

SEUTP Colorado River Mapping & Inventory Summary

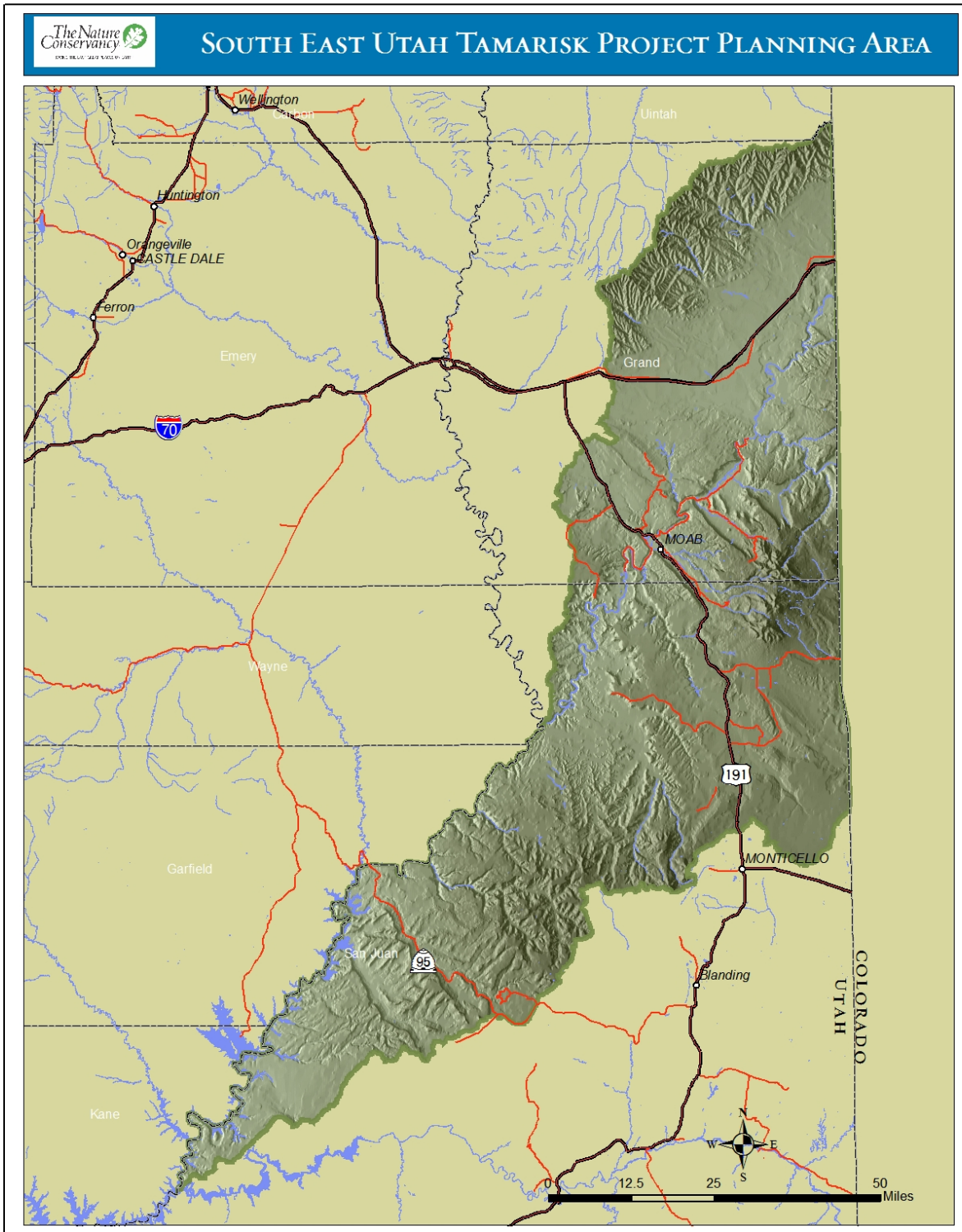
Inventory Background & Objectives: In the development of the Southeastern Utah Tamarisk Partnership (SEUTP) *Woody Invasive Species Management Plan*, the Tamarisk Coalition mapped and inventoried tamarisk infestations along the main stem of the Colorado River and its major and minor tributaries from the Colorado/Utah state line to the San Juan River's confluence with Lake Powell (see Figure 1). The purpose of this mapping effort is to gain a comprehensive understanding of the tamarisk infestation in the Southeastern Utah Tamarisk Partnership (SEUTP) planning area in an economical manner. Quantifying and characterizing the tamarisk infestations throughout the watershed provides a wealth of information for many diverse users. Russian olive was also noted when encountered in this effort, and is most prevalent in the Moab area. The data produced provides large-scale planning level information that can support state, federal, and local policy and decision-making concerning tamarisk control and riparian restoration efforts. Land managers, however, must take into consideration the site specific conditions of each land parcels landowner preferences to select appropriate tamarisk control and revegetation methods.

Inventory and mapping were performed during the spring and summer of 2007 and coordinated with the U.S. Geological Survey's (USGS) efforts to establish a national on-line database conforming to the North American Weed Management Association's mapping standards. Over 850 cumulative miles of the Colorado River and tributaries were surveyed using this approach. This information, in the form of shapefiles and attribute data, has been uploaded onto a digital GIS database which soon will be available on the USGS invasive species website, www.niiss.org.

Goal: The goal of this mapping and inventory project is to efficiently identify 85 to 90 percent of the tamarisk infestations in the SEUTP planning area. This goal is achieved through the inventory approach described below. The remaining 10 to 15 percent of infestations are scattered among minor tributaries and headwaters which can cost more to find than to control. These small, scattered infestations are best identified as a minor component of larger scale control projects.

Mapping Approach: : The Tamarisk Coalition mapped tamarisk infestations along the main stem of the Colorado River and its major tributaries from the Colorado/Utah state line to the San Juan River's confluence with Lake Powell. The photo interpreting approach was derived from protocols developed by the Tamarisk Coalition and commissioned by the Colorado Water Conservation Board (CWCB) to map tamarisk infestations on all major river systems in Colorado. However, those protocols required extensive ground-truthing which is time consuming and relatively expensive. Due to the time and monetary constraints of this mapping project, photo interpretation was the primary method of tamarisk identification and data acquisition. This revision was a result of reflection and experience gleaned from the past mapping effort. John Dohrenwend, a mapping expert residing in Moab, Utah and member of SEUTP, lent his knowledge to improve the accuracy of the mapping approach.

Figure 1: Southeast Utah Tamarisk Partnership planning area of the Colorado River Watershed



The result of these efforts is a comprehensive dataset providing essential information to develop control and revegetation cost estimates, and to better understand impacts wildlife habitat and water losses. The **mapping** approach included seven basic components [Note: whenever tamarisk is indicated, the same inventory and mapping process was used for Russian olive]:

- 1) High resolution aerial and satellite photos were acquired from the USDA's Data Gateway website (<http://datagateway.nrcs.usda.gov/>). These photos were taken in the late summer of 2006 as part of the National Agricultural Imagery Program (NAIP) and are ortho-rectified (usually at 2 meter resolution or better) and are in most cases the most current, consistent source of aerial imagery. These photos were analyzed using a Geographic Information System (GIS) as described below. Imagery provided by Google Earth, free software downloadable at www.earth.google.com, was used as supplemental imagery to increase accuracy.
- 2) These images were then photo interpreted to estimate tamarisk location and density, percent tamarisk cover in upland areas, percent tamarisk cover in riparian areas, the width of the infestation, as well as the presence or absence of cottonwoods, willows, Russian olives, and defoliation possibly caused by the tamarisk leaf beetle, *Diorhabda elongata*. This was accomplished by ground-truthing several locations to gain a thorough understanding of the appearance of tamarisk, willow, cottonwood, and Russian olive on the high resolution aerial imagery and extrapolating that knowledge to surrounding areas. Local knowledge supplemented these limited ground-truthing efforts and a "level of confidence value" was assigned to each area to better inform interested parties of the accuracy reflected in the dataset. Tamarisk locations were recorded using GIS software. Polygons were drawn around suspected tamarisk locations within major riparian corridors in the area and acreages were calculated for each polygon. Each tamarisk polygon created represents a GIS shapefile attached to a set of attribute values. These attributes include the following:
 - a. Tamarisk Density – The estimated percent canopy cover of tamarisk within each polygon
 - b. Percent Upland – The estimated percent of tamarisk canopy cover, within each polygon, where upland plant species would be more prevalent than riparian species after tamarisk control is achieved. These percentages were found using the following criteria:
 - i. For Tributaries –
 1. Tamarisk intermixed with riparian vegetation (e.g. cottonwoods and willows): 30% Upland
 2. Homogenous tamarisk stands downstream of riparian vegetation: 50% Upland
 3. Homogenous tamarisk stands upstream of all other riparian vegetation: 90% Upland
 - ii. For the Colorado Main Stem –

1. Tamarisk in narrow canyons with little to no floodplain and no cottonwoods present, where other riparian vegetation is unlikely to grow: 30% Upland
 2. Tamarisk on floodplains with cottonwoods present: 0% Upland
 3. Tamarisk on or near floodplains far beyond the last cottonwoods: 10% - 20% Upland (discretionary basis)
- c. Percent Riparian – The percent of tamarisk canopy cover within each polygon in the riparian corridor where native phreatophytes such as cottonwoods and willows could exist in the future. This was found by inverting the percent upland value.
 - d. Width of Infestation – Each shapefile was classified as > or < 50 feet, a width above which it is assumed that revegetation would be required following tamarisk removal.
 - e. The Presence or Absence of Cottonwood, Willow, and Russian Olive – Determined by ground-truthing several locations to gain a thorough understanding of their appearance on aerial imagery. Google Earth imagery, used as a reference to increase accuracy, was very helpful in identifying Russian olive.
 - f. The Presence or Absence of *Diorhabda elongata* – The tamarisk stands that were clearly defoliated on the aerial imagery around areas known to be at or near beetle release sites. **No ground-truthing was used and, therefore, this data is merely a reasonable assumption.**
 - g. PI_GT_LK – PI (Photo Interpretation); GT (Ground-Truthing); LK (Local Knowledge) – These designations record the method in which the data from each shapefile was collected. The main sources of local knowledge were anecdotal comments from various county weed managers, state agriculture specialists, the water conservancy district staff, federal weed managers, university researchers, private land owners, and/or others.
 - h. Level of Confidence – Determined by personal knowledge of ecosystem structure, the similarity of the shapefile to sample ground-truthing, the quality of aerial imagery, and the amount of supplemental knowledge from other resources (i.e. ground-truthing, local, or personal knowledge).
- 3) Tamarisk infestations on tributaries to the Colorado River were not mapped where their densities fell below 10%, when levels of confidence dropped to a low level with no likelihood of recovery, or where topography changes led to a rapid drop in confidence levels.
 - 4) Tamarisk was not mapped above 6,500 feet as tamarisk is less invasive above this altitude.

- 5) Following the first round of mapping, a second editing session revisited every shapefile in a cohesive time frame to promote consistency and accuracy. Google Earth was used throughout the editing session as an additional reference.
- 6) The surface of Lake Powell can fluctuate up to 50 feet in any one year as the lake is filled by spring runoff and drained for power production or to satisfy water demands required under the 1922 Colorado River Compact. The result of 40 years of operation is that silt accumulation has occurred at the upper end of Lake Powell and in some side canyons. These are ideal conditions for tamarisk recruitment and they support large monotypic stands of tamarisk, as can be observed from the Hwy 95 Bridge at Hite. Biological control using the tamarisk leaf beetle will be the most practical tamarisk control strategy for this area. Submersion would also be an acceptable solution if significant inflows raise the lake level. As a result, mapping efforts for Lake Powell were restricted to the transition zone of the Colorado River into the lake and a few significant side canyons within the SEUTP area.
- 7) These mapping protocols produce data that is compatible with the national database system created by the National Institute of Invasive Species Science (NIISS - www.niss.org).

Inventory Approach: The inventory quantifies and summarizes the dataset described above. This information is then used to find tamarisk canopy cover acreage and riparian acreage for each shapefile as well as average tamarisk density, average tamarisk acreage per mile, percent riparian habitat, and current water and future losses (acre-feet/year) due to tamarisk infestation. This information is found using the methods described below:

- 1) Tamarisk Canopy Cover Acreage – Found by multiplying each polygon’s acreage by its percent tamarisk cover.
- 2) Riparian Acreage – Found by multiplying each polygon’s acreage by the inverse of its percent upland value.
- 3) Average Tamarisk Density (%) – Found by dividing the tamarisk canopy cover acreage by the total acreage of the polygon.
- 4) Average Tamarisk Acreage per Mile – Found by dividing the tamarisk canopy cover acreage by the cumulative river miles of each river section.
- 5) % Riparian Habitat – Found by dividing the riparian acreage of each polygon by its total acreage.
- 6) Current Water Losses – Based on the amount of water tamarisk is currently using under observed densities minus the water that would be used by native plants.

- 7) Future Water Losses – Assume an infilling of the existing infestation areas (no expansion from existing infested areas) that will likely occur over the next several decades based on similar conditions observed in other states (NM, UT, and NV).

Findings: Tamarisk and Russian olive polygons were projected onto 1-meter high-resolution 2006 aerial photos and converted to user-friendly Adobe PDF files. Because of their very large number (189) and large size (11" x 17"/30+ MB each), these photos are included on the supplementary Data-DVD located in the back of this summary report.

For SEUTP's planning area, the inventories for the Colorado River and its tributaries are presented in tamarisk and Russian olive Tables 1 through 2. Table 1 contains inventory data and presents a summary of the general mapping data (river miles, average density, total acreage, total canopy cover, average acreage per mile, and percent riparian habitat) as well as calculated current and future water losses. Table 2 provides detailed information on each infested area and its unique attributes.

The following summarizes the findings of this mapping and inventory effort:

1. The Colorado River main stem from the UT/CO state line to Lake Powell (280 miles) is infested with 8,850 total acres of tamarisk with an average density of approximately 48%. Riparian land represents over 80 percent of the infested areas. The Scott M. Matheson Wetlands Preserve has the greatest concentration of tamarisk, supporting over 700 acres. Because most of the Colorado River is more incised than the broad floodplain around Moab, the majority of tamarisk infestations tend to be narrow, averaging slightly more than a hundred feet in width.
2. The major tributaries to the Colorado River (Dolores River, Indian Creek, Kane Creek, Mill Creek, Negro Bill Canyon, Mill Creek, North Fork Mill Creek, Pack Creek, and Salt Creek) had an additional 5,010 acres of infestation with an average density of approximately 32% along 162 cumulative stream miles.
3. Thirty minor tributaries of the Colorado River, such as Courthouse Wash and Dark Canyon, are infested with an additional 8,420 acres of tamarisk. Their average tamarisk density is 28 % along 415 miles of mostly ephemeral washes. These tributaries contain less riparian habitat than the main stem, averaging only 53% of areas mapped.
4. It is estimated that 15,430 acres or riparian habitat within the SEUTP planning area are impacted by tamarisk – 7,300 acres along the Colorado River, 3,630 acres on the major tributaries, and 4,500 acres on the minor tributaries.
5. Current Water Losses calculated in this project are based on the amount of water tamarisk is using under observed densities minus the water that would be used by native plants. Figure 2 represents the differences in vegetative cover with and without tamarisk and illustrates how tamarisk will occupy an area much greater

than the riparian zone which typically would support cottonwoods and willows, also phreatophytes. Significant water losses occur as tamarisk occupies upland areas within the floodplain that would normally have dryland xeric vegetation such as grasses, sages, rabbitbrush, etc. The Colorado River and its tributaries generally have upland areas ranging between 20% and 50%. Based on these conditions, the estimates of current water losses above and beyond what native vegetation would use are:

- a. Colorado River main stem from UT/CO state line to Lake Powell = 11,360 acre-feet per year.
- b. Major tributaries = 4,360 acre-feet per year.
- c. Minor tributaries = 6,840 acre-feet per year.

Total estimated Current Water Loss = 22,260 acre-feet per year

6. Future Water Losses calculated in this project assume an infilling of the existing infestation areas that will likely occur over the next several decades based on similar conditions observed in other states (NM and NV). Future water losses from infilling only (no expansion from existing infested areas) are estimated to be:

- a. Colorado River main stem from UT/CO state line to Lake Powell = 23,530 acre-feet per year.
- b. Major tributaries = 13,740 acre-feet per year.
- c. Minor tributaries = 24,440 acre-feet per year.

Total potential Future Water Loss = 61,710 acre-feet per year

[Note: If tamarisk control and revegetation occurs on any of these river or tributary sections, the water lost to the atmosphere through evapotranspiration will remain within the groundwater and/or surface water regimes.]

7. Russian olive is predominantly located within the Moab area along 18 miles of Pack Creek and Mill Creek. Density is highest on Pack Creek at 38% with Mill Creek exhibiting an average of 12 % Russian olive canopy cover. A total of 670 acres on these creeks are infested with Russian olive. Current and potential future water losses for Russian olive are estimated at 420 and 1,850 acre-feet per year, respectively.

Figure 2: Tamarisk Induced Changes in Channel Structure and Associated Habitats

