LANDSCAPE SWITCHING: A NEW SPEED AND TERRITORY FOR DESIGN AGENCY

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As even the most physically inaccessible portions of the surface of the earth are increasingly mapped, digitised and shared in readily accessible formats, it can plausibly be argued that remoteness might be shifting from mere spatial inaccessibility to a less concrete quality produced by admixtures of unpredictability, intangibility and incomprehensibility. That is, if to be remote is to resist exploration, and exploration is now omnipresent through technological augments – such as satellites, GPS and GIS – then remoteness may now only be found in those territories that resist comprehension.[2]

Many varied territorial types fit within this rubric, such as unfinished and feral exurban developments, abandoned by both developers and customers; clusters of data centres, searching out the trifecta of low taxes, cheap physical capital and dormant electric grid power; or radioactive exclusion zones, sheltering vibrant ecological communities. These are landscapes defined not by how they appear – by the alternately ordinary and aberrant images they return – but by how strangely they behave, and in particular *by their tendency to switch rapidly from one landscape state to another*: valued to dis-valued, abandoned to productive, occupied to vacant. Often geographically discontinuous, these networked landscapes are plugged into invisible chaotic systems, such as financial markets, global real estate bubbles, local and national permitting frameworks, and insured risk profiles. Like ecosystems undergoing catastrophic transitions from one steady state to another, they shift suddenly, triggered by forces not easily detectable at the site scale, landscapes made and shaped by actors often entirely agnostic as to the spatial consequences of their decisions.

These territories recommend unexplored questions regarding the agency of the landscape designer. Are we content to confine ourselves to bespoke design operations at the behest of wealthy patrons and institutions, or do we seek a broader agency that would include even these territories formatted by incomprehensibly remote imperatives? (The immense economic and ecological significance of those territories would suggest that the answer must be yes, we seek a broader agency.) What opportunities might exist to inject 'landscape intelligence',[3] to couple multiple performative parameters and programs,[4] to engage the seemingly inactive component of binary switches (the dis-valued, the abandoned, the vacant), or even to reprogram the aesthetic patterns of this internal frontier? Can design utilise the aggregate intelligence of the rule sets that govern these territories toward alternate ends?

In addition to such questions, these territories also engage two significant

> …when conditions change sufficiently to pass the threshold ('saddle-node' or 'fold' bifurcation), a 'catastrophic' transition … occurs … Such catastrophic shifts occur typically quite unannounced, and 'early warning signals' of approaching catastrophic change are difficult to obtain.[1]
>
> Scheffer et al.

contemporary theoretical issues within landscape architecture. The first is concern for flux as a defining condition of contemporary urbanisation, which emerged and gained momentum within the discipline through landscape urbanist discourse.[5] Switching landscapes are fluctuating so rapidly and with so little warning that they easily frustrate efforts to engage them with the tools of both the traditional landscape architect and the landscape urbanist. The capital project is of little use in territories where valuation switches rapidly, rather than growing and declining at predictable, steady rates. Landscape urbanists have often been critiqued for asserting the centrality of flux without effectively engaging it.[6] Our hope is that the study of switching landscapes will begin to build a more robust vocabulary for engaging flux.

The second issue engages concerns raised by the work of architectural theorist Keller Easterling, most notably her contentions regarding 'sites in multiple' and 'spatial products'. Embedded in the former is the idea that sites can be linked not only by material or energetic flows, but also by shared participation in a repetitively implemented systemic logic.[7] Embedded in the latter is the idea that economic systems in particular have the tendency to format the logic driving the generation of networks of sites in multiples.[8] This formatting often supersedes design efforts, producing territories that grow like a wild weed rather than a horticulturally bred ornamental flower. Switching landscapes are very often encountered in multiples and, similarly, are very often spatial products – sometimes intentional, sometimes unintentional.

In an effort to arrive at a provisional understanding of these territories, we offer below a sampled atlas of bifurcations. These switching landscapes progressively accelerate in temporal units and narrow in geographic scope along three defined tracks: *switches*, *glitches* and *twitches*. *Switches* are serious, infrastructural-scale plans or disasters. They reach into the largest, geologic-scale events and armatures humanity has constructed. *Glitches* are somewhat smaller and faster, usually resulting from some external pressure like bank leverage ratios or commodities markets. *Twitches* are the fastest and smallest species of change, temporary oscillations between paired states, such as dry-wet or dead-alive. We describe each of these tracks with a pair of examples, one intentional and one unintentional. Finally, after exploring these three pairs, we conclude with the potential design of a glitch, pushing landscape architecture to engage switching territories.

Switches

INTENTIONAL: THE MORGANZA SPILLWAY

In the wake of the devastating Mississippi River floods of 1927, which displaced a million people, the US Congress passed the Flood Control Act of 1928, which authorised the Army Corps of Engineers to engineer the entire length of the Mississippi River, with the intention of ensuring that no such disaster would ever happen again.[9] One of the first conclusions that the Corps reached in undertaking this titanic engineering effort was that the patchwork system of the levees and minor outlets that then existed along the banks of the river was not only inadequately engineered, but fundamentally flawed. The system, they concluded, needed large-scale release valves, sacrificial landscapes which could, in extreme scenarios, absorb floodwaters at regular intervals along the river.

In Louisiana, the deltaic state formed by the spill of the river into the Gulf of Mexico, three of these switches were built: Old River Control, the Bonnet Carré Spillway and the Morganza Spillway. All three are enormous monuments to infrastructural control, concrete symbols of the strict rationalisation of one of the North American continent's most singularly wild forces.[10] But of the three, Morganza is the most rarely activated. Old River Control is always at least partially open, as it controls the distribution of water between the primary Mississippi River channel and its smaller distributary, the Atchafalaya. Bonnet Carré, less than half the size of Morganza, has been opened ten times. Morganza, though, has only been opened twice, marking the two largest floods on the Mississippi since 1927.

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1. M. Scheffer, S. Carpenter, J. Foley, C. Folke and B. Walker, 'Catastrophic shifts in ecosystems', *Nature*, vol. 413 (6856), 2001, pp. 591–596.

2. R. Holmes, 'OIAML: Oceanographic Instrumentation and Mediated Landscapes', in G. Manaugh (ed.), *Landscape Futures: Instruments, Devices, and Architectural Inventions*, 1st ed., New York: Actar, 2013, pp. 251–252.

3. G. Fulton, 'Towards Landscape Intelligence', *LA! Journal of Landscape Architecture*, vol. 31, 2011, pp. 46–53.

4. InfraNet Lab/Lateral Office, *Coupling*, 1st ed., New York: Princeton Architectural Press, 2010.

5. See, for instance, articles by James Corner, Charles Waldheim and Richard Weller in *The Landscape Urbanism Reader*, Charles Waldheim (ed.), 2006.

6. As an example, see Richard Weller's 'Landscape (Sub)Urbanism in Theory and Practice' in *Landscape Journal*, vol. 27, no. 2, 2008, for an instance of this inability to realise 'landscape urbanism's penchant for indeterminacy' admitted by one of the seminal figures in the early landscape urbanist discourse.

7. K. Easterling, *Organization Space*, MIT Press, Cambridge, 1999, p. 2.

8. K. Easterling, *Enduring Innocence*, MIT Press, Cambridge, 2005, pp. 1–3.

9. S. Ambrose, 'Man vs. Nature: The Great Mississippi Flood of 1927', 2001, www.news.nationalgeographic.com/news/2001/05/0501_river4.html (accessed 30 May 2014).

10. John McPhee's classic article 'Atchafalaya', published in his 1990 collection *The Control of Nature*, provides an excellent overview of this struggle between infrastructure and geology. This struggle is also exceptionally well-illustrated by the contrast between two canonical representations of the Mississippi River valley by the US Army Corps of Engineers, Harold Fisk's 1944 'Geological investigation of the alluvial valley of the lower Mississippi River' and the Corps' 'Project Design Flood' diagram from 1958.

11. B. Sterling, 'Viridian Note 00084: Viridian Disasters.txt.', 1999, www.viridiandesign.org/notes/76-100/00084.html (accessed 30 May 2014).

When opened, the 600,000 c of water that pours through the Spillway radically switches a vast swath of land, the Morganza Floodway. Land that is usually devoted to ordinary rural uses – farming, hunting, storage – instantly became a primary distributary for the world's fifth largest river, deeply covered in fast-moving water, contained by auxiliary levees which are only employed when the Spillway is operational. The Spillway is an on/off switch at the largest scale, crudely binary and yet enormously effective.

UNINTENTIONAL: EXCLUSION ZONES

In the futurist author Bruce Sterling's 'Viridian Note 00166: Chernobyl Wildlife Park', he defines the involuntary park as 'an area of the planet which has returned to savagery due to breakdowns in technological instrumentalism'. Throughout the 'Viridian Notes', Sterling returns to the concept repeatedly, offering a long list of examples available in the late twentieth century: Chernobyl, irradiated by nuclear catastrophe; the Korean Demilitarized Zone, mined and rendered unfit for human habitation by militarily imposed exclusion; and Rocky Flats Wildlife Refuge, created in 1999 after decades of contamination by a nuclear weapons facility.

Since 2011, we have another nuclear exclusion zone to contrast and compare – Fukushima. As a nuclear disaster triggered by an earthquake-induced tsunami, it is a complex switching event, involving mixtures of geologic movements and technological failures. Such combinatory disasters have been termed 'Wexelblat disasters', after an email exchange between Sterling and a correspondent named Alex Wexelblat, and refer specifically to 'collapse, implosion, [and] failure' resulting from 'human technical infrastructure exploited past the limits of its capacity' interacting with planetary-scale processes.[11]

This scale of change is rare, and literally switches resources on or off, as did the nuclear plants at Fukushima and Chernobyl. As the media and affected locales continue to try to digest the disastrous displacement of lives and people, new landscapes are being created that could have been predicted. Paleoseismologists have warned that every few hundred years the tectonic plates off Japan's coast shift and send major tsunamis to the Tohoku region. In fact, one scientist even had a scheduled meeting to discuss the research with Fukushima officials just as the disaster struck.[12] Thus searching out relationships between a particular site and its geological profiles may help prepare for switching events of this scale.

The new landscapes created are both novel and reminiscent of the Chernobyl exclusion zone. Like Chernobyl, both fear of contamination and government decree have produced a sudden depopulation that leaves yards, playgrounds and infrastructures exposed to the entropic tendencies of natural systems. Though this depopulation is tragic in both cultural and moral terms, the land will likely improve in its biological profile over the coming decades. While at Chernobyl there have been some damaging effects on the insects, trees and birds that attempt to live in the most contaminated zones, the overall exclusion area has been transformed into an involuntary park containing surprisingly robust populations of rare animals, such as the lynx, European brown bear, wolves and Przewalski's horse.[13] A parallel reserve will likely develop in the Fukushima area, and it is likely to be at least as significant an ecological boon, given the restricted reserve space of the Japanese archipelago's densely populated coastal and agricultural zones.

Another developing novel switching landscape is composed of the waste-handling infrastructures populating the area around the damaged Fukushima plant. Extensive tank farms of radioactive waste water and 'bag farms' of radioactive soil are expanding rapidly, as no acceptable waste facility has been found.[14] These limbo landscapes are likely to become de facto storage as it is unlikely that any community will accept the volume produced. Meanwhile, a government-backed plan by TEPCO, the plant operator, proposes a frozen, subterranean wall to block groundwater from infiltrating the plant and continually

12. P. Landers, 'The Man Who Predicted the Tsunami', *Wall Street Journal*, 2011, www.wsj.com/news/articles/SB10001424052748704101604576248722573203608.

13. C. L. Brown, 'Chernobyl', *Encyclopedia of Energy*, M. A. Pierce (ed.), Ipswich, MA: Salem Press, 2012.

14. L. Garrett, 'Problems Persist at Fukushima', *Foreign Policy*, 2014, www.foreignpolicy.com/articles/2014/02/20/250000_tons_of_radioactive_soil_in_fukushima_japan.

15. Friends of the Pleistocene, 'Hedging on Stability: Reality Goes Speculative', *Friends of the Pleistocene*, 2013, www.fopnews.wordpress.com/2013/08/10/hedging-on-stability-reality-goes-speculative.

16. Such as the instructive cases of the physical infrastructure of the internet (described in detail in Andrew Blum's *Tubes*) and the iPhone's infrastructural support network (described in detail by Rob Holmes in a talk entitled 'An Atlas of iPhone Landscapes', available at www.m.ammoth.us/blog/2012/02/an-atlas-of-iphone-landscapes.

17. A. Madrigal, 'No Easy Tech Explanation for What Caused Wall St. "Flash Crash"', *The Atlantic*, 2014 www.theatlantic.com/technology/archive/2010/07/no-easy-tech-explanation-for-what-caused-wall-st-flash-crash/59766 (accessed 4 May 2014).

18. D. Kocieniewski, 'A Shuffle of Aluminum, but to Banks, Pure Gold', *New York Times*, 2013, www.nytimes.com/2013/07/21/business/a-shuffle-of-aluminum-but-to-banks-pure-gold.html?_r=1&pagewanted=all& (accessed 4 May 2014).

19. P. Desai, C. Baldwin, S. Thomas, and M. Burton, 'Goldman's new money machine: warehouses', *Reuters*, 2011, www.reuters.com/article/2011/07/29/us-lme-warehousing-idUSTRE76R3YZ20110729 (accessed 4 May 2014).

20. D. Kocieniewski, 'A Shuffle of Aluminum'.

21. Casey Lance Brown, quoted in a press release discussing his 2010 Rome Prize Project. www.media-relations.www.clemson.edu/article.php?article_id=2749.

producing more radioactive water.[15] These landscape prosthetics remain untested, and accelerate geotechnical testing on an unprecedented scale. The allied design fields could benefit from the knowledge gained in these unintentional switches to help predict and prepare for the disaster needs that continually arise from global urbanisation and its intersection with earth processes.

Glitches

INTENTIONAL: FINANCIALISATION AND METRO INTERNATIONAL TRADE SERVICES

In the wake of the global financial crisis, a great deal of reportage and attention was focused on the system of global financialisation, which would appear to exist as a thing only insofar as the aggregate behaviours of a multitude of financial institutions, spreadsheets and trading positions assume collective direction through the collision of a multiplicity of conflicting desires, decisions and rule sets. Yet as we and others have argued elsewhere, every non-corporeal system occupies some corporeal body.[16] Every financial institution is housed in a specific set of buildings, every spreadsheet is on a hard drive in a computer in some particular office or data centre, every trading position originates at a point in physical space.

In any system governed by aggregate behaviour, there are weird dark spots where aggregated lower-level behaviours manifest as bizarre meta-behaviours. For instance, the 'flash crash' of 2010 in the US markets saw algorithmic trading lose tremendous sums of money and suddenly return it in a matter of minutes.[17] So if every such system also occupies a physical geography, such as dedicated high-frequency trading conduits of fibre optics between Chicago and New York, it should also be expected that it also at times produces glitch landscapes every bit as unruly and unexpected as flash crashes.

The Detroit warehouses of Metro International Trade Services are one such algorithmic aberration, a logistical landscape network choreographed by the exploitation of an outdated set of metal trading rules and producing an absurd concentration of global metal supplies in a single North American city. The warehouses leapt to brief prominence when the *New York Times* ran an investigative report in July 2013:

> The story … begins in 27 industrial warehouses in the Detroit area where a Goldman subsidiary stores customers' aluminum. Each day, a fleet of trucks shuffles 1,500-pound bars of the metal among the warehouses. Two or three times a day, sometimes more, the drivers make the same circuits. They load in one warehouse. They unload in another. And then they do it again.[18]

Through its subsidiary Metro International Trade Services, Goldman owned these Detroit warehouses, which were stuffed with a vast quantity of aluminium – more than a million tonnes, a quarter of global inventories. The stuffing, though, was done by the London Metal Exchange, which owned the metals in the warehouses. Consequently, Goldman Sachs ended up making a great deal of money off the rent that the London Metal Exchange paid to Metro International Trade Services – even though Goldman was one of the major owners of the London Metal Exchange.

Meanwhile, as Goldman was collecting huge rents from the London Metal Exchange off its stockpile of aluminium, American aluminium buyers were starved of the metal they wanted to purchase:

> The long delays in metal delivery have buyers fuming. Some consumers are waiting up to a year to receive the aluminium they need and that has resulted in the perverse situation of higher prices at a time when the world is awash in the metal.[19]

Because the London Metal Exchange operates under an archaic rule system that specifies minimum daily metal release requirements by the city rather than by the warehouse, Goldman had every incentive to concentrate the physical position of the aluminium in a very few cities, including Detroit, thus minimising the amount of metal it was

required to release each day. This is because the less metal released, the more money Goldman made, primarily off the rent on its warehouses, but also potentially on the commodities exchange. Moreover, by shuffling metal between Detroit warehouses, Goldman was able to circumvent even the relatively low release requirements imposed by the Exchange, as the Exchange's rules did not require that the daily metal release be delivered to customers, only that it leave the warehouse.[20]

Consequently, a quarter of the world's supply of 'available aluminium' sat in warehouses in Detroit, warehouses that were briefly and suddenly switched to farcically bustling logistics activity, but deserted throughout the rest of the day. As an example of the landscape-scale consequences of the intentional exploitation of a glitch in an obscure segment of the global economic exchange system, this serves to illustrate the incredible capacity of rule-driven behaviour to produce unanticipated and seemingly nonsensical outcomes, while remaining entirely internally consistent.

UNINTENTIONAL: SPECULATIVE REAL ESTATE BUBBLES

The speculative development of land leading to bubble, crisis and crash has a very long history, dating at least to the 'rapid expansion and even more rapid decline' of the Roman villa system.[21] In a bubble, the value of real estate switches from being directly linked to its use-value, to being primarily linked to its utility as a speculative instrument. The glitch-like effect of the bubble is to encourage the rapid and shoddy conversion of landscapes – often landscapes that are part of economically productive agricultural territories or biologically productive reserves – into unproductive components of the speculative economy. This conversion process unfurls across any territory ripe for new or additional housing development, typically linked to some valuable recreational resource like water bodies, golf courses, national reserves, or even merely clean air and water. One of the most spectacular recent examples of this tendency within market systems is the incredible inflation and concomitant explosive deflation of real estate markets in the United States, beginning roughly at the start of the twenty-first century and continuing today.

In the state of Florida, where the greater US housing bubble perhaps reached its most delirious extremity, this *binary switching* typically took the form of the construction of unregulated, unplanned exurban developments. Built at the limits of political, economic, infrastructural and ecological feasibility, these asphalt-and-sheetrock flatlands were assembled as quickly and cheaply as possible to feed the bottom tier of the speculative pyramid, providing seemingly affordable stock for first-time home buyers and out-of-state speculators. They occupied a scavenger niche, concretising the knock-on effects of the soaring values of more established settlements. As a result, they were typically the first properties abandoned in the wake of collapse, leaving exurban Florida traced by the strange hieroglyphics of roads placed and lots demarcated for houses that were never built, and adjacent built ones, now trapped by underwater mortgages. In both cases, post-bubble abandonment produced eerie, feral landscapes, flickering between wholesome Sunshine State suburbia and the reptilian fecundity of Floridian wilderness.

Twitches

UNINTENTIONAL: DISEASE HOTSPOTS

Worse than the devastating economic effects of bubbles, leaky abandoned houses and their pools open a potentially dangerous ecological niche for disease vectors. In Bakersfield, California – one of the other states to experience the most severe effects of the housing bubble – the exponential rise of West Nile cases (up 275 percent from 2006-2007) precisely matched the delinquent mortgage notices of the subprime crisis (up 300 percent over the same period).[22] Pools turned green with algae after maintenance regimes halted, helping mosquitoes thrive. Mosquitoes also received a boost from a drought that attracted birds to these artificial water sources, as birds are the primary vector of West Nile virus. Furthermore, aerial spraying had to be used to combat the breeding, as pools in the area are mandated to remain fenced and locked when the owner is not present.

From the perspective of the designer, the unintended consequences of switching may often be the most significant. Just like in the case of Fukushima, these consequences have some predictability. But it is the predictability of high-significance, low-probability events where intuitive analysis and simplistic risk profiles often fail. It is this remote chance-style planning that we are attempting to both theorise and glean actionable knowledge from.

INTENTIONAL: 'PRECISION CONSERVATION' IN THE CENTRAL VALLEY

In California's agricultural Central Valley, formerly seasonal wetlands have been completely replaced by large, industrially-farmed flatlands. An experimental program called 'BirdReturns' has recently begun to tap into the potential of algorithmically directed decisions to monitor and react to rectify this significant ecological loss. In other words, officials are tapping into *intentional binary switching* of land to help the long list of species dependent on these wetlands. Historically, the Central Valley 'was once one of North America's most productive wildlife habitats', 'an ideal stop for migratory shorebirds on their annual journeys from South American and Mexico to the Arctic and back'.[23] The settlement of the Central Valley and its conversion to one of North America's most agriculturally productive territories, however, meant that those migratory birds must survive at the marginal edges of rice fields and road-impounded puddles.

For 'BirdReturns', the Nature Conservancy utilises data from 'eBird', a program by the Audubon Society and the Cornell Lab of Ornithology, which crowd-sources bird sighting data from across the United

States to generate an enormous database of bird observations.[24] This data permits the Nature Conservancy to predict 'bird density by time and place', or 'where and when birds will need to land'. Cross-referencing this with 'data on water availability' developed 'using predictive satellite maps', the Nature Conservancy has been able to program an auction system that pays farmers to generate temporary habitat by flooding their fields at the very moments in time when bird populations require additional habitats.[25]

Here, conservationists have taken advantage of extremely rapid binary switching to mitigate the deficiency of agricultural land as habitat, and in a more adaptable manner than typical conservation practices allow. Rather than transforming some of an agricultural parcel into habitat all of the time, as traditional spatially-based conservation agriculture design practices do, 'BirdReturns' is a spatiotemporal design practice that transforms all of an agricultural parcel into habitat some of the time, permitting both a greater spatial return and full agricultural utilisation during the remainder of the annual cycle of the parcel. Moreover, like unintentional twitching, 'BirdReturns' is geographically indeterminate: the territorial pattern of parcels utilised is flexible over time, permitting designed habitat to emerge as a shifting mosaic rather than in a single set of spatially-fixed positions.

Switching Landscape Architecture

From the perspective of the landscape architect, one key unanswered question that emerges from this sampled atlas is the question of opportunities for design agency. How, in other words, can unintentional switching become designed switching?

One possible answer is provided by 'Interstitial Seeding', a speculative design project by Ian Miller that engages the heavily contaminated stretch of Texas bayou known as the Houston Ship Channel.[26] The Ship Channel is a massive industrial corridor, dealing in both petrochemicals and other goods. The Ship Channel 'is the largest petrochemical complex in the Americas; it represents half of the nation's basic petrochemical manufacturing capacity and is the largest port in the nation for foreign trade of petrochemical products'.[27] Facilities along the Ship Channel produce, refine and ship oil, produce and ship natural gas, and host a collection of ancillary activities aimed at supporting these industries, such as specialised construction and manufacturing.

'Interstitial Seeding' enters into this utilitarian context, whose extreme instrumentalisation would seem to rule out design operations by locating and reprogramming disused strips of land along the Ship Channel. In the short run, the project proposes to repurpose these neglected scraps, 'leftover space[s] in the boundary between shore and industry',[28] as landscape machines for dealing with petrochemical waste discharges into the channel.[29] This is a relatively traditional design operation, involving topographic configuration, planting and maintenance regimes.

Across longer time scales, however, Miller begins to engage switching: the new 'situationally-appropriate ecologies' that compose the landscape machines – tidal marshes, bottomland hardwood forests and Cajun prairies – become catalysts that trigger the self-guided transformation of petrochemical facilities into ecological reserves in a post-carbon future. By setting up conditions that will guide the development of parcels when they are turned off by broader economic operations – whether the decline of dependence on fossil fuels or technological shifts that result in consolidations in larger industrial parcels further downstream – switching is anticipated and utilised as the implementation mechanism for designed transformation, pointing towards a new speed and territory for design agency.

22. W. Reisen, R. Takahashi, B. Carroll, and R. Quiring, 'Delinquent Mortgages, Neglected Swimming Pools, and West Nile Virus, California', *Emerging Infectious Diseases*, 2008, wwwnc.cdc.gov/eid/article/14/11/08-0719_article.htm#suggestedcitation (accessed 4 May 2014).

23. J. Robbins, 'Paying Farmers to Welcome Birds', *New York Times*, 2014, www.nytimes.com/2014/04/15/science/paying-farmers-to-welcome-birds.html?_r=0 (accessed 4 May 2014).

24. Ebird.org, eBird, 2014, www.ebird.org/content/ebird/ (accessed 4 May 2014).

25. The Nature Conservancy, *Precision Conservation*, 2014, www.conserveca.org/blog_multimedia/precision-conservation.xml (accessed 4 May 2014).

26. 'Interstitial Seeding' was produced by Ian Miller in a landscape architecture studio taught by Rob Holmes at LSU in spring 2013. The studio focused on landscape futures for the industrial and infrastructural edges of the Houston Ship Channel.

27. Shell Center for Sustainability, 'Keeshan and Bost Case Study', 2004, www.shellcenter.rice.edu/uploadedFiles/Shell_Center/Research/Keeshan_and_Bost.pdf (accessed 30 May 2014).

28. Quotation from personal communication between the authors and Ian Miller.

29. P. Roncken, S. Stremke and M. Paulissen, 'Landscape Machines: productive nature and the future sublime', *Journal of Landscape Architecture*, vol. 6, no. 1, 2011, pp. 68–81.