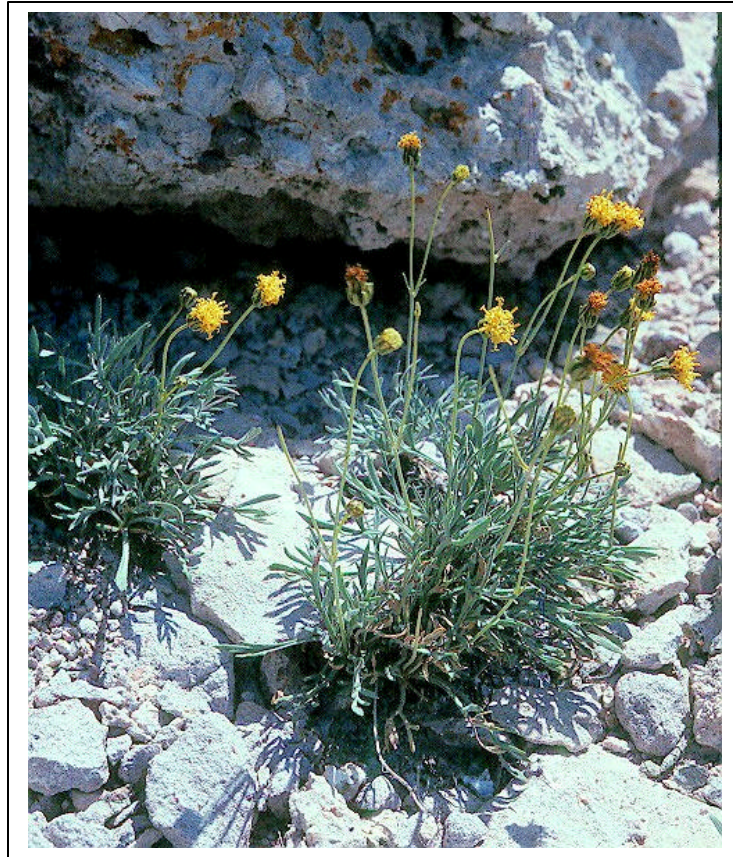


Status of *Thelesperma pubescens* (Uinta greenthread)
in Wyoming



Prepared for
Bureau of Land Management

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ABSTRACT

Status and monitoring reports on *Thelesperma pubescens* (Uinta greenthread) were prepared by Hollis Marriott (1988) and Robert Dorn (1989). A *Thelesperma pubescens* conservation plan was prepared for the Wasatch-Cache National Forest for joint consideration by the Forest Service and the Bureau of Land Management (BLM; IHI Environmental 1995) but was not made final. The objectives set for this study were to collect 2003 trend data from the monitoring transects that were established 15 years earlier in 1988, survey for the species in keeping with a new potential distribution model, and present earlier information in an updated summary document. The 2003 work expanded known *Thelesperma pubescens* distribution by seven sections on Cedar Mountain, re-read the four transects that occur on BLM lands documenting stable or slightly decreasing trends in *Thelesperma pubescens* cover and mainly increases in flowering numbers, and it pooled and updated status information for the species.

Among the most significant status changes comes from out-of-state. In 1995, *Thelesperma pubescens* was collected on the Tavaputs Plateau in Duchesne County, Utah, so there is a need to incorporate Utah information in order to evaluate rangewide status. The task is complicated by two recent and mutually exclusive revisionary taxonomic treatments for *Thelesperma pubescens* relative to *T. caespitosum* and other members of the *Thelesperma subnudum* complex that raised questions whether or not these two taxa are in fact distinct. The taxa are reproductively, geographically, and ecologically isolated in Wyoming but sympatric on the Tavaputs Plateau, intergrading in at least one occurrence.

This report cites the prescriptions and study needs that were identified in the draft *Thelesperma pubescens* conservation plan, and cross-references new information. It would be useful to compile the rest of the survey and monitoring data on the species that has been collected separately by BLM and U.S. Forest Service, and review the terms and boundaries of its habitat being designated as Areas of Critical Environmental Concern on BLM lands. The compilation, coordination, and overriding taxonomic fact-finding needs are incompletely addressed, and they are prerequisites for a cohesive status picture and planning framework.

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Cover photo: *Thelesperma pubescens* on Sage Creek Mountain, by Bonnie Heidel

Table of Contents

INTRODUCTION	1
METHODS.....	1
SPECIES INFORMATION	2
Classification.....	2
Phylogenetic Relationships	3
Legal Status	5
Natural Heritage Rank	6
Description.....	6
Geographic Range.....	9
Habitat.....	13
Population Size	16
Monitoring Trends	17
Population Biology and Ecology	20
Current Management and Potential Threats.....	21
LITERATURE CITED.....	27

Appendix

- Appendix A. *Thelesperma pubescens* element occurrences
- Appendix B. *Thelesperma pubescens* transect location information
- Appendix C. *Thelesperma pubescens* transect data
- Appendix D. Updated state species abstract for *Thelesperma pubescens*

Tables

- Table 1. Characteristic features of *Thelesperma pubescens* and other taxa in the *T. subnudum* group
Table 2. Environmental characteristics of *Thelesperma pubescens* occurrences
Table 3. Climate data from stations nearest *Thelesperma pubescens* occurrences
Table 4. *Thelesperma pubescens* occurrence data
Table 5. Mean cover of *Thelesperma pubescens* - 1988 and 2003

Figures

- Figure 1. *Thelesperma pubescens* whole plant
Figure 2. Close-up of *Thelesperma pubescens*
Figure 3. Illustration of *Thelesperma pubescens*
Figure 4. Distribution of *Thelesperma pubescens* in Wyoming
Figure 5. Potential distribution of *Thelesperma pubescens* in Wyoming
Figure 6. Typical *Thelesperma pubescens* habitat on Cedar Mountain
Figure 7. *Thelesperma pubescens* above cliffs on Cedar Mountain
Figure 8. *Thelesperma pubescens* substrate on Hickey Mountain
Figure 9. Annual precipitation at Mountain View, Wyoming, 1987-2003
Figure 10. *Thelesperma pubescens* cover - baseline (1988)
Figure 11. *Thelesperma pubescens* cover – 15 years later (2003)
Figure 12. *Thelesperma pubescens* trends in flowering (1988-2003)
Figure 13. "Summits" of the mountains occupied by *Thelesperma pubescens*
Figure 14. *Bromus tectorum* on Cedar Mountain Road near *Thelesperma pubescens* habitat

INTRODUCTION

Thelesperma pubescens (Uinta greenthread) is a restricted in Wyoming to three mountains on the north flank of the Uinta Mountains. In order to update the conservation status of this BLM sensitive species, the BLM contracted with the University of Wyoming - Wyoming Natural Diversity Database (WYNDD) to collect 2003 trend data from the monitoring transects of *Thelesperma pubescens* (Uinta greenthread) that were established in 1988, survey for the species in keeping with a new potential distribution model, and update the original status reports on the species. This status update incorporates the detailed status and monitoring reports on *Thelesperma pubescens* that were prepared by Hollis Marriott (1988) and Robert Dorn (1989). It also presents a highlight of the new status information for *Thelesperma pubescens* from Utah, and revisionary taxonomic work that potentially signify changes in the taxonomic levels and relationships between *T. pubescens* and *T. caespitosum*. The 1995 draft conservation plan for *T. pubescens* was not made final, yet there was still some agency progress to report. This report represents a springboard for renewed coordination and dialogue to incorporate the best taxonomic information and scattered agency records into a unified status document and framework for effective conservation.

METHODS

Information on *Thelesperma pubescens* was reviewed during the project, including its diagnostic characteristics, known distribution and status (Marriott 1988, Dorn 1989), as well as its potential distribution model (Fertig and Thurston 2003). The potential distribution model identified polygons of potential habitat concentrated mainly around the three mountains where it is already documented. The record of past surveys was compared, and it was determined that large areas of unsurveyed habitat remained on Cedar Mountain. Other resources that were used for planning and conducting fieldwork included BLM 1:100,000 surface management maps (Evanston, Firehole Canyon), six U.S. Geological Survey maps that spanned the area (Burntfork, Horse Ranch, McKinnon, Reed Reservoir, Soap Holes Reservoir, and Table Mountain quads (7.5'), and BLM color aerial photographs at the same scale as the U.S. Geological Survey maps (photographed in July of 1982).

A monitoring establishment report was incorporated in the first *Thelesperma pubescens* status report (Marriott 1988) and was used in the field for relocating the original monitoring plots and recording plot data in identical manner. The monitoring methods, results, and discussion are all presented in the Monitoring Trends chapter of this report.

WYNDD surveys and monitoring of *Thelesperma pubescens* were conducted July 25-29, 2003. During this period, the species was in flower and fruit. The timing was set to coincide with that of the original 1988 monitoring work to minimize any influences of seasonality on the cover values and flower head numbers of *Thelesperma pubescens*. Additional data was collected on two species of concern that directly overlap in their habitat requirements, *Townsendia microcephala* (Cedar-mountain Easter-daisy) and *Lesquerella parvula* (narrowleaved

bladderpod), in addition to a third species of the same setting but non-overlapping habitat, *Ceanothus martinii* (Utah mountain-lilac).

SPECIES INFORMATION

Classification

Scientific Name: *Thelesperma pubescens* Dorn

Common Name: Uinta greenthread

Synonyms: Hansen et al. (2002) reduced *Thelesperma caespitosum* to a variety of *T. pubescens* (*T. pubescens* Dorn var. *caespitosum* (Dorn) C.J. Hansen, stat. nov. thus reducing *Thelesperma pubescens* Dorn to type variety.

Welsh et al. (2003) reduced *Thelesperma pubescens* to a variety of *T. subnudum*, creating the new combination of *Thelesperma subnudum* A. Gray var. *pubescens* (Dorn) S. Welsh, stat. nov.

Family, Tribe, Subtribe, and Genus: Asteraceae or Compositae (Sunflower family), is comprised of ten tribes. Heliantheae is one of the largest tribes, and the subtribe Helianthinae is the taxonomic and evolutionary base of its tribe (Cronquist 1994). The genus *Thelesperma* is comprised of about a dozen species, native to central and western North America and warm-temperate regions of South America (Cronquist 1994).

History of the Species:

Thelesperma pubescens was first described as a new species by Robert Dorn:

Dorn, R.1983. A new species of *Thelesperma* (Asteraceae) from Wyoming. Great Basin Naturalist 43:749-750.

The type specimen collected by Dorn (3823) is deposited at the Rocky Mountain Herbarium (RM), and was collected in Uinta Co., WY on Hickey Mountain. T13N R114W Sec 13 E 1/2, at 8400 ft, rocky ridge, 20 August 1982. Isotypes are at NY, GH, BRY.

Thelesperma pubescens was first collected by Ann Aldrich, a BLM employee, on Sage Creek Mountain, Uinta Co., WY, in 1979. Robert Dorn collected it on Hickey Mountain in 1982, unaware of the earlier collection. He returned to the same Hickey Mountain collection site six weeks later for better material, which became the type of the species. On July 4, 1983, Dorn discovered another population on Cedar Mountain, which is within sight of the other two mountains. Rod Hardy, a BLM employee, mapped a portion of the Hickey Mountain population on 31 July 1986 in conjunction with oil and gas leasing activities. In 1987, Hollis Marriott, WYNDD botanist, documented it at the south end of Hickey Mountain in an area of active oil/gas leasing. This area is treated as a separate occurrence from the collection site of Robert

Dorn because it is separated by a distance of over 2 miles, separated by unsuitable habitat and breaks in topography in between. Hollis Marriott did additional mapping in 1988 under contract with the BLM and Forest Service to attempt to avoid conflicts with leasing, to establish monitoring transects, and to prepare a status report. Robert Dorn conducted additional survey in 1989, and prepared a status report for the U.S. Fish and Wildlife Service. In addition, it was documented incidental to *Townsendia microcephala* status survey conducted by Walter Fertig as WYNDD botanist (Fertig 1995b) for the Bureau of Land Management and as part of floristic surveys conducted by Charmaine Refsdal (Refsdal 1996, Hartman and Refsdal 1995).

The Wasatch-Cache National Forest conducted a rare plant survey north of Table Mountain in 1994 for the proposed Poison-Table timber sale (cited in IHI Environmental 1995). Two previously unsurveyed areas of potential habitat for *Thelesperma pubescens* were identified and recommended for more comprehensive survey as part of the outcome. Background information on these and any later surveys and occurrence updates have been requested of the U.S. Forest Service.

Phylogenetic Relationships

There were some conflicting reports of its distribution in the literature because Cronquist (1994) treated *Thelesperma subnudum* var. *alpinum*, as a synonym of *T. pubescens*. The former was collected by Atwood and Thompson (7646a) in Wayne County, Utah and described by Stanley Welsh as a new taxon (Welsh 1983). Cronquist (1994) regarded both it and *T. caespitosum* as synonyms of *T. pubescens*.

Review of taxonomic history and status cannot be addressed without presenting phylogenetic relationships. *Thelesperma pubescens* is in the *Thelesperma subnudum* complex (Dorn 1983, Hanson 1998). Dorn noted that *T. pubescens* has stress adaptations (pubescent leaves, reduced leaves, reduced numbers of flower heads, and thick caudex) compared to the widespread taxa, *T. marginatum* and *T. subnudum* with their relatively unspecialized habitat requirements. In keeping with this hypothesis, *Thelesperma pubescens* and *T. caespitosum* were thought to be recent derivatives of *T. subnudum* adapted to more specialized and restricted environments (Dorn 1989 discussed in Fertig 1995a).

Recent biosystematics studies (Hansen 1998, Hansen et al. 2002) indicate a strong genetic similarity between *Thelesperma pubescens* and *T. caespitosum*. Taxonomic relationships in the *Thelesperma subnudum* complex were analyzed using chromosome data, morphological data, DNA-ITS data, and alloenzyme gel electrophoresis data, analyzed separately and together in phylogenetic analysis (Hansen et al. 2002). The taxonomic scope included all three taxa that Cronquist (1994) treated as synonyms. As a result of this work, *T. pubescens*, *T. caespitosum* and *T. subnudum* var. *alpinum* were re-aligned as close relatives. Hansen et al. (2002) reduced *Thelesperma caespitosum* to a variety of *T. pubescens* (*T. pubescens* Dorn var. *caespitosum* (Dorn) C.J. Hansen, stat. nov. thus reducing *Thelesperma pubescens* Dorn to type variety. The only consistent diploids in the entire group are *T. pubescens* and *T. caespitosum*, sister taxa that differ by a single morphological character involving the distribution of pubescence on the leaves. There are also diploid specimens of *Thelesperma subnudum* var. *subnudum* that were collected on the Colorado Plateau, but elsewhere polyploidy prevails across its range. Generally, the

diploid chromosome number is primitive relative to polyploid numbers, offering an alternative interpretation that these sister taxa are ancestral or early offshoots of a common ancestor relative to the rest of the *Thelesperma subnudum* complex.

The taxonomic relationship between *Thelesperma pubescens* and *T. caespitosum* were in question because of the contradiction between Cronquist (1994) and Dorn (1983, 1990) as well as the Atwood and Thompson collection of *Thelesperma subnudum* var. *alpinum* from Wayne County, Utah and subsequent collecting of *Thelesperma* material on the Tavaputs Plateau in Duchesne County, Utah. The Tavaputs Plateau is represented by several collections by Sherel Goodrich and Allen Huber in 1995. On one of the collections (*Goodrich and Huber 25159*), Goodrich noted that: "The pubescence of leaves of this and other recent collections from the West Tavaputs Plateau shows variation that crosses the concepts of *Thelesperma pubescens* Dorn and *T. caespitosum* Dorn. Variation within populations and across populations in this area indicates a single taxon for these plants." Material from the Tavaputs Plateau was included in the Hansen et al. (2002) biosystematics analysis and they reported complete intergradation between it and *T. caespitosum*. The range of possible explanations for intergradation include incomplete primary divergence (i.e., incomplete speciation), or secondary convergence due to hybridization or selection (Hansen et al. 2002).

Hansen et al. (2002) refer to a *Thelesperma pubescens* /*T. caespitosum* clade that is best recognized at the variety level separate from the rest of the *T. subnudum* complex, because their analysis indicated that to do otherwise would be to expand the *T. subnudum* complex even further to include *T. longipes* and *T. filifolium*. Instead, Welsh et al. (2003) reduced *Thelesperma pubescens* to a variety of *T. subnudum*, creating the new combination of *Thelesperma subnudum* A. Gray var. *pubescens* (Dorn) S. Welsh, stat. nov. *Thelesperma caespitosum* is treated as a synonym of *T. subnudum* var. *pubescens*, and *T. windhamii* is retained under the earlier synonym, *T. subnudum* A. Gray var. *alpinum* S. Welsh. In keeping with the Welsh et al. (2003) treatment, all five occurrences of *Thelesperma pubescens* and *T. caespitosum* in Utah and all six occurrences of *Thelesperma pubescens* and *T. caespitosum* would represent the same taxa.

Utah specimens of *Thelesperma subnudum* and the greater complex are characterized by Welsh et al. (1997) as follows:

"The plants occur mainly at elevations below 2135 m [7005 ft] elevation. Dwarf alpine phases occur above that elevation, and because of their small size, lack of rays, and apparent ecotypical differences, these plants are herein designated at varietal level."
(Welsh et al. 2003)

Ecotypes are typically part of a continuous latitudinal or elevation gradient and not reproductively isolated or treated as taxonomically distinct. This prospective expansion of the *T. subnudum* complex also has implications in the treatment of the *Thelesperma* genus as a whole that is underway in the Flora of North America (FNA) project by the FNA genus author, John Strother, an expert in the Heliantheae Tribe.

Essentially, there are three alternate treatments published for *Thelesperma pubescens*. It is recognized along with *T. caespitosum* as separate species in the original monographs (Dorn

1983, 1990). They are reduced to closely-related varieties (*T. p. var. pubescens* and *T. p. var. caespitosum*) by Hansen (1998) and Hansen et al. (2002). Finally, they are reduced to varieties of *T. subnudum* and recognized as synonyms within a broader suite in which the distinctiveness of the latter is rejected. The alternate interpretations presented by the most recent works are compelling but the choices between the two are not clear. Constructive steps in evaluating them include expanded morphological analysis, i.e., looking for additional distinguishing characteristics on specimens or in the field, conducting greenhouse common garden experiments, and conducting additional fieldwork particularly along Tavaputs Plateau environmental gradients. In addition, Hansen et al. (2002) recommended initiating ISSR sequencing of rapidly evolving regions of the *Thelesperma* genome.

Legal Status

U.S. Fish and Wildlife Service status: *Thelesperma pubescens* was designated a Category 2 candidate endangered or threatened species in the Federal Register of September 27, 1985 (U.S. Fish and Wildlife Service 1985). Dorn (1989) recommended downgrading the ranking to Category 3 because of no significant threats, but this change was not implemented. Category 2 species were taxa for which proposing to list them as endangered or threatened was considered appropriate but for which substantial data on biological vulnerability and threats were not currently known or on file to support the preparation of rules. The Category 2 list was discontinued in 1996, and *T. pubescens* has no current status under the Endangered Species Act.

BLM status: Sensitive - Wyoming BLM (USDI BLM 2001, as updated in 2002)

Other status: Sensitive - Intermountain Region of the U.S. Forest Service (USDA FS 1991)

In 1994, the Wasatch-Cache National Forest contracted IHI Environmental (Salt Lake City, UT) to prepare a *Thelesperma pubescens* Conservation Strategy for joint consideration by the USDA Forest Service (Wasatch-Cache National Forest) and the USDI Bureau of Land Management (Rock Springs Field Office). The conservation plan (IHI Environmental 1995) was reviewed by all parties, but was not signed. The three goals of the Conservation Plan were to:

1. Maintain all key populations.
2. Maintain habitat and microenvironmental characteristics of existing populations and suitable potential habitat for additional colonization sites.
3. Prevent the need for formal listing under the Endangered Species Act.

All four known populations of *Thelesperma pubescens* in Wyoming are primarily on lands managed by federal agencies, but there are private and state land tract inclusions. In these places, *Thelesperma pubescens* has no status as a sensitive species or as a Wyoming species of concern on state or private lands except as federal agency actions may be involved.

Natural Heritage Rank

NatureServe (formerly the heritage division of The Nature Conservancy) and the network of state natural heritage programs have assigned *Thelesperma pubescens* a global rank of G1, indicating that it is "critically imperiled because of rarity" throughout its range (NatureServe 2003). The state rank of S1 is identical to the global rank, indicating that it is also "critically imperiled because of rarity" throughout the state (Keinath et al. 2003).

However, two recent revisionary taxonomic treatments represent a need to change this rank. Hansen et al. (2002) recognize *Thelesperma pubescens* and *T. caespitosum* as conspecific (i.e., different varieties of the same species; see history of the species). The global rank would be made a composite of these two taxa, the T rank would reflect rangewide status of the varieties, and the state rank would remain the same. In a contrasting taxonomic treatment, Welsh et al. (2003) treats *Thelesperma pubescens* as a variety of *T. subnudum* and does not recognize the validity of *T. caespitosum*, treating it as a synonym of *T. subnudum* var. *pubescens* (see history of the species). The global rank would be made a composite that also addresses the relatively widespread *T. subnudum* (currently ranked G), the T rank would reflect composite rangewide status of the varieties, and the state rank would also reflect composite rangewide status of the varieties.

Description

Thelesperma pubescens is a perennial herb from a thick, woody, branched caudex and taproot covered with old leaf bases. Flowering stems are 3-12 cm high, glabrous, and mostly leafless. Basal leaves are 1-5 cm long, pinnately compound with 3-5 linear leaflets, and densely short gray-hairy. Flower heads usually occur singly, rarely in pairs, or are sometimes produced later and lower on the stem under prolonged favorable conditions. Each flower head has 2 rows of unequal scarious-margined bracts, and the outer bracts are shorter and often reflexed. Ray flowers are absent. Disk flowers are yellow, 5 mm long, and lack a pappus. Achenes are glabrous, angular, about 4 mm long, and subtended by a long membranous bract (Figures 1-3; Dorn 1983, 1989; Marriott 1988; Fertig et al. 1994, Utah Native Plant Society 2003-04).

Thelesperma caespitosum has pubescence restricted to the leaf petiole while the leaf blades are glabrous. It is noticeably green, compared to the gray-green appearance of *Thelesperma pubescens*. Other Wyoming species of *Thelesperma* have conspicuous ray flowers, leafy stems, or glabrous herbage. A summary of distinguishing morphological characteristics in the *Thelesperma subnudum* group, as highlighted by Hansen et al. (2002), is presented in Table 1.



Figure 1. *Thelesperma pubescens* whole plant, by C. Refsdal



Figure 2. Close-up of *Thelesperma pubescens*, showing asynchronous disk flowers, note: the late bud, by B. Heidel

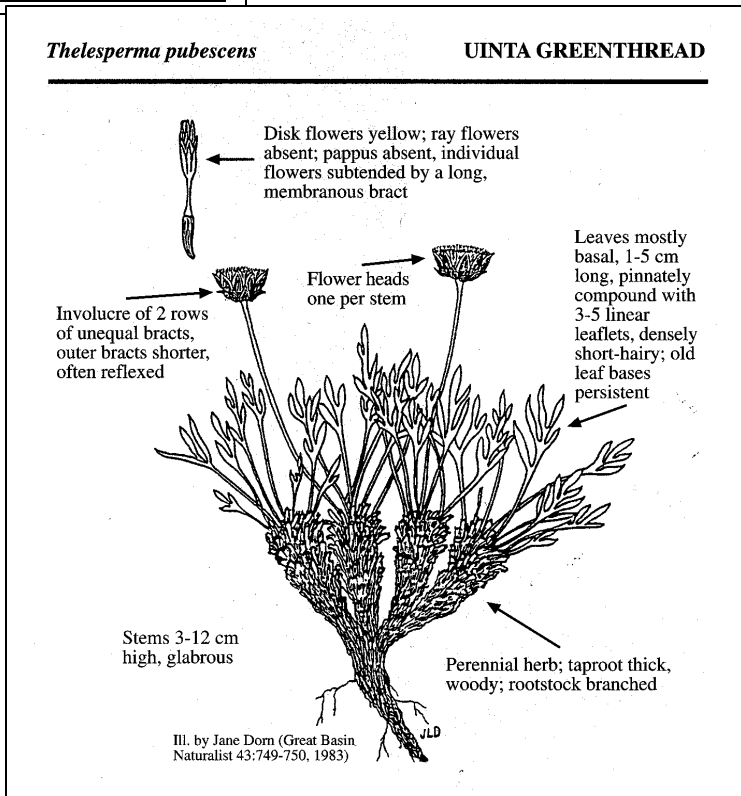


Figure 3. Illustration of *Thelesperma pubescens*, by Jane Dorn (reprinted from Fertig et al. 1994; as published in Dorn 1983)

Table 1. Characteristic features of *Thelesperma pubescens* and other taxa in the *T. subnudum* group (as summarized in Hansen et al. 2002, unless otherwise stated)

Species	Leaves	Ray florets	Pappus	Involucre	Growth form
<i>Thelesperma pubescens</i> (<i>T. p.</i> var. <i>pubescens</i>)	Leaves pubescent and lower stems glabrous, 1.5-4 cm long; appearing gray-green	Absent	Absent	5-9 mm high (from Dorn 1993); 8-14 mm high (from Welsh et al. 2003)	Stems mainly 3-12 cm tall (Dorn 2003), or 9-35 cm tall (Welsh et al. 2003), clustered on a thick, branching caudex with old, persistent leaf bases
<i>T. caespitosum</i> (<i>T. p.</i> var. <i>caespitosum</i>)	Leaves pubescent only on petioles; appearing green	Absent	Absent		Stems mainly 3-19 cm tall, clustered on a thick, branching caudex with old, persistent leaf bases
<i>T. windhamii</i> (<i>T. subnudum</i> var. <i>alpinum</i>)	Leaves and lower stems pubescent, 1.5-4 cm long; appearing gray-green	Absent	Toothed crown	6.3-9 mm (from Welsh et al. 2003)	Stems mainly 3-19 cm tall, clustered on a thick, branching caudex with old, persistent leaf bases
<i>T. subnudum</i>	Leaves glabrous or essentially so, 3-9 cm long	Present	Absent	8-14 mm high (from Welsh et al. 2003)	Stems mainly 9-35 cm tall, scattered along rhizomatous rootstock
<i>T. marginatum</i>	Leaves glabrous or essentially so, 3-9 cm long	Absent	Absent	8-14 mm high (from Welsh et al. 2003)	Stems mainly 9-35 cm tall, scattered along rhizomatous rootstock

The only other rayless composites in its habitat are *Hymenopappus filifolius* (fine-leaf woollywhite), which has long cobwebby pubescence, scale-like pappus, and many flower heads per stem, and rayless forms of *Erigeron compositus* (cut-leaved fleabane), which has hair-like pappus bristles and a single row of involucre bracts

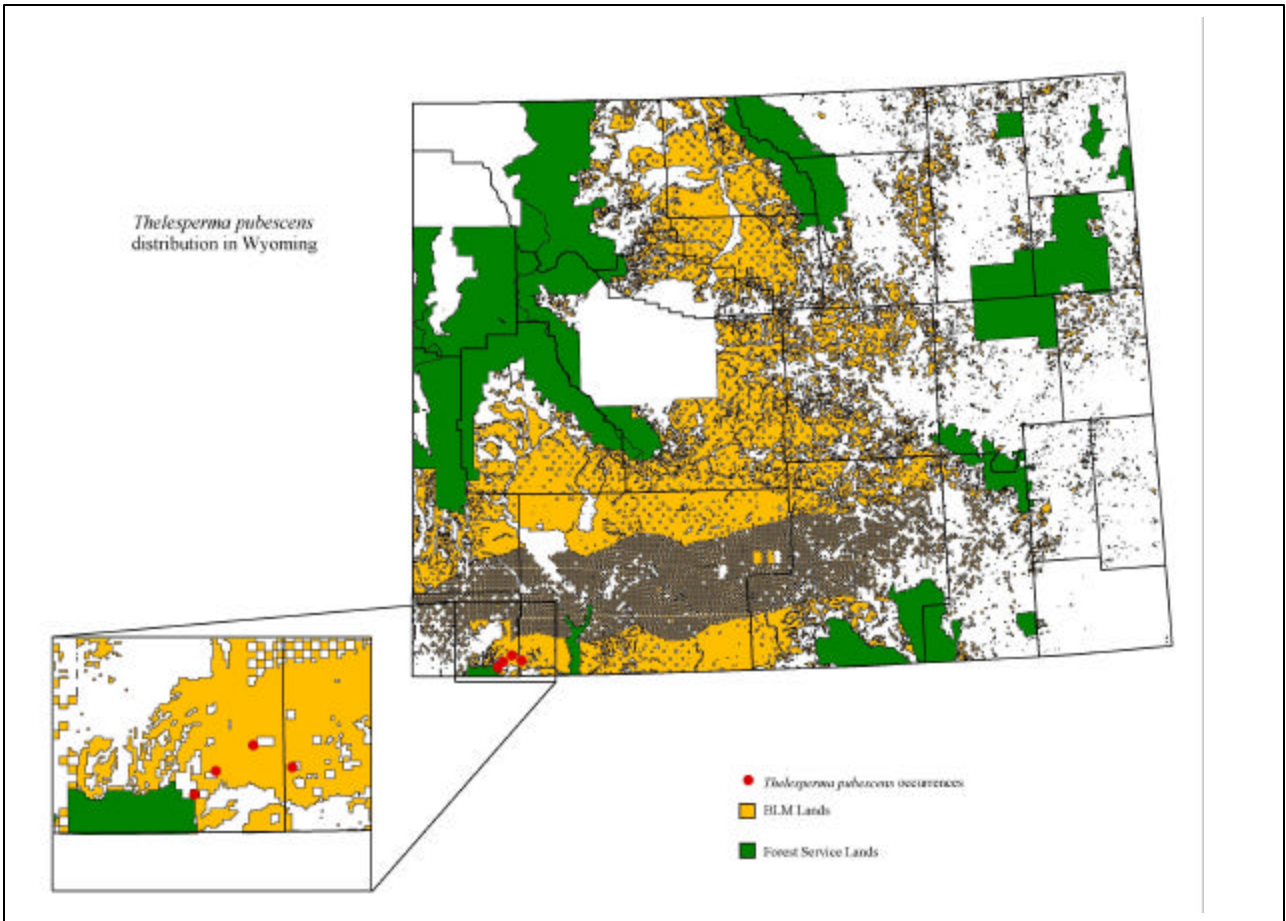
A total of 24 morphological attributes were used in scoring and comparing the members of the *Thelesperma subnudum* subgroup, as taken from monographs and other taxonomic treatments (Hansen 1998). Essentially, only one character in the literature differentiated *Thelesperma pubescens* from *T. caespitosum* and it pertained to leaf pubescence. The two taxa have been characterized as very distinct in the field (Fertig 1995a), they are geographically isolated by distances of about 30 miles in Wyoming, and they are further reproductively isolated in that *T. pubescens* generally blooms a month later than *T. caespitosum* in Wyoming. The 1,500' difference in elevation and contrasting substrates have variously been used to support or refute the taxonomic difference between the two. By contrast, the two putative taxa in Utah are sympatric with complete intergradation in at least one occurrence on the Tavaputs Plateau. The robust stature of Utah material has been incorporated in the revisionary taxonomic treatment presented by Welsh et al. (2003; Table 1).

Geographic Range

Known Distribution: *Thelesperma pubescens* occurs in southwest Wyoming where southwestern Sweetwater and southeastern Uinta counties come together. The occurrences are located at northern fringes of the Uinta Range, also representing the margins of the southern Green River Basin. It occurs on isolated landforms that are referred to as mountains, but they are level tablelands more appropriately considered plateaus. Three occurrences are primarily on lands administered by the Rock Springs Field Office of the Bureau of Land Management, and one is on both BLM land and the Wasatch-Cache National Forest. Tracts of private and state lands are present as inclusions in some populations. Maps of all four occurrences and the supporting data are presented in Appendix A.

There is a collection of *Thelesperma pubescens* that was made in studying Wyoming cushion plant community vegetation in 2001 whose location needs corroboration. The specimen determination process may have mismatched collection information and location information. The collection label indicates a 25 May 2001 collection data by G.P. Jones (s.n.) from Fossil Ridge Rim in Lincoln County, deposited at RM. This would be a major range extension that needs to be checked. Sampling was conducted for the same ecology project on Hickey Mountain, where *Thelesperma pubescens* is already known.

Figure 4. Distribution of *Thelesperma pubescens* in Wyoming



Thelesperma pubescens is verified from the Tavaputs Plateau in Duchesne County, in 1995 collections by Sherel Goodrich and A. Huber. The material was initially all determined as *T. subnudum* var. *caespitosum*, and earlier *Thelesperma* collections from the Tavaputs Plateau originally determined as *T. subnudum* were annotated to *T. subnudum* var. *caespitosum* including earlier BRY collections by Goodrich (5519, 5524, 6130) and by Franklin and Chandler (6256). A review of the 12 *Thelesperma* specimens from the Tavaputs Plateau at BRY by Ben Franklin in 1997 indicated that there are 8 specimens with pubescent leaves that may represent at least three separate occurrences of *Thelesperma pubescens*, mainly concentrated at Badlands Cliffs. There are four collections that have leaves with pubescence restricted to petioles that may represent two separate occurrences of *Thelesperma caespitosum* on the Tavaputs Plateau, including the mixed population (Franklin personal communication 2004; Utah Natural Heritage Program database 2004). The Utah populations are on the opposite side of the Uinta Range from those in Wyoming and at similar elevations. The reports of *Thelesperma pubescens* from Summit County, Utah (Atwood et al. 1991, Utah Plant Society 2003-04) are in error (Welsh et al. 2003; Franklin personal communication 2004).

Extent of Surveys in Wyoming: The most extensive surveys for *Thelesperma pubescens* in Wyoming were conducted in initial stages of documentation by Robert Dorn and in 1987-1988 by Hollis Marriott on landforms capped by Bishop Conglomerate. As a result of the latter, *Thelesperma pubescens* was documented at the southern end of Hickey Mountain for the first time. She surveyed four other areas intensively where it was not found, reported on the next page with the original survey comments (Marriott 1988).

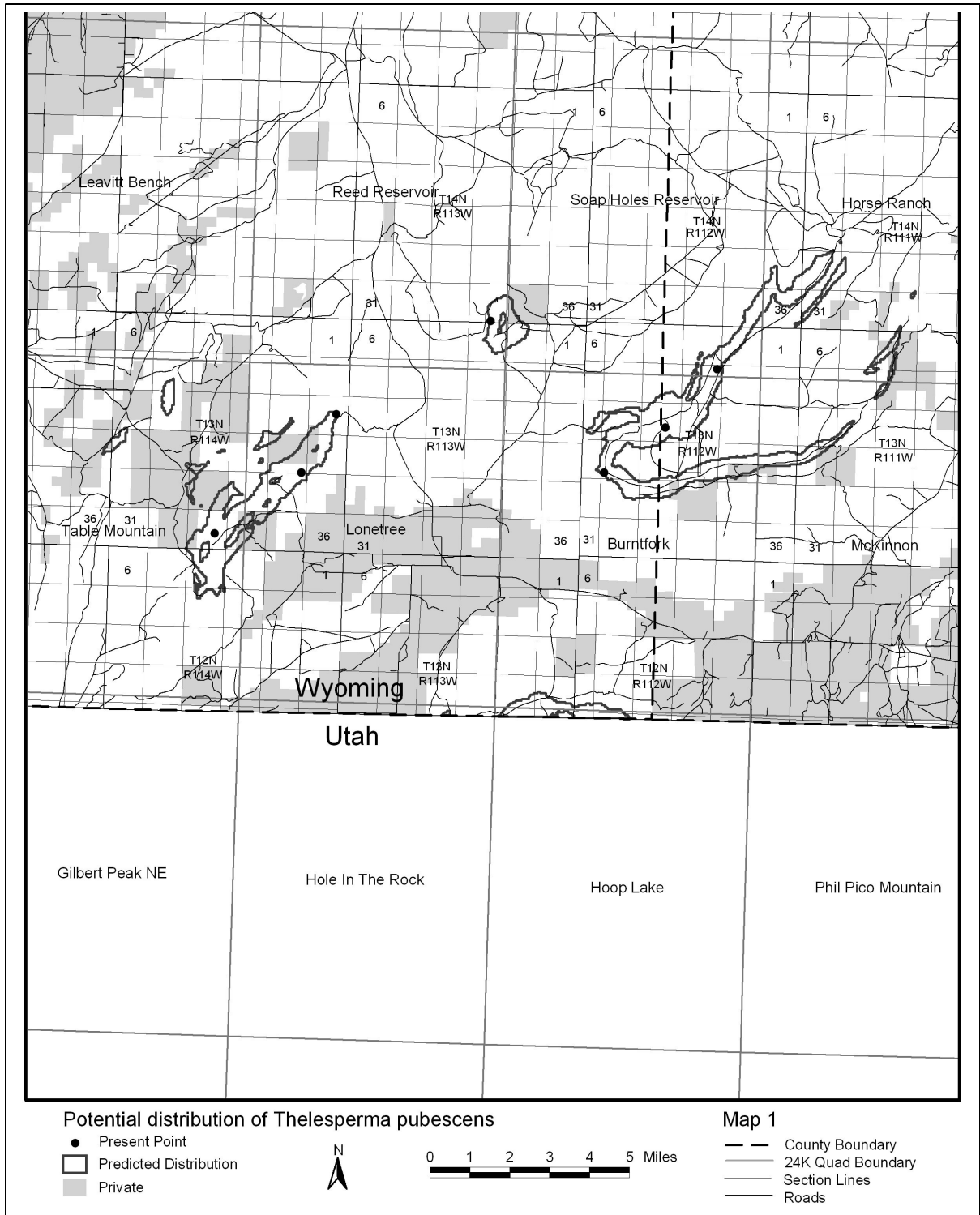
Surveys were conducted:

1. On Wasatch- National Forest, Cottonwood Mountain was surveyed, representing the next Bishop-capped ridge west of Hickey Mountain. There appeared to be ideal *Thelesperma pubescens* habitat, but it had high ground cover of a native *Trifolium*, a competitive nitrogen fixer.
2. On Ashley NF of Flaming Gorge National Monument, the Firehole Canyon was surveyed on the ridge between Big Firehole Canyon and Sage Creek.
3. and 4. On BLM lands, both Little Mountain and Miller Mountain were surveyed, on the east side of the Flaming Gorge.

Most recently in 2003, surveys were expanded on Cedar Mountain and revisited on Hickey and Sage Creek Mountains using the potential distribution model and compared with surrounding landscapes (as far north as Crooked Canyon). Two areas of potential habitat are recommended for future survey including tablelands above Sage Creek, and the ridge running perpendicular to Bald Ridge at the state line. There is a third area on a ridge across from Bigelow Bench, but it is a low priority because it has almost no public land to survey except for a corner of a state school section. Only one of the areas identified in the potential distribution model, on Cottonwood Mountain, was previously surveyed (Marriott 1988). Information whether there are additional survey needs identified on the Wasatch-Cache National Forest also needs to be determined.

Potential Distribution in Wyoming: The potential distribution model was produced for *Thelesperma pubescens* using a range/intersection model, and predicted 39 km² of suitable habitat in Sweetwater and Uinta counties (Figure 5; Fertig and Thurston 2003) based on a set of over ten environmental attributes shared in common at known sites and extrapolated. Two areas identified in this model are recommended for future surveys, in the Bald Ridge area near the Utah state line, and above Sage Creek, west of Hickey Mountain. The third area, on a ridge across from Bigelow Bench, is not shown in Figure 5 but located about 25 miles farther west. It is not a priority because it is primarily on private land.

Figure 5. Potential distribution of *Thelesperma pubescens* in Wyoming (from Fertig and Thurston 2003)



Habitat

Thelesperma pubescens occupies sparsely vegetated settings at the rim crest, often situated above wooded communities such as mountain mahogany communities (Figure 6), but also situated above cliffs (Figure 7) or steep, unconsolidated, highly unstable slopes (Marriott 1988, Heidel 2004). Most of its habitat is classified as cushion plant community, and completion of a report on cushion plant communities, that included sampling at Hickey Mountain, is pending (Jones in progress). It provides a classification of cushion plant communities and compares composition along a gradient with adjoining well-vegetated uplands. The habitat of *Thelesperma pubescens* is distributed in broken or continuous bands from 1-10 m wide on gentle to moderate slopes of mesa rims that are straight or convex (Figure 6), sometimes above cliffs (Figure 7). The most extensive habitat is on west-facing slopes, but all other aspects are represented.



Figure 7. *Thelesperma pubescens* habitat on Cedar Mountain, above cliffs, looking southwest toward Uinta Range, by B. Heidel



Figure 6. Typical *Thelesperma pubescens* habitat on Cedar Mountain, looking north, by Hollis Marriott



Figure 8. Over 20 *Thelesperma pubescens* plants are present in this portion of a 0.25 m² plot on Hickey Mountain South; most are vegetative. Note abundance of red quartzite on Hickey Mountain compared to limestone of other settings, by B. Heidel

The Bishop Conglomerate caps large erosion benches and pediments, the Wyoming landforms on which *Thelesperma pubescens* occurs (Bradley 1964). This formation consists of well-rounded cobbles and boulders, with red quartzite from the Uinta Range (Figure 9), as well as limestone and metamorphic rock that are locally common. Soils at the rims are poorly developed and generally characterized as shallow, sandy loam with many cobbles and gravel intermixed (Dorn 1989). The forces of wind and water erosion have left a gravel residuum overlying the substrate, forming gravel pavements. Elevations range from 8040-8960 ft (2450-2730 m).

The *Thelesperma pubescens* occurrences in Utah are also restricted to Bishop Conglomerate (Utah Native Plant Society 2002-03), and the rim habitat photograph for it on the Tavaputs Plateau has the same distinctive windblasted pattern of parallel mountain mahogany bands diagonal to the ridge that cover much of Cedar Mountain and Sage Creek Mountain west-facing slopes where it occurs in Wyoming.

Table 2. Environmental characteristics of *Thelesperma pubescens* occurrences

Site	EO No.	Elevation Range	Associated Species
Hickey Mountain North	001	8640-8720	<i>Artemisia tridentata ssp vaseyana</i> , <i>Astragalus spatulatus</i> , <i>Chrysothamnus viscidiflorus</i> , <i>Commandra umbellata</i> , <i>Cymopterus acaulis</i> , <i>Elymus spicatus</i> , <i>Eremogone hookeri</i> , <i>Hymenoxys acaulis</i> , <i>Hymenoxys torreyana</i> , <i>Linum lewisii</i> , <i>Phlox muscoides</i> , <i>Paronychia sessiliflora</i> , <i>Townsendia nuttallii</i> , <i>Trifolium andinum</i> .
Sage Creek Mountain	002	8380-8420	<i>Astragalus spatulatus</i> , <i>Draba oligosperma</i> , <i>Eriogonum brevicaulis</i> , <i>Erigeron compositus</i> , <i>Haplopappus nuttallii</i> , <i>Hymenoxys acaulis</i> , <i>Lesquerella alpina var. condensata</i> , <i>Machaeranthera grindelioides</i> , <i>Paronychia sessiliflora</i> , <i>Senecio canus</i> , <i>Townsendia microcephala</i> , <i>Trifolium andinum</i> .
Cedar Mountain	003	8040-8540	<i>Astragalus spatulatus</i> , <i>Carex filifolia</i> , <i>Cercocarpus montanus</i> , <i>Cryptantha caespitosa</i> , <i>Elymus lanceolatus</i> , <i>Elymus spicatus</i> , <i>Eremogone hookeri</i> , <i>Erigeron compositus</i> , <i>Eriogonum caespitosum</i> , <i>Haplopappus acaulis</i> , <i>Machaeranthera grindelioides</i> , <i>Oryzopsis congesta</i> , <i>Oxytropis sericea</i> , <i>Senecio canus</i> ,
Hickey Mountain South	004	8760-8960	<i>Artemisia frigida</i> , <i>Astragalus spatulatus</i> , <i>Elymus spicatus</i> , <i>Eremogone hookeri</i> , <i>erigeron compositus</i> , <i>Eriogonum umbellatum</i> , <i>Hymenpappus filifolius</i> , <i>Lesquerella parvula</i> , <i>Paronychia sessiliflora</i> , <i>Stenotes acaulis</i> .

The potential distribution model produced for *Thelesperma pubescens* predicted 39 km² of predicted distribution (Fertig and Thurston 2003). Continuous variables that were used in the model included elevation, relief, precipitation extremes in all four seasons, and temperature extremes in all four seasons. Categorical variables that were used in the model included surficial geology (mesa and landslide features), bedrock geology, land cover, and soil classification units

(units containing typic haplocryalfts, typic dystrocryepts, and typic haplocryolls; Fertig and Thurston 2003).

The climate conditions in *Thelesperma pubescens* habitat are cold and semi-arid (Table 3). The average conditions during the July flowering period are relatively mild, but marked by high variability in both temperature and precipitation (USDI NOAA 2004). The nearest climate monitoring stations are over 20 miles away and 1500-2000+ feet lower in elevation, so the on-site temperatures are expected to be much lower than indicated by the monitoring stations. The Mountain View station lies north of the Uinta Range like the occurrences, and thus may be more representative.

All Wyoming populations of *Thelesperma pubescens* are in settings where microhabitat conditions have a distinct microclimate associated with them. The microhabitat is generally free of snow by the middle of May (Zobell personal communication 1994 as cited by IHI Environmental (1995). The rim and upper slope positions receive the full force of winds, aided by gravity to maintain early succession conditions. Even though water is readily adsorbed by the soils derived from calcium carbonate bedrock, there are direct losses to evaporation and runoff.

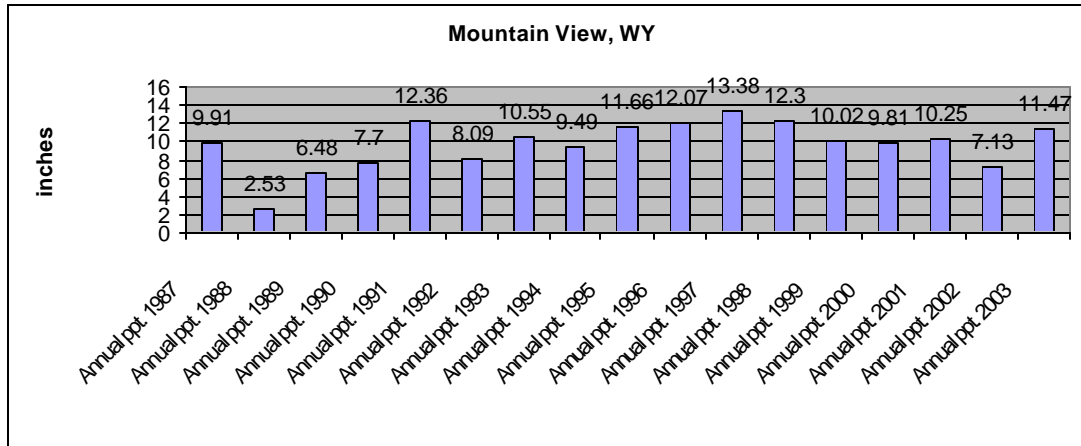
Table 3. Climate data from stations nearest *Thelesperma pubescens* occurrences

Climate variable	Mountain View, WY (Station closest to Hickey Mt) Elev.: 6800', Duration of record: 4/1/1966-7/31/2003	Manila, UT (Station closest to Cedar Mt) Elev.: 6450', Duration of record: 6/17/1952-7/31/2003
Annual ppt. (mean)	9.29	9.17
Mean monthly ppt. of month with highest ppt (May; mean in)	1.19	1.3
Mean, min and max monthly ppt. during peak flowering (July; mean in)	0.96 (0.06/2.53) in.	0.97 (0.10/2.85) in.
Mean annual temperature (F)	41.7	45.3
May mean T (F)	49.0	52.7
July mean T (min/max T; F)	64.0 (47.5/80.4) F	68.9 (53.1/84.7) F

The 1987-88 survey and the 1988 monitoring of *Thelesperma pubescens* included the 1988 drought year (Marriott 1988). A comparison of mean annual precipitation (9.29 in, Table 3, above) with annual values for this period through 2003 shows that 1988 was a severe drought year at 27% of mean annual precipitation (Figure 9). By comparison, 2003 had above normal rainfall levels with 123% of mean annual precipitation (Figure 9). It was generally noted that in

July of 2003, prior to the time of monitoring, there were several major rainfall events. Prolonged thunderstorms interrupted fieldwork a couple times.

Figure 9. Annual precipitation at Mountain View, Wyoming, comparing values for 1988 and 2003 as the years of *Thelesperma pubescens* monitoring



Population Size

Estimates were made of *Thelesperma pubescens* population sizes indicating that total population numbers are in the 100,000 magnitude. The rough estimates were made by recording the approximate length and width of occupied habitat, making a conservative estimate of plant density across each area as a multiple and then adding the values for each subpopulation area. The 1/4 m² frame that was used in reading transects was also used for making estimates of typical densities per m², noting those areas with highest densities. For population estimate purposes, low density figures were used, and the width of occupied habitat was usually 1-5 meters. Not all previously-mapped polygons were revisited, particularly outliers, so this practice served to identify the lower magnitude limits of population size. A summary of estimated population numbers, miles of rim, and acres of occupied habitat are provided in Table 4. The comparison between 1988 estimates and 2003 estimates is discussed in the following section that addresses monitoring trends.

Table 4. *Thelesperma pubescens* occurrence data

Site	EO No.	Est. Pop. Nos. (Dorn 1989)	Est. Pop. Nos. '03	App. length of rim habitat (miles)	Est. area of rim habitat (acres)
Hickey Mountain North	001	4,000	10,000+	2.5	46.0
Sage Creek Mountain	002	675	1,000+	1.75	33.8
Cedar Mountain	003	~abundant	100,000+	13.5	382.5
Hickey Mountain South	004	~abundant	100,000+	1.5	82.0
TOTAL	4 pops.	9,200	200,000+	19.25	544.3

Monitoring Trends

Three permanent 50-meter monitoring transects were established on Cedar and Hickey Mountains to track major population trends with a minimum amount of time, providing an early warning system (Marriott 1988). The total *Thelesperma pubescens* cover was estimated in one of four cover classes (0%, 5%, 5-25%, and 26-50%). It was based on cover classes because it can be time-consuming to discern individual *Thelesperma pubescens* plants, particularly under high density. In addition, the total number of flowering plants was tallied.

The transects were marked at both ends by 33" lengths of 5/8" rebar driven approximately half their lengths into the ground. Rocks were piled around the posts. Maps showing the transect locations are in Appendix C of Marriott (1988), and photographs of transect endpoints were taken in 1988 and 2003. In addition, GPS readings were taken of endpoints (NAD27 Zone 12) in 2003. The starting point is indicated by the bearing that was originally recorded for each transect. A summary of transect location information is presented in Appendix A. Access to the two transects on Forest Service land was not arranged ahead of time, and attempts to access it were unsuccessful.

Fifty 0.25 m plots were laid along each transect at alternate 0.5 meter intervals, beginning at the 0.5 meter point along the tape (Figure 4; Marriott 1988). A 4-sided frame of 0.25 m dimension was used in place of the original demarcation of each plot by two half-meter sticks. Cover class estimates were recorded in one of four categories (O, A, B, or C). They were calibrated within the 0.25 m plots using the following four cover class categories:

O - 0% : None

A - <5% : LOW - Less than 7.1 cm x 7.1 cm (usually 3 or less mature plants)

B - 5-25% : MEDIUM - Between 7.2 cm x 7.2 cm and 25 cm x 25 cm

C - 26-50% : HIGH - Greater than 25 cm x 25 cm

The proportion of plots comprising these high, medium and low cover values was calculated for each transect to determine the relative shifts in cover values. The cover data is presented as a proportion of plots in each cover class for 1988 (Figure 10) and for 2003 (Figure 11). The median of these cover values was used to calculate an approximate mean value per transect (Table 5). The flowering plant number trend is shown in a single graph comparing flowering density in 1988 vs. 2003 (Figure 12). All of the raw data are presented in the Appendix (Appendix B). The 2003 dataset includes only four of the six transects.

Flowering plant numbers were tallied within each plot and recorded regardless of reproductive stage (bud, flowering, fruit stages), though the majority had finished flowering and had set seed.

The trends in cover of *Thelesperma pubescens* show relative stability of distribution patterns within transects over time. There was modest reduction in cover for at least two of the four transects (Cedar Mountain Transects 1 and 2). The Cedar Mountain transect that is stable is in a slightly more sheltered setting below the rim among scattered mountain mahogany cover (Transect 3), and the microhabitat setting may account for the Cedar Mountain trend differences. The Hickey Mountain transect is relatively stable, without a net change in cover, but the

distribution has flattened, i.e., there is a wider range of cover values (both high and low) in 2003 compared to 1988.

The changes in mean cover values indicate declines on all three Cedar Mountain transects and increases on Hickey Mountain (Table 5). In general, the cover values are not evenly distributed throughout the cover value ranges but are skewed to the lower end. The proportion of high, medium, and low cover value plots is not subject to the same mathematical skewing and is taken as a more meaningful representation of cover trend in each transect. The analysis is hampered by the particularly high number of plots with close to 5% cover in most plots. In other words, the accuracy and consistency of judging greater or less than 5% cover has a significant affect on outcome.

The trends in flowering plant numbers of *Thelesperma pubescens* show major increase in three of the four transects over time, with especially large increases at Hickey Mountain Transect 1. The decrease at Cedar Mountain Transect 2 is the exception. It is situated close to a gate, but there was no evidence of increased livestock use and browsing was not noted. One part of the explanation for the high flower numbers on the Hickey Mountain Transect 1 is that many, possibly the majority of flowering plants, had more than one flower head per stem. (Dorn 1983) indicated that it rarely produces more than one flower per individual. It is hypothesized that the mid-summer moisture in 2003 may have promoted production of second flowers, and possibly fostered production of late-to-emerge flowering stems.

The only other trend information on file at WYNDD are observations by Marriott (1988) and Dorn (1989) in which both investigators made visits over a 2-year period. Marriot (1988) noted reduction in flowering plant numbers between 1987-1988, noting drought conditions in the latter year. Dorn (1989) noted no apparent increase or decrease in population extent when comparing populations on Cedar Mountain and Hickey Mountain from 1983-1989. It is reported that the transects on BLM lands were re-read in 1994 (IHI Environmental 1995) and it would be valuable to incorporate these results. It is reported that surveying for *Thelesperma subnudum* was conducted on Wasatch-Cache National Forest in recent years, too, and it would be valuable to incorporate these results.

It was not the original purpose to re-determine an estimate of the total population numbers. However, the three Cedar Mountain transects were read before survey, and this exercise in close inspection indicated that the transects harbored several hundreds of *Thelesperma subnudum* within the 150 m² that they covered. This area is only a very small fraction of occupied habitat, so a point was made of revisiting population size estimates. The 2003 estimates are significantly higher than all previous estimates, also recorded in Table 4 for comparison. This is compelling evidence that there is an increasing trend, though the transect data is the only hard data. One other possible explanation is that the previous estimates represented only flowering plant numbers. The nonflowering plants are far more numerous and inconspicuous. The 2003 transect work indicated that they are well over 10X more numerous than flowering plants. The proportion of nonflowering plant numbers may also decline in harsh

Figure 10. *Thelesperma pubescens* cover - baseline (1988)

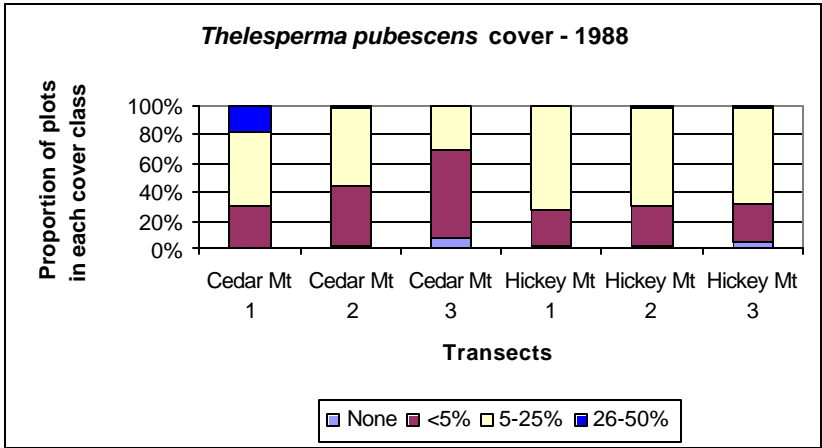


Figure 11. *Thelesperma pubescens* cover - 15 years later (2003)

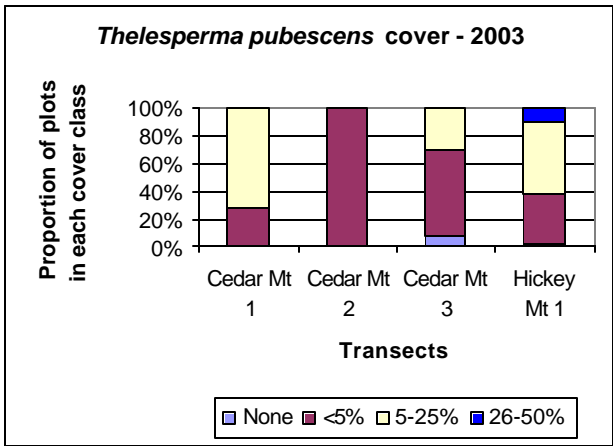
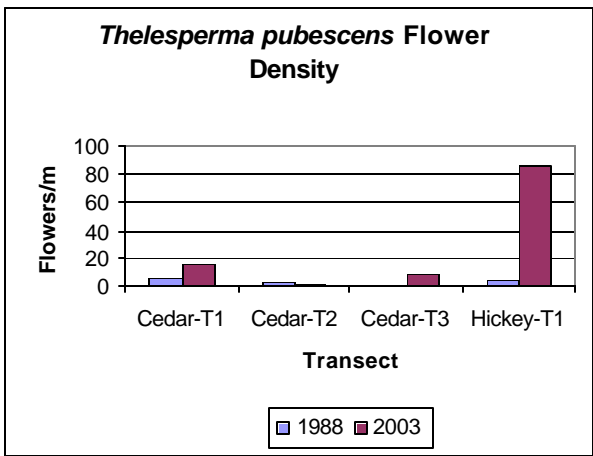


Figure 12. *Thelesperma pubescens* trends in flowering (1988-2003)



years. More time is required using GPS readings to record subpopulation dimensions, and take multiple density subsamples in subpopulations if the precision of subpopulation and population estimates are to be increased.

Table 5. Mean cover of *Thelesperma pubescens* - 1988 and 2003

Transect	Mean cover of <i>Thelesperma pubescens</i> - 1988	Mean cover of <i>Thelesperma pubescens</i> - 2003
Cedar Mt - Transect 1	15.4	11.5
Cedar Mt - Transect 2	9.9	2.5
Cedar Mt - Transect 3	6.0	3.6
Hickey Mt - Transect 1	11.4	12.5
Hickey Mt - Transect 2	11.9	-
Hickey Mt - Transect 3	10.6	-

In light of the shortcomings in calculating a mean cover of *Thelesperma pubescens* for each transect (broad cover classes and skewedness within the cover class categories), it does not warrant consideration for comparing mean transect cover values over time. The merits of calculating flowering stem numbers need at least two consecutive years data for evaluation. The sharp decline in flowering stem numbers at Cedar Mountain - Transect 2 warrants further investigation. This is the harshest of transect sites in terms of steepness and aspect, and may or may not reflect microhabitat.

The monitoring results document that trends are stable or declining slightly. Incorporation of 1994 monitoring data would be ideal before drawing conclusions.

Population Biology and Ecology

Thelesperma pubescens sometimes begins to flower in late June but generally does not flower until early or mid July. Occurrences have been noted in full flower on Hickey Mountain North and on Sage Creek Mountain in the last week of June 1994 at the time that *Townsendia microcephala* was surveyed (Fertig 1995b). Flowering continues into mid August, at least under favorable conditions. Fruits are shed beginning about the end of August (Dorn 1989). In 2003, it appeared that emergence of flowering stems was staggered, with some flowering stems beginning to elongate after most flowering had finished, and many flowering stems producing a second flower head under favorable moisture conditions.

Pollinators are not known. Multiple insect visitors were noted during calm periods including a short-bodied moth with a single conspicuous eyespot, and a long-tailed dipteran, both at Hickey Mountain South. The more common species of *Thelesperma* that are widely grown are rhizomatous, but *Thelesperma pubescens* and closely-related species have no known adaptations for vegetative reproduction.

The seed lacks a pappus so the seed likely drops close to the parent plant. It may be wind-blown because of the exposed surface. The seeds are likely to become wedged in nooks on the rough surface where they remain until conditions are favorable for germination (Dorn 1989).

There is no information available on seed germination and seed biology of *Thelesperma pubescens*. If seeds do not fall until late August, and fall precipitation is low, then it would be adaptive to have a temperature-dependent dormancy-breaking mechanism to postpone germination until spring.

The longevity and mean lifespan of *Thelesperma pubescens* are not known. The age of individual plants is not apparent on casual inspection, but the size of the perennating organ may be an indication. In this case, either the girth of the caudex or length of the caudex that is covered by leaf bases of previous years might be indications of age. Dorn (1989) observed young plants at each population occurrence, suggesting at least some recruitment, but noted that the harsh habitat may constrain overall population growth (discussed in IHI Environmental 1995). There were no signs of cotyledons, but the presence of small plants with few leaves noted in transects in 2003 may correspond with first-year plants.

Current Management and Potential Threats

All four BLM populations of *Thelesperma pubescens* are within Special Status Plant Areas of Critical Environmental Concern (ACEC) established in 1997 by the BLM Rock Springs Field Office (USDI BLM 1997) for the primary purpose of sensitive species conservation. The management objectives are to prevent destruction or loss of special status plant species, provide opportunities for enhancing or expanding habitat, and providing sufficient protection to prevent their listing as threatened and endangered species (USDI BLM 1997). The ACEC boundaries were not listed in planning documents, and it is appropriate to confirm that they correspond with known *Thelesperma pubescens* distribution, amending boundaries as needed.

The ACEC's are closed to direct surface disturbing activities or any disrupting activities, the location of mining claims (withdrawals from mineral location and entry were to have been pursued), no surface occupancy and surface disturbing activities, no mineral material sales, and no use of explosives and blasting. The case of an oil well being developed on Cedar Mountain beside *Thelesperma pubescens* may shed light on the effectiveness of ACEC designation. This designation also closed the areas to off-road vehicle travel, and added provisions for evaluation of allotment management plans and wild horse management in the area to be compatible with ACEC objectives (USDI BLM 1997). The following headings are in the same as those presented in the *Thelesperma pubescens* conservation plan (IHI Environmental 1995), followed by notes from the 2003 field surveys.

Road Development

All of the high plateaus where the species occurs have roads to them, at different levels of development and places over time. Road developments were cited as the most likely cause of existing human impacts to the species (IHI Environmental 1995), while noting Dorn's (1989) suggestion that minor disturbances such as road cuts may actually provide additional habitat. The

Figure 13. The "summits" of mountains occupied by *Thelesperma pubescens* are high, isolated outwash pediments below the Uinta Mountains (looking south), as shown on Cedar Mountain. They are part of large grazing allotments and the perimeter bands of rim habitat are designated as Areas of Critical Environmental Concern, by B. Heidel



Figure 14. The Cedar Mountain Road is the most developed road system to *Thelesperma pubescens* habitat in Wyoming, and runs parallel to occupied habitat for over 4 miles. Segments of the right-of-ways are densely invaded by *Bromus tectorum* (foreground), by B. Heidel



biggest population also has the most well-developed road access open with regular traffic by 2-wd vehicles. The northern end of Cedar Mountain is crossed by a BLM road referred to as both the Cedar Mountain Road and the Rim Road. It runs across the top directly along the western rim for over 4 miles. It appears to meet the standards for oil truck traffic, graded to a 2-lane roadbed, with a right-of-way that was about one lane width. Intermittent segments of the road right-of-way had dense, 100% cover of *Bromus tectorum* (cheatgrass) in addition to other annual non-native species. They were widespread though not everywhere along the 4+ miles of road. Any routine road right-of-way maintenance could promote their spread. The road right-of-way is within 50 m of *Thelesperma pubescens* habitat in places. While the rim habitat seems like a harsh setting for *Bromus tectorum* to invade, the proximity of the roadside habitat with its ameliorating microtopography, soils, and road maintenance practices are likely to maintain the presence of *Bromus tectorum* and increase the likelihood of invasion outside of the right-of-way, possibly into *Thelesperma pubescens* habitat.

Motorized vehicle activity in the habitat, as indicated by tire tracks, was identified as a threat to the species during the summer of 1993 (USDI BLM 1997). However, much of its Cedar Mountain rim habitat is fenced off from the adjoining road. This prevents motorists from establishing their own scenic vista pull-off points from the road. A 2-track road extends south from the bladed road and runs along the southern perimeter, where off-road access to the species' habitat is unimpeded. Any enhancement of this spur road would increase the likelihood of unauthorized rim pull-offs into *Thelesperma pubescens* habitat. There were no signs of ORV use noted, consistent with the ACEC designation.

Some of the road access constructions have removed species' habitat where the roadbed cuts through the rims. The northwest rim corner of Sage Creek Mountain appears to have seen recently bull-dozing activity which may have reduced habitat and the Hickey Mountain North road access to the radio tower may have reduced habitat.

Oil and gas exploration and development

Oil and gas development, including drill pads and roads, were identified as having limited impact because the habitat is generally not suited for development (Dorn 1989). Well construction since this time has been located below the mountains, exception for one wellpad constructed on top of Cedar Mountain near the rim that was recently removed and restored (Joanna Forliano personal communication 2004). A pattern of disturbance that may reflect seismic lines was also apparent over large areas of Cedar Mountain. There are also oil developments including tanks constructed close to *Thelesperma pubescens* habitat at the south end of Hickey Mountain on Wasatch-Cache National Forest, though they are located on level terrain, well-removed from the species' ridge habitat. There is an oil well or associated development on a private tract adjoining the BLM portion of the Hickey Mountain South population.

All other active or inactive exploration, drilling, and ancillary developments that were observed incidental to survey were located at least 0.25 mile away and/or 500+ ft below occupied *Thelesperma pubescens* habitat. This includes the Sage Creek Mountain occurrence, where a field of existing and restored oil wells and accompanying roads and pipelines are located

directly to the south. While there may be limited potential for developing oil wells in *Thelesperma pubescens* habitat, ancillary developments, such as road construction, pipeline construction, and accompanying weed invasions, may be as great or greater a potential influence.

Livestock grazing

Intense livestock grazing was identified as a threat for *Thelesperma pubescens* in the past, potentially reducing vigor if not viability (reported on Sage Mountain by Marriott 1988 and Dorn 1989). Marriott added that it was not known whether livestock or wildlife were using the plants. In addition, the 1988-89 period corresponded with drought conditions and animals may have been feeding on species they would not normally use (Marriott 1988).

Stocking numbers were reduced during 2002 and 2003 on the BLM allotments with *Thelesperma pubescens* (Joanna Forliano personal communication 2004) and there were no signs of stock or stock use in occupied habitat even though cattle were in the Hickey Mountain North pasture and horses were in the northern of the Sage Creek Mountain pastures at the time of survey. Cattle in the past have congregated at the south end of Hickey Mountain (Joanna Forliano personal communication).

It appeared as though there were an abandoned sheepherder's dwelling on Hickey Mountain North. The relative abundance of *Artemisia frigida* and *Chrysothamnus viscidiflorus* there represent vegetation patterns that could be consistent with a history of sheep-grazing. The *Thelesperma pubescens* plants observed on Hickey Mountain North in 2003 appeared to have many flowering stems per plant in a high density, as though caespitose. It is possible, though not proven, that such a growth pattern is associated with the grazing history. There could be other causes for such a pattern if the longevity and resulting growth form of *Thelesperma pubescens* were different on Hickey Mountain North. Initial inquiry of BLM records was made into local grazing history, but information was not available.

Timber harvests

Thelesperma pubescens does not occupy wooded habitat, though there is woodland in the vicinity of Hickey Mountain occurrences, and pockets or bands of woodland below the other two occurrences. The Poison-Table timber sale on the Wasatch-Cache National Forest was reported to include stipulations for new roads with a clearance survey to be conducted to avoid impacts to potential *Thelesperma pubescens* habitat (cited in IHI Environmental 1995).

Miscellaneous potential threats

The radio tower built on Hickey Mountain North adjoins *Thelesperma pubescens* habitat and any expansion or alteration of surrounding grounds potentially affects the species. The access road to the tower is barely passable to 4-wd vehicles and any road improvements would greatly increase traffic.

There is no known herbicide use in the area of *Thelesperma pubescens* occurrences, but the likelihood increases with introduction of *Bromus tectorum* and other non-native species directly adjoining its habitat.

Quarrying for gravel was identified as a potential threat (Dorn 1989). There were no observed signs of quarrying activity. It is not known whether there are any large demands for gravel apart from road construction. There are few regulations on the source material for road construction projects, and the high quality and high volume of alluvial cobble and gravel represented by the Bishop Conglomerate Formation may represent a commercial source.

Cross-reference to the Conservation Plan (from IHI Environmental 1995)

The original conservation strategy and action plan (IHI Environmental 1995) presented seven prescriptions to meet the conservation goals and six study needs. They are paraphrased and underlined below, followed by a summary of any new information. The first two study needs overlapped with the first two prescriptions. The reader is referred to the original conservation plan for subheadings and discussion.

1. Complete searches of remaining potential habitat areas.

Two areas have been identified as priorities by the potential distribution model (Fertig and Thurston 2003) that have yet to be surveyed. The information on surveys conducted by the U.S. Forest Service is being requested to keep a composite picture of survey work. Any other areas identified as priorities for U.S. Forest Service survey are also important to have on record.

2. Coordinate with the BLM to perform ongoing monitoring studies of population biology to assess stability and trends.

All existing monitoring data are to be synthesized. The monitoring conducted by the BLM in 1994 is requested to develop a broader picture of trends and monitoring needs.

3. Conduct basic plant ecology studies in conjunction with the monitoring studies.

The existing monitoring transects with their measurement of cover were not designed to monitor demography. This calls for very precise mapping of individuals. While there is a need for demographic work, it is recommended that demographic work start with greenhouse studies, which may contribute to taxonomic research by helping sort phenetic from genetic characteristics, and provide information to design any future demographic monitoring efficiently.

4. Amend the Wasatch-Cache National Forest Plan to include a specific Management Prescription for *Thelesperma pubescens*, incorporating the conservation strategy.

The status of the Wasatch-Cache National Forest Plan is not known.

5. Establish an interagency *Thelesperma pubescens* Technical Team to oversee implementation of the Conservation Plan.

Distribution of this report is the first step in determining what steps have been implemented, and whether the respective agencies still recognize a need for such a team.

6. Pursue designation of a cooperative National Forest/BLM management area for the southwest Hickey Mountain occurrence.

This would be compatible with the 1997 Area of Critical Environmental Concern designation by the BLM.

7. Review and amend this Conservation Agreement as new information becomes available.

See 5. (above)

The original conservation plan report (IHI Environmental 1995) presented six study needs for implementing effective species conservation. The first two study needs overlap with the first two prescriptions. There are four additional study needs. The reader is referred to the original report for subheadings and discussion.

1. Habitat evaluation studies are needed to characterize substrate pH, ambient light, temperature, and humidity requirements. A recording weatherstation can be placed at one or more of the occurrences to track site-specific precipitation and temperature conditions during the growing season. This will also provide data regarding prevailing wind patterns, especially high intensity events that may transport seeds to new sites for colonization.

The need for detailed documentation of site attributes would be of value particularly in comparison with Utah populations. This comparison might also suggest parameters to test in greenhouse studies. A recording weather station would be of particular value if detailed demographic monitoring is pursued.

2. Reproductive ecology, including pollination, seed set and seed dispersal studies.

This is a critical aspect of species biology, and it is particularly important to pursue if seed set and seed viability are found to be limiting (see 3. below).

3. Germination studies aimed at developing techniques to establish additional populations.

The viability and germination requirements at different times in the growing season might be examined to assess the importance of reproductive ecology. The species is not represented in seedbanks, and this is an appropriate action. The merit of establishing additional populations of this habitat specialist requires careful consideration.

4. Continued investigation of phylogenetic relationships.

The phylogenetic work (Hansen 1998, Hansen et al. 2002) is in print, and the conflicting taxonomic treatment of Welsh et al. (2003) offers contrasting interpretations. A stage of fact-finding, consultation, and specimen review is presented to decide on taxonomic conventions or to pursue a research course for advancing taxonomic and status understanding.

It is noteworthy that the distribution of *Thelesperma pubescens* overlaps with one other BLM sensitive species, in addition to some measure of overlap with two other Wyoming species of concern. *Townsendia microcephala* (Cedar Mountain easter-daisy) occupies rim habitat with *Thelesperma pubescens* on Cedar Mountain and Sage Mountain and occurs nowhere else (Fertig 1995b, USDI BLM 1997). This makes it even more geographically restricted than *T. pubescens*. There were still scattered individuals in flower at the time of *Thelesperma pubescens* survey. In addition, *Lesquerella parvula* (narrowleaved bladderpod) overlaps with *Thelesperma pubescens*

at Hickey Mountain South and Cedar Mountain. Finally, the most extensive population of *Ceanothus martinii* (Utah mountain-lilac) in Wyoming grows on the most exposed Cedar Mountain rim slopes, though on steeper, unstable slopes in different position and aspect compared to *Thelesperma pubescens*. A broader botanical and ecological assessment of all four sites may be warranted.

In summary, this report is an update to the original status and monitoring reports. Stable or slightly decreasing trends in *Thelesperma pubescens* cover are documented on four permanent transects on BLM lands, and predominant increases in flower head numbers. The latter appears to be influenced by climate, so has secondary value in determining trends. This report summarizes subsequent taxonomic, status, and distribution information. It did not have the benefit of survey and monitoring data that has been collected by BLM and U.S. Forest Service, which are to be incorporated before drawing monitoring and status conclusions. It provides a framework for updating boundaries to Areas of Critical Environmental Concern on BLM lands. The monitoring, status compilation, coordination, and taxonomic overview represented by this report are intermediate steps toward a cohesive status picture and planning framework.

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Appendix A. *Thelesperma pubescens* element occurrences

WYOMING NATURAL DIVERSITY DATABASE
-Element Occurrence Record-

THELESPERMA PUBESCENS Number: 001
Common Name: UINTA GREENTHREAD PDAST980B0
Data Sensitive?: Y Identification verified: Y
TNC Global Rank: G1 WYNDD State Rank: S1
Federal Status: WY Distribution Note: ENDEMIC
Management Status: WY BLM SSL
S-USFS R4

County: Uinta
USGS Quad Name: LONETREE
Latitude: 410600N Longitude: 1101300W
South Lat: 410500N East Long: 1101223W
North Lat: 410624N West Long: 1101328W
Map Accuracy: Precise; location is within a 75 foot radius of point
on USGS topo map.

Town/Range: Section: T/R/S Comments:
013N114W 13,23-24,26 SEC 13 N4 OF SE4, NE4 OF SW4,
& W2 OF SE4 OF SW4; SEC 23
SE4; SEC 24 SW4; SEC 26 NE4 OF
NW4 OF NE4

Location: Green River Basin, northwest and southeast slopes of
Hickey Mountain, ca 3.5 miles northwest of Lonetree.

Last Observed: 2003-07-27 First Observed: 1982-07-08
Occurrence Rank: A
Rank Comments: Population abundant and widespread; some
disturbance (2-tracks, fences, radio towers).

Data: 2003-07-27: In fruit and late flower, with less
than 50% of plants in vegetative condition. A few
plants have buds, and flowering activity was
probably prolonged by July rains. Highest
densities are in the southeastern subpopulation,
with up to 10-50 plants per square meter, observed by B.
Heidel.

Population is in 10,000 magnitude. Plants on
Hickey Mountain appear to be more clumped as
though caespitose, with multiple flowering stems,
than elsewhere. Also occurs with *Linum lewisii*,
Trifolium andinum, *Phlox muscoides*, *Cymopterus*
acaulis, *Commandra umbellata*, *Chrysothamnus*
viscidiflorus, *Paronychia sessiliflora*, *Artemisia*
tridentata ssp *vaseyana*.

1994-06-26: Sec 13 colony: observed to be locally
common by W. Fertig, especially on small, raised
rockpile hills. Most plants vegetative, but ca 30%
in full flower. Occurs with *Townsendia nuttallii*,
Arenaria hookeri, *Astragalus spatulatus*, and
Hymenoxys acaulis.

1989-07: Population surveyed by R. Dorn. Total
Hickey Mountain population estimated at ca 4000

plants in 110 acres of occupied habitat.
1988-07: Survey by H. Marriott.
1982-08-20: Population observed in fruit by R.
Dorn.
1982-07-08: Population observed in flower by R.
Dorn.

Habitat: Cushion plant community on windswept edges of flat summit and on benches below summit on very coarse soil derived from the Bishop Conglomerate. Summit covered with sagebrush-grassland, but edges are sparsely vegetated. 2003-07-27: Habitat is at edge of tableland, including upper slopes, rocky flat above rim, and on bands of rockpiles, all generally 1-5 m broad, but over 10 m wide in places.

Elevation: 8640-8720 feet Size: 1000 acres
Comments: Elevation range has been adjusted to correspond with boundaries but not population size.

Managed Area: SPECIAL STATUS (CANDIDATE) PLANT SPECIES AREA OF CONCERN
BLM ROCK SPRINGS FIELD OFFICE

Mgmt Comments: Within active oil/gas field. Northern Hickey Mountain appears to have a history of sheep grazing in the past; in any case, more altered tableland vegetation than all other population sites of the species. ACEC recommended by Marriott (1988) and established in 1996 Green River RMP.

Specimens: Dorn, R.D. (3752). 1982. RM; (3823). 1982. RM Holotype.
Heidel (2718). 2003. RM.

Sources: Dorn, R.D. 1989. Report on the status of *Thelesperma pubescens*, a Candidate Threatened species. Prepared for the US Fish and Wildlife Service by Mountain West Environmental Services, Cheyenne, WY.

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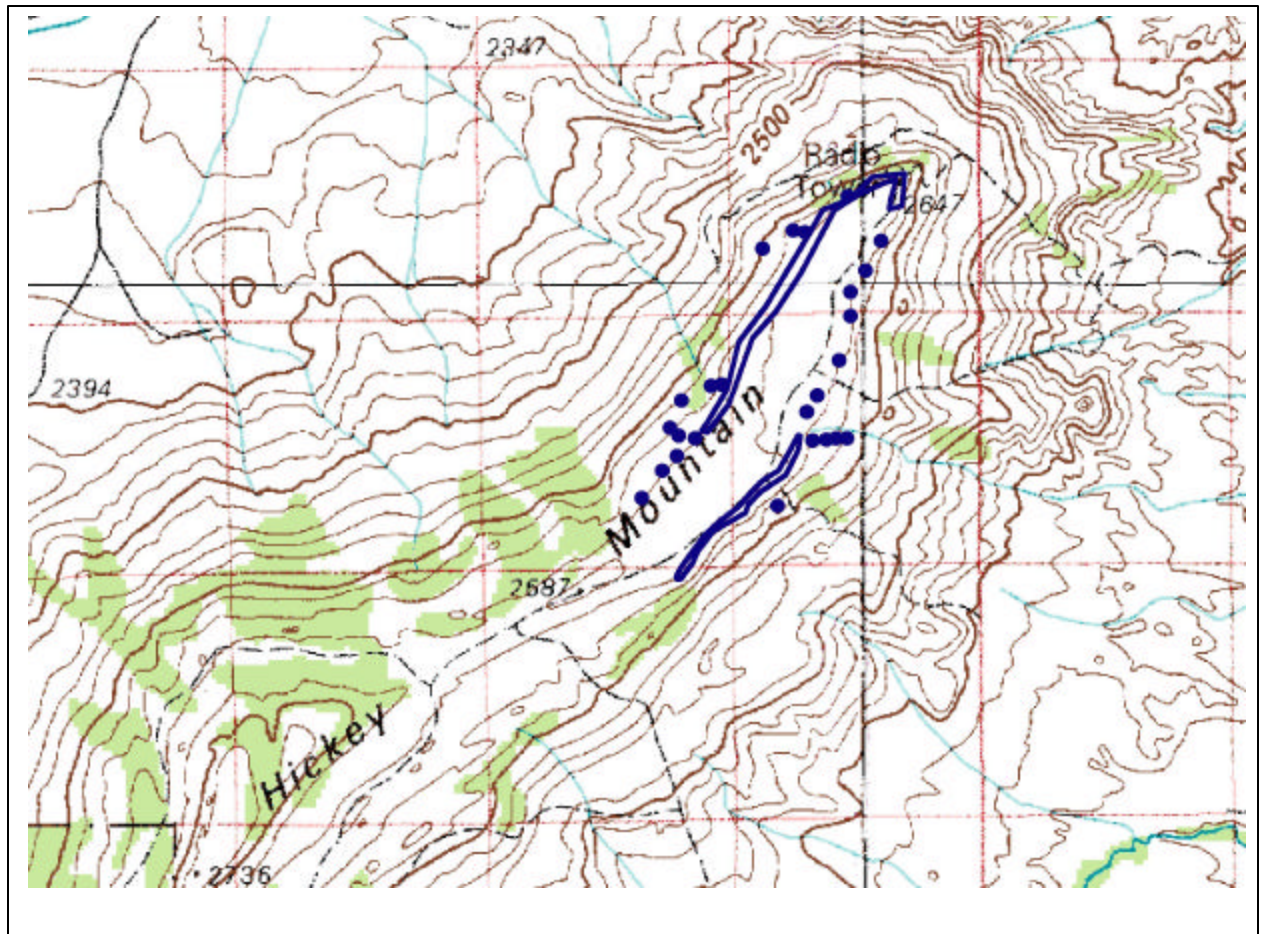
Heidel, Bonnie. Botanist of Wyoming Natural Diversity Database. P.O. Box 3381, University of Wyoming, Laramie, WY. 82071.

Green River Resource Area. 1996. Green River Resource Area Resource Management Plan and Final Environmental Impact Statement. USDI Bureau of Land Management Rock Springs District, Rock Springs, WY.

Author: Walter Fertig

Edition Date: 98-06-11

Thelesperma pubescens
Element Occurrence #001 - Hickey Mountain North
Lonetree Quad (7.5')



— *Thelesperma pubescens*

WYOMING NATURAL DIVERSITY DATABASE
-Element Occurrence Record-

THELESPERMA PUBESCENS
Common Name: UINTA GREENTHREAD
Data Sensitive?: N Identification verified: Y
TNC Global Rank: G1 WYNDD State Rank: S1
Federal Status: WY Distribution Note: ENDEMIC
Management Status: WY BLM SSL
S-USFS R4

Number: 002
PDAST980B0

County: Uinta
USGS Quad Name: REED RESERVOIR
SOAP HOLES RESERVOIR

Latitude: 410835N Longitude: 1100755W
South Lat: 410800N East Long: 1100720W
North Lat: 410855N West Long: 1100807W
Map Accuracy: Precise; location is within a 75 foot radius of point
on USGS topo map.

Town/Range:	Section:	T/R/S Comments:
014N113W	34-35	SEC 34 W4 OF SE4 & S2 OF NE4; SEC 35 SW4SW4
013N113W	03	E4 OF W2 AND SW4 OF NE4

Location: Green River Basin, Sage Creek Mountain, ca 44.5 air
miles east-southeast of Evanston and 7 air miles north
of Lonetree.

Last Observed: 2003-07-28 First Observed: 1979-07-30
Occurrence Rank: B
Rank Comments: Population smallest of known sites, limited
disturbance (2-tracks, fences, grazed).

Data: 2003-07-28: In fruit and late flower with over 75%
of plants in vegetative condition. Highest
densities are 10-50 plants per square meter, but
much sparser in most habitat, observed by B. Heidel.
Population is in
1000 magnitude. Also occurs with *Elymus spicatus*,
Senecio canus, *Paronychia sessiliflora*, *Eriogonm*
brevicaule, *Erigeron compositus*, *Trifolium*
andinum, *Astragalus spathulatus*,
Machaeranthera grindelioides.
1994-06-25: Reported as "common" by W. Fertig. In
flower. Occurs with *Hymenopappus filifolius*,
Townsendia microcephala, *Lesquerella alpina* var.
condensata, *Haplopappus nuttallii*, and *Hymenoxys*
acaulis.
1989-summer: Population estimated at 675 plants by
R. Dorn. Density noted as much sparser than on
Hickey or Cedar mountains.

1987-07-23: Common in appropriate habitat.

1979-07-30: Observed in flower by A. Aldrich. With *Eriogonum brevicaule*, *Astragalus*, and *Draba oligosperma*.

Habitat: Cushion plant community on edges of flat summit of rocky outcrop on very coarse soil derived from Bishop Conglomerate. Summit is covered with sagebrush-grassland, but edges are sparsely vegetated.
2003-07-28: Habitat is concentrated at rim and upper slope in bands, mostly 1-5 m wide.

Elevation: 8380-8420 feet Size: 400 acres

Comments: The elevation range of the EO has been edited to correspond with mapped boundaries, but not the EO size.

Managed Area:

SPECIAL STATUS (CANDIDATE) PLANT SPECIES AREA OF C
BLM ROCK SPRINGS FIELD OFFICE

Ownership:

Mgmt Comments: The road access at the north end has been graded recently. At least 5 roads onto the top have been established with grading equipment; perhaps 3 still in use. The ACEC was established in the 1996 Green River RMP. The tableland is crossed by a fenceline and grazed by horses.

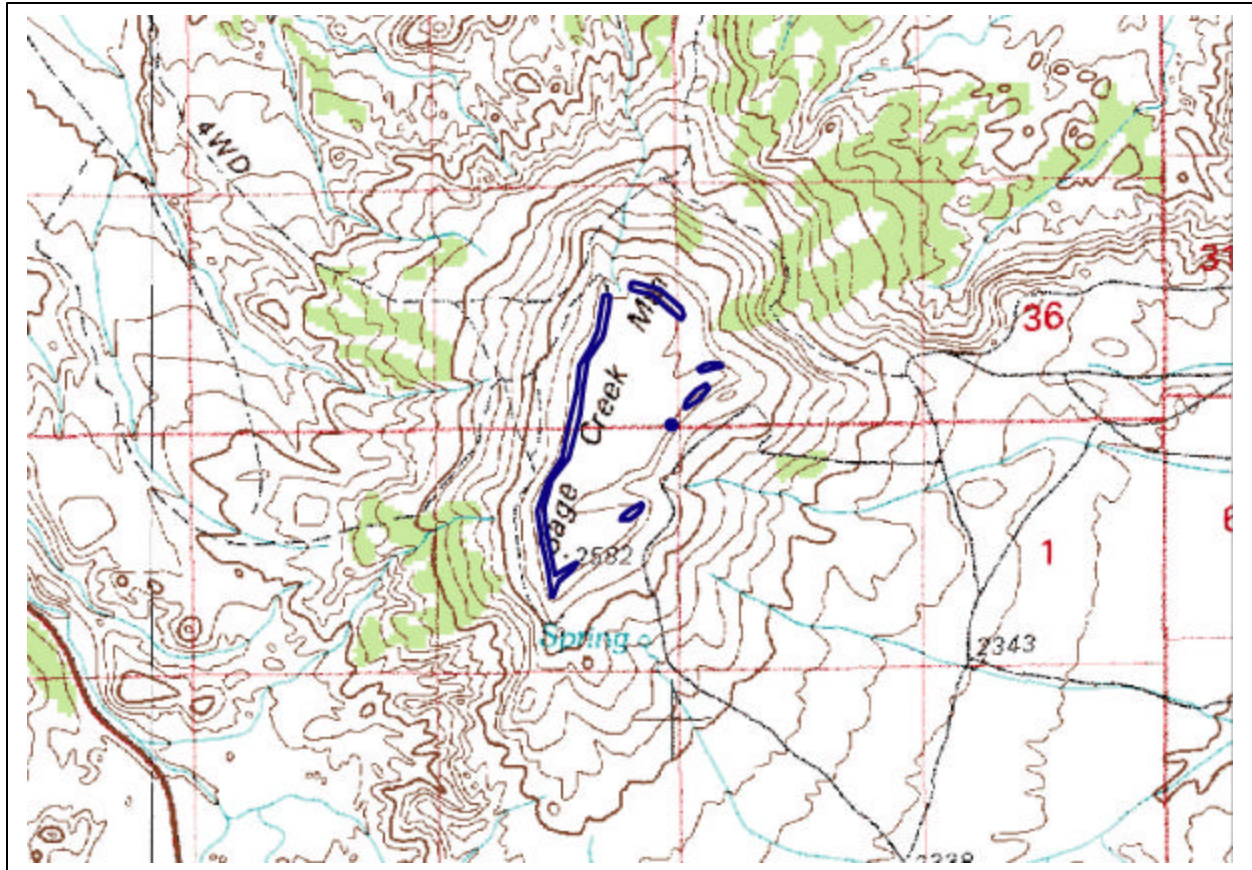
Specimens: Aldrich, A. (592). 1979. RM.
Fertig, W. (14916). 1994. RM, CWC.

Sources: Marriott, Hollis J. Former Heritage Botanist, WYNDD, and former Public Lands Coordinator, The Nature Conservancy. 655 N. Cedar, Laramie, WY 82070. (307) 721-4909.
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Marriott, H.J. 1988. Draft habitat management plan for threatened, endangered and sensitive plant species and their habitats on the Rock Springs District, Bureau of Land Management. Report prepared for the BLM by the Wyoming Natural Diversity Database, Laramie, WY.

Author: Walter Fertig

Edition Date: 94-12-07

Thelesperma pubescens
Element Occurrence #002 – Sage Creek Mountain
Reed Reservoir and Soap Holes Reservoir Quads (7.5')



— *Thelesperma pubescens*

Data: 2003-07-26: In fruit and late flower with over 50% of plants in vegetative condition. A few plants have buds, and flowering activity was probably prolonged by July rains. Highest densities are 10-50 plants per square meter, observed by B. Heidel. Population is in 100,000 magnitude. Also occurs with *Elymus spicatus*, *Cercocarpus montanus* "ribbons" and margins, *Eremogone hookeri*, *Paronychia sessiliflora*, *Astragalus spathulatus*, *Hymenoxys filifolius*, *Erigeron compositus*, *Carex filifolia*, *Oryzopsis congesta*, *Elymus lanceolatus*, *Senecio canus*, *Haplopappus acaulus*, *Eriogonum brevicaule*, *Machaeranthera grindelioides*.
1999-07-04: Sec 10 SW4SE4 colony: observed in flower by R. Dorn. Occurs with *Hymenopappus*, *Arenaria hookeri* and *Cryptantha caespitosa*.

1994-06-11:

Habitat: Edges of flat summit & uppermost slopes on very coarse soil derived from Bishop conglomerate. Summit covered with sagebrush-grassland, but summit edges sparsely-vegetated. 2003-07-26: Habitat is in a wide variety of edge settings in bands 1-10+ m wide.

Elevation: 8040-8540 feet Size: 10000 acres

Comments: Two belt transects were established for monitoring species cover in 1988; re-read in 2003. The estimated population acreage has not been re-examined.

Managed Area:

SPECIAL STATUS (CANDIDATE) PLANT SPECIES AREA OF C
BLM ROCK SPRINGS FIELD OFFICE

Ownership:

Mgmt Comments: The road crossing Cedar Mountain has graded road shoulders with abundant *Bromus tectorum* that has not spread as of 2003. Traffic is relatively heavy. A fenceline separates the road from the adjoining rim, limiting recreational access.

Specimens: Dorn, R. (3858). 1988., (8016, 8019). 1999. RM.
Refsdal, C. (693, 983). 1994. RM; (5783) 1995. RM.
Fertig, W. (14908). 1994. RM.
Refsdal, C. and R.H. Lathrop. (697). 1994. RM.
Heidel, B. (2412). 2003. RM.

Sources: Marriott, Hollis J. Former Heritage Botanist, WYNDD, and former Public Lands Coordinator, The Nature Conservancy. 655 N. Cedar, Laramie, WY 82070. (307) 721-4909.
Dorn, Robert D. Botanical Consultant, Mountain West

Environmental Services, Box 1471, Cheyenne, WY 82003.
(307) 634-6328.

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Neighbours, M. and H. Marriott. 1991. Overlay map and documentation of locations of Category 1 and Category 2 Candidate plant species in Wyoming. Prepared for the US Fish and Wildlife Service, Cheyenne, WY, by the Wyoming Natural Diversity Database, 8 February 1991.

Refsdal, C.H. 1996. A general floristic inventory of southwest Wyoming and adjacent northeast Utah, 1994-1995. Unpublished report prepared for the Bureau of Land Management Wyoming State Office, Bureau of Land Management Vernal Supervisor's Office, US Fish and Wildlife Service, and US Forest Service Region 4 by the University of Wyoming, Rocky Mountain Herbarium, Laramie, WY.

Heidel, Bonnie. Botanist of Wyoming Natural Diversity Database. P.O. Box 3381, University of Wyoming, Laramie, WY. 82071.

Green River Resource Area. 1996. Green River Resource Area Resource Management Plan and Final Environmental Impact Statement. USDI Bureau of Land Management Rock Springs District, Rock Springs, WY.

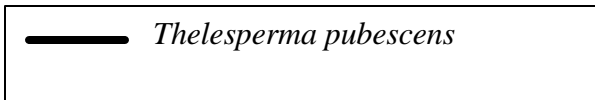
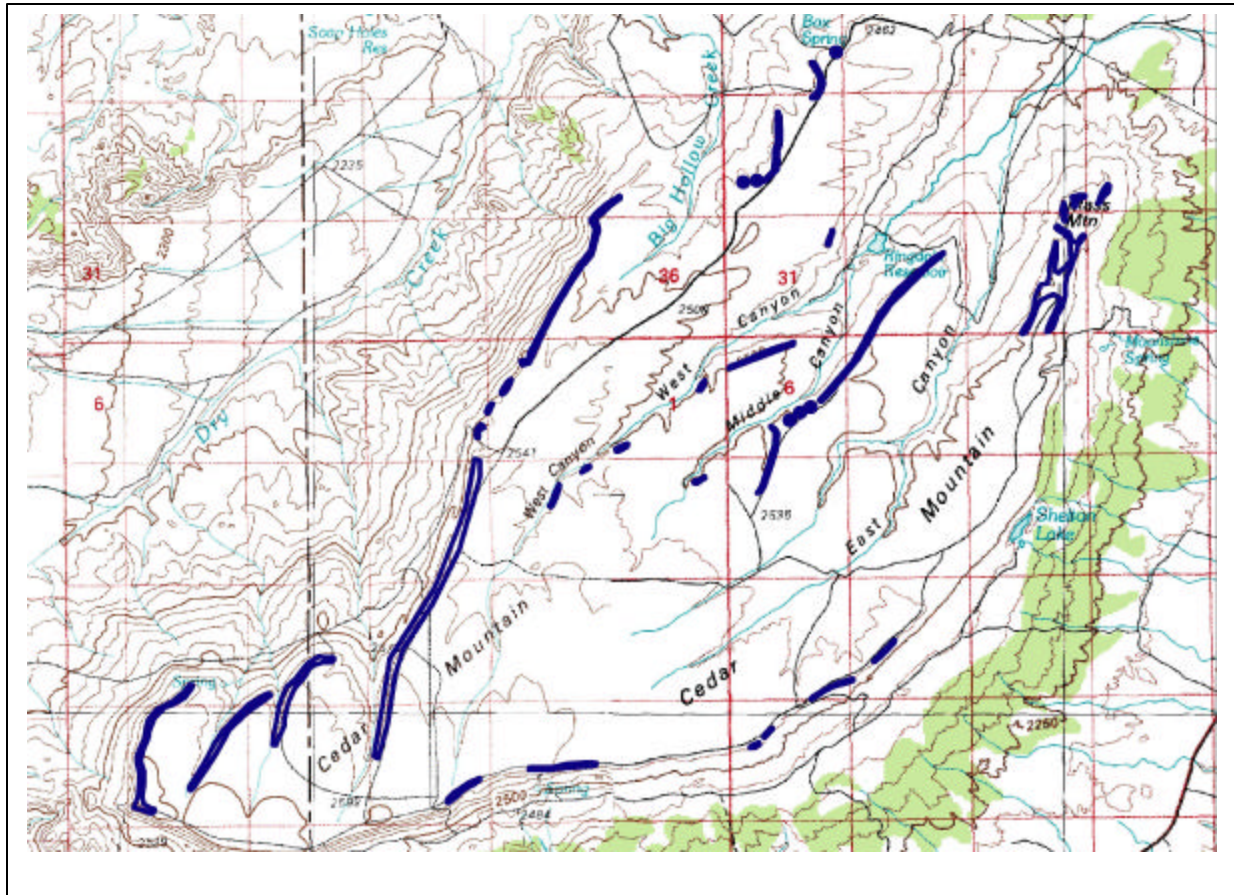
Author: B. Heidel

Edition Date: 03-10-27

Thelesperma pubescens

Element Occurrence #003 – Cedar Mountain

Burntfork, Horse Ranch, McKinnon, and Soap Holes Reservoir Quads (7.5')



WYOMING NATURAL DIVERSITY DATABASE
-Element Occurrence Record-

THELESPERMA PUBESCENS
Common Name: UINTA GREENTHREAD
Data Sensitive?: N Identification verified: Y
TNC Global Rank: G1 WYNDD State Rank: S1
Federal Status: WY Distribution Note: ENDEMIC
Management Status: WY BLM SSL
S-USFS R4

Number: 004
PDAST980B0

County: Uinta
USGS Quad Name: TABLE MOUNTAIN

Latitude: 410340N Longitude: 1101552W
South Lat: 410303N East Long: 1101532W
North Lat: 410410N West Long: 1101626W
Map Accuracy: Precise; location is within a 75 foot radius of point
on USGS topo map.

Town/Range:	Section:	T/R/S Comments:
013N114W	33	E2
012N114W	04	NW4

Location: North slope Uinta Range, southwest summit of Hickey
Mountain and ridge to the southwest, ca 3.5 miles
north of the Utah state line.

Last Observed: 2003-07-27 First Observed: 1987
Occurrence Rank: A
Rank Comments: Most abundant (per acre) and vigorous
occurrence, although not the largest. Major
oil/gas development since 1987.

Data: 2003-07-27: In fruit and late flower, with perhaps
less than 50% of plants in vegetative condition. A
few plants have buds and flowering activity was
probably prolonged by July rains. Highest
densities are 20-100 plants per square meter,
observed by B. Heidel. The
population segment on BLM land approaches or
exceeds 100,000 magnitude. Also occurs with *Elymus*
spicatus, *Paronychia sessiliflora*, *Haplopappus*
acaulis, *Eremogone hookeri*, *Astragalus*
spathulatus, *Erigeron compositus*, *Lesquerella*
parvula, *Artemisia frigida*, *Eriogonum umbellatum*,
Hymenopappus filifolius
1987: Abundant-in places a co-dominant. Plants
most vigorous on ridge at SW end of Hickey
Mountain (taller, more flowers).

Habitat: Edge of flat summit and ridge to SW on very coarse soil
(Bishop Conglomerate, cobble-size fragments common).
Also on cobbly knolls on benches below; habitat open,
sparsely vegetated. 2003-07-27: Habitat is concentrated
above edge in bands mostly 1-5 m wide. Substrate is
sandy loam with gravel pavement, 0-5(35)% slope.

Elevation: 8760-8960 feet Size: 1000 acres

Comments: The elevation range was edited to match with boundaries, but not estimated population acreage. Two transects were established in 1988, the northern one on BLM land was re-read in 2003.

Managed Area:

MOUNTAIN VIEW RANGER DISTRICT
WASATCH-CACHE NATIONAL FOREST
SPECIAL STATUS (CANDIDATE) PLANT SPECIES AREA OF CONCERN
BLM ROCK SPRINGS FIELD OFFICE

Ownership:

Mgmt Comments: The southern end of the population lies above an oil tank, but on rocky terrain above tank and roads.

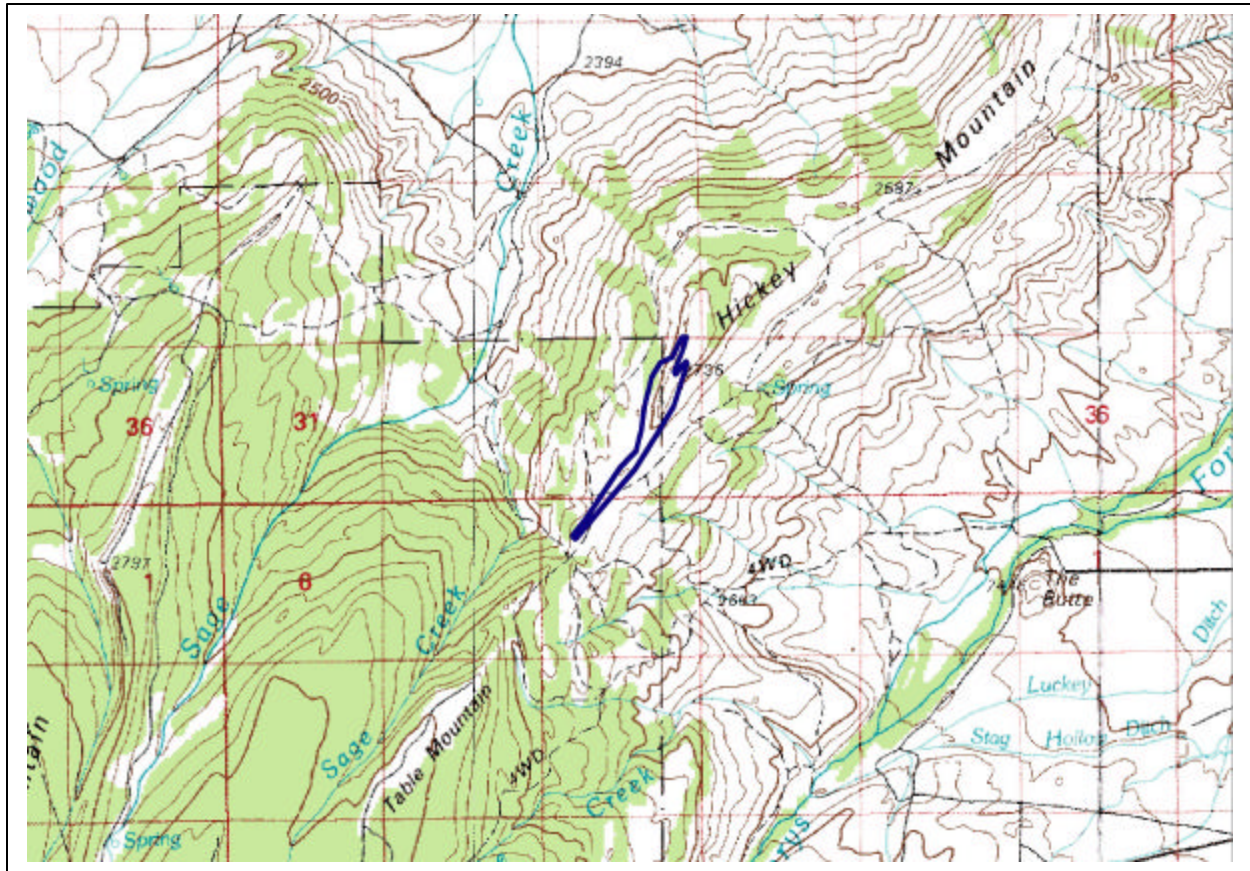
Specimens:

Sources: Marriott, Hollis J. Former Heritage Botanist, WYNDD, and former Public Lands Coordinator, The Nature Conservancy. 655 N. Cedar, Laramie, WY 82070. (307) 721-4909.
Dorn, Robert D. Botanical Consultant, Mountain West Environmental Services, Box 1471, Cheyenne, WY 82003. (307) 634-6328.
Dorn, R.D. 1989. Report on the status of *Thelesperma pubescens*, a Candidate Threatened species. Prepared for the US Fish and Wildlife Service by Mountain West Environmental Services, Cheyenne, WY.
Marriott, H.J. 1988. Inventory and monitoring of *Thelesperma pubescens* (Uinta greenthread), a Category 2 candidate plant species for Federal listing, on Wasatch National Forest and the Rock Springs District, BLM. Report prepared by the Wyoming Natural Diversity Database, Laramie, WY.
Marriott, H.J. 1988. Draft habitat management plan for threatened, endangered and sensitive plant species and their habitats on the Rock Springs District, Bureau of Land Management. Report prepared for the BLM by the Wyoming Natural Diversity Database, Laramie, WY.
Heidel, Bonnie. Botanist of Wyoming Natural Diversity Database. P.O. Box 3381, University of Wyoming, Laramie, WY. 82071.
Green River Resource Area. 1996. Green River Resource Area Resource Management Plan and Final Environmental Impact Statement. USDI Bureau of Land Management Rock Springs District, Rock Springs, WY.

Author: HJ MARRIOTT

Edition Date: 91-03-18

Thelesperma pubescens
Element Occurrence #004 – Hickey Mountain South
Table Mountain Quad (7.5')



— *Thelesperma pubescens*

Appendix B. *Thelesperma pubescens* transect location information

Transect¹	TRS Location	GPS Location	Bearing	Setting
Cedar Mt - 1	T13N R112W S10 center of SE4	N.41.11921 W110.02417	340 mag. N	Transverse across abrupt rim crest + trail
Cedar Mt - 2	T13N R112W S15 W edge NW4 NE4	gap	5 mag. N	Transverse across gentle rim slope
Cedar Mt - 3	T14N R112W S30 NE4 NE4 SW4	N41.16359 W109.97302	28 mag. N	Below rim, parallel to slope
Hickey Mt - 1	T13N R114W S33 NE4 NE4 NE4	N41.06948 W110.26027	170 mag. N.	Above rim crest, on planar
Hickey Mt - 2		-		-
Hickey Mt - 3		-		-

¹ Hickey Mountain transect 2 and transect 3 were not revisited in 2003.

Appendix C. Cedar Mountain Monitoring Data (1988-2003)

Transect Number 1							Transect Number 2							Transect Number 3						
Plot No.	Cover Class (1988)	Cover Class (2003)	Cover Class Change	No. of Flower Heads (1988)	No. of flower heads (2003)	Flower Head No. Change	Plot No.	Cover Class (1988)	Cover Class (2003)	Cover Class Change	No. of Flower Heads (1988)	No. of flower heads (2003)	Flower Head No. Change	Plot No.	Cover Class (1988)	Cover Class (2003)	Cover Class Change	No. of Flower Heads (1988)	No. of flower heads (2003)	Flower Head No. Change
1	15	15	0	0	4	4	1	15	2.5	-12.5	0	0	0	1	2.5	2.5	0	1	1	0
2	15	15	0	1	6	5	2	2.5	2.5	0	1	1	0	2	2.5	2.5	0	0	0	0
3	15	15	0	1	2	1	3	2.5	2.5	0	0	0	0	3	15	2.5	-12.5	0	1	1
4	15	15	0	0	9	9	4	2.5	2.5	0	0	2	2	4	2.5	15	12.5	0	3	3
5	15	15	0	0	9	9	5	2.5	2.5	0	0	0	0	5	2.5	2.5	0	0	1	1
6	38	15	-23	0	9	9	6	2.5	2.5	0	0	1	1	6	2.5	2.5	0	0	5	5
7	15	15	0	0	5	5	7	15	2.5	-12.5	0	0	0	7	15	2.5	-12.5	1	5	4
8	38	15	-23	1	1	0	8	15	2.5	-12.5	1	0	-1	8	15	2.5	-12.5	1	0	-1
9	2.5	15	12.5	1	5	4	9	15	2.5	-12.5	0	2	2	9	2.5	2.5	0	0	2	3
10	15	2.5	-12.5	0	2	2	10	2.5	2.5	0	0	0	0	10	15	2.5	-12.5	0	3	4
11	15	2.5	-12.5	1	1	0	11	2.5	2.5	0	0	1	1	11	2.5	15	12.5	0	1	1
12	15	15	0	0	5	4	12	2.5	2.5	0	0	0	0	12	15	2.5	-12.5	0	0	0
13	38	15	-23	3	8	5	13	15	2.5	-12.5	0	0	0	13	2.5	2.5	0	0	4	4
14	38	2.5	-35.5	0	0	0	14	2.5	2.5	0	0	2	2	14	2.5	2.5	0	0	5	5
15	15	15	0	1	4	3	15	15	2.5	-12.5	0	0	0	15	15	2.5	-12.5	0	3	3
16	15	15	0	0	6	6	16	15	2.5	-12.5	0	0	0	16	2.5	15	12.5	2	6	4
17	38	15	-23	2	2	0	17	2.5	2.5	0	0	0	0	17	15	2.5	-12.5	0	1	1
18	15	15	0	2	4	2	18	15	2.5	-12.5	0	0	0	18	2.5	2.5	0	1	5	4
19	15	15	0	0	2	2	19	15	2.5	-12.5	0	1	1	19	2.5	2.5	0	0	6	6
20	38	15	-23	1	0	-1	20	38	2.5	-35.5	1	0	-1	20	2.5	2.5	0	0	3	3
21	15	15	0	2	4	2	21	2.5	2.5	0	1	1	0	21	15	15	0	0	7	7
22	15	15	0	0	0	0	22	15	2.5	-12.5	0	0	0	22	15	15	0	0	4	4
23	2.5	15	12.5	0	1	1	23	15	2.5	-12.5	0	0	0	23	15	2.5	-12.5	0	0	0
24	15	15	0	0	5	5	24	2.5	2.5	0	0	0	0	24	2.5	2.5	0	0	1	1
25	2.5	15	12.5	0	0	0	25	2.5	2.5	0	1	1	0	25	2.5	2.5	0	0	1	1
26	15	15	0	0	0	0	26	15	2.5	-12.5	2	1	-1	26	15	2.5	-12.5	0	4	4
27	15	15	0	1	1	0	27	15	2.5	-12.5	0	0	0	27	15	2.5	-12.5	0	6	6
28	15	15	0	1	4	3	28	15	2.5	-12.5	1	1	0	28	15	2.5	-12.5	0	1	1
29	15	15	0	2	3	1	29	2.5	2.5	0	1	0	-1	29	2.5	2.5	0	1	0	-1
30	15	2.5	-12.5	10	3	-7	30	15	2.5	-12.5	1	0	-1	30	15	2.5	-12.5	0	2	2
31	15	2.5	-12.5	1	2	1	31	15	2.5	-12.5	2	0	-2	31	2.5	2.5	0	0	4	4
32	38	15	-23	1	1	0	32	15	2.5	-12.5	3	0	-3	32	0	2.5	2.5	0	0	0
33	15	15	0	0	14	14	33	0	2.5	2.5	0	0	0	33	2.5	2.5	0	0	5	5
34	2.5	15	12.5	0	5	5	34	15	2.5	-12.5	2	0	-2	34	2.5	2.5	0	0	1	1
35	15	15	0	4	11	7	35	15	2.5	-12.5	3	1	-2	35	2.5	2.5	0	0	1	1
36	2.5	15	12.5	1	12	11	36	2.5	2.5	0	0	0	0	36	2.5	2.5	0	0	1	1
37	2.5	15	12.5	3	4	1	37	15	2.5	-12.5	4	1	-3	37	0	2.5	2.5	0	0	0
38	15	15	0	0	1	1	38	15	2.5	-12.5	2	0	-2	38	2.5	2.5	0	0	0	0
39	38	2.5	-35.5	9	0	-9	39	2.5	2.5	0	0	0	0	39	2.5	2.5	0	0	0	0
40	2.5	15	12.5	0	8	8	40	15	2.5	-12.5	3	0	-3	40	2.5	2.5	0	0	1	1
41	15	2.5	-12.5	4	5	1	41	2.5	2.5	0	1	1	1	41	2.5	2.5	0	0	5	5
42	2.5	2.5	0	1	6	5	42	2.5	2.5	0	4	0	-4	42	2.5	2.5	0	0	4	4
43	38	15	-23	8	8	0	43	15	2.5	-12.5	2	0	-2	43	2.5	2.5	0	0	1	1
44	2.5	2.5	0	0	3	3	44	15	2.5	-12.5	0	0	0	44	2.5	2.5	0	0	0	0
45	2.5	2.5	0	3	1	-2	45	2.5	2.5	0	0	1	1	45	2.5	2.5	0	0	2	2
46	2.5	2.5	0	0	0	0	46	15	2.5	-12.5	3	0	-3	46	15	2.5	-12.5	0	4	4
47	2.5	15	12.5	4	4	0	47	15	2.5	-12.5	0	4	4	47	2.5	2.5	0	0	2	2
48	2.5	2.5	0	0	3	3	48	2.5	2.5	0	2	0	-2	48	2.5	0	-2.5	0	0	0
49	2.5	2.5	0	0	2	2	49	15	2.5	-12.5	0	2	3	49	0	0	0	0	0	0
50	2.5	2.5	0	0	1	1	50	2.5	2.5	0	1	0	-1	50	0	0	0	0	0	0

Appendix X. Hickey Mountain Monitoring Data (1988-2003)

Transect Number 1							Transect Number 2				Transect Number 3				
Plot No.	Cover class (1988)	Cover class (2003)	Cover Class Change	No. of flower heads (1988)	No. of flower heads (2003)	Flower Head No. Change	Plot No.	Cover class (1988)	No. of flower heads (1988)		Plot No.	Cover class (1988)	No. of flower heads (1988)		
1	5	25	-12.5	1	2	1	1	5	0		1	5	3		
2	5	25	-12.5	1	8	7	2	5	0		2	5	1		
3	5	5	0	1	27	26	3	2.5	3		3	2.5	3		
4	5	25	-12.5	0	11	11	4	5	2		4	5	4		
5	2.5	25	0	0	0	0	5	5	1		5	5	3		
6	5	25	-12.5	1	3	2	6	2.5	1		6	5	0		
7	2.5	25	0	0	3	3	7	2.5	0		7	5	0		
8	5	5	0	2	17	15	8	5	1		8	5	3		
9	5	25	-12.5	3	6	3	9	2.5	0		9	5	0		
10	5	25	-12.5	0	9	9	10	2.5	0		10	5	1		
11	2.5	0	-2.5	0	0	0	11	5	2		11	5	1		
12	2.5	25	0	1	6	5	12	5	1		12	5	2		
13	0	25	25	0	0	0	13	5	2		13	5	1		
14	2.5	5	125	1	51	50	14	5	0		14	5	3		
15	2.5	5	125	3	37	34	15	5	0		15	5	0		
16	5	38	23	3	43	40	16	5	0		16	5	0		
17	2.5	5	125	1	34	33	17	5	2		17	2.5	0		
18	2.5	5	125	0	33	33	18	5	1		18	5	0		
19	2.5	5	125	0	34	34	19	5	2		19	2.5	0		
20	2.5	38	35.5	0	67	67	20	2.5	2		20	2.5	0		
21	5	5	0	0	44	44	21	38	0		21	2.5	0		
22	5	5	0	0	20	20	22	5	0		22	2.5	0		
23	5	5	0	1	11	11	23	5	2		23	5	0		
24	5	5	0	0	19	19	24	5	0		24	5	0		
25	5	5	0	0	16	16	25	5	11		25	5	0		
26	5	5	0	2	45	43	26	5	1		26	5	3		
27	5	5	0	0	44	44	27	5	0		27	5	1		
28	5	25	-12.5	2	18	16	28	5	4		28	5	2		
29	5	5	0	1	24	23	29	5	1		29	5	0		
30	5	5	0	0	15	15	30	5	6		30	5	1		
31	5	25	-12.5	3	8	5	31	5	1		31	2.5	0		
32	5	5	0	0	24	24	32	5	1		32	2.5	0		
33	5	5	0	1	22	21	33	5	0		33	2.5	1		
34	5	25	-12.5	1	16	15	34	5	1		34	2.5	0		
35	5	38	23	0	51	51	35	5	1		35	2.5	0		
36	5	5	0	0	25	25	36	5	1		36	2.5	0		
37	5	25	-12.5	0	8	8	37	5	11		37	0	0		
38	5	5	0	1	11	11	38	5	1		38	0	0		
39	5	25	-12.5	7	6	-1	39	5	2		39	2.5	0		
40	5	25	-12.5	6	11	5	40	2.5	0		40	5	0		
41	5	5	0	1	30	29	41	2.5	0		41	5	1		
42	5	38	23	3	31	28	42	5	0		42	5	0		
43	5	38	23	0	30	30	43	5	5		43	2.5	0		
44	5	5	0	1	27	26	44	5	0		44	5	0		
45	2.5	5	125	0	17	17	45	2.5	0		45	5	3		
46	5	5	0	0	45	45	46	2.5	0		46	5	0		
47	2.5	25	0	0	18	18	47	2.5	0		47	5	0		
48	2.5	25	0	0	10	10	48	0	0		48	5	2		
49	5	5	0	0	24	24	49	2.5	0		49	5	0		
50	5	5	0	0	5	5	50	2.5	2		50	2.5	0		

THELESPERMA PUBESCENS
UINTA GREENTHREAD
Family: Asteraceae

Status:

US Fish & Wildlife Service: None,
formerly a C2 candidate for listing under the
Endangered Species Act
Agency Status: USFS Region 4 Sensitive,
WY BLM Sensitive

Heritage Rank:

Global: G1 State: S1
WYNDD Plant List: State or regional
endemic (under review)
(Very High Wyoming Contribution Rank)

Description: Uinta greenthread is a perennial herb from a thick, woody, branched caudex and taproot covered with old leaf bases. Flowering stems are 3-12 cm high, glabrous, and mostly leafless. Basal leaves are 1-5 cm long, pinnately compound with 3-5 linear leaflets, and densely short gray-hairy. Flower heads occur singly or rarely in pairs and have 2 rows of unequal scarious-margined bracts, with the outer bracts shorter and often reflexed. Ray flowers are absent. Disk flowers are yellow, 5 mm long, and lack a pappus. Achenes are glabrous, angular, about 4 mm long, and subtended by a long membranous bract (Dorn 1983, 1989; Marriott 1988; Fertig et al. 1994).

Similar Species: *Thelesperma caespitosum* has glabrous leaf blades. Other Wyoming species of *Thelesperma* have conspicuous ray flowers, leafy stems, or glabrous herbage. *Hymenopappus filifolius* has long cobwebby pubescence, scale-like pappus, and many flower heads per stem. Rayless *Erigeron compositus* specimens have hair-

like pappus bristles and a single row of involucre bracts.



Above: *Thelesperma pubescens*, by Hollis Marriott.

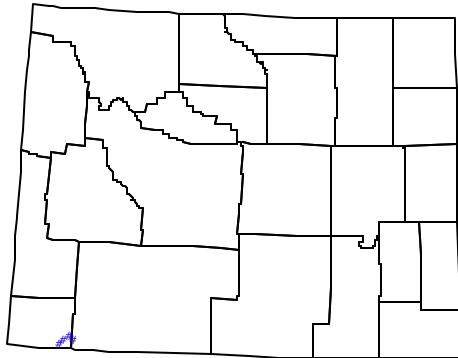
Synonyms: *Thelesperma pubescens* Dorn var. *pubescens*, *T. subnudum* A. Gray var. *pubescens* (Dorn) S. Welsh

Flowering/Fruiting Period: July- August.

Distribution: Endemic to flanks of the northern Uinta Range in southwest Wyoming (Uinta and Sweetwater counties) and the Tavaputs Plateau in northeast Utah (Duchesne County).

Habitat: Uinta greenthread grows on cobbly soils, typically along the summit edges of relict surfaces that now stand as isolated "mountains". These mesa-like mountains are

capped with the Bishop Conglomerate and are sparsely vegetated with cushion plant communities and sagebrush grasslands, sometimes part of mountain mahogany communities below the rim (Marriott 1988, Dorn 1989, Heidel 2004).



Wyoming distribution of *Thelesperma pubescens*.

Occurrences in Wyoming: Known from 4 extant occurrences in Wyoming, most recently observed in 2003, and from 3 occurrences in Utah.

Abundance: Heidel (2004) estimated the total population numbers on the order of 100,000 individuals, including nonflowering plants, covering 540 acres.

Trends: Trends in cover of *Thelesperma pubescens* between 1988-2003 are stable or decreasing slightly (Heidel 2004).

Protection status: Four BLM populations are within Special Status Plant ACECs established by the Rock Springs Field Office in 1997.

Threats: Populations are potentially threatened by road construction, and surface disturbances associated with oil and gas exploration and development, including potential weed invasion.



Above: Habitat of *Thelesperma pubescens* on wind-blasted rims of Bishop Conglomerate, by Hollis Marriott.

Managed Areas: Occurs on lands managed by the BLM Rock Springs Field Office and the Wasatch-Cache National Forest.

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