

Office of Environmental Management – Grand Junction



Moab UMTRA Project
Revegetation and Weed-control Plan

Revision 6

July 2020



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Moab UMTRA Project Revegetation and Weed Control Plan

Revision 6

Review and Approval

7/30/2020

X Luke Mattson

Luke Mattson
TAC Environmental Technician
Signed by: Department of Energy

7/30/2020

X Jason W. Atwater

Jason Atwater
TAC Field Manager
Signed by: Jason Atwater

7/30/2020

X Joseph D. Ritchey

Joseph D. Ritchey
TAC Senior Program Manager
Signed by: JOSEPH RITCHEY (Affiliate)

Revision History

Revision	Date	Reason for Revision
0	April 2009	Initial issue.
1	September 2010	Update includes 2010 areas and future planning.
2	July 2014	Update includes 2014 areas and activities.
3	June 2017	Revision includes update to performance monitoring and activities and incorporation of the Weed Control Plan (formerly DOE-EM/GJTAC1406).
4	July 2018	Updated to include watering schedule and various new methodologies.
5	August 2019	Periodic update to reflect SME recommendations and associated procedures.
6	July 2020	Periodic update to establish revegetation zones and zone numbers.

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1.0 Introduction

The *Revegetation and Weed Control Plan* describes activities for developing, maintaining, and promoting desirable vegetation on approximately 135 acres of the off-pile area at the Moab site, mostly along the eastern portion outside of the Contamination Area (CA) (Figure 1).

1.1 Site Description

The Moab Uranium Mill Tailings Remedial Action (UMTRA) Project site consists of 480 acres of U.S. Department of Energy (DOE)-owned land, located approximately 4 miles northwest of Moab, Utah. Moab has an average annual temperature of 57°F. Average annual precipitation is approximately 10 inches per year (US Climate Data 1981 – 2010).

Soil at the site is highly disturbed due to the removal of topsoil during previous remediation efforts. Soils at the site are variable, but generally alkaline, salty, and fine-grained, which further complicates vegetation establishment. The site is home to several wildlife species, including mule deer, sparrow hawks, coyotes, mountain lions, and beaver. Side channels of the Colorado River run adjacent to the site and provide critical nursery habitat for several species of federally protected native fish.

Vegetation currently consists of a mix of native grasses, shrubs, forbs, and trees, along with several non-native invasive weed species. Staff is currently working to develop a detailed report of vegetative cover and composition present on site.

DOE remediation operations on the site consist of removing radiologically contaminated soil and relocating it to a secure cell located in Crescent Junction, Utah. Currently there remains an area of approximately 135 acres of contaminated mill tailings that are being relocated to the secure holding cell. In 2003, the DOE began remediation of radiologically contaminated soil in non-pile (off-pile) areas of the Moab site. As non-pile areas were remediated, efforts were made to stabilize and revegetate the landscape with a variety of native plant species.

1.2 Purpose and Scope

The purpose of this document is to outline a plan that will continue to promote, and ultimately to realize, the DOE's vision of the site as a self-sustaining native landscape that will require little to no maintenance.

Due in large part to the removal of top soil during previous restoration efforts, much of the off-pile area at the site has been developed with non-desirable weeds such as kochia (*Bassia scoparia*), Russian knapweed (*Acroptilon repens*), tamarisk (*Tamarix sp.*), and others such as perennial pepperweed (*Lepidium latifolium*). Revegetating disturbed areas with desirable, native plant species minimizes production of fugitive dust, while supporting control of erosion and off-site transport of sediment.

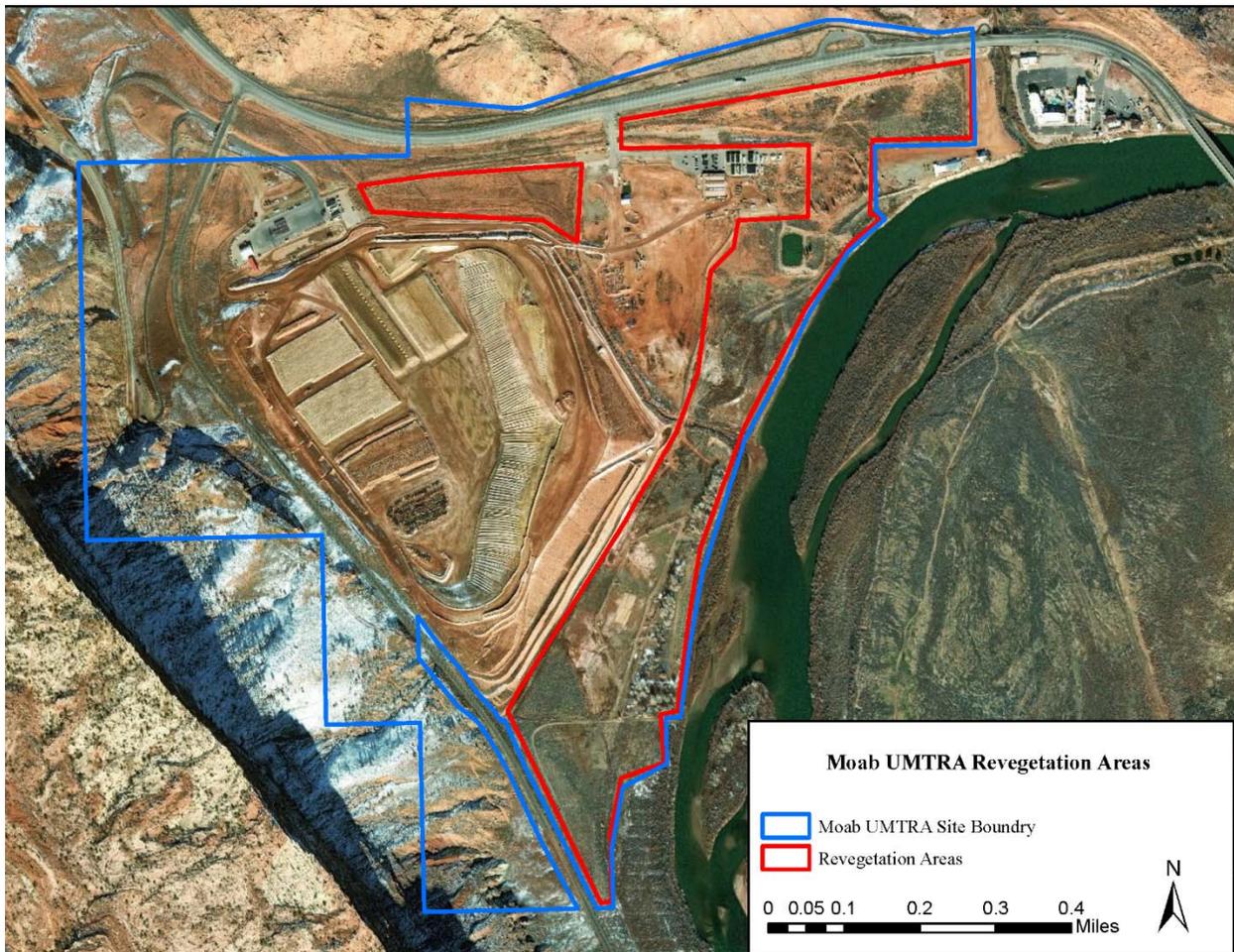


Figure 1. Moab UMTRA Revegetation Areas

2.0 Planning

Post-disturbance ecological restoration, particularly in arid desert environments, is a long-term effort that requires careful and specific planning if desired results are to be achieved. To help manage revegetation areas, staff has begun re-designing and updating delineation of revegetation areas, transitioning from historical irrigation areas (Figure 2) to a more relevant zoned approach (Figure 3).

These zones (27 total) have been categorized based on vegetative composition and cover. Historical irrigation areas and new revegetation zones can be compared in Figures 2 and 3, respectively.

The zoned approach will benefit planning, specifying management strategies, and tracking restoration activities. A zoned approach improves organization, increases efficiency, enables staff to apply specific treatments to certain areas, and strengthens management of work performed.

On an annual basis, each zone will be assessed and color-coded (red, yellow, green) indicating the amount of management needed in each respective area (red = high management; yellow = needs some improvements; green = little to no maintenance). This approach will track progress, while addressing areas that still need attention.

Table 1 provides a brief overview of typical seasonal revegetation activities. Staff is currently developing a more detailed outline of revegetation activities and the materials and labor associated with activities.

2.1 SME, Kara Dohrenwend, 2020 Assessment and Recommendations

On March 12, 2020, the Revegetation staff met with the SME, Kara Dohrenwend with Wildland Scapes, and received guidance on planning the 2020 growing season. Items discussed during the meeting are outlined in the following section. Notes on previous SME site visits are periodically reviewed to ensure suggestions are being considered.

General points discussed regarding successful planning for revegetation of the site:

- It was agreed that the “underperforming area” located in previous irrigation zone F-4 (see Figure 2) now part of zone 12 (see Figure 3) was representative of other non-disturbed areas along the Colorado River; specifically, this area is similar in vegetative composition and cover to riparian areas on adjacent property, Matheson Wetlands. This area has been subject to restoration requirements outlined in a 404 permit issued by the US Army Corp of Engineers. UMTRA staff and the SME has submitted a letter confirming this area has been sufficiently revegetated and began the process to close the 404 permit. It was suggested that taking photos of similar landscapes at the adjacent wetlands would help present this information.
- The use of burn box was discussed as a method to reduce vegetative debris on site and create soil amendments. SME suggested options for partnering with other agencies and borrowing a burn box from an agency that is not in use.
- Planting newly acquired grass seed should commence in June, as the seeds are warm-season germinators.
- Kochia is best managed by mowing prior to seed, allowing grasses to have the opportunity to “outcompete” the kochia. It was also suggested that staff apply a glyphosate product such as Roundup to discourage the spread of kochia.
- SME suggested the Project experiment with some deep-root planting techniques, such as planting saplings in a hole to just above water table depth (capillary fringe). Saplings can be prepared for this method using PVC pipe to the start root system before the tree is planted. Also the SME recommended that trees be planted near other healthy trees that are growing without irrigation, as these can serve as a good indicator to where shallow groundwater is present. Staff should continue to experiment with pole planting cottonwoods and willows derived from stems taken from trees on site. Staff should also consider utilizing irrigation to create stream channels that follow the path of existing healthy trees and planting new trees along these channels using irrigation to aid in their development.
- Suggested tree species include cottonwood, black willow, three leaf sumac, New Mexico Privet, low elevation gamble oak, and hackberry.
- Suggested that staff review information available from the Colorado Plateau Native Plant Program.
- SME recommended that staff apply Roundup to cheat grass in early spring while bunch grasses are still dormant.

Table 1. Typical Seasonal Revegetation Activities

Season	Typical Activities
Winter	Thin tree plots as needed, create compost for soil amendment by feeding downed trees with chipper/shredder, contour around existing flood plots as needed. Plan weed management, planting, soil amendments, and irrigation activities for the spring. Maintain TAC equipment, attend relevant ecological working groups, research revegetation practices, order supplies, ensure irrigation pump/equipment maintenance is complete, assist RAC with snow removal, maintain roads outside the CA, help with gamma scan surveys, develop maps for presenting results, and perform GIS mapping as needed.
Spring	Start-up irrigation systems, conduct maintenance and make any necessary repairs to the system, begin weed control (implement burn plan if appropriate), order seeds and plants for season, perform soil samples, plant cottonwood and willow "poles," continue processing downed trees, apply available mulch or compost to underperforming areas, continue equipment maintenance, and help with seasonal flood planning.
Summer	Preform weed control through mechanical and chemical methods, broadcast seed, plant container stock, irrigate appropriate vegetation, continue to maintain irrigation system and equipment, and help with seasonal flood mitigation and management.
Fall	Planting poles/containers, winterize irrigation system, seeding, thin tree plots as needed, contouring around the tree line, conduct irrigation pump maintenance, and soil sampling.
Ongoing Activities	Developing and applying compost and mulch for soil amendments, perform equipment and road maintenance, performing irrigation repairs and maintenance, developing strategic partnerships, researching relevant restoration practices, and attending working groups.



Figure 2. Moab Site – Previous Irrigation Zones



Figure 3. Moab Site Revegetation Management Zones

3.0 Revegetation Activities

3.1 Planting

Planting includes establishing vegetation in areas that have been newly disturbed and augmenting vegetation in areas previously planted with limited success. Depending on the location and purpose, planting may consist of seeding or planting poles or cuttings and, in some cases, may involve using containerized stock. When seeding, mixes of native species are used to encourage overall successful vegetation establishment. Seed names and application rates are shown in Table 2. Native seed mixes may be used to supplement underperforming areas.

For the 2020 growing season, Revegetation staff modified the historical seed mix, limiting seed to grasses only. The new mix is referenced in Table 3. By planting a mix of commonly observed grasses, staff hopes to promote high ground coverage that can easily be mowed to control weeds such as kochia that will inevitably mix with the grasses. Grasses will not be affected adversely to mowing as would be shrubs and forbs. Seed will be applied to approximately 12 acres in zones 17 and 21 (Figure 3). The proposed seed mix to be supplied by Utah DNR (Department of Natural Resources) on the 7 acres in zone 26 is shown in Table 4.

A pollinator plot has been constructed in Zone 4. Staff has planted live containerized stock in this area. Species for this area include scarlet globe mallow (*Sphaeralcea coccinea*), Palmer's penstemon (*Penstemon palmeri*), firecracker penstemon (*Penstemon eatonii*), and four native daisy (*Tetraneuris acaulis*). Currently, there have been approximately 80 plants installed in this area, with a drip irrigation system utilized to supply water. Staff plans to install another 80 pollinators in this area this year.

Table 2. Seed Name and Application Rates

Common Name	Scientific Name	Application Rate (lb pure live seed/acre)
big bluestem	<i>Andropogon gerardii</i>	1
yellow beeplant	<i>Cleome lutea</i>	0.2
Rocky Mountain beeplant	<i>Cleome serrulata</i>	0.2
inland salt grass	<i>Distichlis spicata</i>	4
slender wheatgrass	<i>Elymus trachycaulus</i>	2
beardless wildrye	<i>Leymus triticoides</i>	2
alkali sacaton	<i>Sporobolus airoides</i>	1
greasewood	<i>Sarcobatus vermiculatus</i>	1

Table 3. 2020 Seed Name and Application Rate

Common Name	Scientific Name	Application Rate (lb pure live seed/acre)
inland salt grass	<i>Distichlis spicata</i>	3.75
slender wheatgrass	<i>Elymus trachycaulus</i>	6.0
basin wildrye	<i>Leymus cinereus</i>	3.75
alkali sacaton	<i>Sporobolus airoides</i>	1.5

Table 4. Seed Name and Application Rate for Zone 25

Common Name	Scientific Name	Application Rate (lb pure live seed/acre)
creeping wildrye	<i>Lemus triticoidess</i>	0.87
yellow beeplant	<i>Cleome lutea</i>	0.45
Rocky Mountain beeplant	<i>Cleome serrulata</i>	0.46
inland salt grass	<i>Distichlis spicata</i>	0.61
western wheatgrass	<i>Pascopyron smithii</i>	0.87
Great Basin wildrye	<i>Leymus cinereus</i>	0.44
alkali sacaton	<i>Sporobolus airoides</i>	0.44

3.2 Watering

Irrigation (by means of, drip systems, sprinklers, and hose reels) may be used to help establish vegetation growth in newly planted areas and to facilitate additional growth in areas that have been revegetated. The irrigation schedule for each zone is designed to apply ample water in the first few years to encourage wide, deep root growth and plant establishment.

After the first few years, the amount of irrigation water applied is reduced to encourage plant adaptation to the local water table/precipitation. The goal is to have resilient native vegetation that does not require supplemental watering.

Irrigation is currently in a transitional state:

- Much of the historical irrigation layout is no longer relevant, and a large portion of the above ground system has been damaged beyond use by years of exposure in the desert environment.
- At this time all of the below ground infrastructure, and the two revegetation pumps at the freshwater pond are in good working order.
- Staff has begun replacing damaged irrigation parts as necessary and removing damaged irrigation that is no longer relevant to current site conditions and goals.
- In summer of 2019 Revegetation staff replaced all emitters on the drip irrigation system in Zone 2 (historically Zones A-Z4, A-Z5, A-Z6).
- A newly installed drip system feed from the 15 hp pump now waters Zone 4, which is now classified as a “Pollinator Plot”

Zone 2 (historically Zones A-Z4, A-Z5, A-Z6) has been fitted with a temporary irrigation system to supply water to approximately 100 native salvaged grasses. Revegetation staff coordinated with Canyonlands National Park to salvage these grasses from a construction project at Island in the Sky. Water application is recorded via irrigation log and will be updated to accurately track water use.

3.3 Pruning and Chipping

Periodic thinning of mature cottonwood and willow trees is performed to improve overall growth and avoid creating a safety hazard. Tree trimmings from pruning/thinning may be shredded in a chipper and spread or composted. Composted materials and wood chips are used to create a soil amendment for underperforming areas to improve soil chemistry and fertility.

Currently, the Moab UMTRA site consists of approximately 11 acres of cottonwood flood irrigation plots. The majority (approximately 85 percent) of the trees in these areas have experienced mortality and are being removed. These areas are referenced in Figure 3 as Zones 15, 16, 18, 19, 22, and 23. These areas were previously referenced as areas C1- C-9 in Figure 2. The removal of these trees is primarily driven by safety concerns of mature, dead standing trees; additionally, from a restoration perspective, the presence of 11 acres of dead trees does not fit into the overall vision for revegetation at the site. Staff has been processing as much of the material as possible from these trees by feeding them through a wood chipper to create organic material that can be utilized in compost operations. There remains a large portion of material left that is too large to be processed by the chipper. Staff is working to determine best methods for utilizing these larger pieces. One option is to employ a burn box.

3.4 Compost Pit and Soil Amendments

Staff is investigating different composting methods to be utilized on site. Currently, staff is chipping vegetative debris generated by dead cottonwood trees and other miscellaneous tree and shrub pruning. Processed debris is blended with soil, bio-char/ash from burn box operations, and other organic material.

3.5 Periodic Assessments

Periodic assessments of vegetation coverage are documented in internal reports. These reports include descriptions of the areas, observations compared to previous data, and photographs showing the areas surveyed.

Soil sampling will be conducted at designated sites to assess the texture, salinity, pH, organic content, and general soil chemistry. Samples will be sent to a certified analytical soil laboratory for analysis. All assessment reports and sampling data and results will be sent to Records Management.

3.6 Oversight Activities

Monthly plans will be developed by Revegetation staff to track activities. These plans will be reviewed, edited, and approved by the Field Manager to help prioritize Revegetation activities and track and document progress.

4.0 Weed Control

The Revegetation staff is responsible for controlling weeds on the 2020 State of Utah Noxious Weed List present at the Moab site (see Attachment 1). Priority is given to areas of recent disturbance where vegetation is not well established. Weed-specific preventive and reactive treatments are implemented, and mapping and monitoring are utilized to assess weed-control results and new infestations.

4.1 Weed Infestation Timing

Various weed species are more prominent during certain times of the year.

- Spring and early summer emergent weeds include kochia and Russian thistle (*Salsola tragus*), also known as tumbleweeds.
- Mid-summer weeds include Russian knapweed (*Acroptilon repens*); diffuse knapweed (*Centaurea diffusa*); puncturevine (*Tribulus terrestris*), also known as goathead, halogeton (*Halogeton glomeratus*), horseweed (*Erigeron Canadensis*), and common cocklebur (*Xanthium spinosum*).
- Fall weeds include: diffuse knapweed, kochia, tamarisk, also known as saltcedar; puncturevine, Russian thistle, Russian olive (*Elaeagnus angustifolia*), and halogeton.

4.2 Weed-control Methodology Descriptions

Weed-control methodologies include applying herbicides/bio-herbicides, bio-controls, physically removing weeds by cutting, pulling, mowing, or a combination of these methods. Care must be exercised during manual removal of weeds to prevent seed spread and dispersal.

Some areas of the site, such as the well field Configuration 5 and the southernmost portion, are periodically mowed to cut down weeds. This activity also promotes growth of grasses and shrubs in these areas. Mowing annuals before flower set can inhibit and sometimes prevent flower and seed set.

Although tamarisk leaf beetles (*Diorhabda elongata*) have reduced tamarisk populations, they do not eliminate the tree. Seedling tamarisk will likely be most affected by the leaf beetle because of its small root mass. Seed production of mature plants is also expected to be reduced by beetle damage.

In some cases, it is helpful to leave the declining trees in place to help keep soils stable while other plants become established. In other cases, removing the aboveground biomass may be necessary. While removing dead tamarisk trees by cutting them, it is important to continue treating the cut stump with Triclopyr to ensure the roots are destroyed as well. Weed-control activities performed are dependent on site conditions and extent of infestation.

5.0 Strategic Partnerships

Over the past year, Revegetation staff has been working to build strategic partnerships with various public and private entities. These relationships are being established to share relevant and unclassified information between parties that will benefit the Moab UMTRA site and the greater community in ecological restoration efforts. These relationships were generally established through the participation of UMTRA staff in local and regional ecological working groups. As the Project progresses, participation in these groups should be encouraged to continue building relationships that benefit the Project. The following is a list of entities with whom relationships have been established and a brief description of the purpose of each of them. Any formal partnerships will be detailed and recorded in an official memorandum of understanding (MOU) between all parties involved.

US Geological Survey (USGS) – Southwest Biological Science Center

USGS scientists with expertise in soil restoration and revegetation of highly disturbed landscapes were invited to collaborate with Moab UMTRA staff plan and develop scientific methods for the management of revegetation areas at the site. Research performed on site by USGS and UMTRA staff can be used as a tool for successful revegetation of the site.

Research should also be used to develop scientific literature that will be beneficial to the broader community of land managers and scientists involved in ecological restoration of disturbed landscapes. Staff has recommended that Zone 22 (Figure 3), which has historically been a difficult area to revegetate, be used as an experimental area for USGS and other partners.

US National Park Service (NPS)

In March 2020, Moab TAC staff traveled to Canyonlands National Park to salvage grasses from an area planned for development of employee housing. Staff received approximately 100 live plants from the Park and transplanted them on site in Zones 2 and 3.

Moving forward, UMTRA staff and NPS plan to coordinate on future projects including additional plant salvaging and acquiring excess soil from park projects to use as amendments at site revegetation areas.

Western State Colorado University

A dialog has been established regarding the integration of graduate students enrolled in Western's Environmental Management program to assist with restoration planning and activities. Students who are interested in restoration of disturbed landscapes, specifically mining legacy cleanup sites, have been invited to present ideas for graduate projects that utilize Moab UMTRA site as a research area. Ideas for projects include, soil stabilization and restoration, vegetative cover and composition studies, novel ideas for general ecological restoration, and future site use. Staff will remain open to suggestions for research projects from students that help future restoration of the site.

Utah Division of Forestry, Fire, and State Lands (DNR)

Staff has been working with Utah DNR to acquire seed procured through a grant provided to DNR for vegetative restoration along the Colorado River corridor. Parties have informally agreed to applying approximately 7 acres of seed mix provided free of charge from DNR. Seed is to be applied to a portion of Zone 25 (Figure 3). Staff plans to broadcast seed in this area in Fall 2020.

Attachment 1. 2020 State of Utah Noxious Weed

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2020 State of Utah Noxious Weed List

The following weeds are designated as noxious for the State of Utah,
as per the, Utah Noxious Weed Act:

African Rue	Common Crupina
Malta Starthistle	Mediterranean Sage
Plumless Thistle	Small Bugloss
Spring Milletgrass	Syrian Beancaper
Camelthorn	Common St. Johnswort
Cutleaf Vipergrass	Elongated Mustard
Garlic Mustard	Giant Reed
Goatsrue	Japanese Knotweed
Oxeye Daisy	Purple Starthistle
Sahara Mustard	Ventenata
Viper Bugloss	Black Henbane
Dalmation Toadflax	Diffuse Knapweed
Dyers Woad	Leafy Spurge
Medusahead	Purple Loosestrife
Rush Skeletonweed	Spotted Knapweed
Squarrose Knapweed	Yellow Starthistle
Yellow Toadflax	Bermudagrass
Canada Thistle	Field Bindweed
Hoary Cress	Houndstongue
Jointed Goatgrass	Musk Thistle
Perennial Pepperweed	Perennial Sorghum species
Phragmites	Poison Hemlock
Puncturevine	Quackgrass
Russian Knapweed	Saltcedar
Scotch Thistle	Cogongrass
Damesrocket	Myrtle Spurge
Russian Olive	Scotch Broom

Pursuant to Utah Noxious Weed Act (Utah Code § 4-17-101 et seq.) and Utah Administrative Code R-68-9-6, it is the duty of every property owner to control and prevent the spread of noxious weeds on any land in his/her possession or control. Enforced weed control measures may be imposed against you for failure to comply with this notice. For any questions you may have, please contact the Utah County Weed Control at 801-851-8638 or visit the Utah County website at www.utahcounty.gov