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What is Good Ecological Restoration?

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Abstract: *The rapid rise of ecological restoration is forcing consideration of what good restoration entails. Defining an end point for restoration is as much an ethical matter as a technical one, but scientifically trained restorationists have largely ignored the former issue. I argue that good restoration requires an expanded view that includes historical, social, cultural, political, aesthetic, and moral aspects. This expanded definition is necessary at a practical level to guide practitioners in the pursuit of excellence and at a conceptual level to prevent restoration from being swamped by technological activities and projects that veer away from ecological fidelity. Ecological fidelity is based on three principles: structural/compositional replication, functional success, and durability. These principles produce effective restoration, which is a necessary but not a sufficient condition of good restoration. An examination of characteristic problems that emanate from technological practices—reverse adaptation, an attention to product at the expense of process, and the separation of actions from consequences—leads directly to an expanded, inclusive framework for restoration. The results of an inclusive restoration process set up conditions necessary for restoration to achieve both ecological fidelity and harmonious human relationships within ecosystems.*

¿Que es una Buena Restauración Ecológica?

Resumen: *El rápido desarrollo de la restauración ecológica lleva a considererar que implica una buena restauración. La definición de una meta para la restauración es un asunto tanto ético como técnico, pero los restauradores con formación científica han ignorado este último. En este trabajo argumento que una buena restauración requiere de una amplia visión que incluye aspectos históricos, sociales, culturales, políticos, estéticos y morales. Esta definición expandida es necesaria en un nivel práctico para guiar a profesionistas en la búsqueda de la excelencia y en un nivel conceptual para prevenir que la restauración se empantane por actividades y proyectos tecnológicos que se desvían de la fidelidad ecológica. La fidelidad ecológica se basa en tres principios: replicación estructural/composicional, éxito funcional y durabilidad. Estos principios producen restauración efectiva, que es una condición necesaria, más no suficiente, para una buena restauración. Un examen de los problemas característicos que emanan de las prácticas tecnológicas—adaptación en reversa, la atención al producto a expensas del proceso y la separación de acciones de las consecuencias—conduce directamente a un marco de referencia expandido para la restauración. Ello resulta en un conjunto inclusive de condiciones necesarias para que la restauración logre tanto la fidelidad ecológica como relaciones humanas armónicas con los ecosistemas.*

What we require, then, is neither disparagement nor celebration of place-sense but an account of those specific conditions under which it significantly furthers what Relph calls environmental humility, an awakened place-awareness that is also mindful of its limitations and respectful that place molds us as well as vice versa.

—*Lawrence Buell,* The Environmental Imagination

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Introduction

The rapid rise of ecological restoration practice is forcing consideration of what good restoration entails. Most evaluative work has focused on technical performance criteria (e.g., Briggs et al. 1994), such as structural replication and composition. Other factors that have been introduced relate to ecological functions of direct interest to people (e.g., wetland filtration) and efficiency considerations (e.g., least investment of materials for greatest

return of restored site). These factors are often construed as technical matters, but they point to wider questions about community participation in restoration, the relationship between ecological and cultural restoration and the importance of aesthetics on restored sites. These concerns broaden the scope of restoration and turn, What is good ecological restoration? into a moral as well as a technical question. I propose we broaden, in theory and in practice, the way we define our work as restorationists.

What is required is a definition of good restoration that simultaneously rests on clear and necessary performance criteria and on the knowledge that the worth of restoration is adjudicated in historical, social, political, cultural, aesthetic, and moral contexts (Higgs 1994). *Restoration and Management Notes* and *Restoration Ecology*, primary sources of information for academic and professional restorationists, publish articles that advocate an explicit moral and cultural context for restoration practice (Jordan 1993; Higgs 1991; Higgs 1994). This advocacy, however, emanates from a minority within the larger restoration community; most practicing restorationists, especially scientifically trained restoration ecologists, have little time, though little hostility, for discussions of an expanded context. Complicated moral and cultural questions are not given fair consideration if they receive "off-the-shelf" responses. I aim, in part, to bring all committed members—restoration ecologists, conservation biologists, restoration practitioners, volunteers, corporate and government sponsors, and environmental activists—into the conversation about the direction and significance of restoration. Failure to achieve clarity on moral and cultural considerations will hinder ecological restoration's potential to generate healthy relationships between the people and the land.

Good ecological restoration entails negotiating the best possible outcome for a specific site based on ecological knowledge and the diverse perspectives of interested stakeholders; to this end it is as much process as product oriented. The definition of good restoration will vary from site to site, but will always be rooted by ecological fidelity: the combination of structural replication, functional success, and durability. To consider only ecological fidelity, as is often the case currently, results in a product-oriented, technical definition of good restoration. Imbedded in a process-oriented view is an environmental humility that simultaneously demands rigor in searching out the best evidence on which to base our actions and an awareness that no matter how hard we try there is always something else to learn. In negotiating goals for a particular restoration, the assumptions that guide the practice are brought up for view and criticism. Good ecological restoration depends as much on technique as on arriving at sensible and defensible tentative answers to tough questions, such as, To what era should a site be restored? How much can be spent on achieving ecological fidelity? Is it better to have many

adequate restorations, or a few good ones? Is restoration, in the sense of returning to some prior state, what we want, or are we better off with a model of regeneration? In adopting an expanded conception of restoration we are pressed to address these questions head on. Restoration practices that hold firm to ecological fidelity and embrace social and cultural goals are much more likely to prosper and endure. Conceiving and deliberating restoration, not just enacting it is eminently practical.

The formation of meaning about restorations thus emanates from our experience of the places we work and the interpretations of our culture that set the larger context. Aldo Leopold provides perhaps the clearest example. We remember his successful Sauk County, Wisconsin, restorations, the subject of his famous *Almanac*, and his vigorous championing of the University of Wisconsin-Madison Arboretum restorations, what most regard as some of the earliest intentional, ecologically based restoration in North America. His reputation is strongly supported through his lyric formulation of a land ethic that endures as the most significant and accessible testament to environmental ethics in North America.

This combination of experience and interpretation is what Buell (1995) calls "place awareness." He proposes that our environmental imaginations are shaped and constrained by this interplay. To attend only to experience forecloses the contexts of our activity just as much as single-minded attention to interpretation ends up cheating the subject. This dialectic presents a clear view of how restoration is shaped in a wider context. For ecological restoration to manifest the qualities of environmental humility, we must become aware that our actions are guided as much by the various cultural environments that make technical achievements sensible as they are by the technical achievements alone. This former point is easily overlooked. Shepard (1995:22) suggests that

> In the past half century we have invented alternative worlds that give physical expression to the denial of disaster. Following the lead and iconography of *The National Geographic* magazine with its bluebird landscapes, and then the architecture of Disneyland happiness, a thousand Old Waterfronts, Frontier Towns, Victorian Streets, Nineteenth-Century Mining Communities, Ethnic Villages, and Wildlife Parks have appeared. One now travels not only in space while sitting still but "back" to a time that never was. As fast as the relics of the past, whether old-growth forests or downtown Santa Fe, are demolished they are reincarnated in idealized form.

What counts as natural is shifting ground in the wake of technological transformations. Borgmann (1995) traces this to a cultural shift in preference for the "hyperreal" over the real. In 20 years, perhaps less, good restoration will be judged according to different, predominant cultural attitudes. People are moving away from direct ecological experience to mediated ones: television, Nintendo, virtual realities. These indoor activities are shaped by a culture of consumption and techno-

logical pattern in which prediction and control ascend as primary values. Restoration in the year 2015 risks being much more a matter of shaping ecosystems to our interests than reflecting the character of the ecosystem through sympathetic understanding and imagination. This reverse adaptation constitutes an inversion of what conservation biologists, ecologists, and restorationists have been striving for. It is not a technological nature we are after, rather it is a nature, or natures, that is a counterpoise to technology.

To avoid this specter those concerned with restoration must address an expanded context in both practice and theory. I argue this in five stages. First, I review various definitions of restoration with regard to context. Second, I highlight the significance of restoration as a cultural movement by making a distinction between restoration and restorationism. Third, I present a traditional and general model of technical performance in restoration as an indication of good restoration is presently understood. This measure of technical performance forms a necessary, but insufficient, base for assessing restoration. Fourth, I add a wider context to the definition of good restoration, layer by tentative layer, until the outlines of a more complicated model can be formed. I conclude by proposing a process-oriented view of restoration practice as a way of arriving situationally at good restoration. This avoids the strong and counterproductive desire to apply to problems moral templates that will only worsen the situation.

Defining Ecological Restoration

One would expect that a practice receiving so much attention and having so many adherents over the past decade would be clearly defined. Such is not the case. The Society for Ecological Restoration has wrestled with an official definition since the society's inception. Their original definition, adopted in 1990, was the longest lived and the most controversial: "Ecological restoration is the process of intentionally altering a site to establish a defined, indigenous, historic ecosystem. The goal of this process is to emulate the structure, function, diversity, and dynamics of the specified ecosystem" (Society for Ecological Restoration 1990). This definition, and similar ones proposed in its wake, indicate a lack of agreement on the most basic issues of what restoration is and what restorationists are attempting to accomplish. For example, some argue that historic standards should not be taken too literally, that a fixation on accuracy in this regard does not address why one time-slice is preferable to another. Others suggest historic standards are impractical in regions where ecological evidence of past conditions is mostly erased. The use of the word indigenous masks the extensive and long-running engagements that First Nations peoples have had with most of

the ecosystems Euro-Americans tend to regard as having once been pristine. European delegates to the society's conferences have puzzled over what indigenous meant on their own continent where the landscape has been transformed by peoples who trace their practices back more than a millennium.

The most recent official definition, put forth by the Society for Ecological Restoration (1995), is "Ecological restoration is the process of renewing and maintaining ecosystem health." The generality in this version is a manifestation of the underlying conceptual complications in arriving at an effective way of describing restoration. It is too general to be of much use in describing the basic elements of restoration practice. Some members of the society have commented rather cynically that the messy debates over an appropriate definition are merely semantic squabbles and that no genuine contribution has been made to advance the practice of restoration. This view ignores the power of language in shaping belief. It also passes over crucial differences in the way restoration is perceived. An agreeable definition forms the base of the larger project of deciding what constitutes good restoration.

Of course, the Society for Ecological Restoration holds no monopoly on definitions. A brief review of alternate definitions illustrates the range of opinion, and more centrally for my argument, the breadth of the context surrounding restoration practice. One of the most widely cited definitions was issued in a report from the U.S. National Research Council (1992):

> . . . *restoration* is defined as the return of an ecosystem to a close approximation of its condition prior to disturbance. In restoration, ecological damage to the resource is repaired. Both the structure and the functions of the ecosystem are recreated. Merely recreating the form without the functions, or the functions in an artificial configuration bearing little resemblance to a natural resource, does not constitute restoration. The goal is to emulate a natural, functioning, self-regulating system that is integrated with the ecological landscape in which it occurs. Often, natural resource restoration requires one of the following processes: reconstruction of antecedent physical hydrologic and morphologic conditions; chemical cleanup or adjustment of the environment; and biological manipulation, including revegetation and the reintroduction of absent or currently nonviable native species (p. 18).

This definition is noteworthy for its detail and attention to the balance of functional repair and structural accuracy. However, it provides no indication of a wider cultural context for restoration practice. Bradshaw's (1980) earlier definition is similar: ". . . restoration is used as a blanket term to describe all those activities which seek to upgrade damaged land or to re-create land that has been destroyed and to bring it back into beneficial use, in a form in which the biological potential is restored." Definitions that fit this general theme of technical proficiency abound in the literature.

As far back as 1975 Cairns et al. distinguished between perception and scientific knowledge:

The characteristics of restored ecosystems are bound by two general constraints, the publicly perceived restoration and the scientifically documented restoration. For example, *recovery* may be defined as restoration to usefulness as perceived by the "users" of the resource. This is significantly different than restoration to either the original structure or the original function (or both) as rigorously determined by scientific methodology (p. 522).

Here, the context set by public perception is plainly less important than that which is "rigorously determined by scientific methodology." How should perception and rigor be balanced? Cairns (1995), a long-time champion of restoration and chair of the National Research Council committee that produced the 1992 definition, answers this question more refinedly 20 years later with his proposal for "ecosocietal restoration:"

Because of its interdisciplinary nature, ecological restoration must involve ecosocietal restoration. This is the process of reexamining human society's relationship with natural systems so that repair and destruction can be balanced and, perhaps, restoration practices ultimately exceed destructive practices. Human society's practices are the best indication of its ethos or set of guiding beliefs. Ecological restoration is a positive statement of cooperation with natural systems (p. 9).

The connection between restoration and humanity runs to the core of many debates over how to define restoration. Cairns' model of ecosocietal restoration forces a recognition that restoration practices manifest social values. However, the question of balance between perception and science remains tilted toward science:

Not only have nonscientists in a wide variety of fields and places undertaken ecological restoration projects, but the field requires the input and cooperation of society to be successful. For example, if done on any significant scale, projects require approval of society or its representatives, significant funding, a long-term commitment to goals, and significant allocation of human, economic, and biological resources. Therefore, communication among disciplines and between scientists, engineers, and the general public and its decision makers is crucial. Also crucial is that all participants, including the general public, have adequate environmental literacy (Cairns 1995) (p. 9).

What Cairns advocates is a recognition of mutual interests on the part of restoration scientists/practitioners and the public. This is an important move, but it does not go so far as to suggest that social practices are an implicit part of restoration. Janzen's (1988) proposal for ecological and biocultural restoration in tropical ecosystems perpetuates a separation between the natural and the human; however, it acknowledges a more significant symbiosis than the economic sustainability of agroecosystems:

Human culture evolved in mutualism and conflict with the natural world. The natural world is by far the most diverse and evocative intellectual stimulation known to humans. Tropical humans are experiencing nearly total loss of this integral part of their mental lives. It is as though they are losing their color vision and most of their hearing. Ten thousand acres of rice is one of the dullest habitats on earth (p. 244).

Rogers-Martinez (1992) pushes the integration of the human and natural one step further in his description of the Sinkyone Intertribal Park project in northern California. The region had been inhabited for millennia by aboriginal peoples who coevolved as part of the ecosystems. The results of Euro-American colonialism were devastating for both ecosystems and the human inhabitants. The challenge in restoring this region is ensuring ecological health and sustainable economic activities (e.g., low impact logging) and renewing cultural practices. If successful, the project will result in a reinhabitation of the landscape, including cultural and economic practices that run counter to the intuitions of many restorationists. The Sinkyone project offers a model for restoration at a larger scale, one that internalizes cultural, political, economic, aesthetic, historical, and ethical practices once thought of as external to and at odds with the main work of ecological restoration.

Jordan et al. (1987) offer this challenge to restorationists: "What sort of relationship with nature does restoration signify and encourage?" This apparently philosophical question compels restorationists to ascertain in clear terms an appropriate cultural context for restoration. I have described a range of definitions extending from the purely technical to "ecocultural." The current, official definition of the Society for Ecological Restoration has backed away from mention of cultural issues by couching the meaning of restoration in terms of the slippery phrase "ecosystem health" (which, of course, could include human presence and livelihood). What I propose is closer to the model advanced by Rogers-Martinez than any of the definitions that pay homage exclusively to ecological (i.e., nonhuman) fitness. A concept of good restoration must incorporate at the outset a wider context. Hence, such an account of restoration must push beyond recognition of a context (e.g., in the case of Cairns) to full acknowledgment of context. This expanded concept still allows a central place for scientific rigor.

There are those who, having read this account of definitions, must still wonder whether the debate over an appropriate definition of restoration has important consequences for what counts as restoration practice. One clear function of definitions is demarcating what is included and what is excluded. For example, would natural landscaping (e.g., the Robert Starbird Dorney Ecology Garden at the University of Waterloo), agroecological projects (e.g., the Land Institute's perennial polyculture projects), cultural-ecological restorations (e.g., the Applegate Partnership in Oregon), and thematic ecological constructions (e.g., the Biodome in Montreal) fit within the current Society for Ecological Restoration definition? A narrow definition risks marginalizing restoration as too expensive and exacting within broader ecological management practices. With a definition too wide, the practice of restoration becomes confused with a host of potentially disturbing initiatives (e.g., Disney's Wilderness Lodge).

Thus, the challenge is to find an agreeable definition that manifests both ecological realities and an awareness of culturally contingent meanings (Hayles 1995).

Having made a strong pitch for the importance of definition, it is also easy to miss the larger cultural significance of ecological restoration by paying too much attention to what the definitions, official or otherwise, refer to. Definitions tend to force sharp boundaries around sites: either a specific project is or is not a restoration. It is easy to miss the more subtle patterns that define the quality and position of the boundaries. Ecological restoration has significance that runs far beyond the limited experiments and hesitant trials of the past few decades that most associate with prairie burnings, Aldo Leopold, wetland restoration, and community volunteer stream cleanups. These activities are important, but they inspire no more than polite smiles from hard-headed industrialists and global environmental negotiators concerned with massive bottom lines and stratospheric holes. To such people ecological restoration appears a fair and benign, Western middle class, pastoral practice, the kind of activity that harms no one and fills in the gaps among the really big problems. This attitude misreads the potency and cultural place of restoration in the contemporary era, as well as conflating size with abundance. There are, of course, a few restoration "megaprojects," such as the Kissimmee River. The Wildlands Project (Johns 1994,1995) and the Buffalo Commons initiative are promising, large-scale proposals. That such large projects are emerging is testimony to the force of restoration as a practice. However, to understand adequately the trajectory, importance, and worth of ecological restoration requires recognition of an expanded context.

Scope and Significance of Ecological Restoration

Perhaps the most transparent view of the larger cultural significance of restoration comes through the notion of redemption. Restoration offers a redemptive opportunity. We heal ourselves culturally, and perhaps spiritually, by healing nature. (To carry the biblical image further, in redemption there is also the possibility of absolution, which provides a strong incentive for action by those racked with guilt over environmental degradation.) Thus, restoration taps potent cultural values that may well accelerate both participation and commitment to its practice in the medium term (10 years).

Redemption, of course, is only one aspect driving the rapid rise of restoration practice. Closely connected is the "win-win" attitude that has swept public and corporate life. Traditional conservation and preservation techniques were, and are, perceived as denying certain groups (e.g., industrial loggers) their lifestyle in order to protect an ecosystem. With restoration degraded lands are returned to a former or ecologically diverse character or a

new value is created (Light & Higgs 1996). This has not escaped the notice of environmental groups, government agencies, and corporations. Restoration is finding an especially comfortable home in corporate boardrooms; for example, an act of restoration in sites around corporate offices is perceived by all as a sound investment.

Not all cultural values are going to support a worthy idea of restoration. Redemption is for many, to be sure, an unusual and troubling way of justifying restoration. Religious images aside, redemption implies that human action can compensate for a prior human misdeed, a view that builds in complicated assumptions about the source of value in nature, the capacity to solve longstanding problems of human intervention with an effectively technical solution (restoration as "technofix"), and beliefs about the ascendancy of contemporary values and practices (i.e., the myth of progress). Similarly, Frederick Turner's thesis that restoration is of one piece with a larger cultural tradition of transvaluing shame into beauty (Turner 1992) has been criticized for universalizing heterodox phenomena (Meekison 1995). Perry (1994) has criticized the "corporatization" of restoration and questioned indirectly the legitimacy of win-win strategies: Who really stands to gain from restoration? We are caught also in a vortex of change about one of the most basic questions: What counts as proper representation of nature? Older images of bucolic country woodlots and mountain vistas are giving way to the cultural productions of roadside rest areas, MTV backgrounds, the "natural" text of video games, "imagineering" at Disney World, and a host of televised images of nature that bear faint resemblance to more deeply rooted cultural ideas about nature (Evernden 1992; Borgmann 1995). These are the kinds of transformations that literary theorists and philosophers speak of as postmodern. The world we are entering is only partly comprehensible in terms of antecedents.

Together this partial list of cultural values and ideas expands the conception of restoration from practice to "mode." The idea of a restorative mode is borrowed from Leo Marx's work on pastoralism, especially his recent speculations on its future. Marx's (1992:212) work is significant for restorationists in that he defines and describes a characteristic American mediation between culture and nature. Pastoralism is an ancient concept the essence of which "is a sophisticated vision of the simple life led by a shepherd (or surrogate) figure, one who mediates between the imperatives of nature and culture, between the dangers and deprivations of the undeveloped environment (wild nature) and the excessive constraints of civilization." By emphasizing its constitution as a mode instead of, say, a practice, is to underscore the mentality or general principle of pastoralism.

Restoration may be divided similarly between the manifold practices of restoration and restorationism. The latter is a mode referring to a characteristic way of

thinking about the relationship between nature and culture and signals perhaps a devolution of these two traditionally opposite representations. Restorationism directs attention to the increasing habit of repairing damage or despoliation. It includes the cultural issues such as redemption and points directly to long-standing traditions of architectural and artifactual restoration. The debates over what counts as good restoration in nonecological domains are fascinating and illustrative for our purposes. They prefigure the kind of issues we might expect to come our way. For example, is it better in the case of the Old State House restoration in Boston to return it to 18th century provincial condition or to reflect the sequential changes made under different ideological and historical conditions (the answer, in 1991, was the latter)? With ecosystems, should we to return to some notion of originality or reflect a "storied" past? The technologies of representation have also become more sophisticated as in the case of Disney's Wilderness Lodge. In Florida Disney has managed the reproduction of an early 20th century national park lodge complete with redwoods and geyser, demonstrating the outer limits of what we might expect ecological restoration to represent (Cypher 1995). The apex of restorationism in one sense is found in the versatile and endlessly plastic technology of virtual reality in which the participant can select to restore whatever is desired in whatever setting.

Taken as a mode, then, restoration becomes a way of understanding "nature" that is connected to a diverse set of practices and institutions. The crucial question is, How is it that the restorative mode can be shaped to honor our relations with ecosystems? In other words, how can restoration as a practice be shaped and directed such that it manifests both high human virtue and ecological responsibility? These are, of course, enormous questions resistant to singular responses. However, the first and most important step to be taken is understanding what is meant by good ecological restoration. In the next section, I provide a straightforward and traditional characterization of effective or technical restoration. There are three main features of life in an advanced technological setting that confound the task of arriving at an appropriate definition. First, there is a tendency to invert means and ends to produce reverse adaptation. Second, there is an overemphasis on product at the expense of process. And, third, the distance between action and consequence grows beyond the easy range of responsible action. Together, these three challenges to the notion of effective restoration compel us to search for an expanded definition.

Effective and Efficient Restoration

How are most current restoration projects adjudicated? It is not difficult to arrive at the answer to this question especially if the various definitions cited above reflect accurately a general view of what restoration is. The goal of restoration is to reproduce by whatever means available a predetermined historic or indigenous ecosystem. This goal inscribes the concept of fidelity—that is, a quest to come as close as possible to restoring what once existed on a specific site. A completely faithful restoration, presumably, is one that exactly replicates the ecosystem. Hypothetically speaking, we could devise a test whereby ecologists were asked to view the so-called original ecosystem alongside the restored version. If no distinction could be made between them, this would be a perfect restoration. There are several difficulties with this asymptotic definition of restoration, not the least of which is the idea of nature as a fixed, determinable entity. What vests us with the authority to make claims about the kind of ecosystem to be restored, especially in cases where it is much easier to make the argument that the restored system is satisfying human interests at least as much as putative "ecosystem interests"?

Ecological fidelity is the avowed goal of restoration, and within it can be discerned three principles: structural/compositional replication, functional success, and durability. Structural/compositional replication most closely manifests the goal of fidelity. A restored ecosystem must strongly resemble the structure and composition of the so-called natural ecosystem. For example, a tallgrass prairie must have close to the expected diversity of floral and faunal species expected, not merely a few easily identifiable or charismatic species. Accordingly, the simple act of a controlled burn over a long-existing pasture, or the spread of seeds in tilled soil, is not likely to produce a faithful prairie in return. Weeding, selective plantings, judicious application of herbicides, and thinning are activities usually necessary to realize anything close to compositional and structural replication. Time is an important element as well. Replication may take as little as a few years in the case of certain kinds of wetlands and as much as many decades for forested ecosystems.

Functional success in inextricably tied to compositional and structural replication; neither one is possible over time without the other. The ecosystem must align ecologically with the system it is designed to reproduce. Biogeochemical processes must operate normally according to the expectations of the specific ecosystem (e.g., flushing rates, ion exchanges, decomposition). Functional success usually depends on management. A prairie cannot be properly sustained if fires are suppressed. Also, some ecosystems depend on human practices—for example, cultural landscapes that have long involved humans as part of the ecological functioning.

The durability of restored ecosystems is an issue of growing importance in the community of restorationists. Evidence is mounting that initial optimism about success rates of certain projects is undeserved. Following their installation a higher than expected number of

restored sites either fall far short of the fidelity objective or require more management than expected. For a restoration to be successful—that is, to achieve the overall goal of fidelity—it must hold up over a significant period of time, significant being defined relative to the type of ecosystem. This creates difficulties for regulatory institutions beyond that which they are typically equipped to handle: striking a balance between longevity and expedience when setting performance criteria.

The extent to which any given restoration project achieves the goal of fidelity I call *effectiveness*. As restoration project, then, is successful in direct relation to how effective it has been in reaching the broad goal of fidelity relative to other similar restorations. Effectiveness is a convenient term because it permits comparison with another layer, or mode, of defining good restoration: *efficiency*. An efficient restoration is an effective restoration accomplished in the least amount of time with the least input of labor, resources, and materials. In identifying efficiency we shift away from strictly technical criteria in defining good restoration. Efficiency introduces a different value system. Instead of valuing the restoration against some predetermined view of what counts as nature, presumably an ecocentric perspective, an anthropocentric scheme is layered on top.

Efficiency matters for several reasons. In a competitive market of ecological restoration, which in some cases is beginning to form in the wake of American policies such as "no net loss," efficiency provides a performance edge for the restorationist. A doctrine of efficiency runs deep in American culture suggesting that in the competition between two activities heading for the same end, the more efficient one is more valuable. Beyond interproject competition, efficiency is defensible because it frees up more resources, materials, and personnel for restoration. Thus, if we want restoration to flourish, we ought to want efficient restoration.

Several distinctive problems arise with restorations measured only against effectiveness and efficiency, and such problems are characteristic of technological practices. The first problem is *reverse adaptation*, a condition that derives from an inversion of the traditional relationship between means and ends. Langdon Winner (1977:229) defines it as "the adjustment of human ends to match the character of the available means." Reverse adaptation is common in advanced technological settings where the sophistication of technique alluringly distracts the practitioner from normal goals. It is evident, for example, in the introduction of microcomputer word processors when writing habits changed in response to the easy movement of blocks of text. The traditional goal of clear writing is subordinated by many to the authority of precise word counts, graphical neatness, and grammar checkers. This is mild and relatively inconsequential. It is striking how much attention at restoration conferences and workshops is given to certain

kinds of technological means at the almost complete expense of clear thinking about the proper goals of restoration. In the absence of clear goals beyond effectiveness, reverse adaptation is a genuine problem for restoration. It produces restorations that match the characteristic patterns of the techniques rather than goals such as fidelity or environmental humility. This is not to diminish the importance of technical improvements in restoration, so long as these refinements are set in proper relation to goals.

The second problem, this one primarily aimed at the doctrine of efficiency, is the enlargement of product at the expense of process. Ecosystems are dynamic complicated living systems and notoriously difficult to predict and regulate effectively. The process of bringing an ecosystem back to health is often time-consuming. Our patience is sorely tried in a consumer society where final products of any kind matter more than the background conditions of production necessary to bring them about. If it were otherwise, we would be much more concerned abut sources of production, unfair labor practices, and environmental devastation of so-called third world countries. The commodity, whether in the form of Twinkies or a salt marsh, is what makes most sense to us in the late twentieth century. The commodification of ecosystems is likely with the advent of mitigation practices, ecological theme parks, and corporate restorations. This trend will focus attention on efficiency of production of restored ecosystems because our interests will lie with the conditions necessary to bring them about.

The third problem, the separation of action from consequence, is a crucial barometer of morality in a technological culture. In effect, the more complicated the infrastructure, the greater the distance between the act of consumption and production (Jonas 1984). Nowhere is this clearer than in the total "costing" techniques that have been devised over the past decade to account for social and environmental costs (formerly "externalities") of production. This separation of action and consequence may well become apparent as restoration practice becomes more professionalized. The professionalization of restoration, in the form of specialized techniques, growing consultancies, competitive strategies, bylaws, and certification, could displace significantly the community-based, largely volunteer projects that have been the inspiration and motive force in restoration over the past two decades (others are confident that professionals and amateurs will happily coexist). If effectiveness and efficiency are the main guides in determining the worth of restoration, then it matters little how restorations are brought about, as exemplified by "reverse adaptation" and the distinction between product and process, so long as they are brought about. The question of why restore becomes increasingly subject to the movements of institutions and technical judgments. In the absence of an expanded set of criteria for evaluating restoration, the

continual separation of action from consequence in technological culture will act on restoration in such a way as to suppress local, heterogeneous, adaptive practices.

Expanding the Scope of Restoration

In searching for an appropriate way of defining good restoration, we should not toss away effectiveness and efficiency. In fact, effectiveness at the very least combines factors that are necessary for any restoration, good or otherwise: fidelity to structure, function, and durability. Efficiency is important inasmuch as these core factors are identified. However, the three technological problems—reverse adaptation, the confusion of product and process, and the separation of action and consequence—press us to consider other issues. Expanding the scope of restoration ecology means reaching out to these other factors.

A few, pointed conceptual questions move us quickly to an expanded realm:

- To what state should we restore (e.g., pre-European)?
- What or who is restoration for (anthropocentric or biocentric motives)?
- How important is participation in restoration practice?
- How much management is permitted on restored sites?
- How important are cultural practices (e.g., agriculture, burning) to restoration?
- Who wins and who doesn't in most restoration projects?
- How seriously should aesthetic considerations be taken in the design of a restoration project?
- Is a technically competent (i.e., effective) restoration accomplished through forced labor, or other coercive means, good restoration?

These questions challenge existing practice, forcing a reconsideration of the wider context of contemporary restoration. These are not epiphenomenal concerns, but vital to the successful development of restoration in the long term. No exhaustive list of categories is planned because categories are best taken cautiously. In the same way that not all ecologists support a separation of structure and function as categories, many social scientists and humanists reject, for example, a strict separation of social and cultural, or deny that one can be subsumed by the other. The issues described above can be arrayed conveniently under the categories of historical, cultural, social, political, aesthetic and moral, although it should be clear that each category will require much greater elaboration in future work.

Historical

There are two senses in which history is an important factor in assessing restoration. First, historical changes in understanding nature, environment, wilderness, and similar vocables point to a new understanding of the subject of restoration as something partly constructed by human values and attitudes. The idea of wilderness, for example, is described by Oelschlaeger (1991) as emanating directly from European colonization; there is no such thing as an essential wilderness. We know this now through an understanding of millennia of intensive and extensive human use of ecosystems. Callicott (1995) touched off a sharp debate when he presented a similar criticism of the idea of wilderness (Noss 1995; Foreman 1995). Second (and related to the question, To what condition should ecosystems be restored?), if wilderness begs reconsideration is it necessary to focus attention on the precolonial landscape? Or must we consider conditions before the arrival of humans, which in many parts of North America would date back to before the last glaciation? By testing assumptions about what counts as nature, a number of assumptions about the end point of restoration crumble.

Cultural

At the 1994 Society for Ecological Restoration conference a number of British restorationists complained effectively that a concept such as "indigenous" or "original" ecosystem is useless for a landscape that has been intensively used by humans for hundreds of years. Restoration for them means restoration of a cultural landscape. This is a matter that has become popular in Europe and also with First Nations peoples in North America. A significant focus in restoration, accordingly, ought to be bringing back into harmony the relations between sustainable human practices and ecological functions. This does not absolve us of responsibility for restoring ecosystems that are regarded as "pristine" or those reflecting little human activity, but, from an anthropological perspective, the pervasiveness of pretechnological human activity needs to be better understood. And, ecologists miss an important constituency if the role of humans in ecosystems is ignored (McDonnell & Pickett 1993).

Social

Reading through the journal *Restoration and Management Notes*, one is struck by the number of projects that involve volunteers. The labor required in many restoration projects has tended to promote community-based projects (e.g., Steve Packard's work in Chicago; Jordan 1993; Stevens 1995). One sensible reading of contemporary restoration is that it has been largely a grassroots movement. This is beginning to change. The scale of res-

toration projects is increasing (e.g., the Kissimmee River project). Corporate restorations are becoming more popular (e.g., Red Wing Shoes headquarters) (Perry 1994). Restoration and mitigation consultancies are on the rise. These developments point to a potential decrease in participatory/community-based projects.

Political

Should we be worried about whether restorations are in any sense democratic? Is there a problem, in an admittedly fictitious case, in having a terrific restoration completed with slave labor? Light and Higgs (in press) argue that restoration is not inherently democratic but has inherent democratic potential. To keep this latter potential in reach requires careful consideration of the political significance of restoration practice. This means asking continually, Who gains and who loses? Answering this question, and related ones, often reveals issues underlying a project. For example, if a corporation is the primary beneficiary of a restoration through an enhanced corporate image, this ought to color our perception of that restoration, but not necessarily undermine the worth of the project. Or, if a restoration is proceeding solely to satisfy a regulatory requirement, as in the case of many wetland mitigation projects, then we ought to take a closer look at the politics in restoration.

Aesthetic

Wilson (1991) points out that aesthetic considerations form a major part of people's appreciation of nature. The widespread and lavishly supported practice of gardening is an illustration of the significance of beauty. Landscape architecture has risen in this century to become a vital part of the construction and reconstruction of the built environment, and landscape design is a determining factor in recreation sites, homes, commercial complexes, and parks. Both gardening and landscape design have strong commitments to formal practices, canons of aesthetic taste, and popular and professional movements. With the rise of natural landscaping in the past several decades, ecological function and structure are important to the success of a project but usually remain subordinate to aesthetic considerations. It is not surprising that ecologically minded landscape architects, whose business it is to design landscapes, have found ecological restoration an attractive alternative and moved close to the center of this new practice. Aesthetic principles are important in restoration to the extent that they enhance public acceptance of restoration. However, public acceptance and aesthetic production easily overwhelm ecological fidelity. Some argue that beauty ought to be the final goal of restoration (Turner 1992), but in any case very little attention has been given to conceptual concerns about aesthetics in the restoration literature.

Moral

The rapid rise of environmental ethics of the past 15 years has demonstrated a plurality of moral perspectives about the environment but perhaps most clearly has shown that many of our actions proceed from an anthropocentric motivation; that is, we are guided by interests distinctly human. Alternatives, such as those associated with deep ecology, suggest a bio- or ecocentric view in which the primary moral subjects are nonhuman. An ecocentric perspective would argue that restoration is good insofar as it serves to enhance the lives of ecosystems from their own perspective. This is difficult for most of us to conceptualize, and it is especially challenging to restoration practice. Is restoration motivated primarily by a desire to help organisms and ecosystems realize their own ways of being, or are we driven by a desire to absolve ourselves of guilt over past environmental transgressions? The matter is not this simple, either, for there are many more categories of ethical thought to be invoked as alternatives to this rather stark dichotomy. These ethical positions challenge deeply held assumptions.

In summary, these six categories challenge and expand the domain of effective and efficient restoration. They build on the technological challenges raised in the previous section and together create a setting for expanding the conception of restoration. Figure 1 illustrates the nested relationship of effectiveness, efficiency, and expanded measure of good restoration.

A Process-oriented View of Good Restoration

An almost natural tendency exists for those who address the evaluative question in restoration to construct a set of objective criteria for measuring the worth of restora-
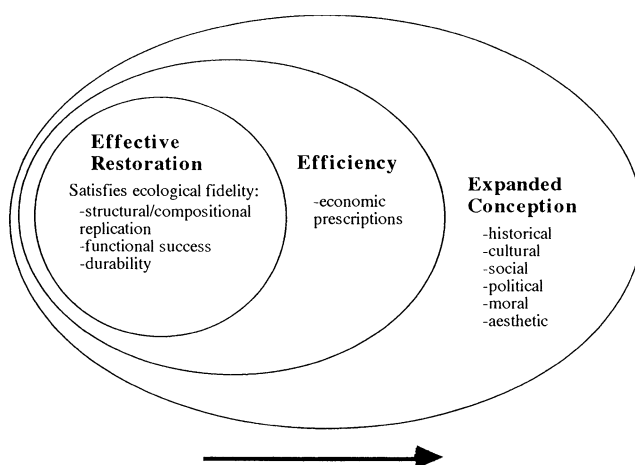

Figure 1. At the core of ecological restoration is a commitment to ecological fidelity. Successive layers of context are added to produce an expanded conception of good ecological restoration.

tion. This applies not only to the matters of ecological fidelity and efficiency but also the expanded factors outlined above. Although perhaps far-fetched, the Holy Grail of the technocratic restorationist would be a numerical ranking system of restoration practice that includes performance criteria for community participation, cultural significance, political rectitude, and moral stature. This is exactly what I want to avoid, knowing full well that living in a technological culture molds us tightly to this way of thinking. The issues about the conflation of process and product hold here: How can we balance what is restored and how it is accomplished? My proposal as simple.

Develop an inclusive process for making decisions about the design, implementation, and management of restorations. By inclusive, I mean a reasonable balance of people who are long-term stakeholders in a landscape: environmentalists, restoration scientists, restoration consultants, amateur naturalists, landholders, corporations with vested interests, local governments, etc. For such groups to work together, they must be comprised of people who are committed to the restoration, not because they necessarily agree on the means or the specific end. As much as possible, people should be given ways of making the most use of their abilities. Sound ways of modeling options must be developed so that reasonable alternatives can be carefully evaluated. There are, of course, many techniques in mediation, negotiation, and participation available within and outside of environmental management, but these have been scarcely applied to restoration. This is, of course, only the briefest sketch of a process-oriented approach to restoration. Much work needs to be done on developing this further.

It is obvious how such a process embraces the expanded conception of restoration, but there is one benefit that deserves special attention. Nature and ecosystems are historically and culturally contingent ideas. There ought not be any single, fixed, correct restoration for any particular site, although the structure, composition, or function will often provide some tight guidelines. By bringing people with diverse interests together and by providing them with a voice in the conduct of restoration, the model will raise manifold assumptions for serious discussion, criticism, and negotiation. For example, in Jasper National Park, the largest of Canada's Rocky Mountain National parks, decisions about restoration may be avoided by letting "nature take its course." Some believe this is the best decision because it supposedly avoids any imposition of human value: nature runs its course. There are many complex assumptions being made in such a decision, such as the meaning of nature and the worth of human involvement, and these become buried under a patina of piety. Exposing such assumptions for scrutiny forces us to address many of the complicated, painful, mind-numbing issues that have in many cases been neglected in favor of easier decisions.

There are several risks in this process-oriented approach. Two come to mind. The first is that opening up cultural assumptions will produce restorations that are far more human than natural. Assuming for a moment that such a dichotomy is valid, I suspect the opposite reaction will prevail. Once assumptions are better identified and information is provided that matches the questions being asked, people will respond in many cases more sensitively than current practice would lead us to believe. In other words, we might expect a net gain in "naturalness." Second, in the absence of clear goals or principles that prevent human involvement in ecosystems, development will accelerate. This is a serious worry. So far, environmental protection has depended on a continuum of natural value, with remote mountain ecosystems as the arbiters of the wild end of the spectrum. Without this kind of model behind us, we may tend to produce and reproduce human intrusions and development. I see no easy way of preventing this, and certainly the force of contemporary capitalism coupled with population increases are corroding the system of protection that has been developed with such difficulty over the past century. By ignoring the political character of these landscapes, however, we are not contributing to creative solutions. As Alex Wilson (1991) suggested,

> . . . none of our relations with the natural world will change until we change the basic relations of power in the Canadian and U.S. societies. Without broad social empowerment and true democratic institutions—neither of which I believe exists in any systematic way in North America today—our connections to the natural world will continue to be characterized by greed and exploitation, the very values so rampant in our social lives (p. 16).

Restoration will become a much more prominent, well-funded practice in the next decade. For it to avoid becoming a passing fad, it must shake loose from some of its commitments (e.g., "indigenous" ecosystems) and turn self-consciously to an oppositional strategy regarding the dominant patterns of technological culture. Whether this happens, depends on the development of authentic engagements (Higgs 1991) between people and ecosystems; in other words, the development of a heightened "place awareness." Early signs of the commodification of ecological restoration are evident and suggest strongly that the best hope for answering the conceptual and practical questions of what is good ecological restoration lies in developing an effective process-oriented view of restoration.

One of the first and most effective strategies in this direction is to reconsider the very name *restoration*. It connotes a fixed, historic, and static notion of ecosystems (although this is what a few proponents, especially ecologists, want). A better alternative, perhaps, is *regeneration*, which gives open recognition to the tentative, developmental quality of sensitive human engagements with ecosystems. The dialectic between experience and

interpretation, which is vital to Buell's notion of place awareness, helps out here. Restoration is situated too close to experience and misses the context of other cultural activities and beliefs. It requires the counterweight of careful reflection (interpretation) in order to comprehend what we are doing through our constructive manipulations of ecosystems. I proposed that ecological restoration offers the prospect of generating healthier relationships between people and the ecosystems in which they live. Generation is a constructive process and when applied to ecosystems suggests that restorationists-as-regenerationists are thinking carefully about the future as well as the past. Regeneration involves merging what we have accomplished and practiced well, and sets this in the context of workable, creative, and faithful engagements with ecosystems.

Acknowledgments

Literature Cited

Borgmann, A. 1995. The nature of reality and the reality of nature. Pages 31-46 in M. E. Soulé and G. Lease, editors. Reinventing nature: responses to postmodern deconstruction. Island Press, Washington, D.C.

Bradshaw, A. D., and M. J. Chadwick. 1980. The restoration of land: the ecology and reclamation of derelict and degraded land. Blackwell, London.

Briggs, M. K., B. A. Roundy, and W. W. Shaw. 1994. Trial and error: assessing the effectiveness of riparian revegetation in Arizona. Restoration and Management Notes 12:160-167.

Buell, L. 1995. The environmental imagination: Thoreau, nature writing, and the formation of American culture. Harvard University Press, Cambridge, Massachusetts.

Cairns, J., Jr. Ecosocietal restoration: reestablishing humanity's relationship with natural systems. Environment 37:4-33.

Cairns, J., Jr., K. L. Dickson, and E. E. Herricks, editors. 1975. Recovery and restoration of damaged ecosystems. University Press of Virginia, Charlottesville.

Callicott, J. B. 1995. A critique of and an alternative to the wilderness idea. Wild Earth 4:54-59.

Cypher, J. 1995. The real and the fake: imagineering nature and wilderness at Disney's Wilderness Lodge. M.A. thesis. Department of Anthropology, University of Alberta, Edmonton.

Evernden, N. 1992. The social creation of nature. The Johns Hopkins University Press, Baltimore, Maryland.

Foreman, D. 1995. Wilderness areas are vital. Wild Earth 4:64-68.

Hayles, N. K. 1995. Searching for common ground. Pages 47-64 in M. E. Soulé and G. Lease, editors. Reinventing nature: responses to postmodern deconstruction. Island Press, Washington, D.C.

Higgs, E. S. 1991. A quantity of engaging work to be done: restoration and morality in a technological culture. Restoration and Management Notes 9:97-104.

Higgs, E. S. 1994. Expanding the scope of restoration ecology. Restoration Ecology 2:137-147.

Janzen, D. H. 1988. Tropical ecological and biocultural restoration. Science 239:234-244.

Johns, D. 1994/95. The Wildlands Project: update. Wild Earth 4:4-5.

Jonas, H. 1984. The imperative of responsibility. University of Chicago Press, Chicago.

Jordan, W. R., III. 1993. The ghosts in the forest. Restoration and Management Notes 11:3-4.

Jordan, W. R., III. 1993. Restoration as a technique for identifying and characterizing human influences on ecosystems. Pages 271-279 in M. J. McDonnell and S. T. A. Pickett, editors. Humans as components of ecosystems: the ecology of subtle human effects and populated areas. Springer-Verlag, New York.

Jordan, W. R., III, M. E. Gilpin, and J. D. Aber, editors. 1987. Restoration ecology: a synthetic approach to ecological research. Cambridge University Press, Cambridge, United Kingdom.

Light, A., and E. S. Higgs. 1996. The politics of ecological restoration. Environmental Ethics 18:227-247.

Marx, L. 1992. Does pastoralism have a future? Pages 209-225 in J. D. Hunt, editor. The pastoral landscape. National Gallery of Art, Washington, D.C.

McDonnell, M. J., and S. T. A. Pickett, editors. 1993. Humans as components of ecosystems: the ecology of subtle human effects and populated areas. Springer-Verlag, New York.

Meekison, L. 1995. Changes in the land: ritual, transformation, and ecological restoration. M.A. thesis. Department of Anthropology, University of Alberta, Edmonton.

National Research Council. 1992. Restoration of aquatic ecosystems: science, technology and public policy. National Academy Press, Washington, D.C.

Noss, R. 1995. Wilderness—now more than ever. Wild earth 4:60-63.

Oelschlaeger, M. 1991. The idea of wilderness. Yale University Press, New Haven, Connecticut.

Perry, J. 1994. Greening corporate environments: authorship and politics in restoration. Restoration and Management Notes 12:145-147.

Rogers-Martinez, D. 1992. The Sinkyone intertribal park project. Restoration and Management Notes 10:64-69.

Shepard, P. 1995. Virtually hunting reality in the forests of simulacra. Pages 17-30 in M. E. Soulé and G. Lease, editors. Reinventing nature: responses to postmodern deconstruction. Island Press, Washington, D.C.

Society for ecological Restoration. 1995. Minutes of the annual meeting of the Board of the Directors. Society for Ecological Restoration, Madison, Wisconsin.

Society for Ecological Restoration. 1994. Definitions, definitions, definitions. SER News 7:5.

Society for Ecological Restoration. 1990. Minutes of the annual meeting of the Board of the Directors. Society for Ecological Restoration, Madison, Wisconsin.

Stevens, W. K. 1995. Miracle under the oaks: the revival of nature in America. Pocket Books, New York.

Turner, F. 1992. Bloody Columbus: restoration and the transvaluation of shame into beauty. Restoration and Management Notes 10:70-74.

Wilson, A. 1991. The culture of nature. Between the Lines Press, Toronto.

Winner, L. 1977. Autonomous technology: technics-out-of-control as a theme in political thought. MIT Press, Cambridge, Massachusetts.