 16.5).

Grasslands are the largest terrestrial ecosystem on the planet and provide a tremendously high carbon storage capacity. This is due to their fibrous and deep root system (often between 4 and 5 m), which is inherent to most grass species, storing carbon deep in the ground. The more carbon stored, the higher the capacity of the soil to actually retain water. If the soil can successfully retain water, it contributes positively to the overall water table and, as a result, the dry seasons can contract as opposed to lengthen. It is generally understood that global grassland systems perform as enormous carbon sinks and are essential to overall climate stability. Grasslands occur where rainfall is too low to support a forest but higher than that which results in desert life forms. Generally, this means between 10 and 30 inches of precipitation, depending on climate and seasonal distribution. When deserts are artificially irrigated and water is no longer a limiting factor, the type of soil becomes the concern. However, if the soil nutrients are favorable, then deserts can be extremely productive due to the ongoing availability of sunlight (Gurevitch and Scheiner 2002). The plants that are adapted to deserts may be annuals, which only grow when water becomes available, flowering and multiplying in low-lying mats, or succulents, which have high storage capacity and thicken to hoard supplies, or, finally, shrubs, which branch copiously and shed their leaves to avoid wilting. All these plants have an imbedded capacity for dormancy in order to withstand fluctuations in water availability or drought. Aridity is demarcated through moisture availability and is historically associated with insufficient rainfall to support trees or woody plant life. Afforestation or "green wall" projects are pouring trees into former grasslands that are selected for their singular purpose of establishing cover as quickly as possible, endorsing trees as a superior ecology.

A shelterbelt planting is a technique that consists of planted rows of woody species. The design typically aims to vary trees for height and leaf structure. Generally, a shelterbelt has three main components: a dense layer of conifers to reduce wind velocity, tall broadleaf trees to extend the area of protection, and low shrubs to slow particulate matter (Figure 16.6). The basis for recommending species alters considerably depending on the particular needs of the site and the region. Regardless of use, the most critical requirement is that the species be adapted to the demands of limited moisture availability, followed by a strong resistance to local climatic stresses (Ritchie 2002).

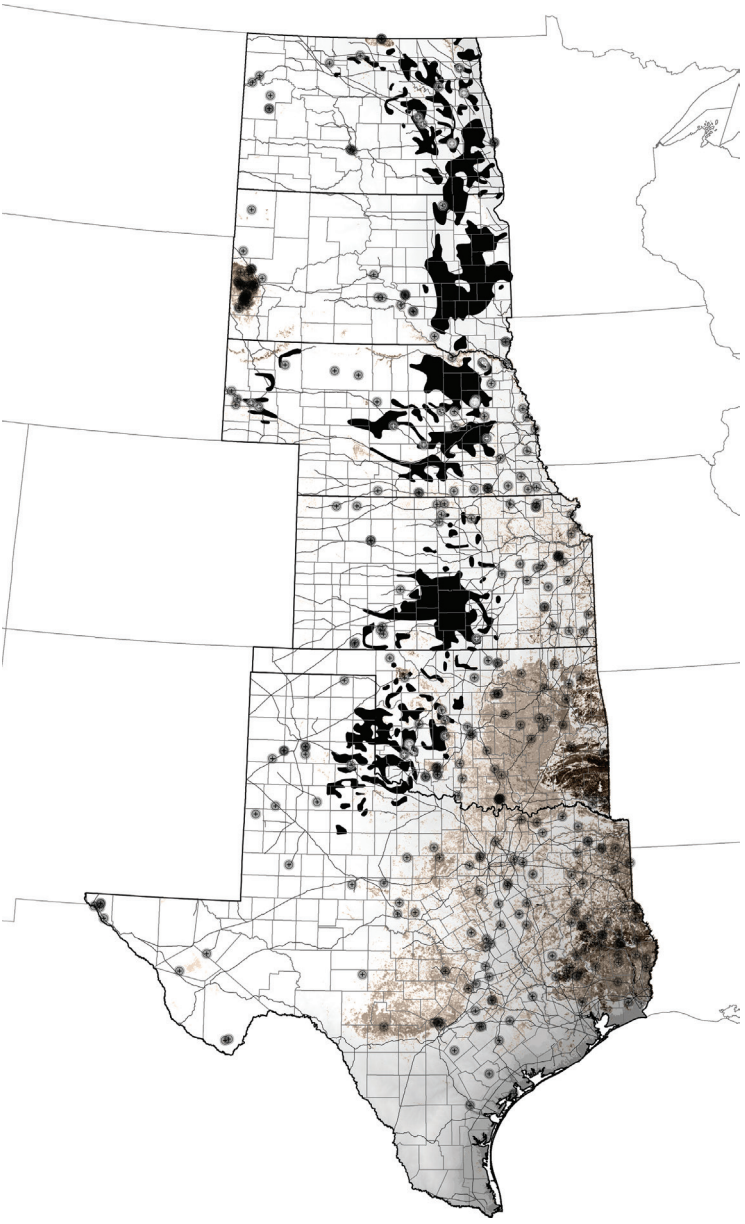


FIGURE 16.5 The Prairie States Shelterbelt. Texas, Oklahoma, Kansas, Nebraska, South Dakota, and North Dakota represent the Prairie States and the site of FDR's Shelterbelt program. Points represent Civilian Conservation Corps Camps, and the planting regions are indicated in black. (Image courtesy of author.)

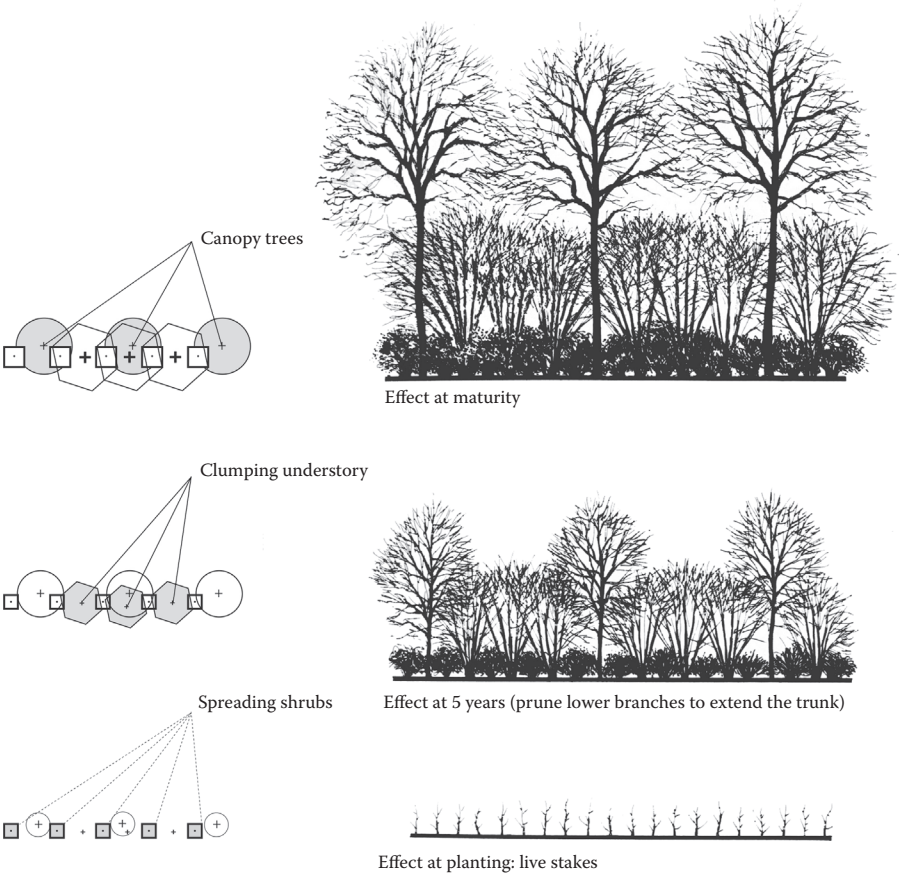


FIGURE 16.6 Typical shelterbelt considerations. (Image courtesy of author. Adapted from Lake States Forest, Experiment Station, *Possibilities of Shelterbelt Planting in the Plains Region*, 1935.)

In the past, the long-term survival and effectiveness of shelterbelts in semiarid areas has been dependent on the combined factors of proper establishment, sound design, and careful species selection—variables that are highly dependent on stewardship. These influences are well documented as founding principles, driven solely on positive results tied to agricultural productivity of adjacent land. The fundamental planting design for FDR's "Shelterbelt Project" was charted by the principles of ecology: resistance, micro-conditions, and diversity but, most critically, it was calculated with the input and ongoing support of a custodian—in this case, a local farmer or land owner with the support of the CCC. Despite even the vast ambitions of species diversity, local specificity, and enlisted labor, the project is reputed for its environmental failures, in particular its cultivation of opportunistic and highly disturbance-adapted species, which continue to prosper across the continent. As a territorial strategy, it was highly effective, positioning "green" as the principal bridge between conflicting

issues, promoting the planting of trees as beneficial to both society and the environment—the tree stands as the symbol of the individual and the nation.

16.4 3 NORTH SHELTERBELT PROJECT, CHINA

The dust storms in Beijing are notorious: not only do they cripple urban infrastructure, damaging railways, highways, and aqueducts, but the airborne particles often coalesce into hazes that utterly obscure visibility. Locals call these storms "The Yellow Dragon." The situation in China is the most illustrative circumstance of rural dynamics affecting urban populations because arid or semiarid land occupies the most significant percentage of land in China. It is currently estimated that 262 million ha of land in China is disturbed by overgrazing, soil erosion, and increased salinity (Zhang 1996). This accounts for 27% of the total land area (or 79% of total arid lands). To give an idea of scale, the issue affects more than 400 million regional inhabitants and impacts more than 100 million people in urban populations of the Bohai Economic Rim, including Beijing, Tianjin, Tangshan, Shenyang, and Qingdao. The shelterbelt forests currently wind their way from the north in Heilongjiang province through more than 500 counties in 13 provinces to Xinjiang. The project claims to extend 23.5 million ha in grids that can be up to 3 km in width (FAO 2002; Xu et al. 2006). This artificial ecosystem is often described as a conservation project in Chinese media (much like FDR's program), which presents an interesting discussion in terms of an appropriate lexicon for both the discussion of designing at regional scales and of planting as a strategy. Because anthropogenic disturbance is considered to be the direct and major cause of soil erosion and vegetation loss in China, it becomes possible to forecast that the afforestation projects will grow along with expanding urbanism (Zhang 1996). The twin forces of economic prosperity and massive migrations are critical measures to this growing condition, in which time, scale, and circumstances are coalescing to create a new environmental paradigm.

The Chinese government has known about the escalating issue of airborne sand since the early 1970s, and it was this awareness that prompted the "3 North Shelterbelt Project" (SFA, FAO 2002). Deng Xiaoping launched the 3 North program in 1978, aspiring to create an extensive network of plantation forests across Northern China, an expanse also called the 3 North region (Figure 16.7). The 3 North project is one of six major developments supported and overseen by the Chinese Forestry Administration (SFA): The Program for Shelterbelt Development along the Middle and Upper Yangtze River, The Coastal Shelterbelt Development Program, The Farmland Shelterbelt Network of The Plains, The Natural Forest Conservation Program, The National Program against Desertification, and the Taihang Mountain Afforestation Program. The proposal describes a "restoration" of more than 42% of the total area of the country (Figure 16.8). This ambition marks the largest unified design project the world has ever seen and the most extensive act of horticulture embossed on terrestrial ecology. The stated objectives also propose productive forest cover, aiming to increase production of wood supplies and fuel wood to meet current and increasing timber demands. Despite this claim, the project relies on a network of locally governed provinces, each with particular cultural, economic, and

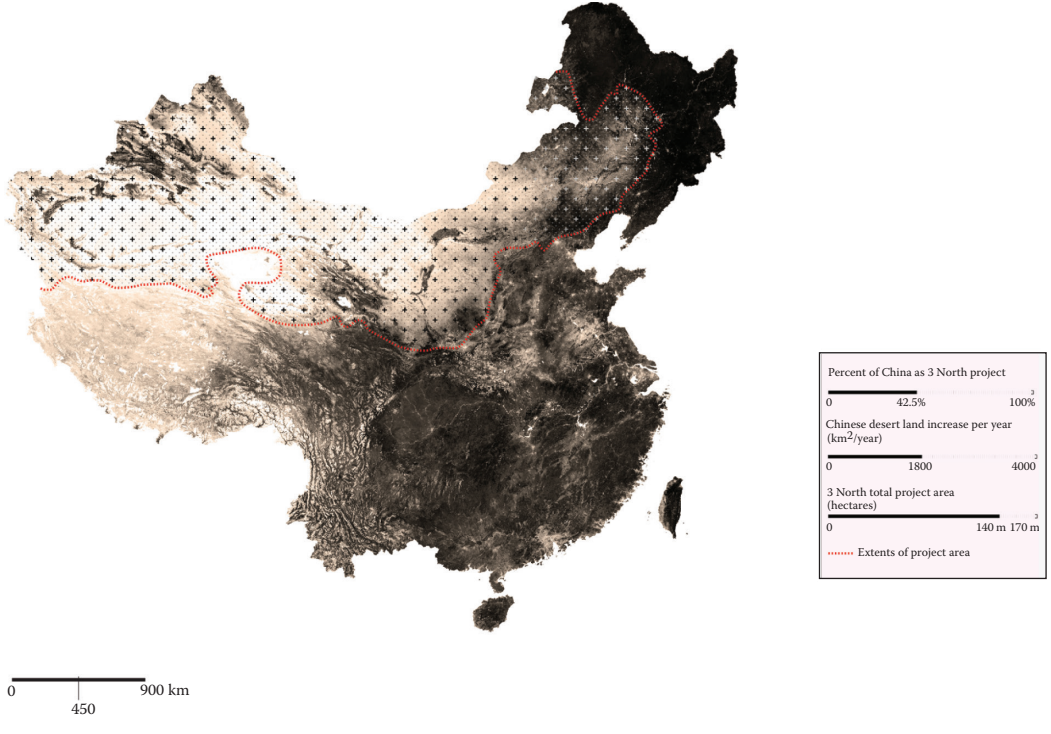


FIGURE 16.7 China 3 North Shelterbelt. The Chinese government has known about the escalating issue of airborne sand since the early 1970s, and it was this awareness that prompted the "3 North Shelterbelt Project." Deng Xiaoping launched the program in 1978, aspiring to create an extensive network of plantation forests across Northern China, an expanse also called the 3 North region. (Image courtesy of author.)

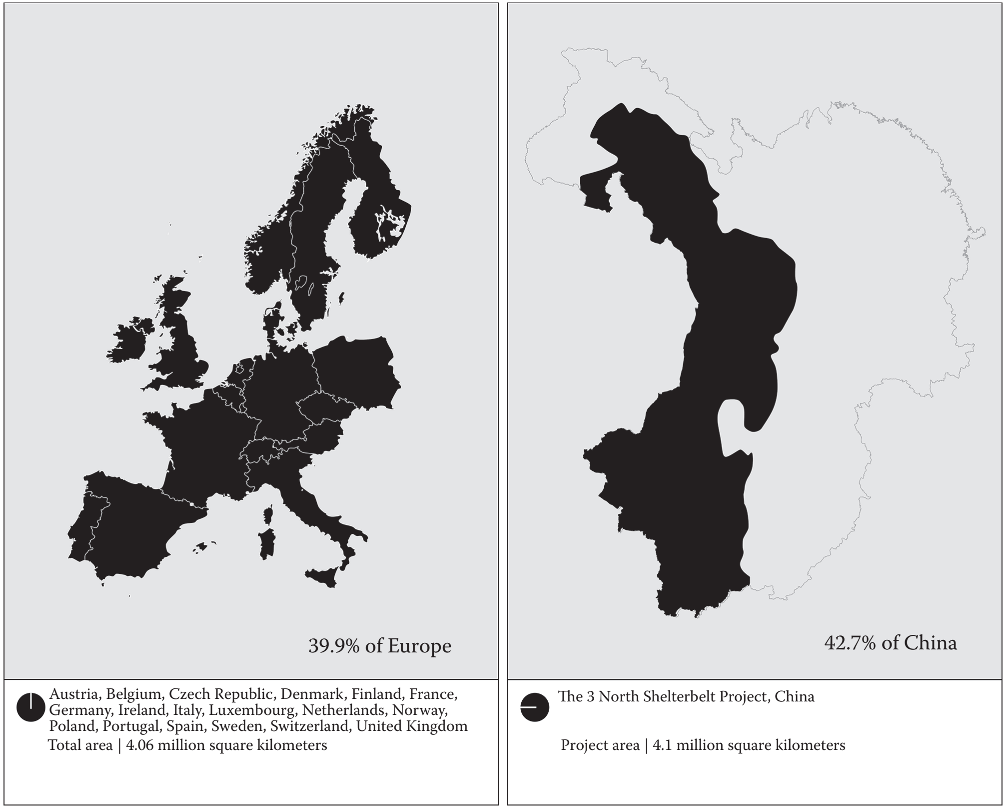


FIGURE 16.8 Scale comparison. The comparison between the scale of the project as outlined by the SFA (State Forestry Administration) in China, contrasted with the same scale as a percentage of Europe. (Image courtesy of author.)

geomorphological pressures. The demands are simply too multifarious to allow for absolute statements of intent; further, the project does not anticipate any form of owner agreement or instruction. The SFA has published results of 10- and 20-year studies of the 3 North project (Figure 16.9). There are varying claims about the success rates, but it is generally accepted that the survival rate is 15% (Wang et al. 2010).

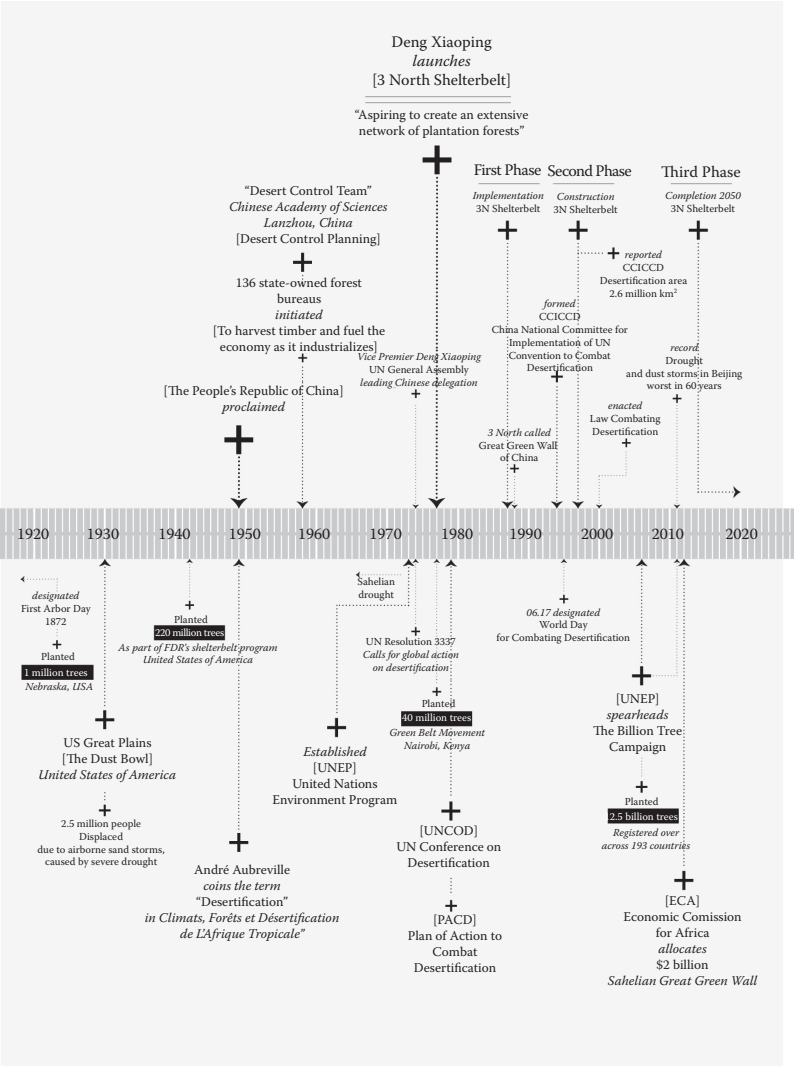


FIGURE 16.9 Timeline of desertification. The combined forces of intergovernmental agency, media frenzy, and population anxiety congregate around the threat of desertification. Common ground is achieved and monitored by posturing tree planting numbers as a means to an end, sponsoring the commodification of nature and the abstraction of territory. (Image courtesy of author.)

The shelterbelts themselves comprise an outer belt 500 m wide with a fence along the perimeter to restrain sand. The plantings are often inserted in chessboard patterns and enclose an area that is presumed to be for future agricultural use. The subsurface is prepared by laying out a 2-m-wide gravel platform between the rows of trees that are planted as bare rootstock. This planting procedure is heavily dependent on labor and community involvement, a limiting factor that was recognized early in the project. Citizens and military alike are recruited to contribute significantly through enlistment, persuasion, and by instilling a sense of partnership in a common environmental enterprise.

16.5 *POPULUS SIMONII*, SIMON'S POPLAR, CHINESE POPLAR

The description of a species offers an alternative reading of the land on which it originated almost as if its history acts as a narrative for describing local geography, terrain, average precipitation, and soil composition. Poplar trees are well known for their versatility to site, adapting to difficult, wet, dry, windy, exposed, or all-around challenging conditions. Not surprisingly, they are found throughout the world and remain the genus of choice in most afforestation projects. *Populus* is the most widely used forest tree genus in genetic modification studies and is regarded as a model tree in forest genetics for its range of varieties and ease of reproduction by cloning (NPCC 1996). The Chinese poplar, *Populus simonii*, is particularly well adjusted to both hot and cool environments, including deserts, revealing its fortitude as a native species. Correspondingly, *P. simonii* has been historically recorded through an association with human activities in the drylands of China (Wang et al. 2010, 19). It grows anywhere and as a result of its resilience, remains the major woody species in the 3 North Shelterbelt program. The species' early success is hinged on fundamental poplar characteristics, including easy propagation, rapid initial growth, and available seed. The scale and spread of poplar varieties is a new chapter in the story of the Chinese poplar, coinciding with the cultivation of arid land. Currently, China accounts for 73% of the world poplar plantation area, which consists exclusively of three main species: *P. simonii*, *P. deltoides*, and *P. nigra* (FAO 2006). According to the State Forestry Administration, poplar accounts for more than 60% of the shelterbelt stock used from 1991 to the present. If one accepts that the official number of forest plantation is 24 million ha, then more than 14 million ha of poplar have been planted to date, illustrating a powerful and disturbing dependence on a single species.

The State Forestry Administration claims that poor survival rates are lowering expectations and forcing a reinterpretation of species selection and diversity (SFA, FAO 2002). The 3 North project is entering its second phase of development and concluding the first phase of assessment. Adverse factors have been recorded that highlight the limited genetic diversity but also describe poor nursery conditions, insufficient site preparation, and low maintenance in large-scale plantings. A report by the Chinese Agriculture University states that most afforestation programs have actually contributed to environmental degradation in arid and semiarid regions (Cao et al. 2008). The most recent developments in Chinese programs do not question the obligation or scale of the tree-planting program itself but tend to emphasize the

need for improved technology or techniques to increase the overall rate of success. These advancements include aerial seedling bombs, dune fixation through particle injection, and plastic-lined tree pits to capture water. It would seem that as the desert advances, the techniques for suppression invite considerable bioengineering and infrastructural promises that exclude human agency.

16.6 GREAT GREEN WALL (GGW), AFRICA

The Sahel is both a geographic region and a climatic range, which spans the African continent between the Red Sea and the Atlantic Ocean. Often referred to as a "transition zone" between the Saharan desert and semi-tropical savannah, it is actually a semiarid region with its own particular vegetative qualities, which transpire in episodes linked to seasonal rainfall. These sporadic conditions historically fostered nomadic pastoral systems, which were closely aligned with the shifting terrain of drylands and the possibilities of irrigation. Therefore, current trends toward permanence do not necessarily align themselves with the cultural or ecological history of the region, which are defined through patterns of movement. Geist recognizes the differentiation in dryland conditions between Central Asia and Africa, indicating that the African drylands do not suffer drought in the same way as the vegetation is highly dynamic and resilient. He also elaborates that it has evolved along with the dynamics of human influences for millennia (Geist 2005, 168), The vegetation tends to respond to human impact in sporadic and unpredictable ways. Accordingly, this is the suggestive rationale for their extreme resilience. Evolving highly responsive root systems and extended dormancies is particular to desert species. Additionally, meager spacing is essential to ecosystem function. Trees are found in isolation or at great distances from one another in order to eliminate subsurface water competition. Trees may appear deprived from a ground-level perspective, but below the surface, they may be developing, simply conserving their energy by limiting exposure. As a system, trees are most often found in association with shrubby grasslands and certainly not as tightly planted grids. Human occupation of the Sub-Sahara and Sahelian desert goes back more than 100,000 years and was held not only through vigilant nomadic routes, but through careful soil and water management (Mortimore 1998). In the current context, the community no longer structures the impact of human habitation, nor is it organized within an environment that relies increasingly on aid or imports. The discussion of productive plant resources can only be useful if it acknowledges a gradient of environments that are interconnected and interdependent. This is especially problematic within a complicated border condition that divides eleven countries.

There are a remarkable number of plans being researched and tested or deliberated and discussed in terms of how to counter the trend of drought in the African Sub-Sahara. However, the current discussions of greening the Sahara fail to acknowledge this history of pulsing occupation. In its place, a future of embedded permanence is projected. Climate modification schemes have been proposed since the 1930s, instigated by the American "Dust Bowl" when the United States first promoted its shelterbelt defense program (Glantz 1977). These technological or environmental cure-alls include green wall projects but are supplemented by

more ambitious plans, including precipitation augmentation through cloud seeding and flooding large inland depressions to create Lake Sahara. In 2005, President Olusegun Obasanjo, President of the Republic of Nigeria, officially proposed a green wall for the Sahara and promoted it as the only solution to desertification (UNEP 2005). It was anticipated as a further implementation strategy to satisfy the request of the United Nations Convention to Combat Desertification (UNCCD) from the UN earth summit in Rio (1992). The regional site was selected through high-definition vegetation mapping, which identified the area between the Sudano-Sahelian savannas and the Sahelian shrublands. The official goal released by the New Partnership for Africa's Development states, "The intent is to erect a physical barrier made of trees over a 15 km-long area linking Dakar to Djibouti—7000 kilometers—in order to stop desert encroachment and protect human and natural systems south and north of the Sahara against the adverse effects of desertification on their economic and social development" (Asante 2006) (Figure 16.10). The intricate authority of each agency is a complex and multifaceted array of acronyms

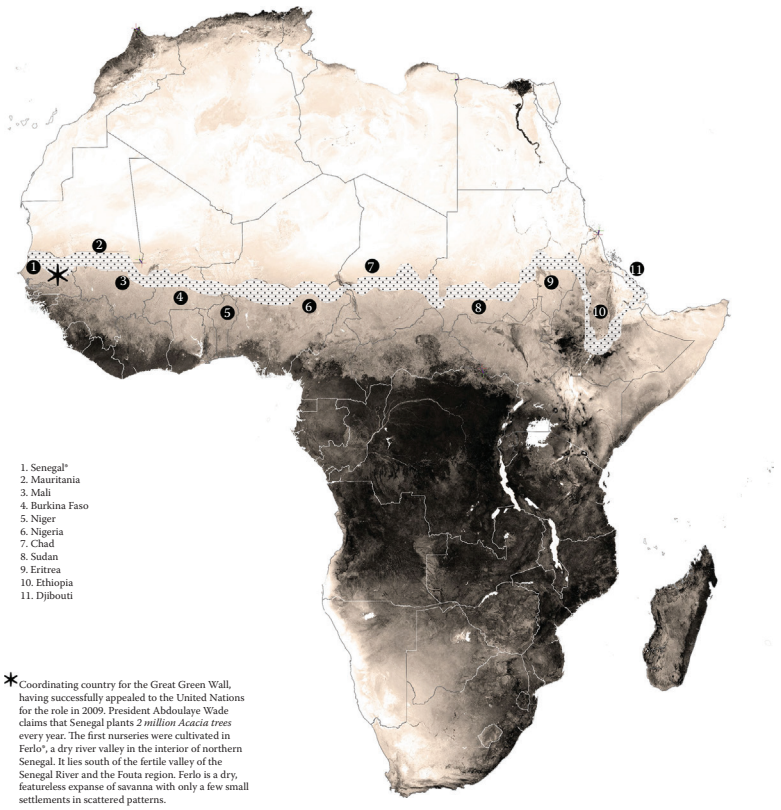


FIGURE 16.10 Africa's Great Green Wall. From Senegal to Djibouti, the Great Green Wall is coordinated by the New Partnership for Africa's Development states, and the first pilot projects are being developed in Senegal, where they have already started publishing tree counts that extend into millions. (Image courtesy of author.)

and agreements. The GGW, still in its formative years, is a proposal being continually reworked according to the growing global concerns and the economic realities of the region. The Community of the Sahel-Saharan States (CEN-SAD) and African Union (AU) claim to be leading the project and in 2011, created the Pan African Agency of the Great Green Wall (PAGGW). This newest agency confirms the project as the most contemporary re-greening initiative on the planet. For policy purposes, each country is actually responsible for adopting and implementing the plantings on their respective soils. At the same time, funding is being secured in sizeable amounts, hundreds of millions from the FAO (Food and Agriculture Organization United Nations) and ECA (Economic Commission for Africa) among others. The number of stages, countries, and agencies that are involved obscures the capital and its associated distribution. It is simply not clear how the money is allocated or being applied to the ground. It seems reasonable to conclude that the funding is caught in the planning phase, which is defended as a necessary first step to implementation. Agency aside, the GGW project is a proposal to consolidate the battle against desertification across eleven countries from West to East Africa. Therefore, the initiative is also an experiment in geopolitical collaboration, not to mention the implicit cultural and religious discrepancies of defining the need for green infrastructure. Is it possible to protect human systems from climate change through a unified dryland replanting initiative?

16.7 *ACCACIA* SP.

The GGW should be considered a theoretical project because the ideas and proposals were only endorsed by the African Union in 2007. In August 2012, the participating countries met in Burkina Faso to strategize and define the framework and deployment approaches. Yet another acronym appears to be publishing additional reports of those proceedings, GGWSSI (The Great Green Wall Initiative of the Sahel), representing the countries rivalry for the funds associated with tree planting projects. Meanwhile, a vegetation policy has been released that identifies and catalogues 37 woody species that are found locally and display drought tolerance. The genus *Acacia* accounts for eight species in this diminutive list, ranging from shrub to tree varieties. However, there are 1250 species in the genus *Acacia*, which are found across the African continent, all of which have been introduced from South Africa or Australia. The extensive history of the *Acacia* and its complicated taxonomy is not pertinent to this discussion; what is relevant is that trees present an especially complex and relatively steady component to arid zones of transition and movement. The first and most common type in the Sahel is deciduous *Acacia* sp., producing the greatest foliage during the rainy season and slowly declining afterwards. A second type is the *Faidherbia albida* (Thorny Acacia), which has an inverted leafing cycle, shedding all of its foliage in the rainy season, and a third type retains its leaves throughout the year (Mortimore 1998). The Thorny Acacia is not only useful for its anomalous growing cycle, but it is also rich in nitrogen, phosphorus, and other nutrients. Plants that grow beneath these trees benefit from their annual leaf fall, which fertilizes the soil and counteracts soil acidity (Ritchie 2002). Locals recognize the benefits, which is why any visitor can observe the trees

interspersed with cropland in many parts of East Africa. But the tree is absent from the vegetation list identified by the GGWSSI. There is no documentation or justification to provide further clarity on the issue at this time except it can be assumed, based on other initiatives, that it is the slow rate of growth working against its inclusion. The assumption that the entire Sahel can be renewed with a dependence on such a small diversity of species is not only unrealistic, but also potentially dangerous and certainly cannot be considered under environmental frameworks. In particular, it ignores the tremendous gains of planting three or more tiers of vegetation and, in particular, grasses that promote microbiotic relationships in the soil. Therefore, both the micro-conditions and the artificial spacing are critical to planning at this stage of the process. Because soil erosion is heavily dependent on spatial arrangements (Forman 1995, 458), it is critical to couple the type of erosion with the species, especially across a continental scale. Additionally, reflecting processes through patterns can ensure that the habitat represents the customs of a region and has an authentic role in sustaining local life and resources.

16.8 CONCLUSION

Green infrastructure is a term that has lost relevance due to a lack of precision and specificity, revealing the deficiencies of color-coded planning. Although it presumes to be analogous to constructing soft resolutions to otherwise hard solutions, the term nevertheless lacks a clear definition sponsoring the commodification of nature and the abstraction of territory. The design profession and, more particularly, Landscape Architecture is positioned to articulate the parameters of this so-called green expression through frameworks that are scalar and strategic and exhibit spatial significance. When applied to territorial and political spheres, the perils of this lack of characterization become more acute. "Green wall" infrastructure endorses the use of billions of seedlings, which lends itself to a quick fix within the broader environmental context. In order to challenge this discourse, it is important to recognize that trees themselves are being positioned as a distraction from the associated power structures that are promoting their planting. With climate issues becoming more and more globally visible, this is an ideal time to draw attention to the practice of landscape amendments as they relate to infrastructural scales. The framework of greening is a specifically urban classification, and its application to remote sites is remarkably problematic because contextual specificity, recognition of local conditions, and gradients of concentration are lacking resolution. In the case of afforestation, human agency is fundamental, instigating a conversation about long-term maintenance and support for artificial affiliations to take root, rejuvenate, and thrive. Afforestation offers a technological or industrial tactic as opposed to a long-term sequence of biological associations or ecological scenarios. This puts tremendous energy—economic and biological—in cultivating growth rather than sustaining relationships. Is there any question that trees are embedded in our cultural consciousness and deeply linked to progress and social responsibility? The issue of control becomes even more apparent when tree planting is presented as a survival strategy and considered the only available solution to save affected people and land. We suffer further when we link greening projects to a do-good mechanism used to offset our urban guilt. Control and defense measures must

be replaced with social, economic, and biological measures that are driven by design principles.

COMMON ABBREVIATIONS

CCICCD: Chinese Committee for Implementing UN Convention to Combat Desertification
CEN-SAD: The Community of Sahelo-Saharan States
ECA: Economic Commission for Africa
FAO: Food and Agriculture Organization United Nations
GGWSSI: Great Green Wall of Sahara Sahel Initiative
NEPAD: New Partnership for Africa's Development
NPCC: National Poplar Commission of China
PAGGW: Pan African Agency of the Great Green Wall. Member states: Burkina Faso, The Republic of Djibouti, The State of Eritrea, The Federal Democratic Republic of Ethiopia, the Republic of Mali, the Islamic Republic of Mauritania, the Republic of Niger, the Federal Republic of Nigeria, the Republic of Senegal, the Republic of Sudan, the Republic of Chad.
SFA: State Forestry Administration of China
UA: African Union
UNCCD: United Nations Convention to Combat Desertification
UNCOD: United Nations Conference on Desertification
UNEP: United Nations Environment Program

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