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## Plant Adaptation Regions: Ecological and Climatic Classification of Plant Materials

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### Abstract

The effective use of plant materials for an array of objectives including conservation, restoration, renovation, landscaping, and bioremediation requires knowledge of the adaptation of each species and, more specifically, knowledge of the adaptation of cultivars, strains, accessions, or ecotypes of a species to specific sites or regions. For agronomic and horticultural plants, specific adaptation information has been and continues to be developed by extensive testing. Rangeland, grassland, park, and restoration project managers often lack the resources to determine adaptation areas for plant materials because of the large number of species that are used and the extensive geographical areas that are serviced. Problems often arise in delineating adaptation areas for plant materials of both native and introduced species. Since ecoregion and plant hardiness zone classification systems integrate many climatic and geographic variables that determine plant adaptation, these 2 systems can be combined to develop Plant Adaptation Regions (PARs). A PAR map of the contiguous United States was developed by merging a widely used ecoregion map with the USDA Plant Hardiness Zone map, and is available in GIS format. Based on their geographic origins and/or test results, plant materials and their general areas of adaptation can be classified using PARs.

### Resumen

El uso efectivo de materiales de plantas para un grupo de objetivos, incluyendo la conservación, restauración, renovación, jardinería y bioermediación, requiere del conocimiento de la adaptación de cada especie, y más específicamente de los cultivares, líneas o ecotipos de una especie a regiones o sitios específicos. En el caso de especies hortícolas o de uso agronómico la información sobre la adaptación específica ha sido y continua siendo desarrollada mediante la pruebas extensivas. Sin embargo, los manejadores de proyectos de restauración de pastizales, parques y praderas a menudo carecen de recursos para determinar las áreas de adaptación para las especies vegetales debido al gran número de especies que son usadas y las áreas geográficas tan extensas en las que son evaluadas. Los problemas a menudo surgen en delinear áreas de adaptación para los materiales vegetales tanto de especies nativas como introducidas. Dado que los sistemas de clasificación de ecoregiones y zonas de resistencia de las plantas integran muchas variables climáticas y geográficas que determinan la adaptación de las plantas, ellas pueden ser combinadas para desarrollar Regiones de Adaptación de Plantas (PAR). Un mapa PAR adyacente de Estados Unidos se desarrolló uniendo un mapa de ecoregión, ampliamente utilizado y un mapa de Zona de Resistencia de Planta del Departamento de Agricultura de los Estados Unidos (USDA) que esta disponible en formato de sistemas de información geográfica (GIS). Basados en su origen geográfico y/o resultados de evaluaciones, los materiales de plantas y sus áreas generales de adaptación pueden ser clasificadas usando las Regiones de Adaptación de Plantas.

**Key Words:** ecoregion, plant hardiness zone, ecotypes, plant germplasm, cultivars, native plants

## INTRODUCTION

Millions of hectares of land in North America need renovation because of natural or human-induced disturbances. The effective use of plant materials for an array of objectives requires knowledge of the adaptation of each species and, more specifically, its plant materials or germplasm, which includes cultivars, strains, accessions or collections, or ecotypes of a species to specific sites or regions. For agronomic and horticultural crops,

substantial research resources are often available, and specific adaptation information is developed by extensive testing. Other users of plant materials, such as rangeland and natural area managers, often lack the resources to determine adaptation of specific plant materials because of the large number of species that are used and the extensive geographical areas that are serviced.

Plant ecologists and biogeographers have developed systems that classify the natural ecoregions of the earth (Bailey 1998b; Brown et al. 1998). These classification systems are similar, but differ in the hierarchical arrangements used. Bailey (1995, 1997, 1998a, 1998b) developed revised hierarchical descriptions of the ecoregions of the United States, North America, and the world.

Ecoregion subzones or provinces such as savanna, steppe, or tundra are characterized by classes of dominant plant formations and are correlated to major soil groups, as climate strongly affects major soil-forming processes. Ecoregion provinces of

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