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Editorial

RESTORATION ECOLOGY: A MAJOR OPPORTUNITY FOR ECOTOXICOLOGISTS

In the field of experimentation, chance favors the prepared mind. [1]
Louis Pasteur

The magnitude of the problem of hazardous waste sites in the United States is substantial and well documented and, as this is being prepared, it appears that the number of sites in other areas (such as Eastern Europe) may be appalling. Obviously, the rehabilitation of such sites to a point that they do not pose a threat to human life and the environment is highly desirable. Reintegrating such sites into the larger ecological landscape in which they occur will require skillful teamwork between the fields of ecotoxicology and restoration ecology.

In an editorial in this journal [2], I noted that ecotoxicology ideally would merge the fields of ecology and toxicology. Sadly, as Brungs [3] notes, the fields of toxicology and ecology are rarely associated, either academically or professionally. However, the applied sciences of ecotoxicology and restoration ecology do have some common ground and, in practice, both work rather well. A cynic might speculate that this is the result of having no robust supporting theory. Both professionals were regarded as "second class citizens" by the classical "pure" professional societies. As a result, their own now-thriving organizations (SETAC and the Society for Restoration Ecology [SRE]) were formed. Belatedly, the classical societies have recognized the importance of both ecotoxicology and restoration ecology, but the new organizations are now well established and not likely to close shop.

The validation of predictions of safety and harm based on laboratory tests in natural systems (or surrogates thereof) is improving our understanding of ecotoxicology. An unsurpassed opportunity for assessing and improving predictive capability and supporting theory for both ecotoxicology and restoration ecology may be in the successful decommissioning of hazardous waste sites and their reincorporation into the larger ecological landscape. Restoration of ecosystems damaged by hazardous wastes requires skillful application of methodology from both ecotoxicology and restoration ecology. There are three possible ways to foster the cooperation and information exchange needed to meet this challenge: 1) an entirely new professional organization could be formed, 2) SETAC and SRE could have occasional joint meetings and/or become affiliated, and 3) SETAC could actively recruit restoration ecologists and provide a forum for further development of the field, i.e., seek manuscripts, hold special symposia, etc.

OPTION 1: FORMATION OF AN ENTIRELY NEW PROFESSIONAL ORGANIZATION

New organizations are formed when the effort required by a group of professionals to form a new society (i.e., all the organizational prerequisites of a society—a journal, a constitution, a schedule of meetings, and all of the other things that identify an organization as a distinct entity from others of a somewhat similar but not identical nature) is perceived to be less than fighting the establishment of an existing organization to get manuscripts published, symposia sponsored, etc. For a new society to be successful and grow, an existing professional society(s) must be sufficiently inflexible to alienate the critical mass of members necessary for a new society. This inflexibility may not be deliberate but rather due to inattention to a newly developing field. For example, as a new field develops, it is often the case that while a small group of people are quite knowledgeable in this field, the entire membership of a particular professional organization is not. Worse yet, members may be aware of the new field but have disdain for it. As a consequence, either due to inattention or disdain, manuscripts in the newly developing field are either forced to conform to standards not appropriate to that field or may be rejected because they are viewed as inappropriate to that particular journal of that particular society. Of course one always has the option

of shopping around for a more flexible organization, and in the natural sciences, such as biology and chemistry, frequently there are journals with sufficient flexibility to accept a sound manuscript even though it may not be of general interest to most readers. Before SETAC was formed, articles now published by *Environmental Toxicology and Chemistry* were published in a wide variety of journals that were willing to accept quality papers, but none were as suitable as *Environmental Toxicology and Chemistry*. Thus, the literature in a newly developing field is spread over a large number of marginally suitable journals and the effort expended in reaching the ideal target audience is enormous compared to that expended by publishing in a journal whose readers share a common interest. Thus, rigidity of existing professional organizations drives away existing members if manuscripts reach too few of the ideal target audience.

In summary, formation of a new society may result from the unwillingness of existing societies to accommodate the natural evolutionary development of new areas of research. The older societies thus lose the excitement of newly developing fields, and a considerable amount of professional energy and time of those in the new field is devoted to organizational matters that could better have been spent on research. One can make a good case for the constant proliferation of new societies since it keeps the tribal units small, establishes a sense of camaraderie that comes from sharing specialized interests, and also decreases substantially the time spent searching through a variety of publications for articles of particular interest. The problem with this is that it leads to intellectual incest: a narrowness of interests and an inflexibility that stifle new ideas and force them into alternative organizational frameworks. Ultimately, this fragmentation of interests is counterproductive to the development of holistic thinking. Unfortunately, professional organizations survive for periods far beyond the days when they were at the cutting edge of science as a whole because members often view them as clubs, although not admitting this, and continue to attend while focusing on narrower and narrower aspects of a highly specialized field.

OPTION 2: OCCASIONAL JOINT MEETINGS AND AFFILIATION OF SETAC AND THE SOCIETY FOR RESTORATION ECOLOGY

Even occasional joint meetings of two markedly different societies can be hard work. Each is reluctant to change a pre-established schedule and these rarely coincide; each has a different idea of what the priorities of the joint meetings should be, each society fears the loss of "turf" or territoriality to the other, the question of whether a special publication or a joint volume of the two society journals (a major problem in itself, especially for librarians) is an issue, and so on. It is important to recognize that the price of this exercise is the price of maintaining diversity and exploring newly developing fields. No profession dares to remain stagnant as usually large scale problems originate outside the discipline rather than within it. In my opinion, one of the great strengths of SETAC has been its problem orientation as opposed to the discipline or subdiscipline orientation of most professional societies. The fact that the organization transcends disciplinary boundaries is proclaimed in both the organizational title and in the title of the journal. It is worth remembering that it was many years before the now well-established linkage between environmental toxicology and environmental chemistry was widely recognized. Establishing connections between what once appeared to be isolated entities is the name of the game in environmental studies. Thus, other connections not as explicitly proclaimed in either the society title or the journal title presumably exist which could reasonably be included among the problems that interest the society. Clearly, decommissioning of hazardous waste sites appears to be one such interest. In addition, if decommissioning is to include reincorporating the hazardous waste site into a larger surrounding landscape, restoration ecology is as essential as environmental toxicology and chemistry. The ecological information is neither trivial nor is it classical. Elsewhere [4] I have traced the origins of restoration ecology to natural history rather than classical ecology. A quotation from Thoreau illustrates this:

> In the planting of the seed of most trees, the best gardeners do no more than follow Nature, though they may not know it. . . . So, when we experiment in planting forests, we find ourselves at last doing as Nature does. Would it not be well to consult with Nature in the outset? For she is the most extensive and experienced planter of us all. . . . [5]
>
> Henry David Thoreau

An even more important issue, however, is that robust ecological theory requires going beyond the mere gathering of data to provide a synthesis, as

E.O. Wilson of Harvard University states so beautifully:

> . . . raw reduction is only half the scientific process. The remainder consists of the reconstruction of complexity by an expanding synthesis under the control of laws newly demonstrated by analysis. [6]
>
> E.O. Wilson

I believe that SETAC committed itself to the pathway of synthesis when it was founded. Just how far this synthesis should go is a matter yet to be determined but it is not unimportant! It may include the relationship of Option 2.

OPTION 3: SETAC ACTIVELY RECRUITS RESTORATION ECOLOGISTS

Merely stating that professionals interested in decommissioning or restoring hazardous waste sites will be welcome in the society and their manuscripts accepted by the journal will not be enough. Even the SRE has not yet focused on this field as actively as it has on areas damaged in other ways such as clearcutting, agricultural damage, and the like. As a result, active recruiting is advisable. Several years ago I was asked to serve a particular journal with the expectation that having my name and several other names associated with a particular subdiscipline (bearing, by the way, no relationship whatsoever to SETAC and its activities) would help attract manuscripts and members in a certain category. This strategy failed for a variety of reasons, but the primary reason was that the main society did not make a significant effort to ensure that the newcomers felt welcome. As an almost inevitable result, an alternative journal was launched which has been quite successful, possibly because it sponsored a major symposium and actively solicited contributions in the area that made the members of the subdiscipline feel quite at home. Furthermore, several issues of the journal were devoted to publishing this particular symposium. Of course the details were more complicated than I have just described, but in one instance the newcomers felt as if they were second class citizens and in the other they did not. That made the difference between success and failure. SETAC might want to follow the course of some other organizations by establishing special subunits, including special editorial sections, etc., to accommodate this new interest. If this option is chosen, a first step might be to devote an entire issue of the journal to this newly developing field. That issue might begin with a statement from the officers of SETAC, including the editor-in-chief of the journal, that SETAC has made a commitment to this area and the issue devoted entirely to it is an indication of the depth of the commitment. Additionally, one should actively solicit contributions in this area and indicate that they will be reviewed by persons competent in this particular field, perhaps even naming a group of reviewers.

SETAC owes its origins to the inability of existing societies to change sufficiently to encompass a vigorous, new, and rapidly developing field. One hopes that SETAC will avoid a similar fate by not only accommodating but welcoming change when newly developed areas have interests congruent with those already accepted by the society. Change is always difficult, especially when the society has reached a stage of camaraderie based on mutual interests, frequent encounters, and the like. On the other hand, focusing too intently on this club-like aspect is what has caused many societies to lose their vitality. Even when this happens membership does not decline, but usually journals of the newer societies are on the cutting edge, while those that have been unable to accommodate change are not. The fact that the unifying force in SETAC was problem solving rather than arbitrary disciplinary constructs is one of its chief strengths. Failure to recognize problems that are new and appropriate for SETAC or being unwilling to accommodate change is rarely fatal but does cause loss of vigor and vitality. In my opinion, restoration of hazardous waste sites is well within the focus of SETAC and should be given serious consideration. Cooperation and incorporation of the developing field of restoration ecology would facilitate optimal solutions to hazardous waste site rehabilitation. Even if this problem is not of particular interest, the society should continually examine other newly developing fields that might well merge with SETAC instead of continuing the fragmentation all too common in professional societies.

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