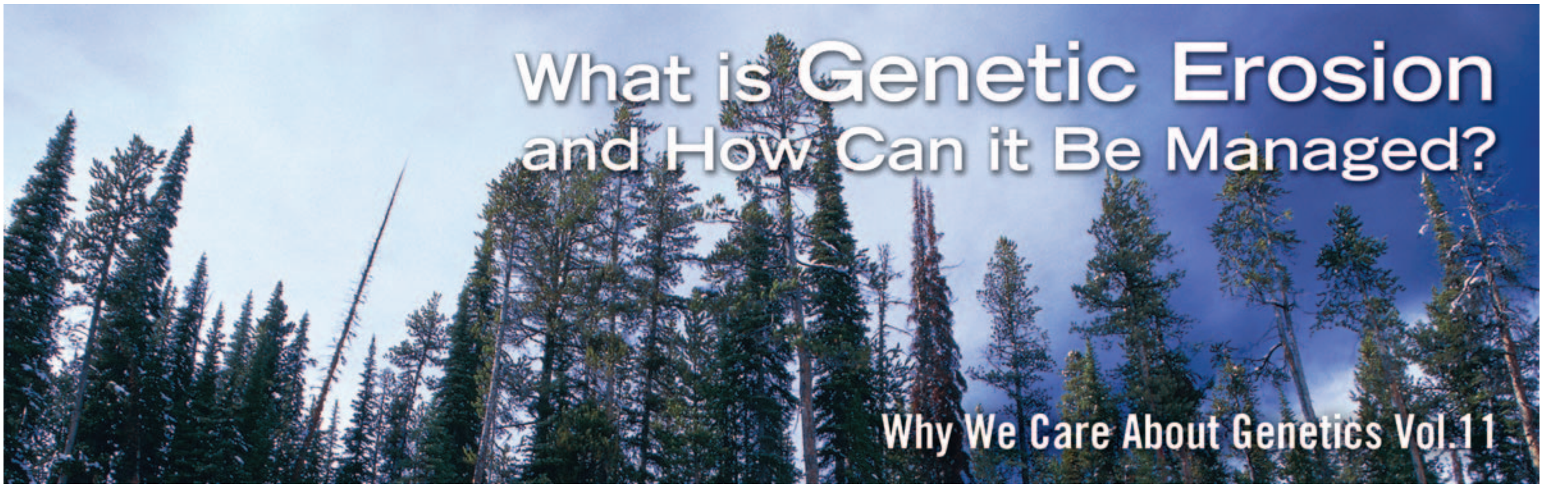

What is Genetic Erosion and How Can it Be Managed?

Why We Care About Genetics Vol.11

The term erosion is evocative of gradual loss of something important that will eventually undermine the health or stability of dependent individuals or communities. As applied to genetic diversity, erosion is the loss of genetic diversity within a species. It can happen fairly quickly — as with a catastrophic event or change in land use that removes large numbers of individuals and their habitat. But it can also occur more gradually and go unnoticed for a long time. Genetic erosion can represent the loss of entire populations genetically differentiated from others, the loss or change in frequency of specific alleles (i.e., different forms of a gene) within populations or over the species as a whole, or the loss of allele combinations.

[genetic erosion can result from habitat loss and fragmentation and seed collections that are too restricted]

Genetic diversity is important to a species' fitness, long-term viability, and ability to adapt to changing environmental conditions (as explained in Volume 1). Also, plant populations that are less genetically diverse may be more susceptible, in some cases, to pathogens or other environmental stresses. Genetically eroded populations may be less competitive with introduced invasive species. Overall, genetic erosion can have cascading effects throughout the ecosystem.

Some loss of genetic diversity is expected under natural conditions as a result of natural selection and genetic drift (see Volume 3). However, these losses are usually not catastrophic, are often balanced by mutation and gene flow, and typically do not occur in concert across the entire species. Generally, loss of genetic diversity is a more serious threat to species that were formerly more widespread and have lost habitat and diversity recently than to species that are naturally restricted in their occurrence.

Influences that could contribute to genetic erosion in native plant species include: major losses of habitat and the resident plant populations; fragmentation of habitat; management activities such as thinning, harvesting, or nursery selections that target certain features of plants; and planting material from a narrow genetic collection in revegetation efforts. For example, in a restoration effort in southern California for eelgrass (*Zostera marina*), genetic analyses revealed that the transplanted eelbeds had significantly lower genetic diversity than natural, undisturbed beds.

Genetic erosion can be addressed at several levels in the spectrum of management activities. Other than the obvious measures of avoiding major losses or fragmentation of habitat (to the extent it disrupts natural gene flow between populations), the risk of genetic erosion in native plant species can be minimized in specific revegetation projects by following these four guidelines:

Collect seeds or other propagation materials (cuttings, for example) in such a manner that representative genetic diversity of the geographic area is conserved. Guidance for genetically appropriate collections can be obtained from the references provided in this volume. Such collections consider the geographic source or provenance, the number

National Forest Genetics Laboratory (NFGEL)
Pacific Southwest Research Station
USDA Forest Service
2480 Carson Road
Placerville, CA USA 95667
http://www.fs.fed.us/psw/programs/nfgel/

Genetic Resources Conservation Program
University of California
One Shields Avenue
Davis, CA USA 95616
http://www.grcp.ucdavis.edu

More Information

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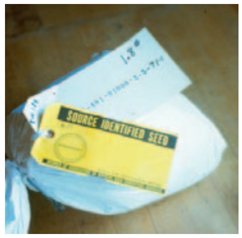

of parent plants, the number of seeds (or propagules) from each plant, and their distance from one another. The life-history features of a plant species will also help to guide appropriate genetic collections. For example, if the species is dioecious, genetic collections should reflect a balance of males and females if collecting vegetative material rather than seeds. If the plant species is known to reproduce asexually, it is important to make collections from various clones rather than within one or a few clones.

[genetically eroded populations may be less competitive with introduced invasive species]

Obtain geographic source information when purchasing plants from a nursery. This information, as well as the collection methods and conditions for growing out the plants, will help you to determine whether there is sufficient genetic diversity in the collection for your revegetation project. By asking for this information, it also helps to convey to the grower that this is an important part of the product's value, and will provide encouragement to collect and provide this information in the future.

Use caution when planting cultivars of native species. There is wide variation in genetic diversity in plants that are marketed as "cultivars" — depending on the original collection and the process it has experienced prior to release. The use of cultivars, per se, does not create genetic erosion. However, if the cultivar is from a narrow genetic base or has been genetically narrowed through nursery practices, and if it is used extensively to replace original plant populations — or planted in large numbers adjacent to plant populations where interbreeding is likely to occur — this may contribute to genetic erosion of the native plant populations.

Photo credits: (left two) Thomas D. "Tom" Landis, USDA Forest Service; (above) James Denny Ward, USDA Forest Service. *www.forestryimages.org.*

Encourge and support nursery management activities that aim to maximize the proportion of seeds that become healthy plantable seedlings. Good nursery management — that is based on awareness of possible genetic variation in seed characteristics, germination requirements, and growth patterns — includes measures to avoid inadvertent selection and minimize the impact on the genetic diversity of the original collection. (See Volume 10 for more information.) ■