EDITORIAL

The Digital and the Organic

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Concept and Reality

The computer's on and the landscape designer goes to work. The precedents for this area have been developed and the planting palettes determined. Which species are typical of the saturated soils and which for the well-drained? What are the site lines that visitors will experience and how does the restored landscape fit in with the other elements of the program, the need for social, athletic, and infrastructure areas? The modern software renders the blueprint and positions each woody plant. The types and specifications for the planting stock to be purchased are all detailed. The new landscape plan is ready for presentation to the regulators and to the landscape owner. The concept is ready to be put onto the ground.

But then the plan is followed precisely but the outcome is not what the designer had envisioned. The planted landscape starts deviating from the computer's digital model. Instead of the planted components simply getting larger over the years, the installation pushes the computer model away and starts molding a new landscape.

Stasis and Change

To an engineer or architect, success usually means stasis. The design is physically strong, resistant to environmental stresses, and keeps the same structure and shape for many, many years. Longevity of the designers' precise vision is evidence that that digital design was done properly.

In restoration ecology, each element of the design is alive and responds to the physical environment or to the neighbor that it bangs up against with a physiological and morphological response. Each plant changes, even if that change is expressed as death when a close neighbor overtops its shoot. Any field ecologist expects that the landscape design, no matter how precisely drawn will not remain the same in the following years. Rather than being evidence that the initial design was faulty, the change is an expression that the restorationist's work is alive and respondent to local stressors. In fact, the evolved life histories of many of the species we work with are hardwired to die after a short period, disperse propagules, and start up again elsewhere. It's an environmental dance with many steps, each of which sashays us further away from the initial designed pattern.

Crawling Over the Ground

Sometimes the deviation from the original design is driven by the movement behavior of constituent plant species. Clonal plant species, both herbs and woodies, are programmed to put up new shoots some distance from where the initial seed germinated. The initial shoot is joined by many other genetically identical shoots ("genets") around it. Over the years the shape of the clone follows environmental gradients, lines of least competitive resistance or lines towards better physical resources. Some clones become dozens of square meters wide and form a solid mass. Others, guerrilla-like, send out stolons or rhizomes that infiltrate the surrounding species' habitat, slowly searching out microsites for success. Many of these expanding clones are competitive bullies that eliminate neighboring plants that were part of the initial design. They erase by their expansion.

A designed habitat of many species may change into a species-poor community where a few taller or aggressive species rule the landscape roost. They care nothing for the sweet colored pattern of a Monet painting, a species-rich mosaic. This is not a failure of the designers' skill, but the reality that individual species have evolved lifestyles. Each plant maximizes its fitness by spreading, either clonally or through the production of seeds, to disperse more widely and neighbors are evicted. "Plants don't move," many students are taught in early education. This is so often not true. The initial design should be thought of as a starting point from which so many new patterns of species placement appear as time goes by.

Home Alone: Pining for Partners

There is never room on a computer drawn landscape plan to add pollinators, seed dispersers, mycorrhizae in the soil, or herbivores. These necessary components of the living landscape are invisible on the plants-only diagram of the restorationist's goals. In this sense, formal design plans are a lie, ignorant of ecological needs. As if a living plant community can persist without mutualists and herbivores driving its dynamics. In the Darwinian world most biologists are suckled on competition as the molder of ecological

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and evolutionary change. We now know that mutualisms can be just as important in steering persistence and change in nature. Plant communities without the animal partners for reproduction or modification of competitive relationships are plant communities which will fail to follow typical successional trends. Organic processes and partnerships always intrude the fate of a restoration. Although mutualists are left off blueprints and site plans, they are both critical but difficult to purposefully install on a project site. The dance of species on a site stumbles without the chorus line of a supporting biotic cast.

Hotter and Wetter, Hotter and Drier

The other challenge to a computer drawn restoration plan is time, and the changing heat and hydrology which are common expressions of a changing climate through time. Some areas will be drier, increasing the stress of aridity. Other areas will be submerged by sea level rise and the landscape becomes benthic. Given the migration of habitat zones due to these climatic dynamics, in the near future designed landscapes will fail or be pushed along as if by a climatic glacier. The alternative is management at great effort toward some artificial stasis.

Landscape designers are challenged to somehow overcome our ignorance of the speed and intensity of climate change on landscape designs. The only thing we know is that the landscapes will change. One can digitally include climatic factors in a model that predicts future ecological communities on site, but too many factors that will drive our future habitats remain unknown; our climatic crystal ball is cloudy. We often recommend that a plan put in many species. Ignorance of the future can be negotiated if we plant a wide variety, knowing that some of them may fail, but others will live. We hedge our palette bets to polish that crystal ball.

Disturbance, Destruction, Failure

Disturbances are integral elements that mold ecological communities at all scales. Fires, floods, ice scouring, gopher mounds, or herds of hard-hoofed mammals can each change landscape structure. We rarely know the frequency or intensity of the disturbance regime in any one place. It is rare for a restorationist to have adequate time to research on the ground or through academic resources the pattern of disturbance on the site being designed.

With rapid climate change the disturbance regime should also change making historic records unfaithful indicators of future performance. It is difficult to get resources to restore a local landscape more than once. However, the changing disturbance patterns on our landscapes will lead to all too many failures. Restoration failure due to unknown disturbance patterns is a cruel reality of our business, not fairly assigned to a professional's shortcoming.

Precision and Flexibility

How elegant and detailed are the computer programs designers use to lay out a landscape plan. The models can be made three-dimensional and can be twisted and tilted to show all vantage points of the careful design. This is all the illusion of precision. The ecological realities outlined above are warnings that the fluidity and dynamics of living plant and animal communities can overwhelm an initial planting scheme. The changes and flexibility of habitats through the years are facts of ecological science. They are the harsh realities that, like those herds of mammals, can thunder through and destroy a planting scheme that is based on a designer's static reverie.