

# NATIVE SHRUB SEED INDUSTRIES IN THE WESTERN UNITED STATES AND AUSTRALIA: STATUS AND OUTLOOK

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## 1. INTRODUCTION

Attempts to improve habitat for wildlife and increase forage for livestock contributed to development of native shrub seed industries in the western United States and in Australia. Shrub seedlings and plantings in both countries are concentrated in areas with low and unpredictable precipitation and high probability for planting failures. In addition, both countries have emphasized the use of native shrub species. However, the scope of these industries and the political, economic, and social forces shaping them have differed considerably.

## 2. THE UNITED STATES

In the western United States, the native shrub seed industry began in the 1940s and 1950s as State game and fish departments strived to improve habitat for expanding *Odocoileus hemionus* (mule deer) populations. Projects initially emphasized direct seeding of *Purshia tridentata* (antelope bitterbrush). Over the next half-century, advances in revegetation technology and shrub research gradually increased the array of shrubs species seeded (Plummer *et al.* 1968). Private shrub seed companies regularly harvested requested species and sold the seed to government agencies for plantings conducted primarily on public lands. Since 1958, the Utah State Division of Wildlife Resources (DWR), for example, has seeded more than 160,000 ha of wildlife habitat, often to mixtures of shrubs, forbs, and grasses (Roundy *et al.* 1997). Seed warehousing by this agency permitted stockpiling of seed in good production years, thus providing some stability for the emerging shrub seed industry and making seed available for reseeding projects conducted by the DWR and other State and Federal agencies (Roundy *et al.* 1997). Early commercial efforts to produce shrub seed in seed orchards were generally not economically viable.

Revegetation uses of shrubs have expanded over the last half century to include plantings for livestock forage, mined land reclamation, watershed stabilization, highway right-of-ways, and low maintenance landscaping (Roundy *et al.* 1997). In 1977 the Surface Mining Control and Reclamation Act was passed at a time when substantial surface mining for coal was occurring on western shrublands. The considerable funding companies committed to mined land reclamation for bond release provided the impetus for major advances in plant material and revegetation research. This process continues to facilitate mined land revegetation throughout the West. Offshoots were and are: (1) greater emphasis on the use of native shrub species and local seed sources; (2) application of new plant materials and revegetation technology for other uses; (3) development of a native plant nursery industry and propagation protocols for producing bareroot or container stock of native shrubs; (4) further growth of the native shrub seed industry.

In recent decades, improvement of degraded riparian systems and wetlands has become a major management concern in the western United States. Active restoration of severely degraded watersheds on private and public lands requires production of planting stock for a large number of willow and cottonwood species as well as associated, more mesic shrubs. Concurrently, the Conservation Reserve Program provided Federal funding to retire highly erodible agricultural land. Wildlife habitat plantings installed on 250,000 ha of these lands at locations across the West required an array of shrub species (USDA Farm Service Agency 2001). Throughout the twentieth century, livestock grazing practices, the introduction of invasive annuals, resulting changes in wildfire regimes, the spread of pinyon-juniper woodlands, widespread invasion of introduced secondary weeds, and decline of wildlife species such as the *Centrocercus urophasianus* (sage grouse) have vastly increased the areas where active restoration using shrub species is required (Monsen and Shaw 2001).

Extensive wildfires of the last decade have created volatile markets for seeds of *Artemisia tridentata* (big sagebrush) and many other shrubs. This instability plus the growing demand for seed of locally adapted sources has created considerable confusion within the industry. The annual market for individual populations of major species is uncertain, as location of wildfires is not predictable. Several approaches are being taken to address this problem: (1) The pre-

variety release program, adopted nationally by the Association of Official Certification Agencies, provides for site identification of wildland collected seed, thereby assuring buyers of seed origin (AOSCA 1997); (2) Recent research has added considerably to our knowledge base on variability in native species (Sanderson & Stutz 2001); (2) Increased seed warehousing by public agencies offers a means of improving market stability through stockpiling of seed in years with good wildland seed production, but warehouse facilities are currently inadequate; (3) Agencies are beginning to examine the practicality of managing wildland shrub stands to improve seed production; and (4) With high seed prices in major wildfire years, some growers are revisiting the production of commercial seed orchards to provide more reliable harvests of frequently seeded shrub populations.

The Interagency Native Plant Development Program (USDI & USDA 2002), developed in response to the extensive wildfires of recent years and environmental concerns for perpetuation of native plant communities, aims to improve availability of local seed sources through development of private native seed enterprises. Goals of the Great Basin Restoration Initiative (USDI-BLM 2000) are to foster proactive efforts to restore fire prone rangelands and combat the spread of weeds and wildfires through management and active restoration where necessary. Multi-year landscape level projects generated by such programs could help to stabilize the shrub seed industry by providing a more continuous need for wildland harvested shrub seed compared to the current emergency requests for post-fire seedings.

### 3. AUSTRALIA

Initial interest in the use of Australian native shrubs developed in the 1960s and 1970s. Here, revegetation with species such as bladder saltbush (*Atriplex vesicaria*) and oldman saltbush (*A. nummularia*) occurred on a small scale in reclamation and erosion control of scalded (Cunningham *et al.* 1976) or salt affected areas (Malcolm 1974). Most activities occurred in eastern Australia and were initiated by the then New South Wales Soil Conservation Service. In these cases re-seeding was associated with mechanical soil treatments such as furrowing (Cunningham *et al.* 1976), pitting (Noble *et al.* 1990), and water-ponding or water spreading (Cunningham 1978). Each treatment was required to hold moisture near the soil surface until adequate rainfall occurred (Noble *et al.* 1990). High cost precluded broad-scale application of these techniques. Throughout this period most seed was harvested on an *ad hoc* basis from wildland stands.

Direct seeding is seen as the cheapest shrub establishment option (\$AUD150-185 per ha) but also the most unreliable (Milthorpe *et al.* 2000). As a consequence, most revegetation involves use of seedlings either as nursery-supplied seedlings (\$AUD650 to \$850 per ha) or as bareroot stock. Approximately 5,000 ha were revegetated in eastern Australia in 2000 (A. Stipple, personal communication). The latter option allows the landholder to propagate material 'on-farm' in a nursery or small plot, a slightly more expensive option than direct seeding, but one that reduces the risk of establishment failure.

The primary force driving interest in the use of Australian native shrubs has been fodder production. Historically, this interest has come from two directions. Firstly, the notion that shrubs provide a 'living haystack', that can be utilized as drought feed when required (Anon 1990). Secondly, that they provide a productive fodder source while ameliorating salt affected lands (Barrett-Lennard & Barson 1995). Both notions are being challenged (Milthorpe *et al.* 2000). Highest production levels are obtained when shrubs are grazed regularly (Clarke 1982). Keeping them as a drought reserve underutilizes the shrub; plants grow beyond the reach of stock and become woody and unpalatable (Milthorpe *et al.* 2000). Furthermore, the high cost of establishment warrants a greater level of utilization to achieve full benefits. *Atriplex nummularia* has been used extensively in saline areas to reduce the water table and accumulate salt, gradually altering saline conditions and allowing the establishment of other pasture species.

More recently, the use of shrubs, in particular *A. nummularia*, for rehabilitation of saline areas in southern and Western Australia has stimulated the growth of this industry. Recent programs have been initiated to revegetate one million hectares of salt affected lands in Western Australia (Malcolm & Lloyd 2001) and will undoubtedly provide further stimulus to develop the industry. Instead of focusing on plantation establishment, these recent initiatives seek to design a species mix of annuals and perennials to ensure lowering of the water-table and reduced soil surface salinity as well as production of fodder and generation of farm income (Barrett-Lennard & Ewing 1998).

### 4. CONCLUSIONS

Shrublands are widespread in both the United States and Australia. However, differences in land ownership and use patterns, government direction, social forces, geography and climate have shaped shrub revegetation efforts and the native shrub industry in each country. In the United States, greater expanses of shrublands managed as public lands and a longer history of shrub use for revegetation contribute to development of larger and more cohesive revegetation programs. In Australia, efforts to revegetate private land holdings are more local in nature, slowing development of a

stable industry, including research and development. Both countries face land management problems related to human use, fire, and invasive species that are likely to contribute to expansion of their shrub seed industries in the near future.

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**AFRICAN JOURNAL OF RANGE & FORAGE SCIENCE**  
**PROCEEDINGS OF THE VII<sup>th</sup> INTERNATIONAL RANGELAND CONGRESS**  
**26 July - 1 August 2003, Durban, South Africa**

ISSN 1022-0119

VOLUME 20 (2)

July 2003

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