

## **Appendix 2: Propose Research and Related Activities for the UP Native Plant Program and Restoration of Communities within the Colorado Plateau**

**November 2004**

### **Development of Adapted Species and Germplasm – Species Identification**

Site adapted germplasm for the Colorado River Region is currently not available for nearly all species proposed for large-scale plantings. Few species or accessions specifically adapted to the Colorado Plateau are available for project plantings. Seeds of some species considered important to the Colorado River region are being investigated from collections obtained from adjacent or other geographical locations. However, this material may or may not be adapted to the Colorado River region. Disturbances within the pinyon-juniper woodlands and sagebrush communities are the most critical areas requiring restoration. It is important that materials developed from this region represent the germplasm or ecotypes that occur throughout the different plant associations where restoration plantings are most likely to occur. Consequently, seeds of most native species common to the Colorado River region must be developed and grown from cultivated fields or closely managed wildland stands to meet existing demands.

There are a number of factors to consider in this process. Most important is the initial collection of seed from representative wildland sites. Studies with most grasses recognize that most species consist of individual ecotypes that usually exist over rather broad regional areas. Consequently, is it important that wildland collections represent the broad germplasm that naturally occur within the region.

**Table 1.** -- Species proposed for development for the Uncompahgre/Colorado Region

Scientific Name	Common Name	Increase Fields	Field Studies
<b>GRASSES</b>			
<i>Pseudoroegneria spicata</i>	Bluebunch wheatgrass		
<i>Bouteloua gracilis</i>	Blue grama		
<i>Bromus marginatus</i>	Mountain brome	x	x
<i>Elymus elymoides</i>	Basin wildrye	x	
<i>Elymus salina</i>	Salina wildrye	x	
<i>Elymus trachycaulus</i>	Slender wheatgrass		
<i>Hilaria jamesii</i>	Galleta		
<i>Koeleria macrantha</i>	Prairie junegrass	x	x
<i>Oryzopsis hymenoides</i>	Indian ricegrass	x	x
<i>Pascopyrum smithii</i>	Western wheatgrass	x	
<i>Poa fendleriana</i>	Muttongrass	x	x
<i>Poa secunda</i>	Sandberg bluegrass	x	x
<i>Sporobolus cryptandrus</i>	Sand dropseed		
<i>Stipa comata</i>	Needle-and-threadgrass	x	x
<b>FORBS</b>			
<i>Achillea millefolium lanulosa</i>	Western yarrow	x	
<i>Aster glaucodes</i>	Blueleaf aster		
<i>Astragalus mollissimus</i>	Woolly milkvetch	x	x
<i>Balsamorhiza sagittata</i>	Arrowleaf balsamroot		
<i>Castilleja chromos</i>	Desert paintbrush		
<i>Cryptantha flavoculata</i>	Rough seed cryptantha	x	x
<i>Eriogonum flavum</i>	Yellow eriogonum	x	
<i>Eriogonum ovalifolium</i>	Cushion buckwheat		x
<i>Eriogonum umbellatum</i>	Sulfur eriogonum		
<i>Erigeron pumilis</i>	Low fleabane		
<i>Eriogonum racemosum</i>	Redroot eriogonum		
<i>Hedysarum boreale germiale</i>	Utah sweetvetch	x	x
<i>Lesquerella rectipes</i>	Straight bladderpod		x
<i>Linum lewisii</i>	Lewis flax	x	x
<i>Lupinus sericeus</i>	Silky lupine		x
<i>Packera multilobatus</i>	Many-lobed groundsel		x
<i>Penstemon cyanocaulis</i>	Bluestem penstemon	x	x
<i>Penstemon</i> spp.		x	
<i>Petradoria pumila</i>	Rock goldenrod	x	x
<i>Senecio multilobatus</i>	Lobe leaf groundsel	x	x
<i>Sphaeralcea coccinea</i>	Scarlet Globemallow	x	x
<i>Stenotus armerioides</i> (Haplopappus)	Thrifty golden weed		x

**Table 1. Cont'd**

Scientific Name	Common Name	Increase Fields	Field Studies
<b><u>SHRUBS</u></b>			
<i>Amelanchier alnifolia</i>	Saskatoon serviceberry		
<i>A. utahensis</i>	Utah Serviceberry		
<i>Artemisia nova</i>	Black sagebrush	x	x
<i>Artemisia tridentata</i> spp. tridentate	Basin big sagebrush	x	x
<i>Artemisia tridentata</i> spp. vaseyana	Mountain big sagebrush	x	x
<i>Artemisia tridentata</i> spp. Wyomingensis	Wyoming big sagebrush	x	x
<i>Atriplex canescens</i>	Fourwing saltbush	x	x
<i>Cercocarpus montanus</i>	Mountain mahogany	x	
<i>Chrysothamnus depressus</i>	Dwarf rabbitbrush	x	x
<i>Chrysothamnus nauseosus</i>	Rubber rabbitbrush		
<i>Chrysothamnus visidiflorus</i>	Low rabbitbrush		
<i>Cowania stansburiana</i>	Cliffrose	x	
<i>Ephedra viridis</i>	Green Ephedra	x	
<i>Ceratoides lanata</i>	Winterfat		
<i>Purshia tridentata</i>	Antelope bitterbrush		
<i>Rhus trilobata</i>	Skunkbush sumac		
<i>Rosa woodsii</i>	Woods rose		

**Table 2** - - Yearly schedule of seed collection for all species

SPECIES	YEARS OF SEED COLLECTIONS			
	2003	2004	2005	2006
<u>Grasses</u>				
<i>Pseudoroegneria spicata</i>				X
<i>Bouteloua gracilis</i>			X	X
<i>Bromus marginatus</i>				X
<i>Elymus elymoides</i>		X		X
<i>Elymus salina</i>		X		X
<i>Elymus trachycaulus</i>			X	X
<i>Hilaria jamesii</i>	X	X		X
<i>Koeleria macrantha</i>	X	X		X
<i>Oryzopsis hymenoides</i>	X	X	X	X
<i>Pascopyrum smithii</i>		X	X	X
<i>Poa fendleriana</i>	X	X	X	X
<i>Poa secunda</i>	X	X	X	X
<i>Sporobolus cryptandrus</i>		X	X	X
<i>Stipa comata</i>	X	X	X	X
<u>Forbs</u>				
<i>Achillea millefolium lanulosa</i>	X	X		X
<i>Astragalus mollissimus</i>		X		
<i>Cryptantha flavoculata</i>		X	X	
<i>Erigeron pumilis</i>	X	X		
<i>Eriogonum racemosum</i>	X	X		
<i>Hedysarum boreale germinal</i>	X	X	X	X
<i>Linum lewisii</i>	X	X		X
<i>Penstemon cyanocaulis</i>	X	X		X
<i>Penstemon spp</i>			X	X
<i>Petradoria pumila</i>		X		
<i>Senecio multilobatus</i>	X	X		X
<i>Sphaeralcea coccinea</i>		X		X
<u>Shrubs</u>				
<i>Amelanchier alnifolia</i>	X	X		
<i>A. utahensis</i>			X	X
<i>Artemisia nova</i>		X		X
<i>A. tridentata ssp. tridentata</i>		X	X	X
<i>A. tridentata spp. vaseyana</i>		X	X	X
<i>A. tri. spp. wyomingensis</i>		X	X	X
<i>Atriplex canescens</i>	X	X	X	X
<i>Cercocarpus montanus</i>		X		
<i>Chrysothamnus depressus</i>		X	X	X
<i>Chrysothamnus nauseosus</i>		X		X
<i>Chrysothamnus visidiflorus</i>		X		X
<i>Cowania stansburiana</i>			X	X
<i>Ephedra viridis</i>	X	X	X	X
<i>Ceratoides lanata</i>	X	X	X	X
<i>Purshia tridentata</i>	X	X	X	X
<i>Rhus trilobata</i>	X	X		
<i>Rosa woodsii</i>	X	X		

Most of the shrubs recommended for use have been grown for seed production in previous trials. Considerable information is available to assist with establishment of seed production programs. A combination of growing conditions will be required to produce adequate crops.

Seed of some native shrubs are currently being collected from the Plateau by commercial harvesters, but no site identified or source identified collections are being advertised for sale. It is important that material of all woody species is produced from this area. Collections of some species can be used from a much broader region than just the Plateau, but collection sites must be carefully inspected. The establishment of cultivated or commercial fields must be administered to assure adapted sources are planted. Fields can be inspected by State Crop Improvement Associations to maintain compliance with existing laws to assure certification.

A primary concern in the use of woody species is the extended period that will be required to establish either wildland managed fields or cultivated fields. Management of existing wildland stands to improve seed yields is a viable and preferred practice. This may not provide the amount of seed needed during many years. Species of particular importance are mountain mahogany, skunkbush sumac, and Woods rose.

## **Acquiring Regional and Local Ecotypes –**

### Wildland Seed Collections

Species proposed for initial development have been screened, and field examinations have confirmed these species are the primary plants that occur within the plant communities that have been most altered and would require the most extensive plantings. In addition, these species are the plants in which seed can be most easily and successfully propagated, and can be reliably established amid wildland conditions. Seeds of most species and most regional populations have been collected during the 2003 and 2004 field seasons, Table 2. A few individual collections may be required in 2005, but unless adjacent areas in Utah and Arizona are added to the studies, large-scale field collections are not recommended beyond 2004.

## **Species Adaptability Studies Defining Ecotypes and Areas of Adaptability**

### Life History Studies

Various species proposed for restoration plantings have not been extensively studied and little information is available related to growth habits, seed formation germination features, and general agronomic attributes. Funding may not be

available to investigate, in detail, all species, but specific studies are required to advance the primary species. The principal species and studies listed in (table 3) are considered the most important studies that should be initially funded. Many “life history” studies can be recommended or conducted through cooperation with different universities.

**Table 3**—Life History Studies propose for selected species

Species	Proposed Studies
<u>Grasses</u>	
Bromus anomalus	Locate, identify areas of occurrence Identify ecotypic relationship DNA Evaluate establishment and growth attributes Enter into seed production
Bromus marginatus	Locate and identify areas of occurrence Compare local ecotypes with other sources, DNA Evaluate areas of adaptability of different collections
Elymus elymoides	Identify occurrence and distribution of subspecies Define areas of adaptation Determine means to improve germination
Elymus salina	Determine presence of separate ecotypes Determine relationship to regional collections DNA Define areas of occurrence Determine methods to improve germination, and seedling establishment
Elymus trachycaulus	Determine if separate ecotypes occur Compare areas of adaptation and growth response of separate ecotypes
Koeleria macrantha	Determine relationship with other regional areas DNA Determine if separate ecotypes occur, map areas of occurrence Determine seed germination and seedbed requirements Determine plant development and periods of growth
Oryzopsis hymenoides	Determine and identify presence of different subspecies Identify presence of regional ecotype DNA Determine methods to improve seed germination
Poa fendleriana	Define origin DNA Determine presence of separate ecotypes Identify seed germination and seedling establishment requirements
Poa secunda	Identify regional populations and presence of local ecotypes DNA

	Define areas of occurrence Evaluate growth and reproductive features
Sporobolus cryptandrus	Identify regional ecotypes DNA Determine areas of occurrence Evaluate growth attributes
Stipa comata	Identify regional and local ecotypes DNA Define areas of occurrence Evaluate differences in growth and reproduction Evaluate competitive attributes
<u>Forbs</u> Erigeron pumilis	Evaluate and define regional and local ecotypes DNA Define areas of occurrence Define seed germination, seedling establishment requirements

#### Shrubs

The primary studies for all shrubs are to determine the presence and relationship of material from the Colorado region with other locations DNA studies. Specific studies related to establishment and growth is not specifically required as considerable data is currently available.

## **DNA and Dark Respiration Trials**

Plants from the Colorado River region appear to be genetically different for similar species collected from other geographical regions. In an attempt to determine if regional differences exist, seeds from three perennial grasses (*Koeleria macrantha*, *Stipa comata*, and *Poa secunda*) have been collected from different location throughout the West. All seeds were collected in 2004. Collection locations have been mapped and described. Seeds are yet to be cleaned, but will be processed and submitted to the USDA Forest Service genetics lab for analysis. Laboratory test for DNA will be conducted in the winter 2004 - 2005.

Respiration trials will be conducted of greenhouse grown seedlings produced from seed samples collected in 2004. Studies will be conducted in the winter of 2004-2005 to determine if the results from dark respiration tests may correlate with the origin and site conditions that occur at different collections sites. Previous studies conducted with other species revealed that dark respiration readings could identify collections that were more drought tolerant and could survive with periods of stress.

**Table 4.** -- Species proposed for comparative evaluations with similar plants from other geographic regions

SPECIES	AREAS OF COMPARATIVE STUDIES			
	Dates			
	Field Collections	DNA Lab Tests	Dark Respiration Tests	Morphological Examinations
<u>Grasses</u>				
<i>Bouteloua gracilis</i>	2006			
<i>Bromus anomalus</i>	2006			
<i>Bromus marginatus</i>	2006			
<i>Elymus elymoides</i>	2005	2005	2005	2005
<i>Elymus salina</i>	2006			
<i>Elymus trachycaulus</i>	2006			
<i>Hilaria jamesii</i>	2006			
<i>Koeleria macrantha</i>	2005	2005	2005	2005
<i>Oryzopsis hymenoides</i>	2005	2005	2005	2005
<i>Pascopyrum smithii</i>	2005	2005	2005	2005
<i>Poa fendleriana</i>	2004-05	2005	2005	2005-06
<i>Poa secunda</i>	2004-05	2005	2005	2005-06
<i>Sporobolus cryptandrus</i>	2006			
<i>Stipa comata</i>	2004-05	2006	2006	2006-07
<u>Forbs</u>				
<i>Achillea millefolium lanulosa</i>				
<i>Astragalus mollissimus</i>				
<i>Cryptantha flavoculata</i>				
<i>Erigeron pumilis</i>				
<i>Eriogonum racemosum</i>				
<i>Hedysarum boreale germinal</i>	2005			
<i>Linum lewisii</i>	2005			
<i>Penstemon cyanocaulis</i>	2005			
<i>Petradoria pumila</i>				
<i>Senecio multilobatus</i>	2005			
<i>Sphaeralcea coccinea</i>				
<u>Shrubs</u>				
<i>Amelanchier alnifolia</i>				
<i>A. tridentata</i> ssp. <i>tridentata</i>	X			
<i>A. tridentata</i> spp. <i>vaseyana</i>	X			
<i>A. tri.</i> spp. <i>wyomingensis</i>	X			
<i>Atriplex canescens</i>	X			
<i>Cercocarpus montanus</i>				
<i>Chrysothamnus depressus</i>				
<i>Chrysothamnus nauseosus</i>	X			
<i>Chrysothamnus visidiflorus</i>	X			
<i>Ephedra viridis</i>				
<i>Ceratoides lanata</i>	X			
<i>Purshia tridentata</i>	X			
<i>Rhus trilobata</i>				
<i>Rosa woodsii</i>				

## **Species Identification, Hybrid Populations, Distribution, and Site Adaptability of Sagebrush**

Populations of big sagebrush including mountain big sagebrush *Artemisia tridentata* spp. *vaseyana* ; basin big sagebrush *A. tridentata* spp. *tridentata*; and Wyoming big sagebrush *A. tridentata* spp. *wyomingensis* occur throughout the Colorado River region and dominate many areas. Studies indicate that individual ecotypes or populations have evolved to occupy different environments and sites. In addition, various hybrids often occupy many intermediate areas. Current studies and field examinations indicate that both the big sagebrush and black sagebrush *Artemisia nova* taxa in the Colorado River region are somewhat different than populations from other regions. Considerable variation in growth forms also suggest that significant hybridization may have occurred. Reports indicate that populations of basin big sagebrush from the Dove Creek region contain the highest protein levels of all sources examined in the west. Most populations of Wyoming big sagebrush throughout this entire region are highly palatable and are heavily browsed by all classes of animals. It is essential to identify and determine the populations and species of sagebrush to harvest, propagate, and plant in remedial programs. If hybrid populations are common and occupy specific communities, it will be necessary to decide what genetic material is propagated for extended planting. Should seed from the hybrid populations be reared and used, or should seed from both parents be mixed and planted.

Consequently it is important to:

- 1). Identify the individual species, hybrids, and specific ecotypes that occur in the entire region of all species of big sagebrush and black sagebrush; and
  - 2). Map the distribution of individual species, and hybrid populations
- Field inspections and mapping could be done under contract or assigned to individuals with the skills to complete the surveys.

## **Site Adaptability and Ecology**

### Field Comparative Studies

Species adaptability trials or plantings should be established to evaluate the general adaptability, growth rate, flowering and seed production features, and general habitat features of individual species and different accessions. Field planting sites should be established at representative locations and individual collections will be planted at these sites to evaluate their performance. At each study site, plantings will be established by direct seeding to evaluate seedbed requirements and establishment features. In addition, transplants can also be grown and field planted to examine growth and response of individual plants. At least three field planting sites should be established on the Uncompahgre Plateau and three or four sites in Utah. Sites will be located in areas representative of the Wyoming big sagebrush, mountain big sagebrush, and

pinyon-juniper woodlands. Study sites should be located, fenced, and some areas cleared in 2005. Initial plantings can be established in the spring of 2006.

These same study sites can also be used to plant and compare collections obtained from adjacent regions. These plantings can be used to assist in determining the range of adaptation of different ecotypes.

Seedling compatibility studies will also be established at these locations. Small plot plantings will be conducted to examine the compatibility of individual native species to establish when planted in mixture and at different seeding rates. Comparative studies could begin in the fall 2004. Due to the number of species and the various combinations of plantings that will be required to restore various communities, a series of seedling compatibility studies will be required.

A). Studies will be required to evaluate combinations of grasses, forbs, and shrubs adapted to the sagebrush communities.

B). Combination of species adapted to more upland Pinyon/juniper woodlands

C). Planting select species into some existing native vegetation as a means to interseed select disturbances.

Seedbed ecology studies will be established at these regional centers to examine and determine the seedbed conditions required to establish individual species. Field plantings and studies could begin in the fall 2005.

**Table 5.** - - Species proposed for germination, seedbed ecology, and seedling competitions studies

SPECIES	PROPOSED AREAS OF STUDY			
	Adaptation	Seedbed Germination	Seedling Ecology	Competition
<b>Grasses</b>				
<i>Pseudoroegneria spicata</i>				
<i>Bouteloua gracilis</i>	X	X	X	X
<i>Bromus marginatus</i>	X		X	X
<i>Elymus elymoides</i>	X	X	X	X
<i>Elymus salina</i>	X	X	X	X
<i>Elymus trachycaulus</i>	X		X	X
<i>Hilaria jamesii</i>	X	X	X	X
<i>Koeleria macrantha</i>	X	X	X	X
<i>Oryzopsis hymenoides</i>	X	X	X	X
<i>Pascopyrum smithii</i>	X	X	X	X
<i>Poa fendleriana</i>	X	X	X	X
<i>Poa secunda</i>	X	X	X	X
<i>Sporobolus cryptandrus</i>	X	X	X	X
<i>Stipa comata</i>	X	X	X	X
<b>Forbs</b>				
<i>Achillea millefolium lanulosa</i>	X			X
<i>Astragalus mollissimus</i>	X	X	X	X
<i>Cryptantha flavoculata</i>	X	X	X	X
<i>Erigeron pumilis</i>	X	X	X	X
<i>Eriogonum racemosum</i>	X	X	X	X
<i>Hedysarum boreale germinal</i>	X	X	X	X
<i>Linum lewisii</i>	X	X	X	X
<i>Penstemon cyanocaulis</i>	X	X	X	X
<i>Petradoria pumila</i>	X	X	X	X
<i>Senecio multilobatus</i>	X	X	X	X
<i>Sphaeralcea coccinea</i>	X	X	X	X
<b>Shrubs</b>				
<i>Amelanchier alnifolia</i>	X	X	X	X
<i>Artemisia nova</i>	X	X	X	X
<i>A. Tridentata</i> ssp. <i>Tridentata</i>	X	X	X	X
<i>A. Tridentata</i> spp. <i>Vaseyana</i>	X	X	X	X
<i>A. Tri.</i> spp. <i>Wyomingensis</i>	X	X	X	X
<i>Atriplex canescens</i>	X	X	X	X
<i>Cercocarpus montanus</i>	X	X	X	X
<i>Chrysothamnus depressus</i>	X	X	X	X
<i>Chrysothamnus nauseosus</i>	X	X	X	X
<i>Chrysothamnus visidiflorus</i>	X	X	X	X
<i>Ephedra viridis</i>	X		X	X
<i>Ceratoides lanata</i>	X		X	X
<i>Purshia tridentata</i>	X	X	X	X
<i>Rhus trilobata</i>	X	X	X	X
<i>Rosa woodsii</i>	X	X	X	X

## **Establishment of Foundation Fields**

Seeds of many species required for restoration projects will eventually be produced from cultivated fields produced by commercial growers or seed companies. Commercial fields will be established using certified seed that is managed and regulated by state seed certification agencies. In most situations, wildland harvested seed will be first planted and maintained in “foundation fields” or “seed increase fields”. These fields will produce certified seed that will be supplied to commercial growers. Foundation fields must qualify as weed-free rearing sites and capable of producing and maintains desired germplasm. Seed produced from foundation fields will be stored and distributed to commercial growers through the Colorado and Utah State Seed Associations. Foundation fields will be established and maintained at the Meeker Plant materials Center, other NRCS Plant Centers, CSU, DWR nursery centers, and Utah State Nursery center. Some species may be grown as foundation fields through cooperation with select commercial growers. Individual contracts will be developed with each grower to assure seed produced is retained or acquired by the UP Project to be used for futures seed increase.

**Table 6** - - Grasses and broadleaf herbs proposed for the initial establishment of foundation fields (Study 5) and field rearing studies (Study 7).

SPECIES	Establishment Foundation Fields		Establishment of Seed Rearing Studies		
	2004	2005	2004	2005	2006
<u>Dates of Establishment</u>					
<u>Grasses</u>					
Bouteloua gracilis					
Bromus anomalus		X			
Bromus marginatus		X		X	
Elymus elymoides		X			
Elymus cinereus		X			
Elymus salina		X		X	
Elymus trachycaulus					
Hilaria jamesii					
Koeleria macrantha		X		X	
Oryzopsis hymenoides	X		X		
Pascopyrum smithii		X			
Poa fendleriana	X			X	
Poa secunda	X			X	
Sporobolus cryptandrus		X			
Stipa comata		X		X	
<u>Forbs</u>					
Achillea millefolium lanulosa	X				
Astragalus eastwoodiae	X		X		
Castilleja chromosa				X	
Erigeron pumilis					
Eriogonum flavum				X	
Eriogonum racemosum	X				
E. ovalifolium					
E. umbellatum	X				
Hedysarum boreale germiale	X		X		
Lesquerella rectipes				X	
Linum lewisii		X			
Packera multilobatus				X	
Penstemon cyanocaulis	X		X		
Petradoria pumila					
Senecio multilobatus		X		X	
Sphaeralcea coccinea		X			
Stenotus armerioides				X	
Penstemon cyanocaulis	X		X		
<u>Shrubs</u>					
Artemisia tridentata					
spp wyomingensis	X				
A. tridentata spp.					
vaseyana	X				
A. nova		X			
Atriplex canescens		X			
Chrysothamnus depressus		X		X	
Cowania stansburiana		X			

### **Establishment of Life History Studies**

Plantings of select species will be established in cultivated fields to evaluate growth, seed production, and harvesting practices to determine those features that need to be addressed in cultivated rearing conditions. (See Table 6).

### **Establishment of Seed Rearing Studies of select species**

Select species will be established at select nursery centers to evaluate culture practices required to produce seed from each species. Studies will be designed to investigate irrigation, row spacing, fertilization, and pollination requirements as needed for each species. ( See Table 6 for the species proposed for nursery rearing studies).

### **Development of Seed Rearing Research with Research Centers- Meeker PMC, CSU, BYU, DWR**

Seed production studies were established at BYU and with DWR at the Ft Green center in the spring 2004. Five broadleaf herbs were individually establish in spaced plantings to individually and collectively evaluate the effects of irrigation and row spacing on plant growth, flower, and seed formation. In additions studies will evaluate seed yields, seed quality, and germination attributes. Studies are scheduled to continue for another 2 seasons, 2006.

Field plantings were also established at Meeker PMC and CSU to produce seed for increase, but the centers will evaluate seed production, and keep record of plant growth and flower development. These studies are primarily aligned to evaluate field production and rearing requirements. The plantings will also be used to evaluate harvesting practices and seed processing techniques. Plantings are expected to be maintained for 2-4 years. These plantings also represent foundation fields and will be used to maintain and increase the germ plasm for extended studies and to increase seed production fields.

### **Shrub seed production Practices**

#### **Treatments to improve wildland seed production of Saskatoon serviceberry and mountain mahogany**

Studies were established in 2003 to investigate the effects of pruning , and removal of understory competition on the flower development and seed production of stands of Saskatoon serviceberry and mountain mahogany. Data has been collected in 2003 and 2004, and are scheduled to continue through 2005.

Various shrubs will be required to support restoration projects. Some seed can be harvested from wildland stands with reasonable success, but a combination of

practice will be required to produce seed in quantity for large plantings (Table 7). Sufficient seed can be harvested from wildland stands in the fall 2004 and provided to select growers to plant large or reasonable acres. Planting designs including row spacing and position of male and female bushes can be developed and furnished to the growers.

2). Improvement and management of wildland stands

Wildland stands can be altered by burning, thinning, pruning, and protection to increase production and assure a more reliable crop each year. Species proposed for wildland management are species that will likely respond best, but are also species that are very slow to establish if planted off-site. In addition, these are plants that require specific insects to pollinate the flowers. (Note table 7 for candidate species)

3). Re-establishment of wildland stands

Various shrubs have been removed by grazing, fires, or other impacts, and could be re-established in a manner to maximize seed production. Plants could be established in spaced rows with a less competitive understory. This arrangement would better assure seed production. Species proposed for managed plantings are listed in (table 7).

**Table 7--** Seed propagation practices suggested to produce seed of select native shrubs  
Proposed Methods of Seed Production

Species	Wildland Harvesting	Wildland Harvesting Managed Stands	Establishment of Wildland Stands	Establishment of Cultivated Fields
AMAL	X	X		
ARNO		X	X	X
ARTRT		X	X	X
ARTRV		X	X	X
ARTR HYBRIDS		X		X
ATCA		X	X	X
CEMO	X	X		
CHDA		X		X
CHNA		X		X
CHVI		X		X
EPVI				X
CELA			X	X
PUTR			X	X
RHTR		X		
ROWO		X		

## **Weed presence, ecology, and control measures**

Distribution and ecology of cheatgrass – an extensive study was completed in 2004 to locate and map the occurrence and distribution of cheatgrass on the Uncompahgre Plateau. In addition, seed from each location were collected and have been cleaned in preparation of DNA analysis. The individual collections will be evaluated to determine if different ecotypes occur and are located in specific environmental site, soil types, elevation, or precipitation zones. DNA studies will be completed in the winter 2004-2005 at the USDA Forest Service Genetics Lab, PNW Station, California.

## **Community Restoration – Species Compatibility**

- 1). Species relationship, grasses, forbs, shrubs
- 2). Seeding rates

## **Interseedings**

Interseeding and compatibility with existing or residual species

## **Restoration of Pinyon/Juniper and Sagebrush Disturbances**

A). Influence of control and treatment measures on species establishment, successional processes, and ecology of woodland and shrub dominated communities

B). Evaluate and compare the effectiveness of different treatment measures upon plant control, recovery of residual species, and plant establishment of seeded species

## **Effects of PJ Treatment Measures to Improve Understory Species and Wildlife Habitat (Colorado Effort)**

Field sampling was conducted in 2003 and 2004 to evaluate the effects of tree removal upon the recovery of understory herbs and shrubs at three project locations. Sites were initially treated by chaining in the early 1960's and were roller hopped within the past 5 years. A significant increase in the native herbs and shrubs has occurred, and trees have not reestablished. (See attaché presentation given at the Western Sage Grouse Meeting, Wenatchee, Washington). Currently, results from this study are being compared with similar treatments from other locations. A paper has been submitted for presentation at the Society Range Management Annual Meeting, Texas, Feb. 2005.

## **Summary**

This Strategic Plan is dynamic in that it will change as new information becomes available, as the results of various studies are evaluated, as new partners are engaged and as funding and other resources vary. A review of this plan will be made annually and modifications made, as necessary to ensure it remains a current documentation of the UP Native Plant Program.

The UP Project Technical Committee, and the agencies and partners they represent, are committed to ensure the objectives of the UP Native Plant Program are achieved