FIELD REPORT

Assessment: Fifteen Elk Ridge Springs, June 27-29, 2016

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September 2016

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Field Sites and Map

- Cottonwood and Bears Ears Allotments

  Currently/actively grazed

  - Sego Spring (C1/W9)
  - Horse Mtn Spring #2 (C9)
  - Double Trough Spring (C8)
  - Big Flat Spring (C6)
  - Crystal Spring (C3)
  - North Long Point/Big Spring (C10)
  - Big Spring (C4)
  - Posey Spring (BE2)
- Babylon Allotment

  Active allotment, but not grazed by cattle (except by trespass cattle) since 2002

  - Kigalia Guard Station Spring (B1)
- White Mesa Cultural and Conservation Area (Gooseberry Allotment)

  Inactive allotment through 2022, not grazed by cattle (except by trespass cattle) since 2002

  - North Notch Spring (W1)
  - FS5149 Spring (W6)
  - East Gooseberry/FS5094 Spring (W5)
  - Duck Lake (W10)Horse Pasture Trail/FS5160 Spring (W3)
  - Poso Spring (W7)

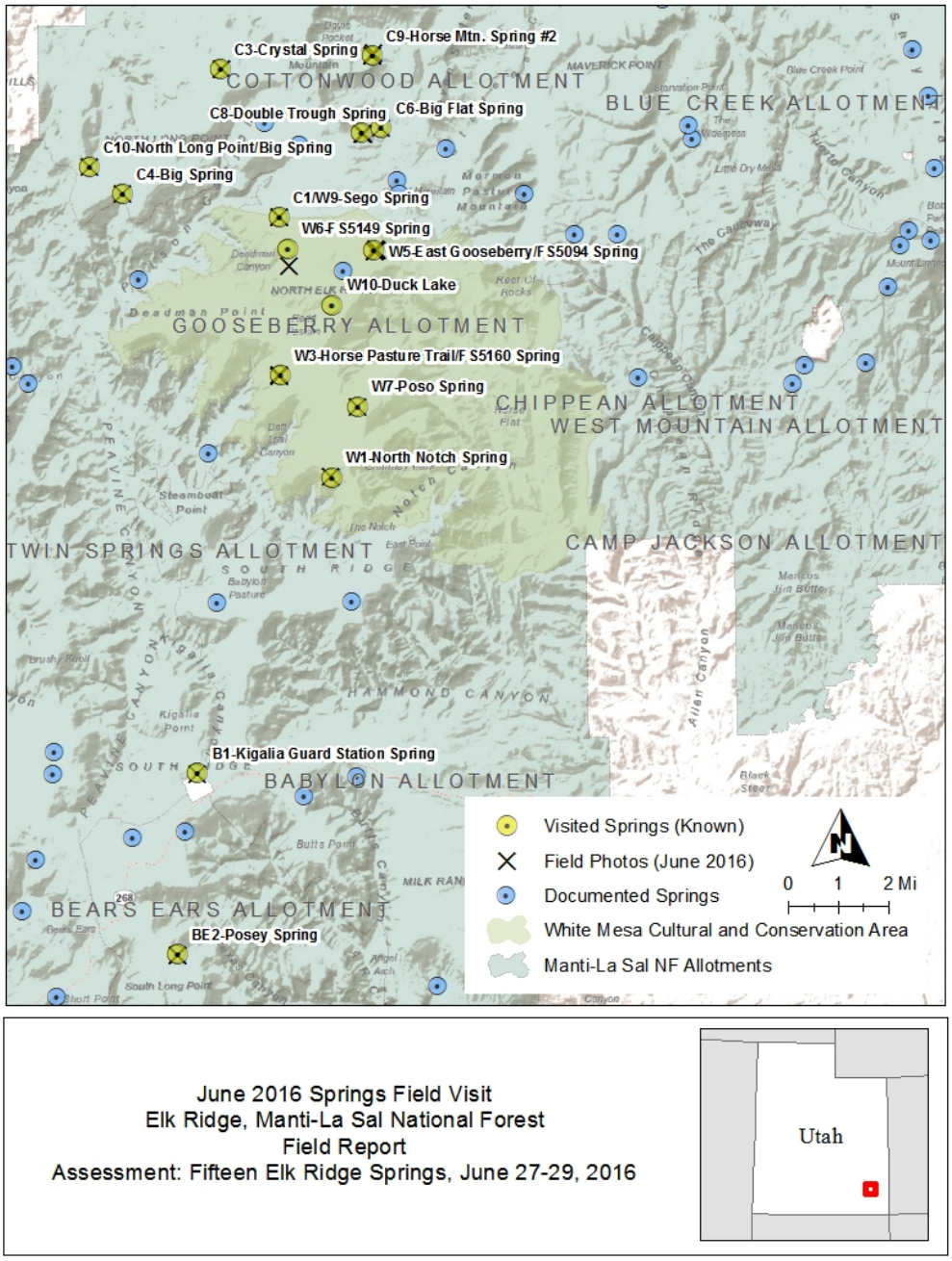

Figure 1 - Field map for Elk Ridge springs assessment, June 2016. Blue circles indicate documented (known) springs locations as obtained from a merged springs file created by Grand Canyon Trust (Stephanie Smith, GIS Program Director) from Geographic Naming Information System (GNIS), National Hydrography Dataset (NHD), and United States Forest Service (USFS) data. Yellow circles indicate which of the documented springs were visited during this field trip. Black "X" symbols indicate visited springs with a georeferenced photograph.

Objective

1. Assess conditions of select springs ecosystem sites in the Elk Ridge region of the Moab-Monticello Ranger District to:
    a. Build foundational information of conditions of springs ecosystems in the Manti-La Sal National Forest, and
    b. Provide documentation to support management decision-making for the conservation of public lands, particularly related to springs protection and restoration needs.

Description

We visited fifteen spring sites in the Elk Ridge region of the Manti-La Sal National Forest including most of the known springs in the White Mesa Cultural and Conservation Area and some of the nearest springs in the neighboring Cottonwood, Babylon, and Bears Ears allotments. We assessed each spring using a systematic qualitative assessment that included documentation of location, water presence, and infrastructure. We recommend additional assessment that addresses riparian vegetation composition more thoroughly, including an account of dominant native and non-native species. Where possible, georeferenced photographs were taken at the spring site.

Field Notes: Cottonwood and Bears Ears Allotments

C1/W9 – Sego Spring

Date: June 27, 2016

Allotment: Cottonwood Allotment

GPS Coordinate (UTM NAD83 12N): 606124 E 4188514 N (presumed source)

Water presence: Water was present in trough, little surface water was present elsewhere.

Water infrastructure: Spring source was developed with spring box (culvert), valve, and trough. Trough had a wildlife escape ramp.

Fence infrastructure: Spring source was fenced.

Grazing evidence: Elk sign was present (type not recorded).

Aspen recruitment/age structure/density/condition: Aspen (*Populus tremuloides*) was present (condition not recorded).

Willow species/age structure/density/condition: Not recorded in this assessment.

Vegetation composition: Aspen overstory with native shrub mid-story and non-native grass dominated understory, including orchard grass (*Dactylis glomerata*).

Restoration recommendation:

- Wildlife water access was limited to water trough. While the full trough could be accessed by larger animals, access for smaller wildlife – including small mammals – was inhibited by the height and design of the trough. Wildlife water access should be improved by increasing the surface water left at the source when cattle are not present in the allotment. For example, water could be left at or shared with the spring source during the off-season (i.e., using a float valve or a variable valve).
- Non-native grasses were present at the site and should be a focus for managers into the future.

Photograph Set 1 (June 27, 2016) - Source and trough at C1/W9-Sego Spring. Photographs are georeferenced and indicated in the field map (Figure 1).

C9 – Horse Mtn Spring #2

Date: June 28, 2016

Allotment: MLSNF-MMRD, Cottonwood Allotment

GPS Coordinate (UTM NAD83 12N): 609138 E 4193776 N (presumed source)

Water presence: Two spring sources were located but surface water was present in only one downstream trough. Overflow from this trough also provided surface water for wildlife, although only as a small wet area where trampling was also present. Lower drainage was damp.

Water infrastructure: Two spring sources were located. Both were developed with spring boxes with sources fenced. Pipelines led to two troughs below. One trough was functional with overflow, the other was damp and with steady leak at the bottom. The troughs did not have wildlife ramps.

Fence infrastructure: Fence was present around spring source and surrounding area but was in need of repair to be functional.

Grazing evidence: Elk sign (tracks, scat) observed at spring source and in runoff area.

Aspen recruitment/age structure/density/condition: Aspen (*Populus tremuloides*) was present with some regeneration and recruitment.

Willow species/age structure/density/condition: Not recorded in this assessment.

Vegetation composition: Aspen was dominant in overstory with diverse grass and forb dominant in understory. Native vegetation was dominant across the site including aspen, fowl mannagrass (*Glyceria striata*), lupine (*Lupinus* spp.), rushes (*Juncus* spp.), sedges (e.g., *Carex* spp.), and wild rose (*Rosa woodsii*). Non-natives were uncommon and included dandelion (*Taraxacum* spp.) at a low density.

Restoration recommendation:

- Exclosure fencing around spring source is important, however this could be expanded to include a larger area of riparian vegetation.
- The pipeline and troughs should be managed to control for overflow which encouraged erosion downslope of the trough. For example, the pipeline and trough could be in use only seasonally when cattle are in the pasture and water could be left at or shared with the spring source during the off-season (i.e., using a float valve or a variable valve).
- Both troughs should have adequate wildlife escape ramps which would be partially submerged in the trough, touch the bottom of the tank, and have a portion of the ramp flush with the inside of the trough (as many stranded animals will swim the perimeter of a tank in search of escape and may go under an existing ramp if a portion of it is not flush with the inside wall of the tank). We recommend following the guidelines outlined in Water for Wildlife Handbook for Ranchers and Range Managers[1] for wildlife friendly cattle tanks and troughs.

[1] Taylor, D. A. R, and M. D. Tuttle. 2007. *Water for Wildlife Handbook for Ranchers and Range Managers*. Bat Conservation International, USA.

Photograph Set 2 (June 28, 2016) – Developed spring source (left) and overall site (right) at C9-Horse Mtn. Spring #2. Photographs are georeferenced and indicated in the field map (Figure 1).

Photograph Set 3 (June 28, 2016) - Two troughs at C9-Horse Mtn Spring #2. Photographs are georeferenced and indicated in the field map (Figure 1).

C8 – Double Trough Spring

Date: August 10, 2016

Allotment: MLSNF-MMRD, Cottonwood Allotment

GPS Coordinate (UTM NAD83 12N): 608843 E 4191244 N (one presumed source)

Water presence: Two spring sources were developed and not accessible by all wildlife. Trough provided primary surface water as wet meadow had very little surface water.

Water infrastructure: Two spring sources were developed with spring boxes. Trough outside of fenced area seemed to have low water quality (algae buildup). Name of spring (discovered after the field visit) suggested that two troughs exist, although only one was located.

Fence infrastructure: Exclosure fence (around spring source) was present but not functional as it was incomplete and in need of repair.

Grazing evidence: Elk sign (scat), cattle sign (scat, tracks), and game trail were noted. Wet meadow had signs of ungulate trampling.

Aspen recruitment/age structure/density/condition: Not recorded in this assessment.

Willow species/age structure/density/condition: Not recorded in this assessment.

Vegetation composition: Native grasses were dominant in wet meadow. Outside of wet meadow orchard grass and smooth brome were noted.

Restoration recommendation:

- The exclosure fence should be repaired to adequately protect the spring sources and wet meadow. Wildlife water access should be increased to be more than just the trough water as smaller animals have limited access. For example, the pipeline and trough could be in use only seasonally when cattle are in the pasture and water could be left at or shared with the spring source and wet meadow during the off-season (i.e., using a float valve or a variable valve).
- Trough should have an adequate wildlife escape ramp which would be partially submerged in the trough, touches the bottom of the tank, and has a portion of the ramp flush with the inside of the trough (as many stranded animals will swim the perimeter of a tank in search of escape and may go under an existing ramp if a portion of it is not flush

with the inside wall of the tank). We recommend following the guidelines outlined in Water for Wildlife Handbook for Ranchers and Range Managers (referenced previously) for wildlife friendly cattle tanks and troughs.

- Non-native grasses were present at the site and should be a focus for managers into the future. We encourage managers to research and apply site-appropriate methods where possible.

Photograph Set 4 (June 28, 2016) – Spring sources were developed with culverts (left, middle) and trough (right) at C8-Double Trough Spring. Photographs are georeferenced and indicated in the field map (Figure 1).

C6 – Big Flat Spring

Date: June 28, 2016

Allotment: MLSNF-MMRD, Cottonwood Allotment

GPS Coordinate (UTM NAD83 12N): 609406 E 4191415 N (wet meadow)

Water presence: Surface water was present only as wet meadow, no flow.

Water infrastructure: None observed.

Fence infrastructure: None observed.

Grazing evidence: Willow hedging was present from heavy browsing. Some were present hummocks in wet meadow area.

Aspen recruitment/age/structure/density/condition: Not recorded in this assessment.

Willow species/age structure/density/condition: Coyote willow (*Salix exigua*) was present and was heavily hedged from browsing.

Vegetation composition: Wet meadow area had dominant native riparian vegetation, although some non-native Kentucky bluegrass (*Poa pratensis*) noted.

Restoration recommendation:

- We recommend additional protections for the wet meadow area at this spring, such as an exclosure fence which could limit trampling. The beginnings of hummocks were noted in the wettest areas due to trampling impacts.

Photograph 5 (June 28, 2016) - Wet meadow at C6-Big Flat Spring. Photograph is georeferenced and indicated in the field map (Figure 1).

C3 – Crystal Spring

Date: June 28, 2016

Allotment: MLSNF-MMRD, Cottonwood Allotment

GPS Coordinate (UTM NAD83 12N): 604245 E 4193394 N (presumed source)

Water presence: Upland drainage from meadow led into an exclosed spring source. Overflow from downstream trough followed game trail and then flowed into a riparian drainage. This flow allowed for some surface water to be available for wildlife outside of the fenced spring source.

Water infrastructure: Spring source was fenced with exclosure and was piped to trough downstream. The trough did not have a wildlife escape ramp.

Fence infrastructure: Spring source had a wooden fence exclosure that was broken in one section and was in need of repair. Adjacent to spring site, a barbed wire fence divided two pastures and was also in need of repair.

Grazing evidence: Ungulate tracks were present (species not identified) and cattle sign (tracks, scat) was noted on both sides of pasture fence. A wildlife camera was also noted on a nearby tree facing the spring site, likely hunters were using the cameras to track elk or deer presence.

Aspen recruitment/age structure/density/condition: Aspen (*Populus tremuloides*) was present with some regeneration and recruitment – ramets not browsed.

Willow species/age structure/density/condition: Not recorded in this assessment.

Vegetation composition: Native vegetation was dominant, some invasive orchard grass (*Dactylis glomerata*) was present near spring source.

Restoration recommendation:

- We recommend that the fences be repaired both around the spring source and along the pasture division.
- The riparian drainage, to which the trough overflow contributed, was not well protected from grazing ungulates and exhibited the potential for erosion. This erosion could potentially be managed. For example, the trough could be in use only seasonally when cattle are in the pasture and water could be left at or shared with the spring source during the off-season (i.e., using a float valve or a variable valve).
- Troughs should also have an adequate wildlife escape ramp which would be partially submerged in the trough, touches the bottom of the tank, and has a portion of the ramp flush with the inside of the trough (as many stranded animals will swim the perimeter of a tank in search of escape and may go under an existing ramp if a portion of it is not flush with the inside wall of the tank). We recommend following the guidelines outlined in Water for Wildlife Handbook for Ranchers and Range Managers (referenced previously) for wildlife friendly cattle tanks and troughs.
- Non-native grasses were present at the site and should be a focus for managers into the future. We encourage managers to research and apply site-appropriate methods where possible.

Photograph Set 6 (June 28, 2016) – Source (left) and trough (right) at C3-Crystal Spring. Photograph is georeferenced and indicated in the field map (Figure 1).

C10 – North Long Point/Big Spring

Date: June 28, 2016

Allotment: MLSNF-MMRD, Cottonwood Allotment

GPS Coordinate (UTM NAD83 12N): 599964 E 4190142 N (presumed source)

Water presence: Some surface water was present below troughs. Spring box culvert was dry.

Water infrastructure: Spring source was developed with a culvert spring box. Below, two troughs were present as well as a human-made pond with earthen berm.

Fence infrastructure: Source was fenced partway.

Grazing evidence: Elk sign (tracks, scat) was present. A wildlife camera was also noted on nearby tree facing the spring site, likely hunters were using the cameras to track elk or deer presence.

Aspen recruitment/age structure/density/condition: Aspen (*Populus tremuloides*) present, condition not noted.

Willow species/age structure/density/condition: Not recorded in this assessment.

Vegetation composition: Native vegetation (aspen and mixed conifer) was dominant in overstory and native rushes, forbs, and grasses were dominant in understory (species not recorded).

Restoration recommendation:

- Troughs should have adequate wildlife escape ramps which would be partially submerged in the trough, touches the bottom of the tank, and have a portion of the ramp flush with the inside of the trough (as many stranded animals will swim the perimeter of a tank in search of escape and may go under an existing ramp if a portion of it is not flush with the inside wall of the tank). We recommend following the guidelines outlined in Water for Wildlife Handbook for Ranchers and Range Managers (referenced previously) for wildlife friendly cattle tanks and troughs.

Photograph Set 7 (June 28, 2016) – Source exclosure (left) and developed source (right) at North Long Point/Big Spring (right). Right photograph is georeferenced and indicated in the field map (Figure 1).

C4 – Big Spring

Date: June 28, 2016

Allotment: MLSNF-MMRD, Cottonwood Allotment

GPS Coordinate (UTM NAD83 12N): 601048 E 4189267 N (presumed source)

Water presence: Surface water was not accessible at source or at trough, but at low flow in a runoff channel down into drainage. This surface water was accessible to wildlife.

Water infrastructure: Spring source was covered with plywood and rock. Trough was not functional but outflow followed a runoff channel down into drainage. No wildlife escape ramp was present in the trough.

Fence infrastructure: Spring source was fenced, fence was functional.

Grazing evidence: Wildlife cameras were noted on nearby tree facing spring site and salt lick was present on ground suggesting hunters using salt licks and cameras to both attract and track elk and deer.

Aspen recruitment/age structure/density/condition: Aspen (*Populus tremuloides*) present with some regeneration.

Willow species/age structure/density/condition: Not recorded in this assessment.

Vegetation composition: Native vegetation (aspen and mixed conifer) was dominant in overstory, non-native grasses, namely orchard grass (*Dactylis glomerata*), and native sedges (*Carex* spp.) present in understory.

Restoration recommendation:

- Troughs should have an adequate wildlife escape ramp which would be partially submerged in the trough, touches the bottom of the tank, and has a portion of the ramp flush with the inside of the trough (as many stranded animals will swim the perimeter of a tank in search of escape and may go under an existing ramp if a portion of it is not flush with the inside wall of the tank). We recommend following the guidelines outlined in Water for Wildlife Handbook for Ranchers and Range Managers (referenced previously) for wildlife friendly cattle tanks and troughs.

Photograph Set 8 (June 28, 2016) – Source exclosure (left, middle) and outflow (right) at C4-Big Spring.

Photograph 9 (June 28, 2016) - Spring source was developed with covered spring box at C4-Big Spring. Photograph is georeferenced and indicated in field map (Figure 1).

BE2 – Posey Spring

Date: June 29, 2016

Allotment: MLSNF-MMRD, Bears Ears Allotment

GPS coordinates (UTM NAD83 12N): 602838 E 4164558 N (presumed source)

Water presence: Surface water was present inside a developed spring box (culvert) and trough. Willow was noted in drainage below water infrastructure but no surface water was present. Downstream human-made pool area was also dry.

Water infrastructure: Spring source was developed with a sunken culvert that leads to a trough, although outflow pipe is blocked and seems buried. There was also a human-made pool area created with a berm/earthen dam below the spring source and trough. No wildlife escape ramp was present in the trough.

Fence infrastructure: Not recorded in this assessment.

Grazing evidence: Mule deer sign (tracks) was noted. Wildlife camera was also found on nearby tree facing spring site, likely hunters using wildlife cameras to track elk or deer.

Aspen recruitment/age structure/density/condition: Not recorded in this assessment.

Willow species/age structure/density/condition: Willow present (species and condition not recorded).

Vegetation composition: Native vegetation was dominant, including native sedges (*Carex* spp.) although non-native grasses, namely orchard grass (*Dactylis glomerata*), smooth brome (*Bromus inermis*), and Kentucky bluegrass (*Poa pratensis*) were abundant.

Restoration recommendation:

- Trough should have an adequate wildlife escape ramp which would be partially submerged in the trough, touches the bottom of the tank, and has a portion of the ramp flush with the inside of the trough (as many stranded animals will swim the perimeter of a tank in search of escape and may go under an existing ramp if a portion of it is not flush with the inside wall of the tank). We recommend following the guidelines outlined in Water for Wildlife Handbook for Ranchers and Range Managers (referenced previously) for wildlife friendly cattle tanks and troughs.

- Non-native grasses were present at the site and should be a focus for managers into the future. We encourage managers to research and apply site-appropriate methods where possible.

Photograph Set 10 (June 29, 2016) - Developed spring source (left) and trough (right) at BE2-Posey Spring. Photograph is georeferenced and indicated in the field map (Figure 1).

Field Notes: Babylon Allotment

B1 – Kigalia Guard Station Spring

Date: June 27, 2016

Allotment: MLSNF-MMRD, Babylon Allotment

GPS coordinates (UTM NAD83 12N): 603466 E 417072 N (presumed source)

Water presence: Surface water was present in a small area with a wet meadow, but water flow was fairly stagnant.

Water infrastructure: Spring source was developed with a spring house and spring box.

Fence infrastructure: A fence was present around surface water area of spring including some of the surrounding area and may have been a pasture fence rather than an exclosure. The gate of the fence was open and the fence was in need of repair.

Grazing evidence: Elk sign (scat) was noted but no cattle sign was noted. Browsing was evident - willows and other native shrubs were hedged by browsing. Hummocking due to trampling was observed.

Aspen recruitment/age structure/density/condition: Aspen (*Populus tremuloides*) was present and dominant but with very little regeneration or recruitment.

Willow species/age structure/density/condition: Willow was present (species not documented) but was heavily browsed and hedged.

Vegetation composition: Aspen was dominant in overstory and non-native grasses were dominant in understory, namely orchard grass (*Dactylis glomerata*) and smooth brome (*Bromus inermis*).

Restoration recommendation:

- Fence should be repaired so that it would be functional when/if neighboring pasture is grazed. If the area around the spring is intended to be grazed, the surface water area and surrounding riparian vegetation should be fenced to allow willow recruitment and reduce riparian hummocking.

- Non-native grasses were present at this site. We encourage managers to research and apply site-appropriate methods where possible.

Photograph 11 (June 27, 2016) - Spring house and surface water at B1-Kigalia Guard Station Spring. Photograph is georeferenced and indicated in the field map (Figure 1).

Field Notes: White Mesa Cultural and Conservation Area

W1 – North Notch Spring

Date: June 27, 2016

Allotment: MLSNF-MMRD, White Mesa Cultural and Conservation Area

GPS Coordinates (UTM NAD83 12N): 607807 E 4180094 N (presumed source)

Water presence: Surface water was present as a steady, low flow small creek from spring source/emergence to a small cattail-dominated wet area created by earthen dam.

Water infrastructure: Trough and pipeline were present but neither is functional. Historical human-made berm/earthen dam created a small wet area.

Fence infrastructure: Fence exclosure was present around spring source and surface water, but were in need of repair to be functional.

Grazing evidence: Elk sign (tracks) was noted. Hummocks were also present indicating historical livestock grazing impact.

Aspen recruitment/age structure/density/condition: Not recorded in this assessment.

Willow species/age structure/density/condition: Not recorded in this assessment.

Vegetation composition: Non-native grasses were dominant in understory, namely orchard grass (*Dactylis glomerata*) and smooth brome (*Bromus inermis*), although native sedges and rushes were abundant (species not recorded). Both native thistles and exotic bull thistle (*Cirsium vulgare*) were also present.

Restoration recommendation

- If the White Mesa Cultural and Conservation Area continues not to be grazed, it would be possible to remove most infrastructure (except for the protective source exclosure). If the area were to be grazed in the future, the exclosure fence should be expanded to protect the larger riparian area, not just the spring source.
- Non-native bull thistle can be managed by periodic pulling before seed set.

Photograph 12 - Outflow from source at W1-North Notch Spring. Photograph is georeferenced and indicated in the field map (Figure 1).

W6 – FS5149 Spring

Date: June 27, 2016

Allotment: MLSNF-MMRD, White Mesa Cultural and Conservation Area

GPS Coordinate (UTM NAD83 12N): 606456 E 4186948 N (at trough)

Water presence: Surface water was present as leaked water from trough, into which there was a very low water flow. Trampling was present below trough in this wet area.

Water infrastructure: A pipeline and trough were present. The trough had a leak and did not have a wildlife escape ramp.

Fence infrastructure: Spring source had an exclosure fence.

Grazing evidence: Elk sign (tracks) was noted.

Aspen recruitment/age structure/density/condition: Not recorded in this assessment.

Willow species/age structure/density/condition: Not recorded in this assessment.

Vegetation composition: Native plant species were dominant (species not recorded in this assessment). Non-native grasses, namely orchard grass (*Dactylis glomerata*) and smooth brome (*Bromus inermis*), were present in the old road that provides access to the site but these are not dominant.

Restoration recommendation:

- If the White Mesa Cultural and Conservation Area continues not to be grazed, it would be possible to remove most infrastructure (except for the protective source exclosure). If the area will be grazed in the future, the trough should be repaired and/or the leaked flow should be managed to avoid erosion downslope of the trough. For example, the pipeline and trough could be in use only seasonally when cattle are in the pasture and water could be left at or shared with the spring source during the off-season (i.e., using a float valve or a variable valve).
- If the trough is to remain, it should have an adequate wildlife escape ramp which would be partially submerged in the trough, touches the bottom of the tank, and has a portion of the ramp flush with the inside of the trough (as many stranded animals will swim the perimeter of a tank in search of escape and may go under an existing ramp if a portion

of it is not flush with the inside wall of the tank). We recommend following the guidelines outlined in Water for Wildlife Handbook for Ranchers and Range Managers (referenced previously) for wildlife friendly cattle tanks and troughs.

Photograph 13 (June 27, 2016) - Trough at FS5149 Spring. Photograph is georeferenced and indicated in the field map (Figure 1).

W5 – East Gooseberry/FS5094 Spring

Date: June 28, 2016

Allotment: MLSNF-MMRD, White Mesa Cultural and Conservation Area

GPS Coordinate (UTM NAD83 12N): 609212 E 4187427 N (at first pipeline noted, source not located)

Water presence: Springs complex covered a broad area from one piped source through a first channel, then a small pond created by a human-made berm/earthen dam, and then another pipeline. Water flow was steady and low throughout the springs complex. Spring source(s) were not located, likely there were multiple sources/emergence zones.

Water infrastructure: Pipeline (presumably connected to primary source) at one flow fed into a top channel and then down into a pool created by a historical, human-made berm/earthen dam.

This pool drained down into the forest as a series of small flows, possibly via another pipeline (not found). Other springs/sources likely contribute to flow which was steady but low and continued downhill. The pipeline noted at the first outflow and first channel seemed to be functioning and was likely connected to the source. Pipeline from historical pool to wooded complex also seemed functional, although it was difficult to see connection. Old pipe observed in wooded area of springs complex was rusted, its functionality was unknown.

Fence infrastructure: Some historical fencing was present but seemed to have little impact on wildlife access.

Grazing evidence: Elk sign (scat, tracks) and elk trampling were noted at historical pool and wooded area of springs complex. No cattle sign or disturbance was noted. Mule deer also were observed. Trampling was noted at human-made pond and in wooded area of springs complex.

Aspen recruitment/age structure/density/condition: Aspen (*Populus tremuloides*) was present - browse was noted throughout but was not consistent. The least amount of aspen browse was noted at first pipeline outflow.

Willow species/age structure/density/condition: Not recorded in this assessment.

Vegetation composition: Native and non-native, invasive grasses were present upland of pool including native fowl mannagrass (*Glyceria striata*) as well as non-native orchard grass (*Dactylis glomerata*) and smooth brome (*Bromus inermis*). Exotic Kentucky bluegrass (*Poa pratensis*) may also be present (species not confirmed) but non-native vegetation does not seem to be dominant. Bull thistle (*Cirsium vulgare*) was present as a localized infestation at first outflow and around pool.

Restoration recommendation:

- The springs complex provided substantial surface water. The high diversity of native plants and multiple riparian areas suggest that this area should be an important conservation focus.
- If the area is not grazed in the future, the infrastructure could be removed.
- Non-native grasses were present at the site and should be a focus for managers into the future. We encourage managers to research and apply site-appropriate methods where possible.

- The non-native, invasive bull thistle can be managed by periodic pulling before seed set.

Photograph Set 14 (June 28, 2016) - Pipeline (possibly connected to primary spring source; top left) flowed (top middle) into top channel (top right) and then down into pool (created by historical, human-made berm or earthen dam; bottom left). Pool drained down into forest via series of small flows (e.g., bottom middle) likely via a pipeline (not found). Other springs/sources contributed to flow which was steady and continued downhill in and around wooded area (bottom right). All photos but bottom right are georeferenced and indicated in the field map (Figure 1).

W10 – Duck Lake

Date: June 28, 2016

Allotment: MLSNF-MMRD, White Mesa Cultural and Conservation Area

GPS Coordinate (UTM NAD83 12N): 607845 E 4185635 N (along edge of wet area at Duck Lake)

Water presence: Wet meadow was formed by groundwater coming to the surface and was supplemented by precipitation.

Water infrastructure: None.

Fence infrastructure: Exclosures were present around Bebb's willow (*Salix bebbiana*) and aspen (*Populus tremuloides*) restoration sites. Exclosures were functional.

Grazing evidence: No grazing evidence was detected within exclosures, but browse was common outside the exclosures.

Aspen recruitment/age structure/density/condition: Some aspen were growing toward recruitment height within exclosures while aspen were present but with little to no recruitment outside exclosures.

Willow species/age structure/density/condition: Some Bebb's willow growth toward recruitment was noted within exclosures, although no recruitment of willows was noted outside exclosures (heavy browsing).

Vegetation composition: Native riparian vegetation was dominant, including willow (species not recorded). Some invasive bull thistle (*Cirsium vulgare*) was noted throughout site.

Restoration recommendation:

- We recommend that the willow exclosures be maintained to promote aspen and willow recruitment.
- The non-native, invasive bull thistle can be managed by periodic pulling before seed set.

No photograph was taken during this field visit.

W3 – Horse Pasture Trail/FS 5160 Spring

Date: June 29, 2016

Allotment: MLSNF-MMRD, White Mesa Cultural and Conservation Area

GPS Coordinate (UTM NAD83 12N): 606133 E 4183391 N (presumed source)

Water presence: Spring source led to trough which overflowed into riparian area. Trough seemed to have steady low flow.

Water infrastructure: Spring source was piped to trough. No wildlife escape ramp was in the trough.

Fence infrastructure: Spring source had exclosure fence.

Grazing evidence: Wildlife cameras were noted on a tree at the spring; likely hunters were using wildlife cameras to track wild ungulate presence.

Aspen recruitment/age structure/density/condition: Aspen was present, condition not recorded.

Willow species/age structure/density/condition: Not recorded in this assessment.

Vegetation composition: Native vegetation was dominant with aspen mixed conifer overstory and high diversity of native forbs and grasses in understory (species not recorded).

Restoration recommendation:

- If the White Mesa Cultural and Conservation Area continues not to be grazed, it would be possible to remove most infrastructure (except for the protective source exclosure).
- If the area will be grazed in the future, the trough area should be managed so as to avoid erosion downslope of the trough. For example, the pipeline and trough could be in use only seasonally when cattle are in the pasture and water could be left at or shared with the spring source during the off-season (i.e., using a float valve or a variable valve).
- If the trough is to remain, it should have an adequate wildlife escape ramp which would be partially submerged in the trough, touches the bottom of the tank, and has a portion of the ramp flush with the inside of the trough (as many stranded animals will swim the perimeter of a tank in search of escape and may go under an existing ramp if a portion of it is not flush with the inside wall of the tank). We recommend following the guidelines

outlined in Water for Wildlife Handbook for Ranchers and Range Managers (referenced previously) for wildlife friendly cattle tanks and troughs.

Photograph Set 15 (June 29, 2016) – Presumed emergence zone (top left), exclosure fence (top right), and trough at Horse Pasture Trail/FS5160 Spring.

W7 – Poso Spring

Date: June 29, 2016

Allotment: MLSNF-MMRD, White Mesa Cultural and Conservation Area

GPS Coordinate (UTM NAD83 12N): 608659 E 4182353 N (at drainage/beginning of stagnating pools)

Water presence: Natural drainage led to series of stagnating pools. Ample surface water was available for wildlife but with little water flow (very small outflow through small breach in earthen dam).

Water infrastructure: Earthen dam was present at end of channel creates stagnant pool/artificial wetland and discourages flow. Mosquito population was incredibly healthy here.

Fence infrastructure: Not recorded in this assessment.

Grazing evidence: Elk sign (scat, tracks) was abundant. Wildlife cameras were noted on tree suggesting hunters were using wildlife cameras to track elk or deer presence.

Aspen recruitment/age structure/density/condition: Not recorded in this assessment.

Willow species/age structure/density/condition: Not recorded in this assessment.

Vegetation composition: Not recorded in this assessment.

Restoration recommendation:

- We recommend removing earthen dam to aid in restoring more natural flow regime to avoid stagnating pools. If earthen dam must remain, some flow must be allowed downstream to encourage greater water flow than exists currently. The situation observed during the field visit created an impact hotspot at the pool and encouraged stagnant water (presumably low water quality) and mosquitoes.
- Non-native vegetation, e.g., wooly mullein (*Verbascum rhapsus)*, was present but has the potential to be managed over time through pulling or clipping seed heads prior to seed set.

Photograph 16 (June 29, 2016) - Multiple pools in drainage (foreground) and earthen dam/berm (background) at W7-Poso Spring.

Recommendations

Summary of springs conditions:

Nearly all of the Elk Ridge springs visited during this trip were developed with infrastructure indicative of historic or ongoing human use and had little surface water available for springs-dependent plants or wildlife, other than troughs or trough leaks/overflow. W10-Duck Lake and C6-Big Flat Spring were exceptions as they were both undeveloped wet meadows.

Of the developed springs, W1-North Notch Spring and W5-East Gooseberry/FS 5094 Spring had seemingly lesser impact to the natural environment as they had surface water accessible to wildlife and regenerating native vegetation. Both were in the White Mesa Cultural and Conservation Area which has not been grazed by livestock for 14 years.

Eight of nine developed spring sites with troughs lacked adequate wildlife escape ramps.

At most of the springs sites (nine of fifteen sites), native vegetation was dominant, however nine of fifteen sites had perennial, non-native, and/or invasive grasses such as orchard grass and/or smooth brome present.

In the sites where willow was documented, heavy browsing was noted which limits the regeneration and recruitment of this species. W10-Duck Lake was an exception as exclosures here had been constructed and maintained specifically for aspen and willow growth. At the time of the field visit, we observed that the exclosures were resulting in successful regeneration of willow.

Assessment and monitoring recommendations:

All springs visited during this field trip were successfully cross-walked with documented springs data in a Geographic Information System. No previously undocumented springs were visited or discovered during this trip. Spring sites are displayed in the field map (Figure 1). We recommend ongoing monitoring of these springs sites and assessments that record more detailed information than that included in this report. This detailed information should include characterizations of infrastructure presence, condition, and impact (e.g., spring boxes, troughs), including exclosure fences. This information would help identify opportunities for restoration, whether infrastructure removal or repair, as well as potential impediments to wildlife water access. In addition the assessment protocol should include recording of the basic presence/absence and condition of key focal species, such as aspen; native riparian vegetation including willow; and focal non-native species, such as orchard grass or Kentucky bluegrass. This would provide the information needed to identify restoration opportunities with respect to aspen and willow regeneration and recruitment as well as non-native invasive species management needed to sustain these important springs sites.

General restoration recommendations:

Our primary restoration recommendations for springs along Elk Ridge are focused on managing the erosion and incised channeling at riparian areas, improving the wildlife compatibility of existing infrastructure, and managing non-native invasive species.

Most of the springs (eight of fifteen) had exclosure fences to protect the spring sources from erosion or trampling (C1/W9-Sego Spring, C9-Horse Mtn Spring #2, C8-Double Trough Spring, C3-Crystal Spring, C4-Big Spring, W1-North Notch Spring, W6-FS5149 Spring, and W3-Horse Pasture Trail/FS5160 Spring). This is an important first step. We encourage managers to

expand these protections to include the larger riparian and/or drainage areas where possible, particularly at C9-Horse Mtn Spring #2 and W1-North Notch Spring, and to repair fences at B1-Kigalia Guard Station Spring, C9-Horse Mtn Spring #2, C8-Double Trough Spring, C3-Crystal Spring; and at W1-North Notch Spring, and W6-FS5149 Spring if livestock grazing is resumed.

In addition, where the spring source is fully developed and no surface water is available beyond a trough, actions should be taken to increase wildlife water access. While a full trough could be accessed by larger animals, access for smaller wildlife – including small mammals – is often inhibited by the height and design of a trough. Springs-dependent species (such as springsnails) and pollinators are threatened by complete capture of water which limits or eliminates water access. Wildlife water access should be improved by increasing the surface water left at the source. For example, a pipeline and trough could be in use only seasonally when cattle are in the pasture and water could be left at or shared with the spring source during the off-season (i.e., using a float valve or a variable valve). Where there is flow from a leaking or overflowing trough, trampling or erosion is likely also present if the pasture is actively grazed. Some of this flow overflow can be managed into natural drainages with check dams to alleviate erosion, but only if trampling does not pose a risk to the utility of the check dams themselves.

Wildlife compatibility must be considered for spring infrastructure, namely tanks and troughs, especially where these provide the only source of water at a fully developed site. Eight of the nine troughs visited during this trip did not have wildlife escape ramps; only C1/W9-Sego Spring had a wildlife escape ramp. Every trough should be equipped with at least a basic wildlife escape ramp. Often, springs are fully developed with the only perennial surface water available in the wildlife troughs. These troughs however have steep sides with narrow edges, limiting safe access for smaller wildlife including small mammals, birds, and insects. An adequate wildlife escape ramp is one that is partially submerged in the trough, touches the bottom of the tank, and has a portion of the ramp flush with the inside of the trough (as many stranded animals will swim the perimeter of a tank in search of escape and may go under an existing ramp if a portion of it is not flush with the inside wall of the tank). We recommend following the guidelines

outlined in Water for Wildlife Handbook for Ranchers and Range Managers[2] for wildlife friendly cattle tanks and troughs.

Invasive species like dandelion and bull thistle were only detected at three sites (C9-Horse Mtn Spring #2, C10-North Long Point/Big Spring, and W10-Duck Lake) and could be managed by hand-pulling or digging before seed set. However, invasive, non-native grasses were detected at six of the visited spring sites (B1-Kigalia Guard Station Spring, C1/W9 Sego Spring, C8-Double Trough Spring, C6-Big Flat Spring, BE2-Posey Spring, W5-East Gooseberry/FS5094 Spring). Kentucky bluegrass, orchard grass, and smooth brome were the most prevalent non-native grasses and are also some of the most difficult to manage. Some approaches, such as selective hand-pulling, may be ineffective for persistent patches or may even encourage the spread of the species. We encourage managers to research and apply site-appropriate methods where possible. Where these non-native species do not dominate the native plants, restoration addressing invasive plants may be a lower priority compared to the other restoration actions recommended here. However, the ratio of native to non-native grasses should be monitored over time and, most importantly, non-native invasive grasses should not be considered for restoration or forage purposes in the future.

[2] Taylor, D. A. R, and M. D. Tuttle. 2007. *Water for Wildlife Handbook for Ranchers and Range Managers*. Bat Conservation International, USA.