

Stewardship Now?

Reflections on Landscape Architecture's Raison d'être in the 21st Century

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ABSTRACT Written on the occasion of the centenary of landscape architectural education at the University of Pennsylvania (1914–2014), this paper is a wide-ranging reflection upon landscape architecture's highest ambition: to serve as the agent of large-scale landscape stewardship leading to an ideal state of sustainability. Stewardship, as conceived by Ian McHarg, is critically examined, with discussion of how nature and ecology are constructed in McHarg's worldview and how this legacy continues to inform landscape architectural discourse. Reactions to and extensions of McHarg's planning methodology are summarized with particular emphasis on the lineage of thought emerging in large part, but not entirely, from the University of Pennsylvania's Department of Landscape architecture (UPenn). As it emerged out of the rift between planning and design that opened up in late 20th century landscape architecture, landscape urbanism is discussed and situated within the deeper and broader concept of stewardship, as is the emerging interdisciplinary field of Geodesign. The theory of stewardship is then related to the current global crisis of biodiversity depletion and the research directions in this regard being undertaken at UPenn's landscape department are outlined.

KEYWORDS Stewardship, Ian McHarg, ecology, landscape architecture, urbanism, planning, design, geodesign, biodiversity

If one can view the biosphere as a single superorganism, then the Naturalist considers that man is an enzyme capable of its regulation, and conscious of it. He is of the system and entirely dependent upon it but has the responsibility for management, derived from apperception. This is his role—steward of the biosphere and its consciousness. (McHarg, 1992, 124)

It takes a lot of hubris to even to think of ourselves as stewards of the earth. Do we want the remote and infinitely difficult task of managing the earth? Do we want to be made accountable for its health...? I would sooner expect a goat to succeed as a gardener than expect humans to become stewards of the earth. There can be no worse fate for people than to conscript them to such a hopeless task. (Lovelock, 1988, 228)

INTRODUCTION

In the face of the ecological apocalypse one need not be ashamed of feeling incapacitated, but for landscape architects the situation is particularly acute because we, unlike any other profession I am aware of, repeatedly state that we are able to do something about it. To wit, in a letter to the *New York Times* in 1924, Robert Wheelwright, co-founder and co-editor of *Landscape Architecture Quarterly*, a practicing landscape architect and the first director of the program of landscape architecture at the University of Pennsylvania (UPenn), noted that “there is but one profession whose main objective has been to co-ordinate the works of man with preexistent nature and that is landscape architecture.”

Devoting his entire career to this very idea, Ian McHarg, who assumed the Chair at UPenn in 1954, said it was our imperative to “green the earth, restore the earth [and] heal the earth” (1992, iv). In his magnum opus *Design with Nature*, McHarg refers repeatedly to the ideal human as the “good steward” (1992, 29, 53, 101, 123, 124, 197). In 1984 his successor, Anne Whiston Spirn concluded her prescient urban study, *The Granite Garden*, with the edict that the redesign of the city was not just a matter of aesthetics and economics: the very survival of the human race was at stake (1984, 275). And to this day, introducing a new compendium of his own writings, James Corner, (Chair at UPenn from 2000–2012) asserts that landscape architecture can provide “the very bedrock, matrix and framework upon which a city can thrive sustainably with nature” (2014, 11).

The tenor of these individual proclamations is also enshrined in the various charters of landscape architecture’s professional organizations. For example, the American Society of Landscape Architects (ASLA) says that its mission “is to lead, to educate, and to participate in the careful stewardship, wise planning, and artful design of our cultural and natural environments” (2013a). Furthermore, their Sustainable Sites Initiative recommends “in all aspects of land development and management [we should] foster an ethic of environmental stewardship — an understanding that responsible management of healthy ecosystems improves the quality of life for present and future generations” (2013b).

The Australian Institute of Landscape Architects (AILA) also stands by stewardship, explicitly defining it as the activity of “taking responsibility for and management of the landscape through master planning, design, recycling, conservation, regeneration, and restoration” (2013). AILA goes on to state that “as a matter of urgency” Australia must plan “an integrated national spatial framework for landscape-scale conservation and regeneration” (2013), a scale of work to which I will return later. Similarly, the Aotearoa-New Zealand Landscape Charter explains that stewardship is “a responsibility to nurture the continued health and diversity of landscapes, and ensure the sustainable integration of protection, production, recreation, and habitation values for all living things” (New Zealand Institute of Landscape Architects 2013).

Intentionally or otherwise, the International Federation of Landscape Architects (IFLA) does not use the word ‘stewardship’, but it does state that landscape architects are “called upon to contribute towards safeguarding the viability of the natural environment and towards developing and maintaining a humane built environment in cities, towns and villages” (IFLA). The calling to which IFLA refers is that of creating an ecologically benign global civilization. McHarg called it a “command” (1969, 122).

Interestingly, the Chinese Society of Landscape Architects (CSLA), whose jurisdiction will do more than anywhere else on earth to make or break civilization’s prospects of sustainability, refrains from biblical injunctions on the matter. According to their website, the CSLA is merely concerned with the “preservation of national natural, cultural and historical resources” and building an “eco-friendly and beautiful habitat” (2013). China’s most celebrated landscape architect Kongjian Yu, however, is less circumspect. In his monograph, near a photograph of himself with Ian McHarg, Yu writes:

Every hour three species disappear. We must redefine what seems pleasurable and beautiful to us—especially in landscape architecture—itself a crucial profession in the struggle for sustainable ecology. . . . Both global and local conditions compel us to embrace an art enmeshed with fostering survival, promoting land and species stewardship (2012, 44).

Today stewardship in common parlance means variously to serve and to manage. In landscape architectural discourse since McHarg, it means of course to oversee the large-scale relations between natural and cultural systems. Writing in this journal in 1988 Robert Scarfo traced the etymology of the word to 8th century England where the *steward* was a keeper of pigs (60). Scarfo organized the predominantly agricultural history of stewardship into four historical phases; the immediate, the transitional, the separate, and the external. Along this transect he identified that the distance between the subject (steward) and the object (land) has increased over time. According to Scarfo, as a fundamental characteristic of modern professionalism we now find ourselves in the phase of being predominantly “external” to the

land we purport to steward. He argues, however, that this degree of separation from that which we purport to care for isn't theoretically contradictory and needn't lead to superficiality. It is, for Scarfo, precisely the combination of our capacity for a relatively objective large-scale temporal and spatial overview (afforded by being external to the object), along with some degree of the site-specificity (personal experience and careful site analysis), that is best suited to the ecological and social challenges the world now faces. (67)

Typically, when the word stewardship is uttered landscape architects either nod approvingly or roll their eyes. On the one hand, our declarations of stewardship distinguish us as a profession and are proportionate to the magnitude of the ecological crisis. On the other, claims to stewardship are, as James Lovelock indicated at the outset, just hubris: in our case a small profession with an inferiority complex inspired by a charismatic leader (McHarg 1920–2001) continuing to make inflated statements about both its purpose and its capacity. Like no other, the word *stewardship* hangs over landscape architecture with moral gravitas, casting the shadows of what Daniel Nadenicek and Catherine Hastings described so succinctly as the “separation of words and work” (2000, 160).

McHarg and Lovelock are, however, just different sides of the same coin: while McHarg's vision of stewardship is arcadian and ennobling, Lovelock's description of its impossibility is a dystopian ploy to shock us into temperance so as to avoid further climate change. In any event, with atmospheric carbon levels now over 400 parts per million, a global population expected to peak at circa 10 billion this century, and an ecosystem in triage, it would seem we have no choice *but* to engage in some form of both locally and globally coordinated stewardship. The question then is to what degree landscape architects are involved in this process and to what degree our actions are precautionary or reactionary.

Despite the hubris of stewardship, Lovelock does express some faith in human agency when he writes in his 1988 biography of the planet, *The Ages of Gaia*, that in order to solve our global problems “we need a general practitioner of planetary medicine” (1988, 171). Seemingly oblivious to the role landscape architects think they can play in this regard, he asks “Is there a doctor out there?” (1988, 171). Had McHarg read this plea he would surely have offered Lovelock both the

diagnosis and the remedy. Twenty-five years on we can ask what landscape architects have done and are doing about a planet Lovelock believes to be now terminally ill and one still under the mismanagement of a society McHarg considered pathological.

In order to better inform debate about this large topic, this paper reviews landscape architecture's self-declared mandate of stewardship. It does so by examining Ian McHarg's legacy and tracks a lineage of thought that emerged, not exclusively, but influentially through UPenn's landscape program. This rumination is inspired by my assumption of the Chair of this program on the occasion of its centenary (1914–2014).¹ Later, I relate the theory of stewardship to global biodiversity depletion and describe a current research initiative, which aims to apply design intelligence to zones of conflict between urban development and habitat conservation at a scale commensurate with the crisis.

MCHARG'S THOUGHT

Ian McHarg's *Design With Nature* not only crystallized the burgeoning environmental zeitgeist of the 1960s and 1970s, it also provided a metaphysical purpose and practical method by which human reason could finally reach a rapprochement between modernity and natural (landscape) systems. Insofar as he believed in a grand synthesis of culture and nature yet to come, McHarg was a romantic, but, unlike romanticism, it was the scientific method in the form of rational (regional) planning and not idiosyncratic, artistic inspiration that would bring it about. Although oftentimes he displayed the traits of an ideologue, McHarg was a complicated thinker and his impassioned writings are redolent with many of the still unresolved intellectual and creative tensions between art and science at the heart of the discipline he came to represent.

Disgusted by Judeo-Christianity's founding narrative of dominion and its other-worldliness, McHarg articulated a vision of oneness with the Earth instead of the “Creator”. Reflecting the target of his critique and the scale of his thinking, McHarg's language was of biblical proportion, something both atheists and theologians would, for different reasons, take issue with. For example, in this journal in 1985, Nancy Denig penned a stern rebuke to McHarg, arguing he had misunderstood and misrepresented the Bible

in general and Genesis in particular. Denig argued that *dominion* does not automatically infer exploitation; rather it is the expression of custodianship and, as such, signifies the responsibility bestowed upon humanity for all that God has created. As she explains, “[e]xploitation is one of the consequences of other courses that man is free to choose—the course of pride or of greed or of distorted theology, for example, but it is not the way laid out for man in the Bible. Judeo-Christian man is called, instead, into a relationship with nature founded upon dominion, stewardship, and co-existence”. (1985, 103)

The theology of stewardship becomes more problematic when we consider that the Christian Right of American politics can also use the term to describe their own sense of destiny. For example, Dr Michael Coffman who, according to his own website is “a respected scientist and ecologist,” is a lobbyist against global environmental policy that he believes infringes on national sovereignty and individual property rights.² As the President of Environmental Perspectives, Inc. (EPI), and Executive Director of Sovereignty International, Coffman says he provides “solutions to environmental problems based on Judeo-Christian principles of stewardship as contrasted with pantheistically-based (sic) environmentalism”. Coffman’s big achievement in this regard was his persuasion of Congress not to sign the United Nations’ Convention on Biological Diversity (CBD)—a critically important convention to which we will return in more detail later.³ As it happened, along with the United States only five other nations rejected the CBD: Andora, Iraq, Somalia, Brunei, and East Timor.⁴ Coffman is now actively working against North American rewilding initiatives, best personified by his alter ego, Dave Foreman, head of the Rewilding Institute, which aims to return 50 per cent of North America to wilderness.⁵

Larger questions of Christianity’s causality to or complicity with the ecological crisis notwithstanding, Denig, in her response to McHarg, turns our attention to the second reading of Genesis where we are instructed not to dominate ‘The Garden’ but to “dress and keep it”.⁶ This “narrative of stewardship” as Carolyn Merchant refers to it (2003), weaves an alternate history of Judeo-Christian thought stretching from St. Benedict and Francis of Assisi to Thomas Aquinas and, in our times, magisterial (environmental) thinkers such as Rene Dubos, Pierre Teilhard de Chardin

and Thomas Berry. Arguably, to dress and keep it is another way of saying “design with Nature” and so McHarg’s relationship to Christianity is somewhat confounding for his critics.

Philosophically, McHarg’s worldview is Aristotelian, not Platonic. His world is biological, creative, and teleological. For McHarg creativity is not just what artists do, it is the way the world works. Creativity is evolution’s mechanism for resisting entropy or, as he put it, “raising matter up” to new levels of order (negentropy) (1992, 53). Creativity is the function by which organisms achieve form and that form is a direct result of the reciprocal “fitting” of organism to environment. Recognizing this, caring for this, and fitting in with this is, for McHarg, humanity’s ultimate purpose (1992, 196–197).

As any thinking landscape architect must, McHarg struggles with the philosophical and practical problem of how to place human consciousness within evolution. His preferred evolutionary theorist is Lawrence Henderson (1878–1942) who, like James Lovelock with his Gaian theory some time later, declared that evolution’s engine is not just individuals being selected, but the collective nature of the biosphere self-creating the optimal conditions for life (1913). For McHarg, Henderson’s symbiotic version of evolution and notion of the earth as a superorganism deepened the meaning of Darwin’s otherwise mechanistic system of selection (1992, 46).

As Robert Cook has recorded, the holistic notion of flora and fauna constituting a superorganism was popular in the first half of the 20th century (2000, 119). The collective idea of the superorganism then became the ecosystem, which Eugene Odum, writing in 1954, described as inherently predictable, self-regenerative and ultimately climactic and stable. This image of nature as a harmonic and directional system is one in which, for McHarg, industrial, urban culture was an aberration in the natural order of things. As Cook explains, in this old paradigm the influence of human culture is largely perceived as negative, a disturbance that undermines the tendency of the ecosystem toward equilibrium. (120)

In McHarg’s schema, human consciousness should follow the logic of nature’s harmonic system. In the first of many paradoxes in McHarg’s thinking we are being asked to rationally accord with a system that finds its harmony through irrationality

(unconsciousness). If, however, we collapse the nature/culture divide upon which this particular paradox rests then it is possible to think, as James Lovelock does, that it is not just we who are sentient, it is the earth itself that, *through* us, has become sentient. The paleontologist Tim Flannery takes this to its logical conclusion when he writes that:

[I]f the global human superorganism survives and evolves its surveillance systems and initiatives to optimize ecosystem function [it] raise[s] the prospect of an intelligent Earth—an Earth that would through her global superorganism [humans], be able to foresee malfunction, instability, or other danger and to act with precision. If that is ever achieved the greatest transformation in the history of our planet would have occurred (2012, 279).

In this grand narrative, consciousness as humans experience it is not an aberration; on the contrary, it is sanctified in terms of evolution. As such, McHarg's theory is complete and his enlightened Adam can return to the garden as its designated caretaker. And this is precisely what McHarg means when he declares that humanity is “splendidly equipped to become the manager[s] of the biosphere; and give form to that symbiosis which is his greatest role, man the world's steward” (2007, p. 71).

Despite this neat and self-serving formulation of human destiny and purpose, paradoxes don't just disappear. McHarg can never account for why his Adam (or rather Eve) has, as history attests, so resolutely refused to fit into the garden. Moreover, if nature over time designs itself to fit together then how do we explain all its absurd excesses at the species level and calamities at the ecosystem level? McHarg's end point of nature and culture reconciled through the application of reason is also based on the spurious assumption of their separation in the first place and, finally, his case for design *with* nature rests on scientific principles that could be turned just as easily to support the case for design *against* nature—all depending of course on how one defines Nature in the first place.

Amidst his general tenor of certitude, there are moments in *Design with Nature* when McHarg realizes his biological determinism is inherently contradictory and philosophically problematic. For example, while describing a fictional superior culture whom he

calls the Naturalists, he notes that despite their many virtues they are fundamentally flawed because they can only act on “impeccable evidence”, and yet the world they interpret is, as he puts it, “finally unknowable” (1992, 125). And so for the logic of designing with nature to hold together, McHarg had to not only valorize nature but also overlook the problem that nature is inevitably a cultural construct. Just as it has been for the environmental movement at large, for McHarg postmodern sophistry was not going to get in the way of ecological salvation. And he was probably right that it shouldn't.

Things get more convoluted when he explains that the legal system of this fictional society is determined “in favor of the natural,” but in the very next sentence says “there is no unnatural” (1992, 125). The only possible conclusion he can draw from this paradox is that “scientific knowledge is incomplete and will forever be so, but it is the best we have” (1992, 29). Indeed; but, as Anne Spirn concluded nearly a decade later in writing about the Department he led for almost 30 years, McHarg exaggerated the rectitude of science and misappropriated it as a determinate of culture (2000, 112). As she explains:

[W]hen McHarg calls ecology “not only an explanation, but also a command,” he conflates ecology as a science (a way of describing the world), ecology as a cause (a mandate for moral action), and ecology as an aesthetic (a norm for beauty). It is important to distinguish the insights ecology yields as a description of the world, on the one hand, from how these insights have served as a source of prescriptive principles and aesthetic values, on the other. (Spirn, 2000, 112)

Due to modernity's association with oppressive, technocratic reason and its failure to deliver the enlightened utopia it had promised, postmodern scholarship generally approached any form of totalized vision or grand narrative such as McHarg's with suspicion, if not derision. Ursula Heise, Professor of English and Sustainability at UCLA summarizes it thus:

[T]he basic goal of cultural studies for the last twenty years has been to analyze and in most cases, to dismantle appeals to “the natural” or “biological” by showing their groundedness in

cultural practices rather than facts of nature. The thrust of this work therefore, invariably leads to skepticism about the possibility of returning to nature as such or of the possibility of places defined in terms of their natural characteristics that humans should relate to (2008, 46).

Consequently, the cultural climate of postmodernity that dominated design schools in the last decades of the 20th century generally frowned upon McHarg's 'positivist' planning method. Whereas McHarg thought obeisance to his method transcended the expression of individual artistic subjectivity, post-modernists saw it as not only diminishing the liberty of art, but a perpetuation of the myths and dangers of objective knowledge and its instrumental application that had characterized modernity since the scientific revolution of the 16th century. I was part of that critique: for better or worse, we all wanted to make our own maps, not tracings (Weller, 2004).

PEDAGOGY AT PENN

Although it served well to underpin the analysis stages of professional environmental planning and became perfunctory in that regard, by the mid-1980s at UPenn and schools around the world, the application of McHargian planning had become mechanistic and increasingly unable to yield anything other than prescriptive and static large-scale land use maps. Simultaneously—following the money—the profession shifted its focus away from regional planning toward civic space. McHarg's successor Anne Whiston Spirn (chair from 1987–1994) realized the need to connect the disparate scales of design and planning and, along with them, the different spheres of art and science that by now threatened to tear apart the otherwise holistic theory of landscape architecture. Consequently, through her writings and her research in Philadelphia's neighborhoods, Spirn led the way back into the ecological and social complexity of the city and with it opened the door to the semiology of design. (Spirn, 1984)

Along with Spirn, Laurie Olin, who has taught design studios at UPenn since 1974, also realized the need to balance the art and culture of design with

the department's overwhelming preoccupation with objective mapping. Turning McHarg's realization that "there is no unnatural" on its head, in 1988 Olin argued that whilst nature should indeed remain the fundamental source of landscape architectural inspiration, the artistic ways in which this well-spring could be interpreted should be "as broad and varied in scope as that of the numerous landscapes, things, and events in the universe" (1988, 150). Two years later, also from within UPenn's own ranks, McHarg's student James Corner published a pivotal two-part paper—again in this journal—that explicitly aimed to recover the landscape architectural design project from science and return it to art (1990). Corner claims to have read McHarg's *Design with Nature* five times in his first year at UPenn and his entire corpus of both written and designed work since can be interpreted as a reaction to—and ultimately respectful critique of—McHarg's oeuvre (Corner, 2014).

In 1994, as if to pull the pendulum back from McHarg with an equal and opposite force, UPenn then appointed the eminent garden historian John Dixon Hunt as Chair. Hunt oversaw a design renaissance at Penn; one actively promulgated by young faculty such as Corner, Anuradha Mathur, and Dilip da Cunha who all drew inspiration from post-structuralism and the "paper architecture" that covered the walls of design schools at the time. For Hunt, Corner, and Mathur, the landscape is a palimpsest that writes us as we write it, the two in a constant state of becoming. Landscape is as much mind as it is matter and, if that is true, then landscape architecture necessarily involves the exploration and expression of both.

Corner refers to this dynamic interplay as "the landscape imagination" (2014), a surfacing of that which was repressed in McHargian planning, and it became the centerpiece of landscape architectural education at Penn for the next two decades (1992–2012). What was a large-scale biophysical problem for McHarg became a question of site-specifically nuanced cultural critique, a case of plotting not planning for Corner and Mathur. As such, over the course of the last two decades, history, cultural geography, landscape design, urban design, and a concern for representation all flourished at Penn, but planning *per se* withered.

DESIGN/PLANNING

As Spirn and others have identified and variously tried to mend, the cost of these tensions between planning and design was a discipline split. On the one side the planners, following the higher truth and “deeper form” (Lyle, 1991) of nature’s lineaments in order to save the world. On the other the designers, arguing that the aesthetics of environmentalism are as important as the thing itself (Meyer, 2000) and that you cannot save the world with the same technocratic rationality that created the problem in the first place (Corner, 1991, 159–161). Whereas McHarg’s followers thought design was only truly meaningful when it expressed the deep processes that shaped the earth, designers such as Martha Schwartz, Diana Balmori, Kathryn Gustafson, George Hargreaves, Peter Walker, Laurie Olin, Christophe Girot, Paolo Burgi, and Peter Latz argued variously for the importance of poetics, history, spectacle, and individual creative agency in their work. Along with many others, these designers resurrected landscape architecture as an artistic enterprise from what Marc Treib described (somewhat superficially) as McHarg’s “anti-aesthetic” (49) and what Elizabeth Meyer referred to as the field’s “invisibility” (2000, 190). With this design renaissance the profession has rapidly earned a global reputation as the purveyor of artful and urbane public space, but the price paid was that the ecological reach of such work was primarily restricted to the symbolic order of things. In short, signification replaced stewardship.

Away from the spotlights of design culture, landscape planners and academics such as Phil Lewis, Julius Fabos, Dana Tomlin, Joan Nassauer, Frederick Steiner, Carl Steinitz, John Tillman Lyle, Jack Dangermond, Jack Ahern, Robert Thayer, and Richard Forman have all contributed, over many years, to critiquing, refining and furthering McHarg’s methodology and vision. For example, as the title suggests, Frederick Steiner and George Thompson’s *Ecological Design and Planning* (1996) brought together both artistic and instrumental approaches to ecology and expanded the intellectual range of the discipline. Following the success of his first book *Gray World–Green Heart: Technology, Nature and the Sustainable Landscape* (1997), Thayer’s more recent book *Life Place: Bioregional Thought and Practice* (2003) attempts to demonstrate how a bioregional sense of place can shape not just settlement patterns at a large scale, but

every aspect of a community’s material, political and spiritual well-being. Central to this is Joan Nassauer’s emphasis on stewardship as literally the act of caring. She argues that the small radius and emotional subjectivity of caring for the people and places around us can build in scale and impact through social networks so as to bridge the local and the regional, if not the global. (2011)

Richard Forman’s seminal contributions to our understanding of landscape ecology are well known and his recent book *Urban Regions* (2008) extends McHarg’s vision by systematically measuring the ecological consequences of different forms of urban growth. His latest work *Urban Ecology: The Science of Cities* (2013) links the scale of landscape ecology to that of urban design and offers a comprehensive set of principles and methods with which to improve the ecological health of urban environments.

Through consistent conferences and publications both Julius Fabos and Jack Ahern continue to advance landscape conservation and restoration through the theory and practice of creating greenways (Fabos, et al 2013). In documenting the growth of this movement, Ahern puts forward the Wisconsin Heritage trail, some 300km of connected landscape corridors designed by Phil Lewis in 1964, as a prototypical project (2004). Greenways were then given the imprimatur of the White House in 1987 when the President’s Commission on Americans Outdoors declared that they would thread “. . . through cities and countrysides like a giant circulation system” and “give every American easy access to the natural world”. (Hellmund and Smith, 2006, 32) Writing in 2006 Paul Hellmund and Daniel Smith estimated in the United States alone there were over 3000 such greenways. As the 2013 Fabos Conference on Greenways confirms, the theory and practice of designing these systems is now a mature and vibrant international movement and, as I will argue below, greenways (or ecological networks as they tend to be referred to in European discourse) are needed on a global scale if we are to secure some semblance of a biodiverse ecosystem this century (Fabos et al, 2013).

As documented in his magnum opus *A Framework for Geodesign: Changing Geography by Design* (2012), Carl Steinitz has in the course of a lifetime of methodological experimentation, considerably expanded and refined the frontiers of McHargian

planning. Along with Jack Dangermond he refers to this as “Geodesign,” defined as “a design and planning method which tightly couples the creation of design proposals with impact simulations informed by geographic contexts, systems thinking and digital technology.” (Flaxman, 2012, 12)⁷ Steinitz explains that Geodesign is not a new profession or a newly designed thing. Rather it is a rubric under which collaborations between landscape architects, planners, geographers and GIS technicians take place. (2012) Although a proliferation of terms can have the adverse effect of devaluing landscape architecture, by rebranding landscape planning as Geodesign, Steinitz and Dangermond do a canny thing. The term works to amalgamate the sciences with the humanities and to combine both with the proactivity and creativity of *design*. As an expression Geodesign seems to off-load the self-righteousness and religiosity of “stewardship” and resituate it within the lighter techno-utopianism of contemporary digital culture.

By virtue of the technology that underpins it and the interdisciplinary platform it creates, Geodesign encourages design intelligence to move away from the object and toward the systemic nature of things. And this, I hasten to add, need not be and is not intended to be an anti-aesthetic project; rather, I think we can now agree that the aesthetic and the systemic are inextricably interwoven in the complex nature-culture of the contemporary landscape. This is largely what MIT’s Center for Advanced Urbanism Research Director Alan Berger means by ‘systemic design’ which, as he points out below, builds on, rather than negates McHarg’s legacy.

[T]he next great project for landscape architects is to pick up the pieces of regional systems left in the wake of economic schema, political indecision, ad hoc development, a negligent public and flawed environmental health policy. Our challenge, if we are to build something greater out of the detritus that escaped McHarg’s grasp, is to intelligently interpret the systematic thinking brought forth by him (2007, 7).

Dirk Sijmons, curator of the 6th International Architecture Biennale in Rotterdam (appropriately titled “Urban by Nature”) writes that Berger’s theory and practice of systemic design “. . . entails a reunification

of design and planning and it is only then that we will be able to address the combined problems of climate change, environmental degradation and poverty.” (2007, 95) History teaches that technology and design will not solve the world’s problems as Geodesign “digi-topians” (to coin a term) say it will, but their belief that we are at the beginning of a revolution in terms of how much of the world we can measure, what we can model, and what we can then do with that information is of profound importance for both the theory and practice of landscape architecture and its mandate of stewardship.

THE URBAN QUESTION

Somewhat indicative of landscape architecture’s sluggish intellectual pace is the fact that it was some 40 years after the publication of *Design With Nature* that the first relatively thorough deconstruction of McHarg’s philosophy and method was attempted. In 2010, University of British Columbia landscape academic Susan Herrington found that McHarg had misinterpreted Darwin, idealized the stability of ecosystems, and failed to appreciate that mapping is *not* the whole truth. Herrington also explained how McHarg’s admiration for the English garden as a precedent for “designing with nature” was contradictory and that by extension his planning methods ultimately aided and abetted low-density sprawl. (2010)

On the question of sprawl, Herrington is now joined by Andres Duany (spokesman for the Congress of the New Urbanism) and one of McHarg’s own students Ignacio Bunster Ossa (now Principal with Wallace Roberts Todd—formerly Wallace McHarg Roberts and Todd). Both argue that whenever density is reduced because of landscape planning’s privileging of landscape systems over compact urban form, one risks not seeing the forest for the trees. (Duany and Talen, 2013, Bunster-Ossa, 2014). Bunster Ossa, along with a chorus of others, argues for high-density environments with sophisticated green infrastructure as opposed to the sprawling metropolis replete with vast open spaces.

Whilst McHargian planning *could* lead to a sprawled landscape (The Woodlands in Houston is a compromised example of this), Kathleen John-Adler of Rutgers draws to our attention lesser-known papers by McHarg where, contrary to the contempt for the city that he expresses in *Design With Nature*, he

advocates for medium density, modern courtyard housing as an ideal synthesis of culture and nature which would amplify urbanity and restrain sprawl. (2013)⁸ In consideration of these papers John-Adler finds that McHarg was fundamentally concerned for “the quality of open space, not its quantity” and that his career was predominantly a quest for “the ideal configuration of open space and built form” (2014, 204). In this sense McHarg was less a conservationist pitted in an epic struggle against the city; he was a prototypical landscape urbanist.

In a deft semantic move Charles Waldheim, at a small symposium in Chicago in 1996, spliced ‘landscape’ and ‘urbanism’ together and in doing so compressed the binary coding of nature and culture that had so strongly shaped landscape architecture’s identity, and arguably McHarg’s worldview, up to that point.⁹ For the landscape urbanist the city is not antithetical to nature: it is a *new* nature. Writing in 2011, Neil Brenner and Christian Schmid refer to this new nature as ‘planetary urbanization’ and describe it as follows:

The situation of planetary urbanization means that even spaces that lie well beyond the traditional city cores and suburban peripheries- from transoceanic shipping lanes, transcontinental highway and railway networks, and worldwide communication infrastructures to alpine and coastal tourist enclaves, “nature” parks, offshore financial centers, agro industrial catchment zones and erstwhile “natural” spaces such as the world’s oceans, deserts jungles mountain ranges, tundra, and atmosphere—have become integral parts of the world wide urban fabric. (2011, 12)

With the systematic reach of the global city in mind, the conceptual development of landscape urbanism was also promulgated by what Robert Cook described as the new paradigm in ecology, wherein ecosystems are understood as inherently chaotic and humans are accepted as a part and parcel of both their history and their future. For Cook, as for landscape urbanism, this new paradigm “challenges any clean distinction between culture and nature”. (2000, 121) It follows then that cities can no longer be conceived as tightly bounded cultural enclaves set against landscape backdrops; rather they are now extensive networks

woven across megaregional territories. Peter Calthorpe describes this new landscape as one where “[m]ore than stand-alone ‘sustainable communities’ or even ‘green cities’ we now need sustainable regions—places that carefully blend a range of technologies, settlement patterns and lifestyles” (2012, 14). In his book *Urban Green: Architecture for the Future*, journalist Neil Chambers brings this idea to life:

The end goal would be to have revitalized region[s] support tens of millions of people while producing natural niches for multiple ecosystems of native plants and animals to flourish and abound, where agriculture, infrastructure, and power production is integrated into nature in a way that enriches rivers, forests, economics, and communities. . . . Biologists, engineers, ecologists, architects, zoologists, designers, hydrologists and a host of other disciplines would need to work together to restore multiple eco-zones (2010, 178).

Technology and human nature are never so benign, but Chambers’ idea that human agency can be a constructive rather than destructive part of bioregions is the philosophical prerequisite for new material practices. This is precisely what McHarg meant by designing with nature; it is what Steinitz means by Geodesign, and it is what I consider to be landscape urbanism’s real potential. (Weller, 2006, 2008, 2009, 2013)

Just as McHarg did, landscape urbanists look to science for inspiration; but instead of a nature that was predictable, what we found appealing and relevant was the fact that it was not. A recognition and acceptance of indeterminacy in both cultural and natural systems is not to abandon clearly conceived futures, rather it is to open design and planning to probabilities as opposed to master plans which assert a fixed and final form. Following on from Cook, Kristina Hill explains that a spatiality of fixed boundaries (McHargian predeterminations based on static mapping overlays of different subjects) can no longer adequately define ecology. She says: “places must be seen as part of a changing context in which trends cannot be exactly predicted [and] surprises should be expected” (2005, 155).

As such it is no longer a case of circumscribing development here and not there and then expecting the world to blithely conform. Rather, the

designer/planner seeks to use the temporal and spatial dynamism of both the ecological and developmental systems to catalytically inflect the course of events within a range of possible futures. Rod Barnett of Washington University broadly accounts for this development in design thinking over the last two decades in his new book *Emergence in Landscape Architecture*, where he writes:

Cities are being understood as open, non-linear systems enriched like ecosystems by disturbance and dependent upon feedback loops to achieve greater levels of complexity and resilience, landscape architects working in the urban realm are harnessing the metaphors of flow and self organization to develop new kinds of solutions to growing urban problems. (2013, 88)

Frustratingly vague as this will be to the planner still wedded to linear processes, the inquiry that the butterfly effect of chaos theory opens up is useful both conceptually and practically because it reverberates between the scale of design and the scale of planning. This is important for several reasons. First, from Google Earth to tipping points in complex systems, a foregrounding of scalar gradation and systemic interconnectivity approximates the way we now think the cultural and natural world works (Meadows, 2008). Second, we are now more acutely aware of the need to adapt to the spatial and temporal dimensions of climate change which is forcing the movement of all species at both local and bioregional scales (Opdam, Luque, and Jones, 2009) Third, there is a mounting need to reconcile top-down global environmental policy settings with the specific (chaotic) nuances of local cultural landscapes. Fourth, if we accept that urbanization is the dominant cultural force of the 21st century, as landscape urbanism says we must, then we need to engage that phenomenon on its own logistical terms and those terms are now being played out simultaneously across local, megaregional, and global territorial scales. As Richard Forman advises, it is “[only] by recognizing and addressing landscape changes across different scales (perhaps at least three) [that] planners and designers [can] maximize protection of biodiversity and natural processes”. (Dramstad, Olson and Forman 1996, 130)

BIODIVERSITY

Global population is expected to grow for most of the 21st century, stabilizing at somewhere around 10 billion people. (UN, 2012a) In theory, population will stabilize (and then decline) predominantly because of urbanization: that is, in cities individuals have greater access to education and family planning and the constraints of spatial congestion and economic competition discourage large families. If these 10 billion people can be fed and a functional dimension of the world’s biodiversity simultaneously protected, then there is the historical prospect of humanity becoming the first species to escape the Malthusian law of diminishing returns. This eventuality might ultimately be what McHarg meant by “fitting,” albeit now on entirely technological and urban terms.

In order to feed 10 billion people we will need to either extract twice the current global yield from the same agricultural area or clear more habitat. (Evans, 1998) We will probably have to do both. Adams (2012) estimates that approximately 31% of the earth’s terrestrial area (four billion hectares) is covered by forest. (UN, 2012b)¹⁰ A recent report in *Science* concluded that between 2000 and 2012, the world lost 2.3 million square kilometers of forest and only added 80 million: a net loss of 1.5 million. (Hansen et al, 2013) This trend is likely to continue.

Inversely, the Aichi Biodiversity target of the United Nation’s Convention on Biological Diversity (CBD), to which 194 nations are signatories, stipulates that by 2020, 17% of the world’s habitat be legally protected. (CBD 2011a) Currently 13% of global habitat is under some form of protection according to the International Union for the Conservation of Nature (IUCN). Four percent might seem relatively modest until you consider that it equates to 1,739,589 Central Parks. (Weller and Hands, 2014) Where nations do not have 17% of their original habitat to protect—and most do not—then the convention sets a target of 15% habitat reconstruction. (CBD, 2011a) Most importantly, according to the CBD 17% protected habitat cannot be achieved simply by setting aside a large area of land in say, Siberia. Rather, the convention mandates that protected areas be both representative of the world’s 867 ecoregions and that this habitat be interconnected into coherent ecological networks. (CBD, 2013) As Erle C. Ellis explains:

“[t]he critical challenge therefore is in maintaining, enhancing and restoring the ecological functions of the remnant, recovering, and managed novel ecosystems formed by land use and its legacies within the complex multifunctional anthropogenic landscape mosaics that are the predominant form of terrestrial ecosystems today and into the future”. (2013, 179)

Typically, attempts to reconnect fragments of extant habitat in highly modified landscapes run against the grain of the cadaster, conflict with political boundaries, and clash with agricultural logistics and infrastructure. Therefore, whilst areas of relatively pristine habitat require protection and management practices largely determined by a site’s extant composition, creating landscape connectivity on a scale commensurate with the CBD targets is a project of great *novelty*.¹¹ Indeed, if the CBD targets are taken seriously then they imply a landscape project of unprecedented scale requiring immense political, entrepreneurial, and cultural imagination; in a word, *stewardship*.

Pre-eminent in this regard are the Dutch, who have been actively planning and constructing a National Ecological Network (NEN) of protected areas and ‘robust corridors’ since 1990. (Jongman and Bogers, 2008) This national planning is supported by a ‘defragmentation plan’, which addresses the specifics of how ecological corridors transcend jurisdictional boundaries and physical impediments to link existing fragments of habitat into a coherent national matrix. Although small, rich, and culturally inclined towards such rational planning, the Dutch example is exemplary because it is not just about linking remote areas of mountainous wilderness but rather about reorganizing an entirely novel, national ecosystem so that urbanism, agriculture, and biodiversity can coexist in a mutually beneficial manner.

In 2001, Graham Bennett and Piet Wit reported to the IUCN that there were at least 150 active ecological network projects of a landscape or regional scale around the world (Bennet and Wit, 2001). No doubt there are now many more. However, unlike the Dutch who not only have a national (and financed) plan but also a plan that is nested within the superstructure of the Pan European Ecological Network (PEEN), an overwhelming majority of the 194 nations who are party to the CBD 2020 Aichi targets have no

semblance of spatial planning. And, when they do, they tend to be thick green lines or fuzzy airbrushed zones superimposed over maps at a scale so extensive as to be meaningless. For example, in the world’s 35 biodiversity “hotspots” (Figure 1), where biodiversity is by definition most unique and most threatened (Mittermeier, 2011), only 12 of 104 nations who preside over this territory have spatial plans for large-scale ecological networks.¹²

This suggests that despite agreeing to targets that have explicit spatial consequences for land use, governments are unwilling and or unprepared to engage in such planning. It also might mean that landscape architects are not yet organized to offer their services on this topic or to do so at this scale. This also indicates that there is a significant disconnection between landscape architecture and the global conservation effort and community, who are otherwise extremely active and well organized in this regard. Indeed, when I recently met with the head of the CBD, Braulio F. de Souza Dias, in Montreal to discuss this very issue, he indicated that he was unfamiliar with the capabilities of landscape architects and had never heard of Ian McHarg. This is *our* problem, not his.

At UPenn we are conducting preliminary mapping to ascertain the difference between the CBD target of 17 per cent protected habitat and what (according to GIS data) is actually protected on the ground today. The first phase of this mapping focuses on the 425 ecoregions that constitute the world’s 35 hotspots (see Figures 1–3). This base mapping is intended to lay a foundation upon which interdisciplinary teams could begin work to develop accurately spatialized transnational land-use plans that visualize exactly how to apply otherwise abstract biodiversity conservation targets (see Figure 3).¹³ Whilst applicable primarily at an ecoregional scale, this research also aims to integrate planning for biodiversity protection and landscape connectivity with different urban growth scenarios that meet population forecasts in given regions. As studies by the Yale School of Forestry estimate, there will be approximately another 1.2 million km² of land subsumed into urban development globally by 2030 and much of it in the world’s biodiversity hotspots (Seto, Güneralp and Hutyra, 2012). In this regard, as well as mapping the biodiversity target shortfalls at the ecoregional scale, we are mapping the main cities in the world’s biodiversity hotspots (176) and identifying

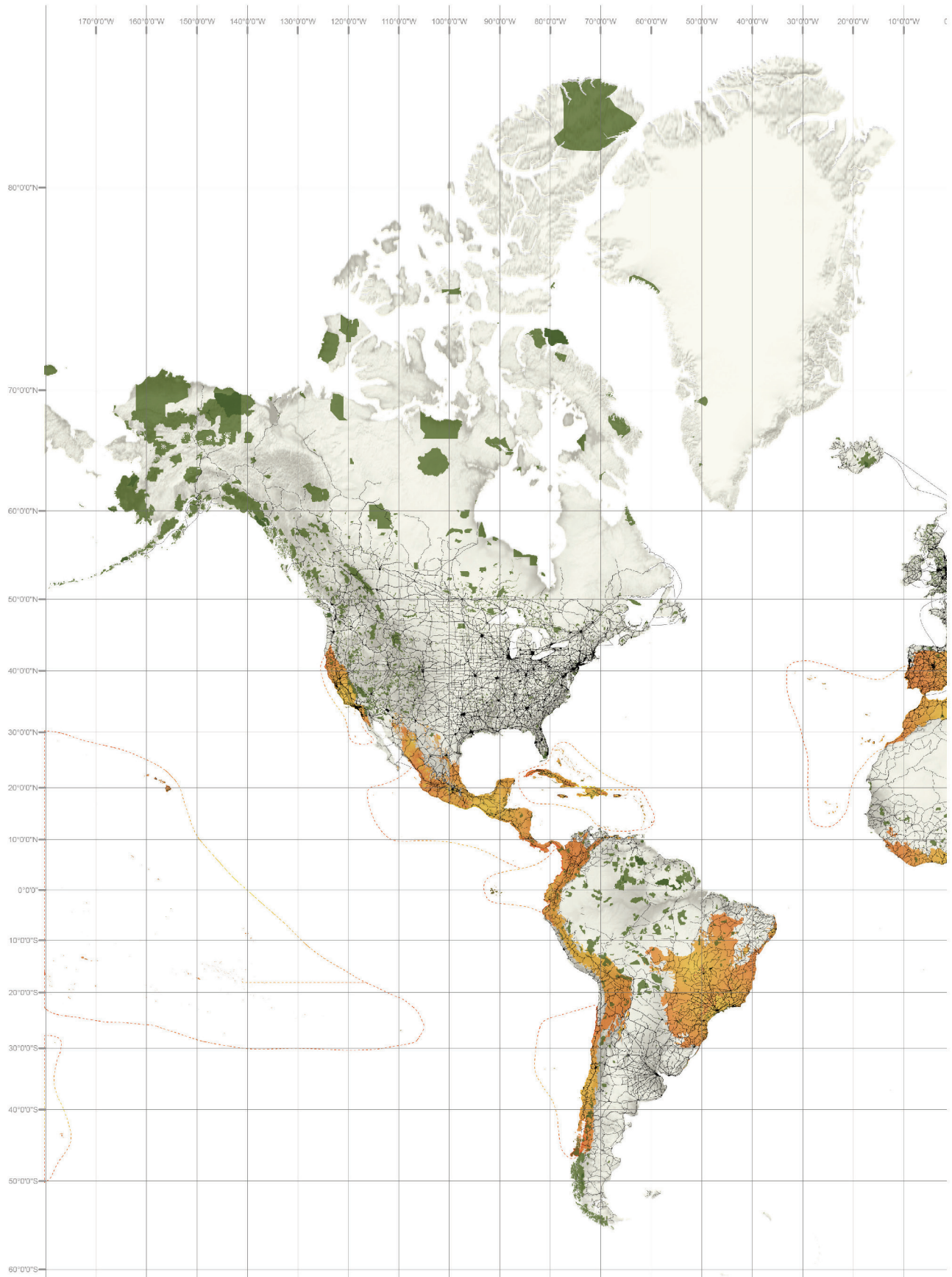
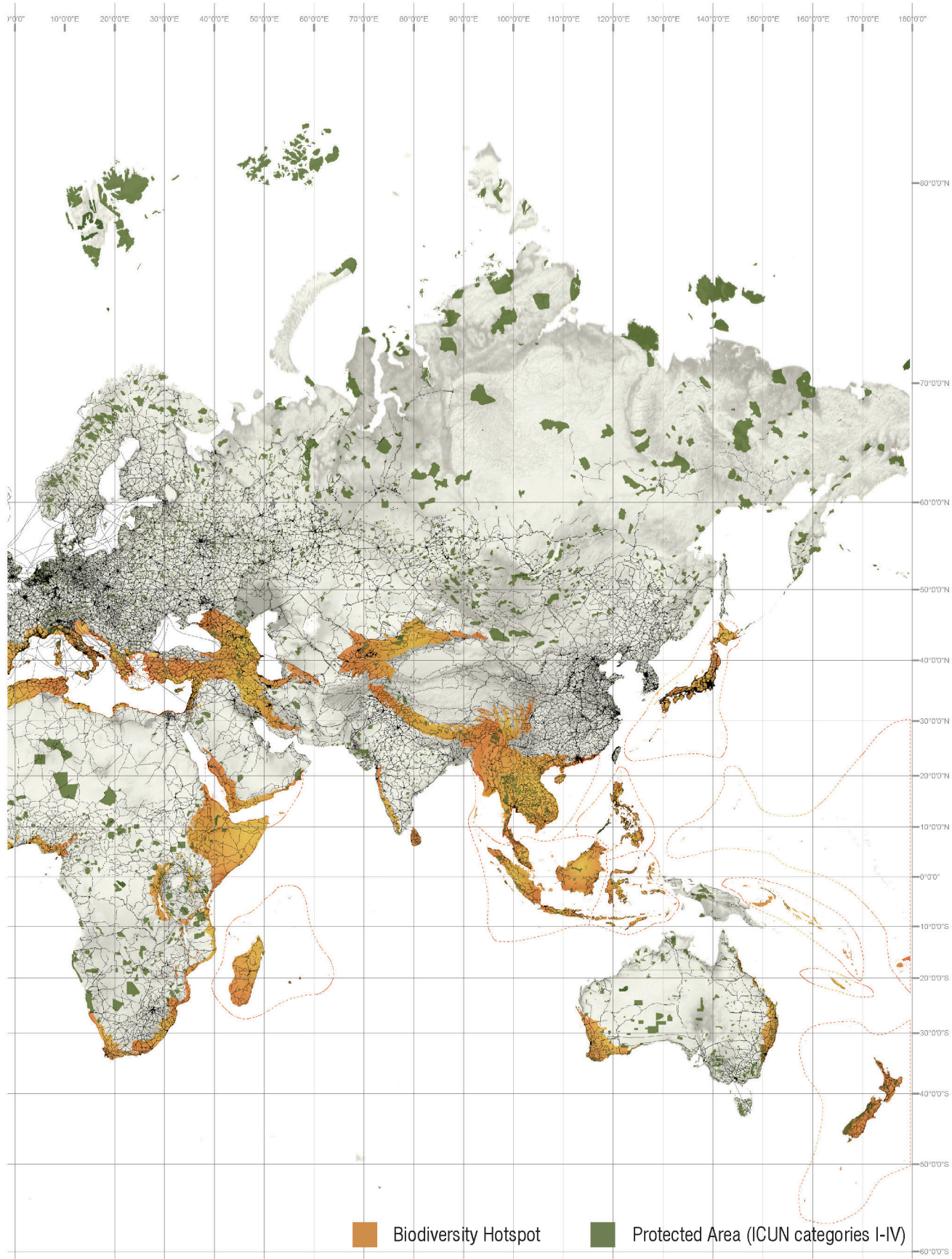


Figure 1
 Location of the 35 biodiversity hotspots in the world relative to areas of protected habitat (IUCN categories I-VI).



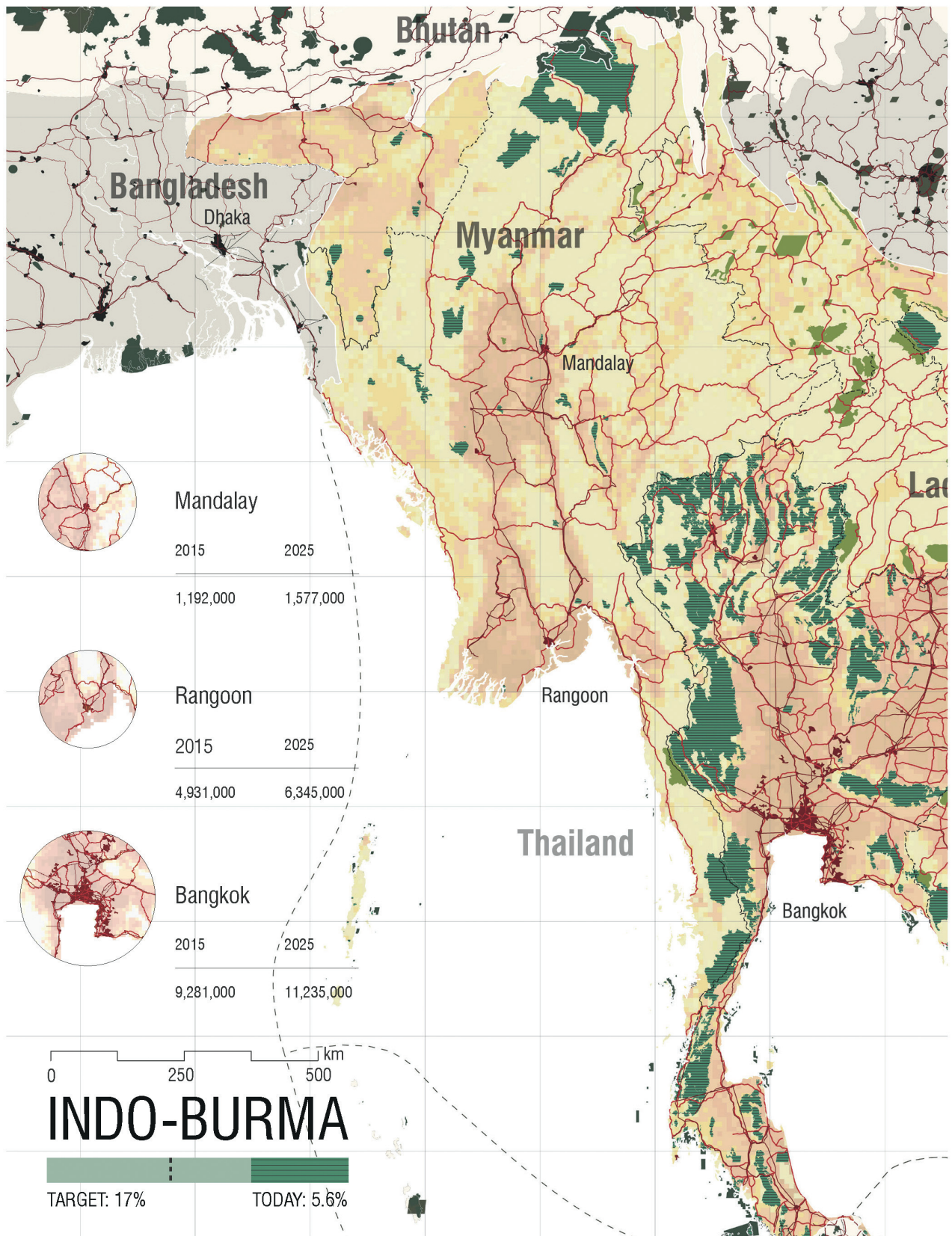
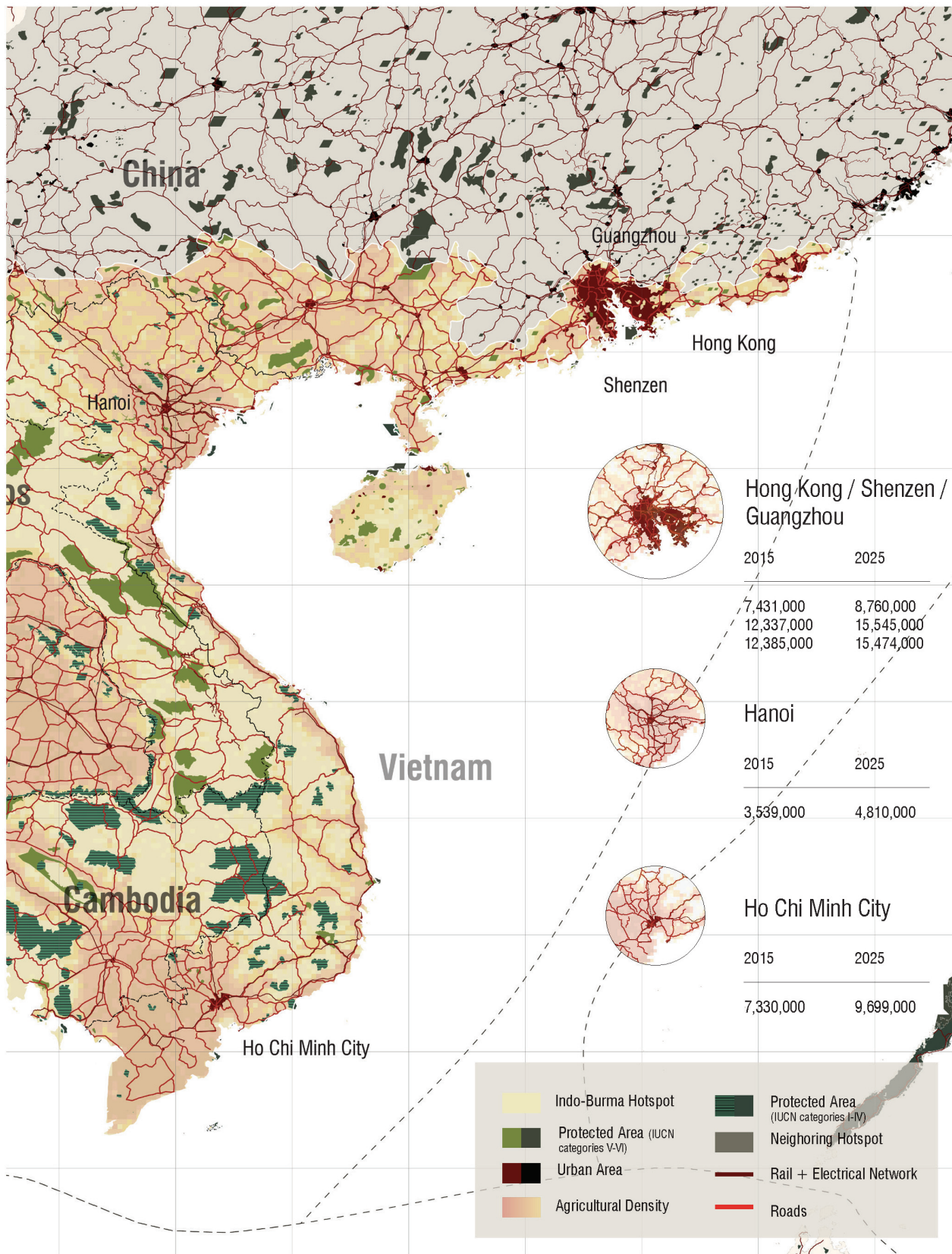


Figure 2

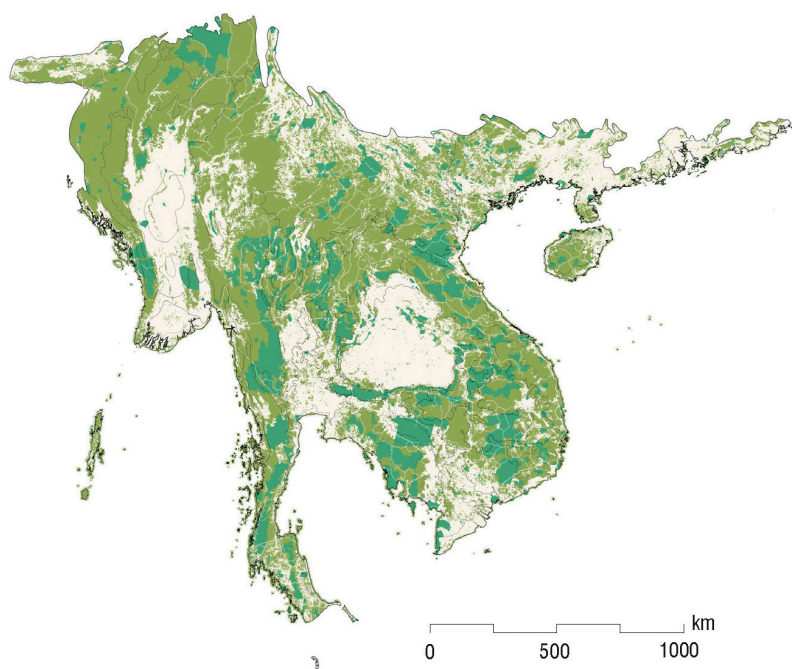
A map of the Indo-Burma hotspot. The scale bar on the bottom of the hotspot map indicates the difference between the United Nations Convention on Biological Diversity's 17% (Aichi) target of protected habitat (IUCN categories I-VI) and the amount of habitat that is currently protected.



INDO-BURMA

Terrestrial Ecoregion *Aichi Biodiversity Target* Shortfalls

TARGET 11: 17% of every terrestrial ecoregion is under conservation



2,373,057 km² extent

3 BIOMES

Tropical & Subtropical Moist Broadleaf Forests
Tropical & Subtropical Dry Broadleaf Forests
Mangroves

33 ECOREGIONS

ENDEMIC PLANT SPECIES
13,500

ENDEMIC ANIMAL SPECIES
1,042

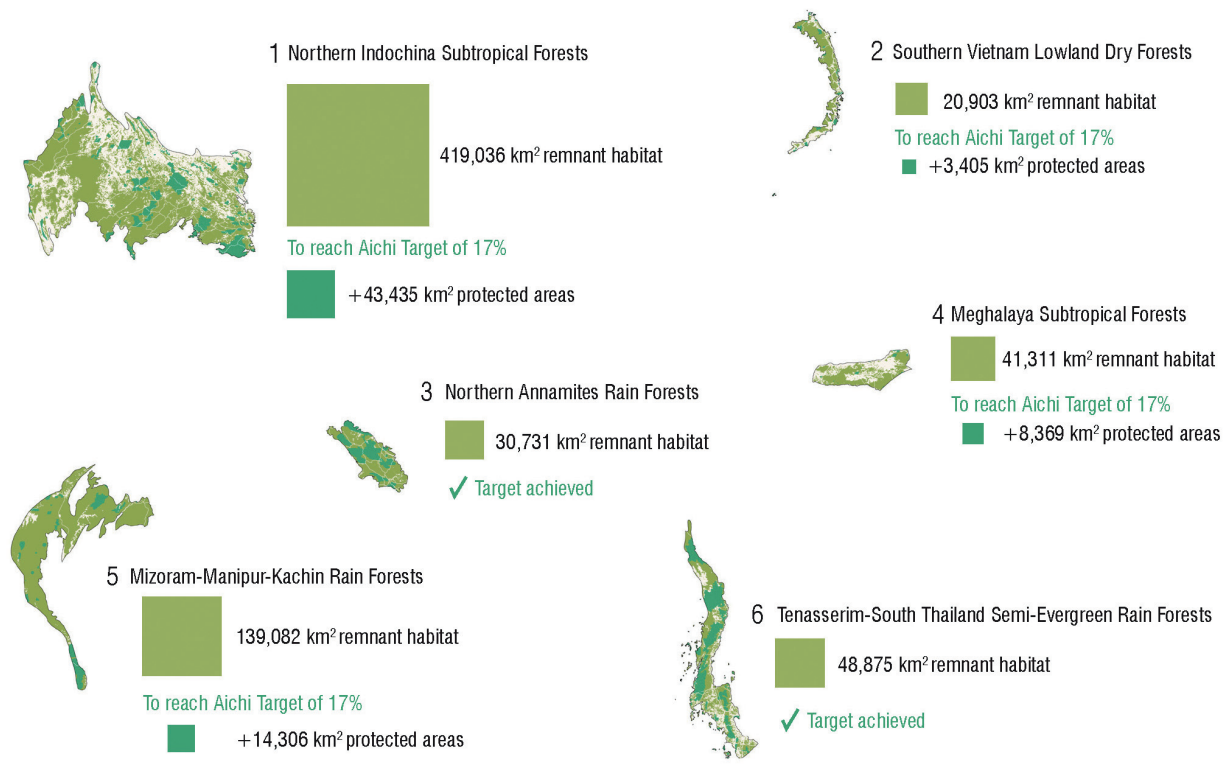
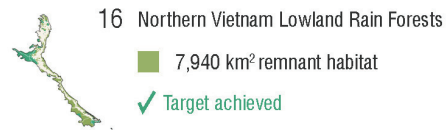
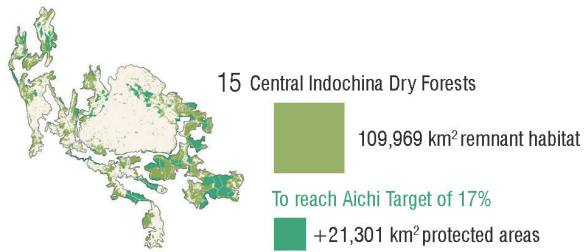
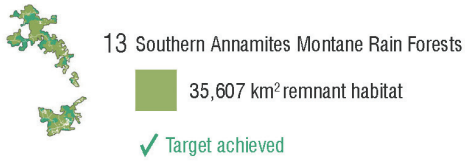
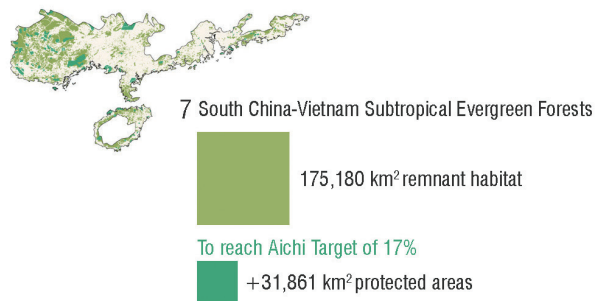
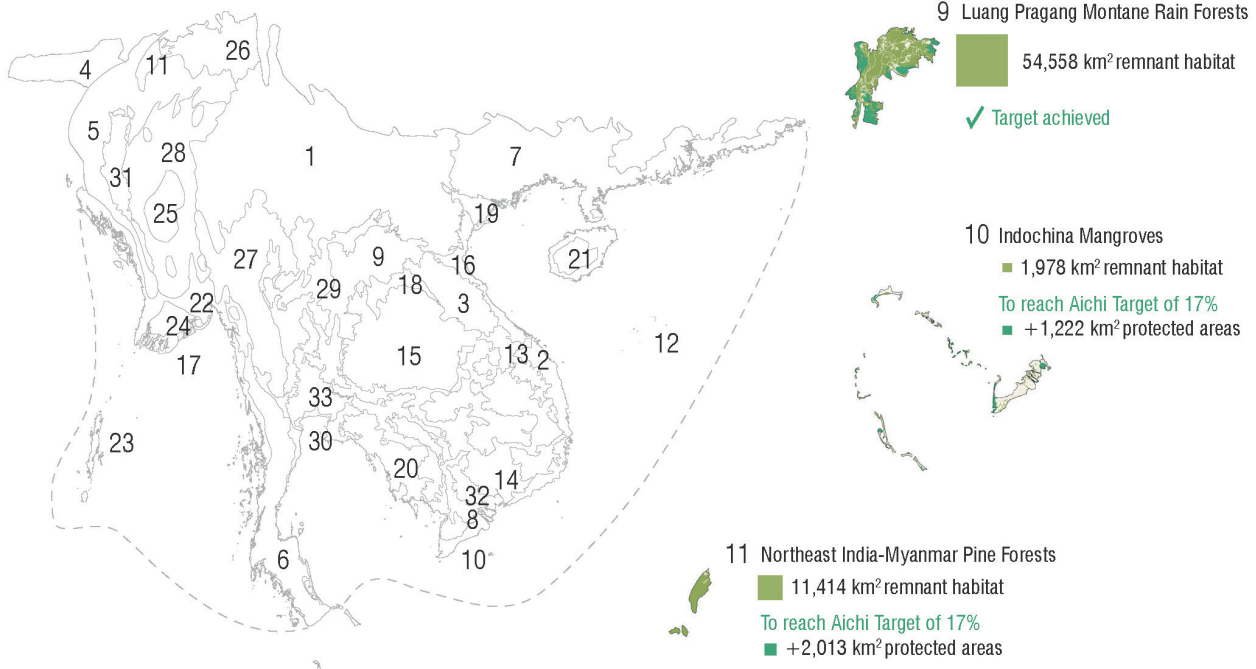


Figure 3

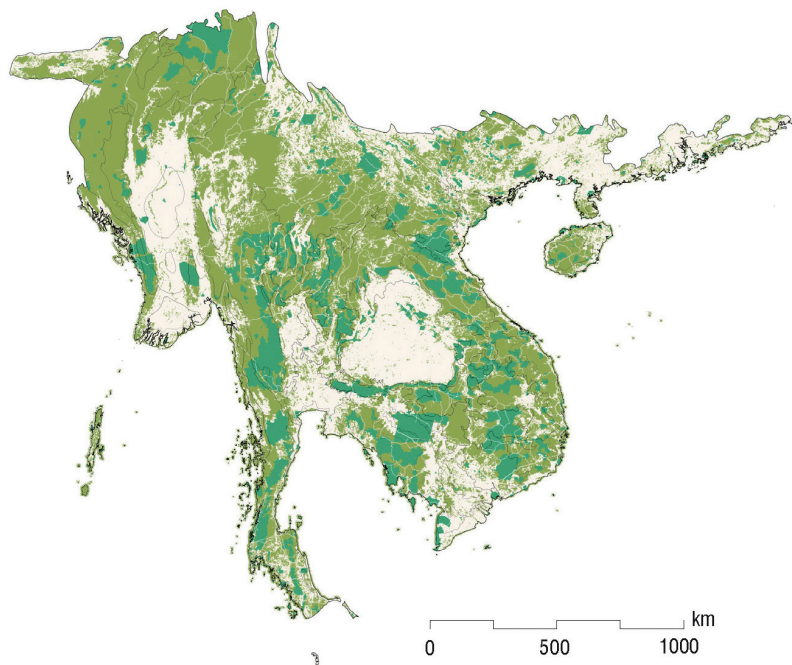
This map shows the 33 ecoregions within the Indo-Burma hotspot. The amount of land needing to be protected and/or restored (dark green: IUCN categories I-VI) within each ecoregion in order to realize the 2020 17% Aichi target is identified. Light green represents land area that is neither urbanized nor under intensive cropping and has potential to become viable habitat.



INDO-BURMA

Terrestrial Ecoregion *Aichi Biodiversity Target* Shortfalls

TARGET 11: 17% of every terrestrial ecoregion is under conservation



2,373,057 km² extent

3 BIOMES
Tropical & Subtropical Moist Broadleaf Forests
Tropical & Subtropical Dry Broadleaf Forests
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33 ECOREGIONS

ENDEMIC PLANT SPECIES
13,500

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1,042

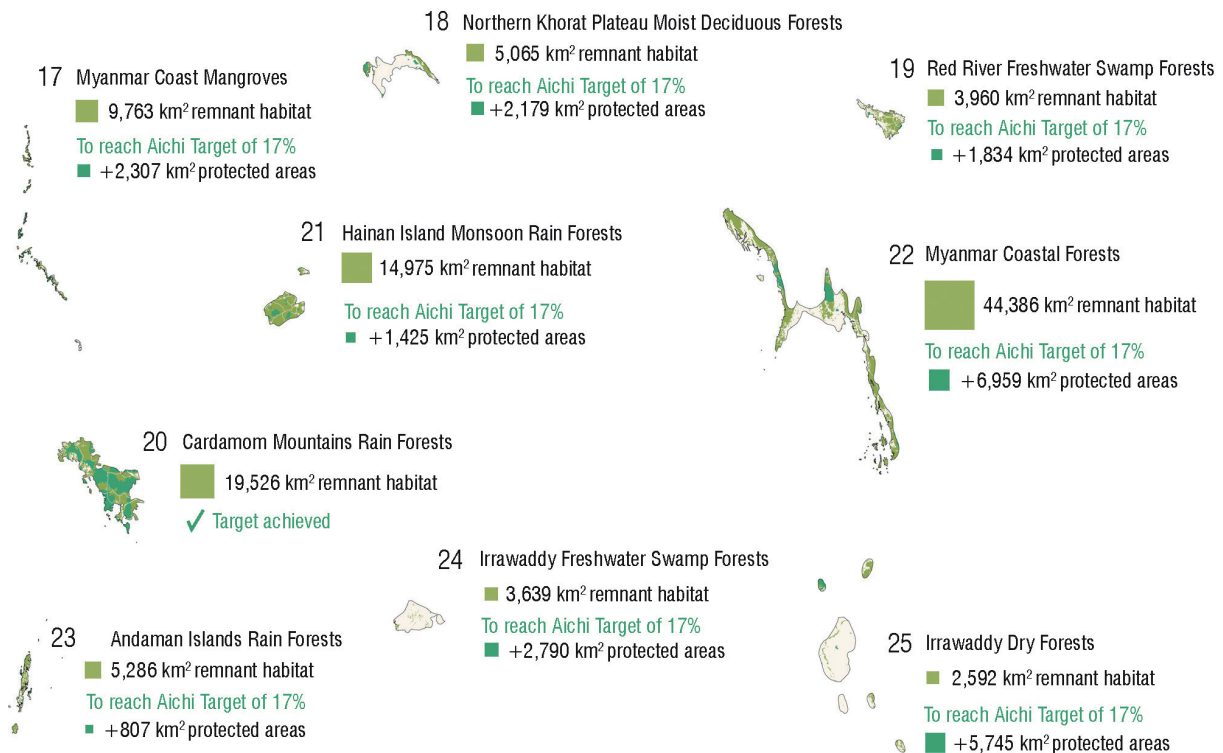
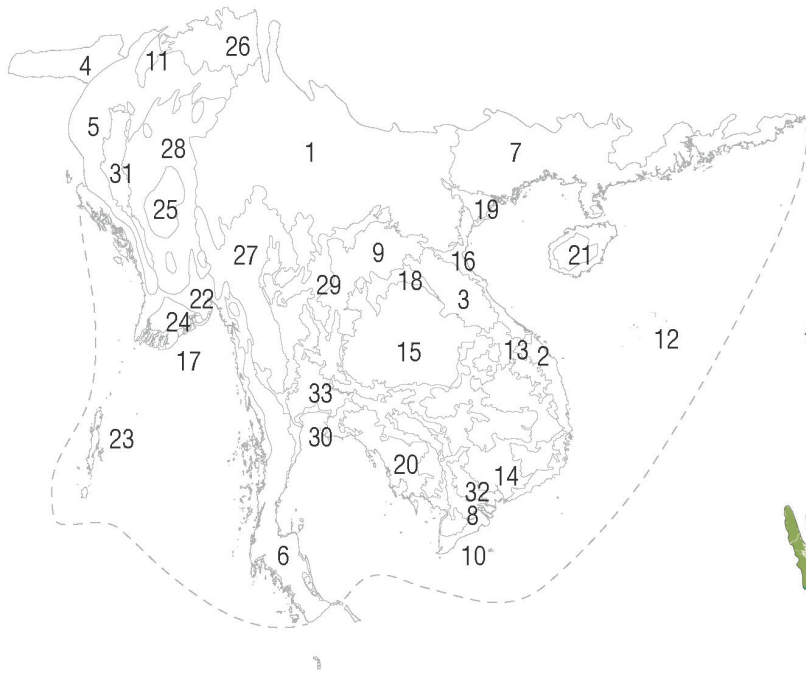


Figure 3 (continued)

This map shows the 33 ecoregions within the Indo-Burma hotspot. The amount of land needing to be protected and/or restored (dark green: IUCN categories I-VI) within each ecoregion in order to realize the 2020 17% Aichi target is identified. Light green represents land area that is neither urbanized nor under intensive cropping and has potential to become viable habitat.



26 Northern Triangle Subtropical Forests



42,947 km² remnant habitat
 ✓ Target achieved

27 Kayah-Karen Montane Rain Forests



84,574 km² remnant habitat
 ✓ Target achieved

28 Irrawaddy Moist Deciduous Forests



78,671 km² remnant habitat
 To reach Aichi Target of 17%
 +20,052 km² protected areas

29 Northern Thailand-Laos Moist Deciduous Forests



28,242 km² remnant habitat
 ✓ Target achieved

30 Chao Phraya Lowland Moist Deciduous Forests



6,724 km² remnant habitat
 To reach Aichi Target of 17%
 +590 km² protected areas

31 Chin Hills-Arakan Yoma Montane Forests



30,853 km² remnant habitat
 To reach Aichi Target of 17%
 +2,628 km² protected areas

32 Cardamom Mountains Rain Forests



19,526 km² remnant habitat
 ✓ Target achieved

33 Tonle Sap Mekong Peat Swamp Forests



1,620 km² remnant habitat
 To reach Aichi Target of 17%
 +2,049 km² protected areas

zones where their pre-urban growth is on a collision course with remnant habitat. As the International Federation of Landscape Architects lobbies UNESCO for a ‘Global Landscape Convention,’ surely the hotspots warrant our immediate and globally coordinated attention. More important than yet more conventions and declarations, we need design intelligence to be on the ground and deeply embedded in these crisis landscapes.

CONCLUSION

The conclusion to the recent Global Assessment of Urbanization, Biodiversity and Ecosystems Services report stresses the now common view that cities can only be a part of a larger agenda of environmental stewardship:

As centers of human innovation, and perhaps the most active frontier of our impact on the planet in shaping its landscapes and seascapes, cities offer arenas for enormous opportunities to reimagine and invent a different kind of future with room for humans and other species to thrive. Cities may well be the ground where we secure a globally sustainable future—one that builds on nature-based solutions and ecosystem-based adaptation, and establishes responsible environmental stewardship at the heart of public interest. (Elmqvist et al, 2013 740)

There is no doubt that landscape architecture today is thoroughly committed to the city; indeed, in a flourish rivaling McHarg, Charles Waldheim claims that ‘landscape architects are the urbanists of our age’ (2014). Landscape architecture’s urban achievements since McHarg are considerable and will continue, but the theory of landscape urbanism upon which Waldheim makes this claim is cut short if it only pertains to the scale of urban design and the discipline becomes overly preoccupied with the city at the urban design scale. Landscape urbanism’s most powerful insight is that ‘the city’ is ecological and that it is not a discrete object but now a global system without edge. The greater potential for landscape urbanism therefore is to scale up to Brenner’s ‘planetary urbanization’ and link the McHargian tradition of large scale landscape planning with the global conservation and scientific community

to help develop spatial plans that show how the ubiquitous forces of urbanization and its related industrial and agricultural infrastructure can be reconciled with biodiversity.

Understandably, the retort will be that this is hubris (again) and that, in any event, there is no market for landscape architecture at the larger scale. To the latter, it is the academy’s role to go where the profession cannot afford and open new research agendas, which should in turn lead to new markets. To the former, to now draw a line around landscape architecture at the scale of urban public space or recoil into the local in spite of the global on the very occasion of globalization’s cultural, political and economic hegemony would be a mistake of historical proportion. Worse, this will be accused of a return to planning again forsaking artfulness for instrumentality. As I have consistently argued, landscape architecture is an art of instrumentality and the discipline, like the landscape itself, is no longer neatly divided by scale and method. (2004, 2006) Of course, we use different methods at different scales and for different programs but, as I have tried to develop in this essay, in accordance with global culture, global ecology, and emerging technologies, what we once called landscape design and landscape planning lie on a continuum of design intelligence. McHarg called it stewardship and others now call it Geodesign or landscape urbanism, but in this century, the world should come to know it simply as the increasingly broad and important practice of landscape architecture.

NOTES

1. For documentation of the history of the landscape program at the University of Pennsylvania see: Weller, Richard and Meghan Talarowski., 2014, ‘Transects: 100 Years of Landscape architecture and Regional Planning at the University of Pennsylvania, Applied Research + Design Publishing, San Francisco.
2. <http://www.epi-us.com/coffman/coffman.htm>
3. <http://www.newswithviews.com/Coffman/mike4.htm>
4. <http://www.cbd.int/information/parties.shtml>
5. <http://rewilding.org/rewildit/>
6. As Bruce Hull (2006, 127) explains, the instruction to “dress and keep” the garden has also been translated variously as “till” “serve”, “care” and “guard” the garden. Either way, this second narrative explicitly places us in some form of stewardship role, whereas the first does not.

7. This definition is credited to both Michael Flaxman and Stephen Ervin; See; Steinitz, Carl. 2012. *A Framework for Geodesign: Changing Geography by Design*. Redlands, CA. Esri Press. p 12.
8. The papers are "Open Space and Housing" (1955), "The Court House Concept" (1957), and "The Humane City" (1958).
9. As a matter of historical accuracy the term landscape urbanism was in the air in the early 1990s and existed as such before it was heralded in the United States in 1996. For example, the Australian academic Peter Connolly said in a 1994 presentation at RMIT that a "language of landscape urbanism barely exists and needs articulating". Connolly also championed the notion of 'landscape as urbanism' in his 1995 essay, '101 Ideas About Big Parks', *Kerb: Journal of Landscape Architecture*, no 1, Melbourne: RMIT University Press.
10. Definitions of what constitutes forest cover vary between nations and between organizations, but generally the minimum requirement is 10% tree cover in landscapes where trees can reach five meters in height.
11. Chief editor of the journal *Landscape Restoration* Richard Hobbs and his colleagues define novel ecosystems as "a system of abiotic, biotic and social components (and their interactions) that, by virtue of human influence, differ from those that prevailed historically, having a tendency to self-organize and manifest novel qualities without intensive human management. Novel ecosystems are distinguished from hybrid ecosystems by practical limitations (a combination of ecological environmental and social thresholds) on the recovery of historical qualities." (Hobbs et al. 2013. 58)
12. The 12 nations are Myanmar, India, Laos, Brazil, Sudan, Palau, Philippines, Papua New Guinea, Bolivia, Peru, Nicaragua, and Georgia.
13. The global conservation community generally recognizes the existence of 35 biodiversity hotspots in the world. In 1988 Norman Myers identified 10 global biodiversity hotspots featuring exceptional concentration and endemism of plant species under unusual threat of destruction (Myers 1988). Since that time the hotspots concept has gained significant momentum in redefining global environmental priorities and focusing global conservation efforts. Today a total of 35 biodiversity hotspots are recognized worldwide. Together, these areas contain at least 50% of the world's total plant species and 42% of the world's terrestrial vertebrates as endemic (Mittermeier et al. 2004). The original and unique habitat in these hotspots is at least 70% depleted and is under imminent threat of total destruction due to habitat fragmentation related to urbanization, agriculture, and related economic activities. Originally representing 16% of the Earth's surface, the unique habitat of these 34 hotspots have diminished to just 2.3%. Consequently, research and activism have primarily focused on the urgency of preserving this biodiversity

to reduce the risk of extinction of "more than half of our natural heritage" (ibid., 37). In Figure 3, the scale bar at the bottom of each hotspot ecoregion map indicates the difference between the United Nations Convention on Biological Diversity's 17% (Aichi) target of protected habitat and the amount of habitat that is currently projected. The calculation of protected areas is based on the first 4 of the International Union for Conservation of Nature's (IUCN) 6 protected area types. The six types are: 1a, Strict Nature Reserves; 1b, Wilderness Areas; 2, National Parks; 3, National Monuments; 4, Habitat and Species Management Areas; 5, Protected Landscapes (modified landscapes of cultural, ecological, and scenic value); and 6, Protected Areas with sustainable use of natural resources. From a strict biodiversity conservation perspective, categories 1-4 are favored in the literature. See: http://www.iucn.org/about/work/programmes/gpap_home/gpap_quality/gpap_pacategories/

REFERENCES

- Adams, Emily A. 2012. World Forest Area Still on the Decline. http://www.earth-policy.org/indicators/C56/forests_2012 [June 20, 2013].
- Ahern, Jack. 2004. Greenways in the USA: theory, trends and prospects. In *Ecological Networks and Greenways: Concept, Design and Implementation*, ed. Rob Jongman and Gloria Pungetti, 34-53. New York: Cambridge University Press.
- American Society of Landscape Architects. 2013a. <http://www.asla.org/AboutJoin.aspx> [June 20, 2013].
- . 2013b. The Sustainable Sites Initiative: Guidelines and Performance Benchmarks. [http://www.sustainable-sites.org/report/Guidelines and Performance Benchmarks.pdf](http://www.sustainable-sites.org/report/Guidelines%20and%20Performance%20Benchmarks.pdf) [June 20, 2013].
- Australian Institute of Landscape Architects. 2013. Sustainable Settlement, Green Infrastructure. The Australian Landscape Charter. <http://www.aila.org.au/charter/> [June 20, 2013].
- Barnett, Rod. 2013. *Emergence in Landscape Architecture*. New York: Routledge.
- Bennett, Graham, and Piet Witt. 2001. *The Development and Application of Ecological Networks: A Review of Proposals, Plans and Programs*. IUCN Report, B1142. Gland Switzerland: IUCN World Conservation Union and AIDEnvironment.
- Berger, Alan. 2007. Preface. In *Ian McHarg: Conversations with Students: Dwelling In Nature*, ed. James Corner and Brian Hawthorne and Lynn Margulus. New York: Princeton Architectural Press.
- . 2009. *Systemic Design Can Change the World*. Amsterdam: Sun Publishers.
- Brenner, Neil, and Christian Schmid. 2011. Planetary urbanization. In *Urban Constellations* ed. Mathew Gandy, 10-13. Berlin: Jovis Verlag.

- Bunster-Ossa, Ignacio F. 2014. *Reconsidering Ian McHarg: The Future of Urban Ecology*. Chicago: American Planning Association, Planners Press.
- Calthorpe, Peter. 2012. Urbanism and Climate Change. In *Sustainable Urbanism and Beyond: Rethinking Cities for the Future*, ed. Tigran Haas, 14–17. New York: Rizzoli.
- Chambers, Neil. 2010. *Urban Green: Architecture for the Future*. New York: Palgrave Macmillan.
- Chinese Society of Landscape Architects. <http://www.chsla.org.cn/en/> [June 20, 2013].
- Convention on Biological Diversity. 2011. Quick Guide to the Aichi Biodiversity Targets: Target 11. <http://www.cbd.int/doc/strategic-plan/targets/T11-quick-guide-en.pdf> [July 20, 2013].
- . 2012. Cites and Biodiversity Outlook—Action and Policy: A Global Assessment of the Links between Urbanization, Biodiversity, and Ecosystem Services. <http://www.cbd.int/doc/publications/cbo-booklet-2012-en.pdf> [July 20, 2013].
- . 2013. Aichi Target 11 Technical Rationale. <http://www.cbd.int/sp/targets/rationale/target-11/> [July 20, 2013].
- Cook, Robert, E. 2000. Do landscapes learn? Ecology's "new paradigm" and design in landscape architecture. In *Environmentalism in Landscape Architecture*, ed. Michael Conan, 115–132. Washington, DC: Dumbarton Oaks Research Library and Collection.
- Corner, James. 1991a. Landscape architecture and critical inquiry. *Landscape Journal* 10(2): 155–172.
- . 1991b. A Discourse on Theory II: Three tyrannies of contemporary theory and the alternative of hermeneutics. *Landscape Journal* 10(2): 115–133.
- . 1996. *Taking Measures Across the American Landscape*. New Haven and London: Yale University Press.
- . 1997. Ecology and landscape as agents of creativity. In *Ecological Design and Planning*, ed. George F. Thompson, and Frederick R. Steiner, 80–108. New York: John Wiley and Sons.
- . 2014. *The Landscape Imagination: The Writings of James Corner*. New York: Princeton University Press.
- Denig, Nancy. 1985. On Values Revisited: A Judeo-Christian Theology of Man and Nature. *Landscape Journal* 4(2): 96–105.
- Dramstad, Wenche E., James D. Olson, and Richard T.T. Forman. 1996. *Landscape Ecology Principles in Landscape Architecture and Land-Use Planning*. Washington DC: Island Press.
- Duany, Andres and Emily Talen. 2013. *Landscape Urbanism and its Discontents. Dissimulating the Sustainable City*. Gabrioloa Island, Canada: New Society Publishers.
- Ellis, Erle C. 2013. (Anthropogenic Taxonomies) A Taxonomy of the Human Biosphere. In *Projective Ecologies*, ed. Chris Reed and Nina-Marie Lister, 168–183. New York: Actar and Harvard Graduate School of Design.
- Elmqvist, Thomas, Susan Parnell, Michail Fragkias, Julie Goodness, Burak Guneralp, Maria Scewenius, Marte Sendstad, Peter J. Macotullo, Karen C Seto, Robert I McDonald, and Cathy Wilkinson. eds. 2013. *Urbanization, Biodiversity and Ecosystem Services: Challenges and Opportunities—A Global Assessment*. Dordrecht, Netherlands:Springer
- Evans, Loyd, T. 1998. *Feeding the Ten Billion: Plants and Population Growth*. Cambridge, UK: Cambridge University Press.
- Fábos, Julius.G., Mark Lindhult,., Robert.L Ryan,., and Madeline Jacknin.. eds. 2013. *Proceedings of Fábos Conference on Landscape and Greenway Planning 2013: Pathways to Sustainability*. University of Massachusetts, Amherst, April 12–13, 2013. Amherst, MA: Department of Landscape Architecture and Regional Planning, University of Massachusetts, Amherst.
- Flannery, Tim. 2011. *Here on Earth: A Natural History of the Planet*. New York: Atlantic Monthly Press.
- Flaxman, Michael. 2012. Paper presented at Geodesign Summit; Redlands CA, January 2010. Amended by Stephen Ervin at the Geodesign Summit, Redlands, CA, January 2012 Cited in Carl Steinitz, *A Framework for Geodesign: Changing Geography by Design*, 12. Esri: Redlands, California:.
- Flint, Andrew. 2006. *This Land: The Battle over Sprawl and the Future of America*. Baltimore, Maryland: The Johns Hopkins University Press.
- Forman, Richard T.T. 2008. *Urban Regions: Ecology and Planning Beyond the City*. New York: Cambridge University Press.
- . 2013. *Urban Ecology: The Science of Cities*. New York: Cambridge University Press.
- Hall, Sir Peter, and Ulrich Pfeiffer. 2000. *Urban Future 21: A Global Agenda for Twenty First Century Cities*. Oxon: Taylor and Francis.
- Hansen, M. C., P. V. Potapov, R. Moore, M. Hancher, S. A. Turubanova, A. Tyukavina, D. Thau, S. V. Stehman, S. J. Goetz, T. R. Loveland, A. Kommareddy, A. Egorov, L Chini, C. O. Justice, J. R. G. Townshend. 2013. High-resolution global maps of 21st-century forest cover change *Science* 342(6160): 850–853.
- Heise, Ursula K. 2008. *Sense of Place and Sense of Planet: The Environmental Imagination of the Global*. New York: Oxford University Press.
- Hellmund, Paul C., and Daniel S. Smith. 2006 *Designing Greenways: Sustainable Landscapes for Nature and People*. Washington DC: Island Press.
- Henderson, Lawrence J. 1913. *The Fitness of the Environment*. New York: Macmillan.
- Herrington, Susan. 2010. The Nature of Ian McHarg's Science. *Landscape Journal* 29(1):1–20.
- Hill, Kristina. 2005. Shifting sites. In *Site Matters: Design Concepts, Histories, and Strategies*, ed. Carol Burns and Andrea Kahn, 131–156. New York: Routledge.

- Hobbs, Richard, J., Eric S. Higgs, and Carol M. Hall. 2013. *Novel Ecosystems: Intervening in the New Ecological World Order*. Hoboken, N.J.: Wiley-Blackwell.
- Hull, Bruce, R. 2006. *Infinite Nature*. Chicago: The University of Chicago Press.
- International Federation of Landscape Architects. 2013. http://www.iflaonline.org/index.php?option=com_content&view=article&id=34&Itemid=57 [June 20, 2013].
- International Union for the Conservation of Nature. 2013. <http://www.iucn.org/> [Saturday, 27 July 2013].
- John-Adler, Kathleen L. 2013. Towards a New Landscape: Modern Courtyard Housing and Ian McHarg's Urbanism. *Journal of Planning History* XX(X) 1–20.
- Jongman, Rob, and Marion Bogers. 2008. Current Status of the Practical Implementation of Ecological Networks in the Netherlands, European Centre for Nature Conservation. <http://www.ecologicalnetworks.eu/documents/publications/ken/NetherlandsKENWP2.pdf>. [September 8, 2014].
- Lovelock, James. 1988. *The Ages of Gaia: A Biography of Our Living Earth*. London, W.W. Norton.
- . 2010. *The Vanishing Face of Gaia: A Final Warning*. New York, Basic Books.
- Lyle, John, T. 1991. Can Floating Seeds Make Deep Forms? *Landscape Journal*. 10:37–47.
- McHarg, Ian. L. 1992. *Design With Nature*, 25th Anniversary ed. New York: John Wiley and Sons.
- Merchant, Carolyn. 2003. *Reinventing Eden. The Fate of Nature in Western Culture*. New York, Routledge.
- Meyer, Elizabeth K. 2000. The Post Earth Day Conundrum: Translating Environmental Aesthetics into Landscape Design. In *Environmentalism in Landscape Architecture*, Ed. Michael Conan, 187–244. Dumbarton Oaks Research Library and Collection.
- Miller, James, R. 2008. Conserving biodiversity in metropolitan landscapes: A matter of scale (but which scale?) *Landscape Journal*. 27:114–126.
- Mittermeier Russell, A, Will R Turner, Frank W Larson, Thomas M Brooks and Claude Gascon. 2011. Global Biodiversity Conservation: The Critical Role of Hotspots. In *Biodiversity Hotspots: Distribution and Protection of Conservation Priority Areas*, ed. Frank E. Zachos and Jan Habel, 3–22. Luxembourg: Springer.
- Nassauer, Joan. 2011 Care and Stewardship: From Home to Planet. *Landscape and Urban Planning*. 100/4. 321–323.
- New Zealand Institute of Landscape Architects. http://www.iflaonline.org/index.php?option=com_content&view=article&id=26&Itemid=36 [June 20, 2013].
- Nadenicek, Daniel J. and Catherine M. Hastings. 2000. Environmental Rhetoric, Environmental Sophism: The Words and Work of Landscape Architecture. In *Environmentalism in Landscape Architecture*, ed. Michael Conan, 133–161. Dumbarton Oaks Research Library and Collection.
- Opdam, Paul, and Dirk Wascher. 2004. Climate Change Meets Habitat Fragmentation: Linking Landscape and Biogeographical Scale Level in Research and Conservation. *Biological Conservation* 117:285–297.
- Opdam, Paul, Sandra Luque, and K. Bruce Jones, 2009, Changing Landscapes to Accommodate for Climate Change Impacts: A Call for Landscape Ecology. *Landscape Ecology* 24(6):. 715–721.
- Opdam, Paul, and Eveliene Steingröver. 2008. Designing metropolitan landscapes for biodiversity: Deriving guidelines from metapopulation ecology. *Landscape Journal* 27(1): 69–80.
- Scarfo, Robert. 1988. Stewardship and the Profession of Landscape Architecture. *Landscape Journal*, 7(3): 46–51.
- Seto, Karen C., Burak Güneralp, B. and Lucy R. Hutyrá. 2012. Global Forecasts of Urban Expansion to 2030 and Direct Impacts on Biodiversity and Carbon Pools. Proceedings of the National Academy of Science of the United States. 109(40): 16083–16088.
- Sijmons, Dirk. 2009. Utopia's Practical Cousin. In *Systemic Design Can Change the World*, ed. Alan Berger, . Amsterdam, Sun Publishers.
- Spirn, Anne.W. 2000. Ian McHarg. Environmentalism and landscape architecture. Ideas and methods in context. In *Environmentalism in Landscape Architecture*, ed. Michael Conan, 97–114 Dumbarton Oaks Research Library and Collection.
- . 1984. *The Granite Garden: Urban Nature and Human Design*. Basic Books.
- Steiner, Frederick R. ed. 2006. *The Essential Ian McHarg: Writings on Design and Nature*. Washington, DC: Island Books.
- , and George F. Thompson, eds. 1997. *Ecological Design and Planning*. New York: John Wiley and Sons.
- , and Ian McHarg, eds. 1988. *To Heal the Earth: Selected Writings of Ian McHarg*. Washington DC: Island Press.
- Steinitz, Carl. 2012. *A Framework for Geodesign: Changing Geography by Design*. Redlands, CA.: Esri Press.
- Thayer, Robert. L . 1997. *Gray World–Green Heart: Technology, Nature and the Sustainable Landscape*. New York: John Wiley and Sons.
- . 2003. *LifePlace: Bioregional Thought and Practice*. Berkeley, CA: University of California Press.
- Treib, Marc. 1995. Must landscapes mean?: approaches to significance in recent landscape architecture. *Landscape Journal* 14(1): 46–62.
- United Nations. 2012 a. Food and Agriculture Organization, Forest Resources Assessment 2012: Global tables (Rome, 2010) accessed at http://www.earth-policy.org/indicators/C56/forests_2012. [September 8, 2014].

- United Nations. 2012 b. World Population Prospects. The 2012 Revision. See: <http://esa.un.org/unpd/wpp/index.htm>. [September 8, 2014].
- Waldheim, Charles. 2014. Claiming Landscape as Architecture. In *Cities and Nature*, ed. Frederick Steiner. Lincoln Land Institute. In Press.
- Weller, Richard. 2004. *Room 413: Innovations in landscape architecture*. Philadelphia, PA: Penn Press.
- . 2006. An Art of Instrumentality: Thinking Through Landscape Urbanism. Charles Waldheim (ed), *Landscape Urbanism: A Reference Manifesto* New York: Princeton Architectural Press.
- , 2008. Landscape Sub-urbanism: Towards a Theory and Practice of Landscape Architecture in Contemporary Suburban Conditions. *Landscape Journal* 27(2): 255-270.
- . 2009. *Boomtown 2050: Scenarios for a Rapidly Growing City*. Perth, Australia: UWA Publishing.
- and Julian Bolleter. 2013. *Made in Australia: The Future of Australian Cities*. Perth, Australia: UWA Publishing.
- and Tatum Hands. 2014. Building the Urban Forest. *Scenario Journal*. See: <http://scenariojournal.com/article/building-the-global-forest/>
- Wilson, Edward.O. 2006. *The Creation: An Appeal to Save Life on Earth*. New York: W.W Norton and Co.
- Zachos, Frank.E., and Jan Christian Habel, eds. 2011. *Biodiversity Hotspots: Distribution and Protection of Conservation Priority Areas*. Luxembourg: Springer.

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