Defining the Limits of Restoration: The Need for Realistic Goals

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Abstract

The search for a universal statement of goals for ecological restoration continues to generate discussion and controversy. I discuss the diverse roots of restoration ecology, and show how the complex lineages within the field have led to diverse, and divergent, sets of goals. I then review the three major themes that currently are used to develop statements of goals: restoration of species, restoration of whole ecosystems or landscapes, and the restoration of ecosystem services, and point out both the advantages and the limitations and problems associated with each category. Finally, I suggest that restoration ecology would be better served by recognizing that the diversity of conditions requiring restoration demands much flexibility in goal setting, and that restorationists should seek to develop guidelines for defining the sets of conditions under which different kinds of goals are appropriate. I further suggest that goals would be more easily and more appropriately set if restorationists would set forth at the outset the true scope and limitations of what is possible in a given project.

Key words: goal-setting, wetlands, conservation biology, ecosystem management, ecosystem services, landscape management.

Introduction

The specification of goals for restoration projects is frequently described as the most important component of a project, because it sets expectations, drives the detailed plans for actions, and determines the kind and extent of post-project monitoring. Not surprisingly then, the nature of restoration goals is the subject of frequent comment (Aronson & Le Floc'h 1996; Box 1996; Hobbs & Norton 1996; Kershner 1997; and many others). Although the statement of restoration goals can take many forms, it remains unclear if there is an optimal way of specifying goals, and if so, what form this statement should take. In particular, debate within the communities of both restorationists and conservationists has been concerned with the appropriate level of organization at which goals should be specified (Aronson & Le Floc'h 1996; Goldstein 1999). The level of organization (species, communities, ecosystems, watersheds, or landscapes) in turn reflects the ecological processes that practitioners may perceive as critical to the restoration effort (Allen et al. 1997; and associated papers therein).

Like conservation efforts, restoration can be oriented around particular species, can address community composition, or may be centered on whole ecosystems or landscapes (Risser 1995; Falk et al. 1996; Kershner 1997). Goals may also be stated in terms of ecosystem services. The recent attempt to place a dollar value on such services (Costanza et al. 1997) has accentuated the interest in using services as a basis for goal-setting. The debate as to which of these levels is the appropriate, optimal, or best focus of restoration and conservation goals has excited strongly worded statements (Goldstein 1999; Risser 1999; Walker 1999) addressed to both conservationists and restorationists. Here, I review the relative merits and pitfalls associated with specifying restoration goals based on species, ecosystem functions, and ecosystem services, and offer some suggestions.

Multiple Goals from Multiple Origins

The goals set for restoration projects are highly variable, in part, because restoration ecology has a complex, heterogeneous lineage. Four main themes can be discerned (Fig. 1). Each reflects a largely separate course of development of the theory and practice of restoration. One line is derived from conservation biology and is centered on the restoration of individual species. Species-centered goals for restoration are reflected in a variety of recent publications (Falk et al. 1996). Conservation biologists have also emphasized the recognition and preservation of rare or endangered communities, and restoration goals centered on the reestablishment of such assemblages can be considered a facet of the conservation-derived root of restoration. Efforts by state Natural Heritage programs to identify and restore rare communities exemplify this theme. Practitioners of this form of restoration emphasize the need to duplicate natural conditions as a standard of restoration success. Currently, the restoration of communities—particular associations of organisms—is a primary focus of many restoration efforts.

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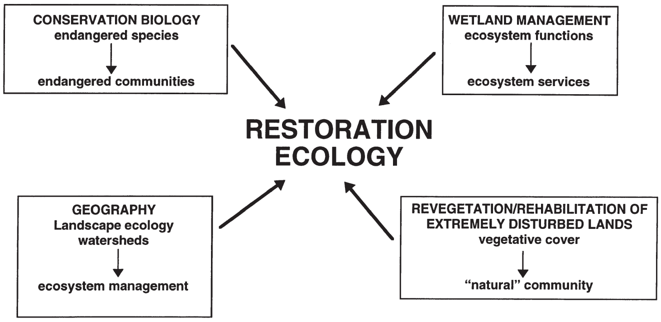

Figure 1. The separate strands contributing to the development of restoration ecology. Developments within each strand have contributed to the complexity of the field.

Another historical base within restoration ecology comes from the disciplines of geography and landscape ecology. Practitioners in these fields look at entire landscapes (Zonneveld 1995; Aronson & Le Floc'h 1996; Heathcote 1998; Naveh 1998), often using watersheds as the unit of restoration. This approach is at the opposite extreme of ecological organization from the species-centered approach, and reflects its origin in disciplines that have rarely involved studies of individual species. Landscape-scale goals derive, in part, from the long history in Europe of landscape management. Recently, the ecosystem/landscape approach has been incorporated into the idea of ecosystem management (Grumbine 1994; Vogt et al. 1997) and is the most commonly cited ideal for setting restoration goals.

Wetland restoration represents a third, separate lineage within the discipline of restoration ecology. The practice of wetland restoration and creation developed independently of the above two strands, and was driven, to a large extent, by legislative mandates for the mitigation of damage to wetlands by economic development and by agriculture. These laws, in turn, were driven by the perception that many of the ecological processes that take place in wetlands are of value to society; wetland mitigation, thus, became an effort to replace those processes and values. Although the perception of ecosystem services performed more broadly by all ecosystems was a quasi-independent development (de Groot 1992; Costanza et al. 1997), the concept has been most extensively developed within the arena of wetland management as the perceived value of ecological processes within wetlands became widely recognized (Anonymous 1995; Zedler et al. 1998). Ecosystem services now are incorporated extensively in wetland management programs, in which "functional replacement" is the explicit goal of laws and regulations.

A fourth, independent strand in the braided structure of restoration ecology is the long history of attempting to manage the extreme, often toxic, results of resource extraction. An extensive literature has developed, describing methods for reestablishing some semblance of a functioning ecosystem on spoils, mine pits, overburdens, salinized or highly eroded soils, etc. (Lal & Stewart 1992; Munshower 1994). Restorationists working on such projects often do not pretend to create replicas of the ecosystems that were originally on the site; rather, the goal is usually to establish a functional ecosystem.

The disparate historical roots of restoration ecology are apparent in the diversity of implicit and explicit goals of restoration efforts. In order to see how restorations are oriented in current work, I surveyed nearly 100 articles published during the past three years in *Restoration Ecology.* About 25% of the papers described projects whose purposes were to restore species, whereas 30% addressed the restoration of ecosystems, watersheds or landscapes, with little or no attention to individual species. The remaining 45% were concerned with a variety of goals addressing the restoration of particular assemblages of species, or levels of diversity, or sets of biotic interactions. Approximately 15% of the projects involved extremely disturbed conditions, including mine sites, waste sites, gravel pits, and roadsides; 18% were concerned with wetland restoration and creation. The rest were more or less evenly divided among forest, aquatic, grassland/prairie, and other types of ecosystems. In a special issue on riparian restoration (*Restoration Ecology*, Volume 5(4), 1997), the majority of authors discussed landscape-level criteria for setting goals and priorities. Thus, recent practice in restoration ecology continues to reflect, in its published results, the variety of historical sources for the field.

Restoration of Species

The restoration of species is predicated on an understanding of the autecology and habitat requirements of the species of concern. Common foci for research include the genetic structure of populations and metapopulations, population biology, minimum viable population size, issues of local adaptedness, and the kinds of interspecific interactions (predators, prey, mutualists, competitors) that may be important in establishing or maintaining populations.

The advantages of species-centered restoration are clear (Table 1): species threatened by extinction are rescued, or at least given a better chance of survival. The recent delisting of several endangered species testifies to the importance and possible success of this approach. There are several problems, however, that may be associated with attempts to restore individual species (Table 1). First, the definition of a species' habitat, which is an essential, primary step in defining conditions for both conservation and restoration, can involve implicit, unrecognized knowledge of ecosystem- or landscape-level interactions and processes. Failure to understand the

Table 1. Advantages and disadvantages of designing restoration with respect to different types of goals.

Level	*Advantages*	*Disadvantages & Causes of Failure*
Species	Rescue of endangered species Increase in biodiversity	Lack of recognition of ecosystem- and landscape-level interactions and processes Inadvertent damage to other species Attention to one target species may divert attention to other species
Ecosystem functions	Recognition of large-scale processes necessary for species' persistence Encouragement of integration of management goals of diverse agencies, interest groups Recognition of dynamic nature of ecological entities	Definition of "ecosystem" unclear; can lead to problems identifying unit to be restored Definition of "ecosystem function" unclear; functions are heterogeneous in scale and generality, and are poorly correlated with each other
Ecosystem services	Generation of public support, funding Specific actions readily identified	Same problems of definition, scale as with ecosystem function Value depends on constancy of "willingness-to-pay," economic conditions Creation of one service may preclude others

larger-scale processes may lead to failure of reintroductions, many of which may appear paradoxical (Montalvo et al. 1997). An excellent example of such problems is the attempt to create habitat for the endangered Light-footed clapper rail in salt marshes of southern California (Zedler 1996). Although the correct vegetation and hydrology were restored at the mitigation site, nitrogen cycling was limited by sediment texture, resulting in stands of *Spartina foliosa* (saltmarsh grass) that were too short and sparse to allow birds to breed. Efforts to increase nitrogen supply by fertilization only resulted in allowing another plant, *Salicornia bigelovii*, to competitively displace the desired grasses (Boyer & Zedler 1999). Because of the linkage of sediment texture at the created site to nitrogen dynamics, and their linkage to the composition of the vegetation, all attempts to restore the rail at this site have been abandoned (J. Zedler, personal communication). It is likely that similar unforeseen connections between habitat variables and ecosystem or landscape processes have affected other species-based restoration efforts.

Another problem, sometimes associated with species-based restoration, is the ancillary damage done to other species as a result of an intense effort focused on one species. Meffe (1992), for example, described attempts to restore salmonid fisheries in the Pacific Northwest as "techno-arrogance" because the methods used to increase fish populations are causing a variety of other conservation problems, such as increased fishing of native salmon stocks and genetic "pollution" of native populations. He points out that similar problems have arisen with efforts to restore other endangered species, including sea turtles.

Species-oriented restoration implicitly demands that the restoration effort attempt to recreate the habitat of the target species, without regard to the habitat requirements of co-occurring species, including species over the complete spectrum of organisms—microbial, floral, and faunal—that make up an ecosystem. The widely accepted view of communities as individualistic associations of species suggests that the community that develops in a site restored to meet a particular species' needs may or may not be similar to communities in which the target species was originally found. Thus, the agency or group that decides which species should be the object of restoration efforts may inadvertently cause the loss of habitat for species for which there are no competing interest groups to generate public support. It follows that if conservation and restoration are focused exclusively on species, as called for by Goldstein (1999), for example, non-target species, especially small, obscure species in poorly known groups, may inadvertently suffer.

Ecosystem Functions and Ecosystem Management

Perceptions of some of the problems associated with species-based conservation, together with a widespread increase in appreciation for the integrated function of whole landscapes, led to the development of ecosystem-based paradigms for directing conservation and restoration efforts (Risser 1995; Walker 1992, 1995), and of ecosystem management as an approach to land management and restoration (Grumbine 1994; Christensen et al. 1996; Pearson & Klimas 1996). This approach recognizes that the viability of populations of all species, including rare and endangered species, depends on the maintenance of large-scale, as well as small-scale, ecological processes, on the presence of a characteristic mosaic of community types over a broad area, and on the movements of individuals and populations over large areas.

The advantages of using ecosystem management as an organizational framework for restoration have been well summarized by Allen (1996) (Table 1). He points out that the ecosystem-level framework encourages restorationists to both pay attention to landscape-level dynamics and to attempt to integrate an understanding of these large-scale processes with the small-scale processes of soil ecology and species biology. He also points out that the "management" part of the phrase encourages thinking about the widest possible range of interventions that affect both large- and small-scale processes.

The use of ecosystem-level goals for restoration and conservation has been strongly criticized, in large part because key concepts and terms are poorly defined (Goldstein 1999) (Table 1). For example, the idea of ecosystem management suffers from vagueness in the definition of ecosystem, as well as in the definitions of other terms used to define the goals of ecosystem management (i.e., ecosystem integrity or ecological health) (Wilcove & Blair 1995). Allen (1996) has pointed out, however, that many of the concepts used in species-based conservation and restoration are similarly vague. "Minimum viable population size" can be given a mathematical definition, but is hard to apply to real-life situations. Levels of anthropogenic disturbance and pollution that affect the health of populations are vigorously debated (for example, the controversies over organochlorine pollutants in the Great Lakes and their effects on organisms [Carpenter 1995; and related articles]). The goal of conservation biology that "components of the ecosystem should [not] be perturbed beyond natural boundaries of variation" (Mangel et al. 1996, p. 338) leaves open the definitions of what are the "components of the ecosystem" (never mind the definition of ecosystem) as well as what are the natural boundaries of variation. Many other examples could be cited. Lack of precision in the definition of ecological terms has been a controversial issue for decades in ecology as a science, but has not prevented its effective application in both conservation and restoration. Thus, although criticisms of the vagueness of terms used to develop ecosystem-based goals may be legitimate (Goldstein 1999), the same criticisms apply to other foci for restoration. To deny the importance of ecosystem-level processes because of problems of definition ignores both the importance of these processes and the long history of using poorly defined terms to good purpose in many specific cases of restoration and conservation.

However, even if we accept the fuzziness of the general concepts invoked in ecosystem management and restoration, there are additional problems of definition that hamper the use of ecosystem functions as a basis for restoration goals (Table 1). The fundamental premise of this approach is the recognition of ecosystem processes, or functions, that create and drive the system, and that are both a result of structure (e.g., species composition) and a causative factor in creating structure. However, the concept of ecosystem function is equally vague. Every discussion of this idea lists a somewhat different set of items. Table 2 lists an amalgam of items culled from a variety of sources; it is as idiosyncratic and individualistic as (and has no greater validity than) any other list. The point is that the processes that make up ecosystem function are as variable as the definition of ecosystem itself. Just within this list, there is tremendous heterogeneity. Some processes, such as nutrient cycling or energy flow integrate the activities of numerous organisms (e.g., the extraordinary, if poorly recognized, diversity of soil organisms; Wall & Moore 1999). Others, such as succession or mutualisms, reflect the biology of particular species and are population-level phenomena, rather than ecosystem processes as usually defined. Some processes (e.g., diversity) reflect purely biological phenomena, whereas others reflect purely physical phenomena (disturbance regimes caused by storms) and still others reflect complex mixtures of biological and physical forces (soil formation and water quality). The items in Table 2 are also heterogeneous in terms of the scales of space and time over which they apply and over which they are measured. Some items (e.g., succession and mutualisms) are variously included or excluded from lists of ecosystem functions, depending on the viewpoint of the list-maker.

Measurable components of each of the processes listed in Table 2 have the same problems of heterogeneity, although they are more readily definable. Table 3 lists, as examples, the quantifiable components of three of the most commonly cited ecosystem functions. Again, the measurable components of each process are heterogeneous with respect to the time and spatial scales of the phenomena they index, and heterogeneous

Table 2. Processes included under the rubric "ecosystem functions."

Category	*Process*
Material flow	Energy flow
	Nutrient cycling
	Nutrient retention/loss
	Carbon storage
	Productivity
	Water flow
	Water turnover rates, flow rates (aquatic)
	Transfers to/from other ecosystems
Physical elements	Disturbance regimes (fire, disease, storms)
	Water quality
	Landscape structure
	Soil formation
Biological structure	Trophic structure
	Predation/herbivory rates
	Succession
	Resilience/resistance
	Diversity
	Mutualisms
	Passive vs. active dispersal

Table 3. Quantifiable components of selected ecosystem processes.

Ecosystem Function	*Quantifiable Component*
Energy flow	Food web architecture (number and kinds of trophic links) Respiration rates Ratios of respiration to productivity or to biomass Alternate energy flow paths (e.g., detrital vs. herbivory) Decomposition rates Trophic pyramid
Nutrient cycling	Mineralization rates Decomposition rates Organic matter "quality" indices Standing stocks of nutrients (total and/or available) Losses due to leaching, gas loss, erosion Different processes for different nutrients (e.g., immobilization of N, chemical forms of P, cation exchange, solubility of ca, anion adsorption of S) Identity of limiting nutrient(s)
Productivity	Rates of growth; biomass change per unit time Cover, maximum standing crop biomass Carbon flow (i.e., respiration rates or O_2 uptake rates) Primary vs. secondary or net ecosystem production Primary production: allocation to different tissue types (e.g., root:shoot, woody:leaf)

with respect to the number of species of organisms involved in the expression of the index.

Furthermore, correlations among the components of Table 3 (or Table 2) are either unknown or are variable. For example, in Swedish forests experimentally fertilized with nitrogen, the amount of carbon in the forest floor increases with added N (= nutrient cycling), but the microbial respiration rate (= energy flow) and biomass decrease (Nohrstedt et al. 1989). Experimental studies of the correlations between biodiversity and various measures of ecosystem function often show increases in productivity, plant cover, resilience, and biomass with increasing species diversity (Tilman et al. 1996; Naeem & Li 1997; McGrady-Steed et al. 1997; Tilman et al. 1997). But these studies are frequently highly simplified microcosms of protists (McGrady-Steed et al. 1997; Naeem & Li 1997), or relatively simple experimental grassland or grassland microcosms. Opposite patterns have been demonstrated in other ecosystems (e.g., in boreal forests, as studied by Wardle et al. 1997*a*, 1997*b*). No studies have been conducted in systems such as temperate salt marshes, which are known for both their low plant diversity and their high productivity, or sedge wetlands of the coastal plain, which are known for their high diversity and low productivity. The widely acknowledged association of high plant diversity at low to moderate levels of productivity (Rosenzweig & Abramsky 1993) also suggests that relationships among ecosystem functions are complex and not readily predictable or generalizable from simple laboratory models or from studies of a small number of ecosystem types.

Ecosystem Services

"Ecosystem services" are a third major source of goals for restoration and conservation. The specification of ecosystem services is as varied as the specification of ecosystem function. Three recently proposed lists of services are given in Table 4. The categories of services are overlapping but not identical; many other such lists in the literature similarly reflect the individuality of their authors. Although the services themselves are poorly defined, they all share the characteristic of being driven by considerations of human valuation. The advantage of using ecosystem services as a goal for restoration (Table 1) is that the compelling and obvious human interest generates dollars and political support, just as species of charismatic megafauna generate support for conservation (Wilcove & Blair 1995). However, one runs the risk that changes in technology, the economy, and/or society will undercut or devalue the service. This risk has been frequently pointed out with respect to efforts to place a dollar value on ecosystem services, such as that by Costanza et al. (1997). In addition, it is likely that restoring one particular service will preclude the provision of other services. For example, Marble (1992) details the particular characteristics of flora, fauna, hydrology, landscape setting, soils, etc. needed to promote the various ecosystem services provided by wetlands. Comparison of these lists reveals that the features needed to produce one service are sometimes the opposite of those needed for other services. For example, to promote nutrient removal, the water source to the wetland should have high nutrient concentrations (low quality), but to support bird habitat, high-quality water (low nutrient concentrations) is needed. To promote nutrient removal, a restricted outlet, low flow rates and mineral soils of any texture are recommended, but to support the export of production to downstream systems, moderate flow rates, permanently open, large outlets, and fine-textured soils are required. Although no one expects any given wetland to provide all possible services, the creation of qualities to maximize one specified service may well preclude other services which would otherwise be possible (Table 1).

Several other issues are germane to the discussion of setting restoration goals. The highly dynamic, ever-changing nature of ecosystems has been frequently pointed out (Pickett & Parker 1994), but the implications of this paradigm for choosing restoration goals are often conveniently ignored. Efforts to restore a species by cre-

Table 4. Ecosystem services proposed in recent publications.

Costanza et al. 1997	*Anonymous 1995*	*Christensen et al. 1996*
Gas regulation	Floodwater storage, attenuation	Maintain hydrological cycles
Climate regulation	Maintenance of fish habitat	Regulate climate
Disturbance regulation	Biodiversity	Clean air and water
Water regulation	Wood production	Atmospheric chemistry
Water supply	Water quality maintenance	Pollination of crops, etc.
Water treatment	Waterfowl, furbearer population maintenance	Maintain soils
Erosion control		Store and cycle nutrients
Soil formation		Detoxify pollutants
Nutrient cycling		Provide beauty and inspiration
Pollination		
Biological control		
Food production		
Raw materials (e.g., rubber, fiber, lumber)		
Recreation		

ating habitat may ignore its temporal instability. For example, *Chrysopsis falcata* (sickle-leaved aster), a rare plant in New Jersey, grows on bare sand in open, unvegetated areas of the New Jersey Pinelands. Presumably, the plant relied on periodic intense wildfires to create new habitat, and seed banks to survive the long periods between fires during which its habitat became revegetated. The plant has recently become established on some sand and gravel mine sites, whose expanses of bare sand offer ideal habitat. When mining activities threaten these populations, efforts are made to create new habitat for those populations. These habitats are by definition ephemeral, yet restoration plans rarely take this fact into account.

This example raises another issue. Many habitats that support rare plants and animals, or high diversity, are the result of human activities, and depend on these activities for their continued existence. The importance of grazing by domestic animals has been pointed out for species-rich grasslands in both the United States and Europe (Bakker & Berendse 1999; Howe 1999). Similarly, limestone fens in New Jersey support many rare plants and the endangered bog turtle; recent research suggests that they depend on grazing by dairy cattle to maintain the unforested conditions that these species require (J. Tesauro, personal communication). Schuyler (1999) has similarly pointed out that many of the rare plants of the New Jersey Pinelands thrive in habitats created by human activities, and that human activity is necessary to help them survive. The point is that, in order to meet a variety of restoration goals, it is sometimes necessary to harness human activities and presence, thus perpetuating something that cannot be considered "natural."

What Should Be the Goals of Restoration?

In this analysis, I have pointed out both advantages and limitations to each of the various paradigms for developing restoration goals. If all frameworks for developing restoration goals are flawed, how should restorationists proceed? I suggest two ways of thinking about restoration goals that may help resolve the problem.

First, recognize—explicitly and clearly—that there is no one paradigm or context for setting restoration goals. Goals need to be developed appropriately for each project, relative to scope and reasons for the restoration effort. The sometimes acrimonious search for a single paradigm for restoration and conservation (Goldstein 1999; Risser 1999; Walker 1999) ignores the tremendous diversity of both ecological conditions and the ways in which humans interact with nature. There is no reason why the goals appropriate to the restoration of bauxite mine spoil or the land around a zinc smelter should be transferred to efforts to restore large watersheds or whole landscapes, or particular endangered species restricted to peculiar habitats. It is as if ecologists are in search of general laws comparable to the laws of Newtonian physics (e.g., one gas law that works for all gases under all conditions), but seek to apply them to the probabilistic quantum world. I suggest that ecologists need to develop probabilistic laws. What are the sets of conditions under which it is important to address large-scale ecosystem processes? Species-specific mutualisms? Can sets of conditions be recognized that mandate particular methods or goals for restoration projects?

With a view towards starting such a search for sets of conditions, I suggest that when inputs of physical energy, in the form of water or wind movement, are dominating forces in structuring an ecosystem, then ecosystem- or landscape-level processes which integrate the activity of many species and/or address physical components of the system should be the primary focus in developing restoration plans. This principle is recognized, for example, in the large-scale criteria used for planning and prioritizing riparian zone restoration (see *Restoration Ecology* volume 5[4S]), where the force of flowing water is the primary structuring element of the system. Similarly, the Everglades are dependent on the large-scale flow of surface water, and coastal dune restorations must start with the forcible, large transport of sand by wind that structures the environment. In environments less strongly affected by the kinetic energy of flowing fluids, such as grasslands or upland forests, other generalities should be sought. Similarly, separate generalities could be sought for sites with extreme soil chemical or physical conditions. By thus identifying sets of conditions that require different types of goals and procedures for restoration, the diversity of both ecosystems and situations requiring restoration (as reflected in the history of restoration ecology sketched above) can be accommodated.

Second, be realistic within the community of ecologists and restorationists, and even more so with the public, about what restoration ecology can accomplish. Restorations carried out to meet goals of conserving species, or providing specific services, or revegetating extremely damaged lands, are both appropriate and necessary. But these restorations should be recognized for what they are, without the pretense that they result in a replica of the original, "natural" system, or that they are, by definition, superior to or inferior to community- or ecosystem-based restoration. Rather, they are appropriate under certain sets of conditions.

Being realistic is also necessary in portraying the results of ecosystem-oriented restorations. Although whole systems can indeed be created, their resemblance to natural systems is often questionable. Certainly, the available information suggests that many restorations do not closely resemble "the real thing," even after more than a decade (Bischel-Machung et al. 1996; Galatawitsch & van der Valk 1996; Zedler & Calloway 1999). Moreover, restorations may succeed with some taxa but fail with others at the same time (Simenstad & Thom 1996), whereas others appear to be largely successful (Clewell 1999).

Realism in recognizing the limits of restoration would do much to resolve the conflicts among restorationists with different kinds of restoration projects, because it would no longer be necessary to shoe-horn every restoration into the same set of goals. Realism—or honesty—in admitting and portraying the differences between a functionally created ecosystem and the presumed original and natural system will also do much to help guide legislation and policy. For example, current wetland policy is based on the premise that creation and restoration of wetlands (mitigation) replace damaged or destroyed natural sites with sites of equivalent ecological complexity. Perhaps if the community of restorationists were more forthcoming in saying that, although a functioning wetland can be created, it should not be considered an exact replacement for the original, wetland policy would be more stringent in determining when mitigation can be offered in lieu of preservation.

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