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Ecologically Appropriate Plant Materials for Restoration Applications

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The areas targeted for restoration are often the modified ecosystems that are rapidly becoming the planetary norm, and when ecosystem modification has been extensive, local genotypes may not be the most effective for repair. Here, local has value *is presented as a paradigm for the restoration of such systems as a corollary to* local is best *for systems that have sustained less modification. In many cases, adaptation may be enhanced through genetic variation or applying artificial selection, particularly for generalist species. Ecologically appropriate plant materials are those that exhibit ecological fitness for their intended site, display compatibility with other members of the plant community, and demonstrate no invasive tendencies. They may address specific environmental challenges, rejuvenate ecosystem function, and improve the delivery of ecosystem services. Furthermore, they may be improved over time, thereby serving to ameliorate the increasingly challenging environments that typify many restoration sites.*

Keywords: ecological restoration, local adaptation, native plant materials, novel ecosystems, restoration genetics

Ecological restoration is most often applied to assist the recovery of an ecosystem that has been degraded, damaged, or destroyed (SERI 2004). Because areas targeted for restoration often display impaired ecosystem function and ecosystem services (for the definitions of key terms, see box 1), a primary aim of restoration is reinitiating natural processes that reestablish desired ecosystem form and function (Jones et al. 2010). Consequently, the development of plant materials for restoration should be conducted with these principles in mind.

In the present article, I discuss three issues, sometimes overlooked or misunderstood, that restoration practitioners should ponder for effective restoration practice given such challenges: (1) emphasizing the whole for the achievement of restoration objectives, (2) using genetic variation to counter environmental challenges, and (3) appreciating the practical considerations that distinguish restoration applied to pristine ecosystems from that applied to novel ecosystems. This discussion is followed by a presentation of three biological principles (the individualistic concept, ecological fitting, and general adaptation) and their application to the questions of when and how ecological restoration can be accomplished through the development and use of more effective plant materials. I conclude with a definition of ecologically appropriate plant material and a justification for its development and use in ecological restoration.

Three issues integral to effective restoration practice

Let us consider three issues that affect the effectiveness of restoration practice.

Emphasizing the whole for the achievement of restoration objectives. When the primary emphasis of a restoration effort is on local plant genotypes per se, the emphasis on ecosystem repair may become secondary, and it may be presumed that only local genotypes may effect repair. In such cases, local genotypes may be chosen not because they are effective but because they are local. Such an approach is lacking if it does not recognize that the genotypes needed to restore the desired ecosystem function and services may differ from those that were present in the past (Stockwell et al. 2003). The neglect of the ecosystem as a whole in order to emphasize the integrity of one of its parts—for example, a plant population—may inadvertently lead to an undesired consequence—that is, the failure to correct the ecological damage that prompted the restoration effort in the first place. In short, when it comes to restoring the land, the land itself should receive primary consideration.

For the development of restoration plant materials, the use of local genotypes may be a place to start, but when evolutionary potential is limited, it may not be the best place to finish (Broadhurst et al. 2008, Hoffman and Sgrò 2011,

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