## RESULTS AND DISCUSSION

### Overall Inventory and Ecological Health Summary for Spotted Dog WMA

The breakout of land ownership within the outer boundary of Spotted Dog WMA (Figure 6) is:

- Total acres within the modified boundary of the WMA (includes private lands and MTDNRC administered lands) = 35,301.03 acres
- Private inholdings = 1,315.38 acres (3.7 percent)
- MTFWP lands = 24,053.00 acres (68.1 percent)
- MTDNRC lands = 9,932.65 acres (28.1 percent)
- TOTAL ACRES OF MTFWP AND MTDNRC = 33,985.65 acres (96.3 percent)

The total acres in Spotted Dog WMA by lotic, lentic, and upland types (including vegetation types [i.e., forest/ woodlands, shrublands, grasslands, and modified sites]) (excluding the private inholdings):

- Lotic sites = 706.85 acres (2.1 percent) (lotic sites on MTFWP lands = 469.99 acres; lotic sites on MTDNRC lands = 236.86 acres)
- Lentic sites = 13.53 acres (0.0 percent)
- Upland sites = 33,265.27 (97.9 percent)
    - ❖ Forest/Woodland site = 7,566.72 acres (22.7 percent)
    - ❖ Shrubland sites = 4,371.78 acres (13.1 percent)
    - ❖ Grassland sites = 21,223.77 acres (63.8 percent)
    - ❖ Modified site = 103.00 acres (0.3 percent)
- TOTAL ACRES = 33,985.65

Figure 7 is a topographic map of Spotted Dog WMA showing the location and health score categories of all 192 sampled sites.

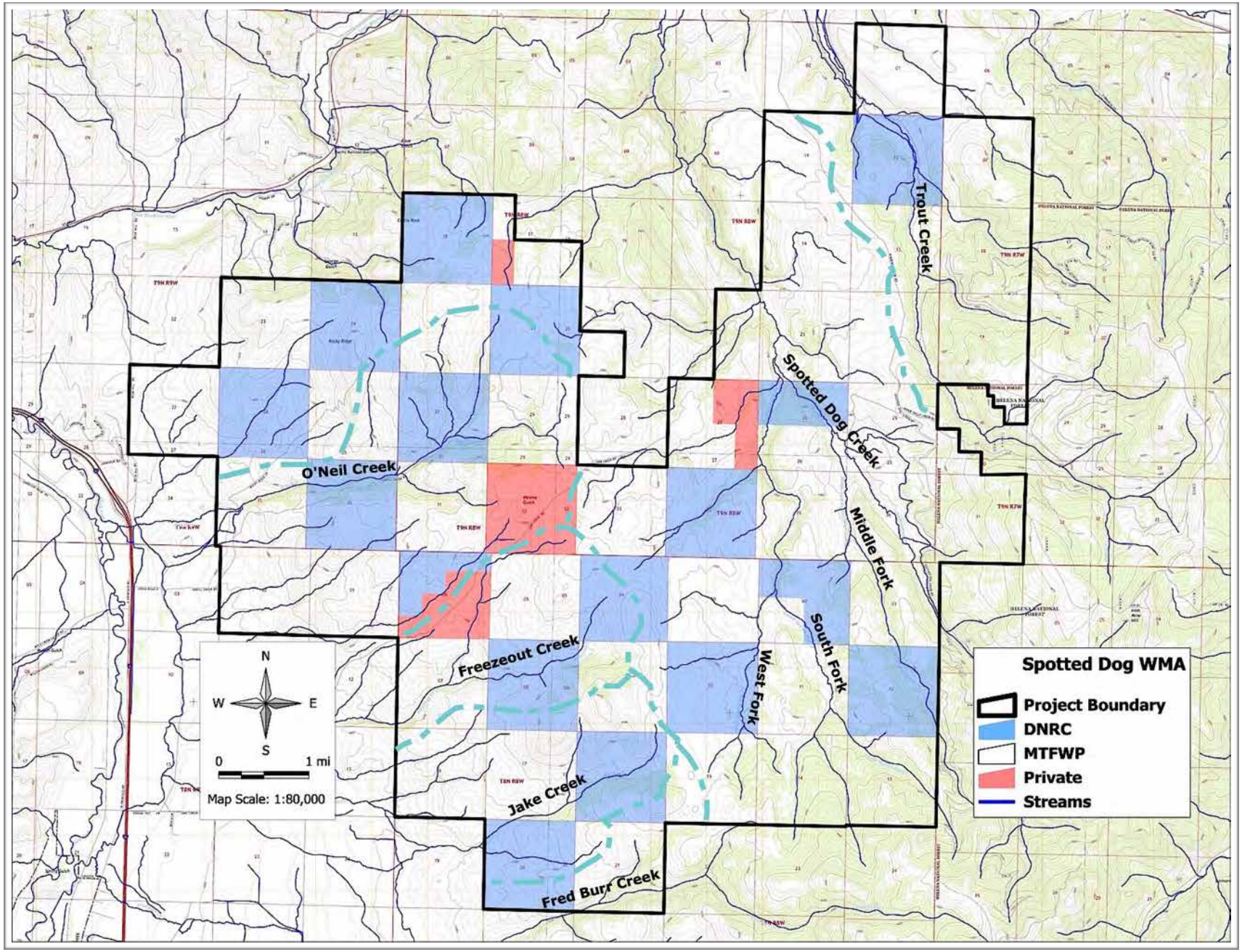


**Figure 6.** Topographic map of Spotted Dog WMA showing the major streams (dash lines approximate watershed boundaries)

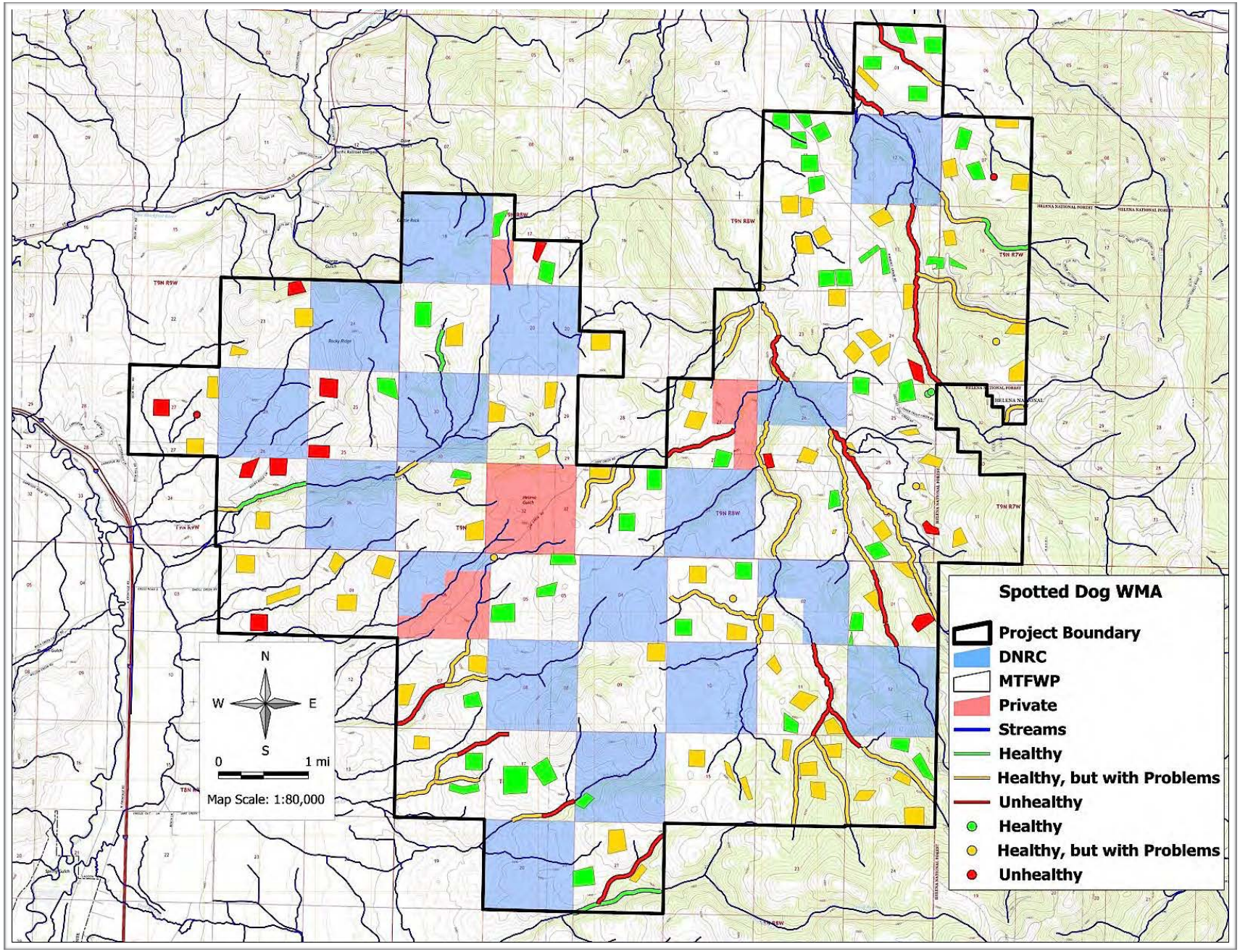


**Figure 7.** Topographic map of all 192 sites sampled in Spotted Dog WMA

Lotic and lentic wetland sites in Spotted Dog WMA occupy only a very small portion of the entire property, but these sites are far more important than their proportional area would suggest. Upland sites are in much better overall health than the lotic and lentic sites (Table 4). Another estimated 236.86 acres of lotic wetland are on MTDNRC lands that lie within the outer perimeter boundary of Spotted Dog WMA, but these MTDNRC sites were not accessed for inventory or ecological health assessment. Upland sites have what appear to be fewer polygons per acre than do the lotic and lentic sites. This is because the lotic and lentic sites are inventoried as a 100 percent sample, whereas the uplands are inventoried as a representative sample.

**Table 4.** Distribution and range of ecological health scores among the various site in Spotted Dog WMA

| Type | Number of Polygons | Acres | Weighted[1] Average Vegetation Score[2] | Weighted[1] Average Physical Site Score[2] | Overall Weighted[1] Average Health Score[2] | Range of Health Score[2] |
|---|---|---|---|---|---|---|
| Lotic Sites on MTDNRC Lands | | 236.86 | — | — | — | — |
| Lotic Sites | 55 | 469.99 | 63% | 60% | 62% | 83% - 35% |
| Lentic Sites | 9 | 13.53 | 63% | 65% | 64% | 95% - 38% |
| Upland Sites | 128 | 33,265.27 | 70% | 82% | 75% | 100% - 38% |
| ***WMA TOTAL*** | ***192*** | ***33,985.65*** | ***70%*** | ***82%*** | ***75%*** | ***100% - 35%*** |

[1]Weighted average score = scores are weighted based upon the size (acres) of each polygon

[2]Health score categories:

100% to 80% = Healthy/Proper Functioning Condition

79% to 60% = Healthy, but with Problems/Functioning at Risk

<60% = Unhealthy/Nonfunctional

Approximately two thirds of Spotted Dog WMA is occupied by grass dominated uplands (grasslands) (Table 5), which received the highest health scores among all the types of upland site. Forest/woodland sites received the lowest scores, reflecting the great degree of recent disturbance from timber harvest activities. (Coniferous forest and aspen woodland are both included in the forest/woodland type, but parenthetically separated in Table 5.)

**Table 5.** Distribution and range of health scores in Spotted Dog WMA upland inventory and ecological health assessment polygons among the various upland vegetation types

| Type | Number of Polygons | Acres | Weighted[1] Average Vegetation Score[2] | Weighted[1] Average Soil/Landscape Score[2] | Overall Weighted[1] Average Health Score[2] | Range of Health Score[2] |
|---|---|---|---|---|---|---|
| Forest/Woodland | 32 | 7,566.72 | 58% | 82% | 68% | 97% - 38% |
| Coniferous Forest[3] | (29) | (7,467.36) | (58%) | (82%) | (68%) | (97% - 38%) |
| Aspen Woodland[3] | (3) | (99.36) | (60%) | (97%) | (76%) | (83% - 68%) |
| Shrubland | 12 | 4,371.78 | 61% | 83% | 70% | 84% - 49% |
| Grassland | 83 | 21,223.77 | 76% | 82% | 79% | 100% - 44% |
| Modified | 1 | 103.00 | 68% | 77% | 73% | 73% - 73% |
| ***UPLAND TOTAL*** | ***128*** | ***33,265.27*** | ***70%*** | ***82%*** | ***75%*** | ***100% - 38%*** |

[1]Weighted average score = scores are weighted based upon the size (acres) of each polygon

[2]Health score categories:

100% to 80% = Healthy/Proper Functioning Condition

79% to 60% = Healthy, but with Problems/Functioning at Risk

<60% = Unhealthy/Nonfunctional

[3]Coniferous forest and aspen woodland types are part of the forest/woodland type

A large part of the lotic wetland sites (39 percent of the total acres) are in the Unhealthy category, and most of the remainder are Healthy, but with Problems (57 percent of the total acres) (Table 6). Of the few small lentic sites, over half (56 percent) are rated Unhealthy. The condition of these lotic and lentic wetland sites reflects the long history of livestock use and the habit of the livestock to disproportionately impact these wetland systems. Over two thirds of all upland sites have health issues and are rated Healthy, but with Problems or Unhealthy. Approximately a third of all upland sites rated as Healthy.

**Table 6.** Distribution of Spotted Dog WMA area by site type and among the three health categories

| Type | Number of Polygons | Acres | Healthy/Proper Functioning Condition[1] Acres (%) | Healthy, but with Problems/Functional At Risk[1] Acres (%) | Unhealthy/ Nonfunctional[1] Acres (%) |
|---|---|---|---|---|---|
| Lotic Sites | 55 | 469.99 | 19.76 (4%) | 267.49 (57%) | 182.74 (39%) |
| Lentic Sites | 9 | 13.53 | 0.57 (4%) | 5.27 (40%) | 7.39 (56%) |
| Upland Sites | 128 | 33,265.27 | 11,699.39 (35%) | 18,011.08 (54%) | 3,554.81 (11%) |
| ***WMA*** | ***192*** | ***33,748.49*** | ***11,719.72 (35%)*** | ***18,283.84 (54%)*** | ***3,744.94 (11%)*** |

[1]Health score categories

100% to 80% = Healthy/Proper Functioning Condition

79% to 60% = Healthy, but with Problems/Functioning at Risk

<60% = Unhealthy/Nonfunctional

Forest/Woodland sites in Spotted Dog WMA rated mostly Healthy, but with Problems, and Unhealthy (Table 7). Only three percent rated Healthy. This range of condition reflects the degree of disturbance from timber harvest over the past two decades, or so. The shrublands show a broad range of health rating, reflecting the heavy variation of usage by livestock experienced by these sites, as one goes from north to south. Lower health ratings are concentrated toward the north end of the shrubland zone along the west side of the WMA, where it appears that livestock concentrations have been greatest—likely due to close proximity to the point of turn-in entry for the livestock each season. These shrublands also provide important winter range for wildlife, but there is no obvious reason for any differential north to south pattern of use by the wildlife. Grasslands occupy approximately two thirds of all upland area on the WMA. Over half of these grasslands are rated as Healthy, but with Problems or Unhealthy. In general, the healthier grasslands tend to be in better condition the farther they are from a watering source, although the distance from water is not always measured “as the crow flies,” since the livestock are observed to follow roads and paths great distances around to avoid steep slopes.

**Table 7.** Distribution of Spotted Dog WMA upland area among the three health categories and the various upland vegetation types

| Type | Number of Polygons | Acres | Healthy/Proper Functioning Condition[1] Acres (%) | Healthy, but with Problems/Functional At Risk[1] Acres (%) | Unhealthy/ Nonfunctional[1] Acres (%) |
|---|---|---|---|---|---|
| Forest/ Woodland | 32 | 7,566.72 | 252.58 (3%) | 5,859.87 (78%) | 1,454.25 (19%) |
| Shrubland | 12 | 4,371.78 | 1,818.93 (42%) | 1,500.02 (34%) | 1,052.83 (24%) |
| Grassland | 83 | 21,223.77 | 9,627.88 (45%) | 10,548.19 (50%) | 1,047.73 (5%) |
| Modified | 1 | 103.00 | 0.00 (0%) | 103.00 (100%) | 0.00 (0%) |
| ***UPLAND*** | ***128*** | ***33,265.27*** | ***11,699.39 (35%)*** | ***18,011.08 (54%)*** | ***3,554.81 (11%)*** |

[1]Health score categories

100% to 80% = Healthy/Proper Functioning Condition

79% to 60% = Healthy, but with Problems/Functioning at Risk

<60% = Unhealthy/Nonfunctional

**Percent of the Upland Area Inventoried**

The total upland area (not including lotic and lentic areas or private inholdings) represented in Spotted Dog WMA encompasses 33,265.27 acres. The 128 polygons comprising this inventory sample cover 2,388.42 acres, for a 7.2 percent sample rate of the upland area as a whole. A breakdown of the sample by vegetation type is presented in Table 8.

**Table 8.** Distribution of the inventory sample of upland sites in Spotted Dog WMA among the various upland vegetation types

| Upland Vegetation Type | Number of Polygons | Total Sampled Polygon Acres | Acres of Landscape Represented | Percent of Vegetation Type the Sampled Polygons Represent |
|---|---|---|---|---|
| Forest/Woodland | 32 | 452.36 | 7,566.72 | 6.0% |
| Conifer Forest | (29) | (446.42) | (7,467.36) | 6.0% |
| Apen Woodland | (3) | (5.94) | (99.36) | 6.0% |
| Shrubland | 12 | 266.50 | 4,371.78 | 6.1% |
| Grassland | 83 | 1,663.28 | 21,223.77 | 7.8% |
| Modified Site | 1 | 6.28 | 103.00 | 6.1% |
| ***TOTAL*** | ***128*** | ***2,388.42*** | ***33,265.27*** | ***7.2%*** |

**Overall Lotic Ecological Health Assessment Scoring Summary**

For the purpose of summarization, polygons were separated into six groups by drainage (Figure 8), and average health scores within each group were examined. The groups range from two polygons on Fred Burr Creek, to 28 polygons in the Spotted Dog Creek drainage.

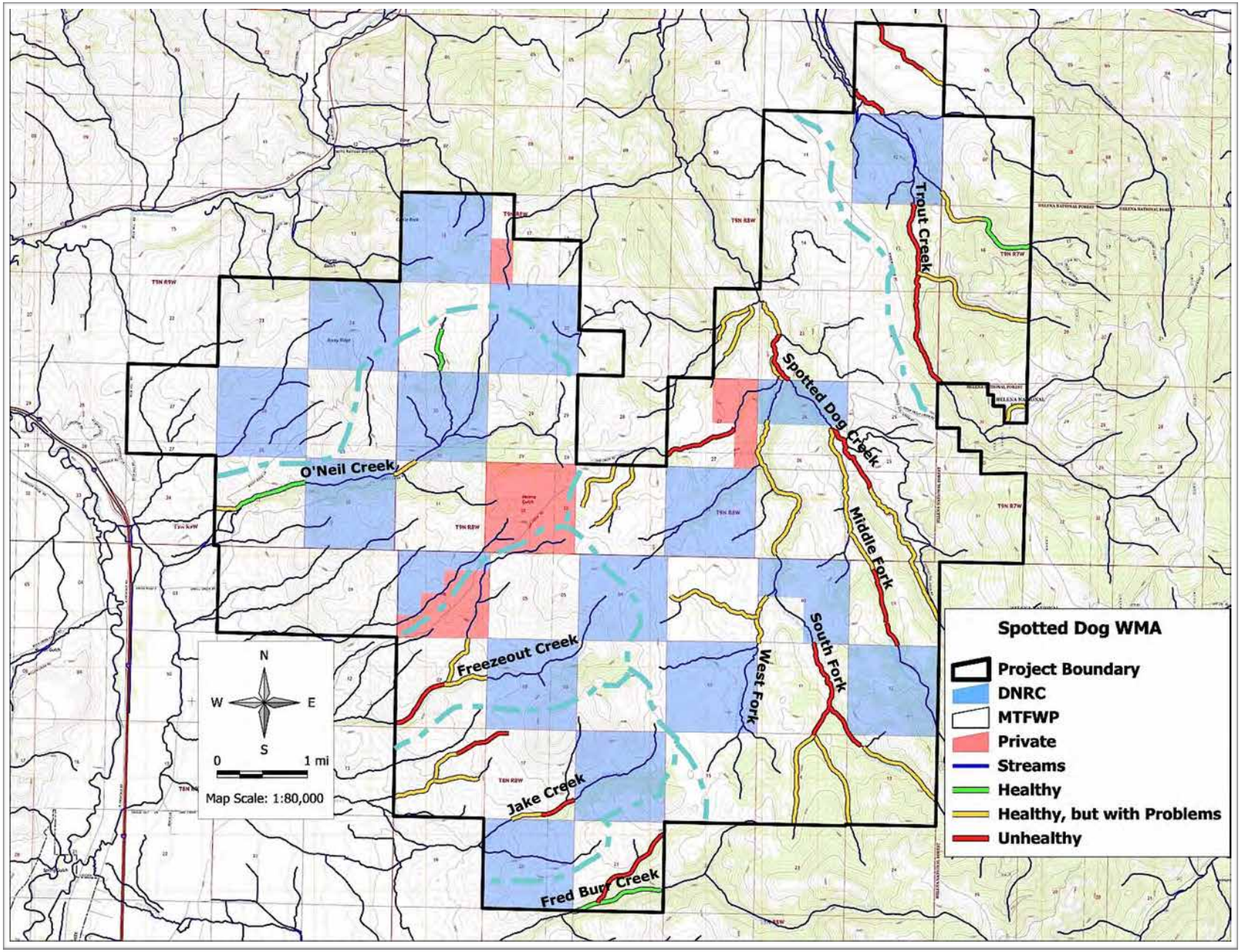


**Figure 8.** Topographic map of the 55 lotic sites sampled in Spotted Dog WMA (dash lines approximate watershed boundaries)

**Lotic Ecological Health Assessment Scoring Summary of Individual Stream Drainages**

Average overall lotic riparian health in Spotted Dog WMA is at the low end of Functional At Risk (Healthy, but with Problems), with a rating of 62 percent (Table 9). Individual polygon ratings range from 35 to 83 percent (Appendices D and E). The long history of livestock grazing, timber harvesting, and other land uses have concentrated impacts on the riparian zones, including invasive weed infestations, physical degradation of the stream channel, vegetation structural and compositional alteration, including introduction of non-native species. However, for most of these impacts, other than the invasive weed presence, there remains great potential for recovery. For the most part in Spotted Dog WMA, the hydrologic, edaphic, and vegetative components necessary for full recovery are still present on all sites. A few reaches on the main stems of Trout Creek and Spotted Dog Creek have suffered significant channel degradation that will make recovery of those sites more lengthy and difficult. (***Note:*** Complete ecological health assessment scoring data for each individual inventory polygon is provided in Appendix B.)

Only Trout Creek rated Nonfunctional (Unhealthy) (Table 9), while Freezeout Creek, Jake Creek, and Spotted Dog Creek rated just above the threshold in Functional At Risk (Healthy, but with Problems). Fred Burr Creek and O'Neil Creek also rated Functional At Risk (Healthy, but with Problems), but much closer to the Proper Functioning Condition (Healthy) category.

**Table 9.** Summary of riparian health ratings (weighted by polygon size) on the 55 lotic polygons inventoried in Spotted Dog WMA, broken out among the six stream drainages (health values given in percent ratings, where 100 percent represents perfect health rating)

| | Inventoried | | Percent Health Rating | | | Overall Health |
|---|---|---|---|---|---|---|
| Area (Polygons) | River Miles | Acres | Vegetation | Soil/Hydrology | Overall | Category[1] |
| Fred Burr Creek and Tributary (2 polygons) | | | | | | |
| | 2.20 | 11.82 | 64% | 83% | 74% | FAR |
| Freezeout Creek and Tributaries (3 polygons) | | | | | | |
| | 1.83 | 8.81 | 62% | 68% | 65% | FAR |
| Jake Creek and Tributaries (6 polygons) | | | | | | |
| | 3.00 | 17.10 | 61% | 62% | 61% | FAR |
| O'Neil Creek (4 polygons) | | | | | | |
| | 1.84 | 14.79 | 65% | 94% | 79% | FAR |
| Spotted Dog Creek and Tributaries (28 polygons) | | | | | | |
| | 19.84 | 361.17 | 64% | 60% | 62% | FAR |
| Trout Creek and Tributaries (12 polygons) | | | | | | |
| | 7.38 | 56.30 | 63% | 46% | 54% | NF |
| ***TOTALS/AVERAGES*** | ***36.09*** | ***469.99*** | ***63%*** | ***60%*** | ***62%*** | ***FAR*** |

[1]Health Categories:

PFC (Proper Functioning Condition [Healthy]) = score rating from 80 to 100 percent

FAR (Functional At Risk [Healthy, but with Problems]) = score rating from 60 to 80 percent

NF (Nonfunctional [Unhealthy]) = score rating below 60 percent

***Fred Burr Creek and Tributary***—This small drainage in Spotted Dog WMA consists of one polygon along the main stem of Fred Burr Creek and another polygon along an unnamed tributary entering from the north, both in Section 21 along the south edge of the WMA (Figures 9 and 10).

Table 10 summarizes the two polygons in the Fred Burr Creek drainage. The two polygons in such close proximity contrast starkly in health rating. The single polygon on the main stem of Fred Burr Creek rates in the Healthy category, while the tributary reach rates Unhealthy. Both polygons score barely above the threshold for Unhealthy on the vegetation side of the assessment, losing points for invasive weed infestation, disturbance increaser species, and woody species browse level. The polygon along the main stem of Fred Burr Creek has six species of invasive weeds, but less than approximately three percent of total invasive weed species cover. However, the tributary polygon has approximately 10 percent total canopy cover of invasive weeds, with two species (*Carduus nutans* [nodding plumeless thistle] and *Bromus tectorum* [cheatgrass]) each having three percent cover.

**Table 10.** Summary of riparian health ratings (weighted by polygon size) on the 2 lotic polygons inventoried along Fred Burr Creek and its tributaries (health values given in percent ratings, where 100 percent represents perfect health rating)

| | Inventoried | | Percent Health Rating | | | Overall Health |
|---|---|---|---|---|---|---|
| Area (Polygons) | River Miles | Acres | Vegetation | Soil/Hydrology | Overall | Category[1] |
| Fred Burr Creek and Tributary (2 polygons) | | | | | | |
| | 2.20 | 11.82 | 64% | 83% | 74% | FAR |

[1]Health Categories:
PFC (Proper Functioning Condition [Healthy]) = score rating from 80 to 100 percent
FAR (Functional At Risk [Healthy, but with Problems]) = score rating from 60 to 80 percent
NF (Nonfunctional [Unhealthy]) = score rating below 60 percent

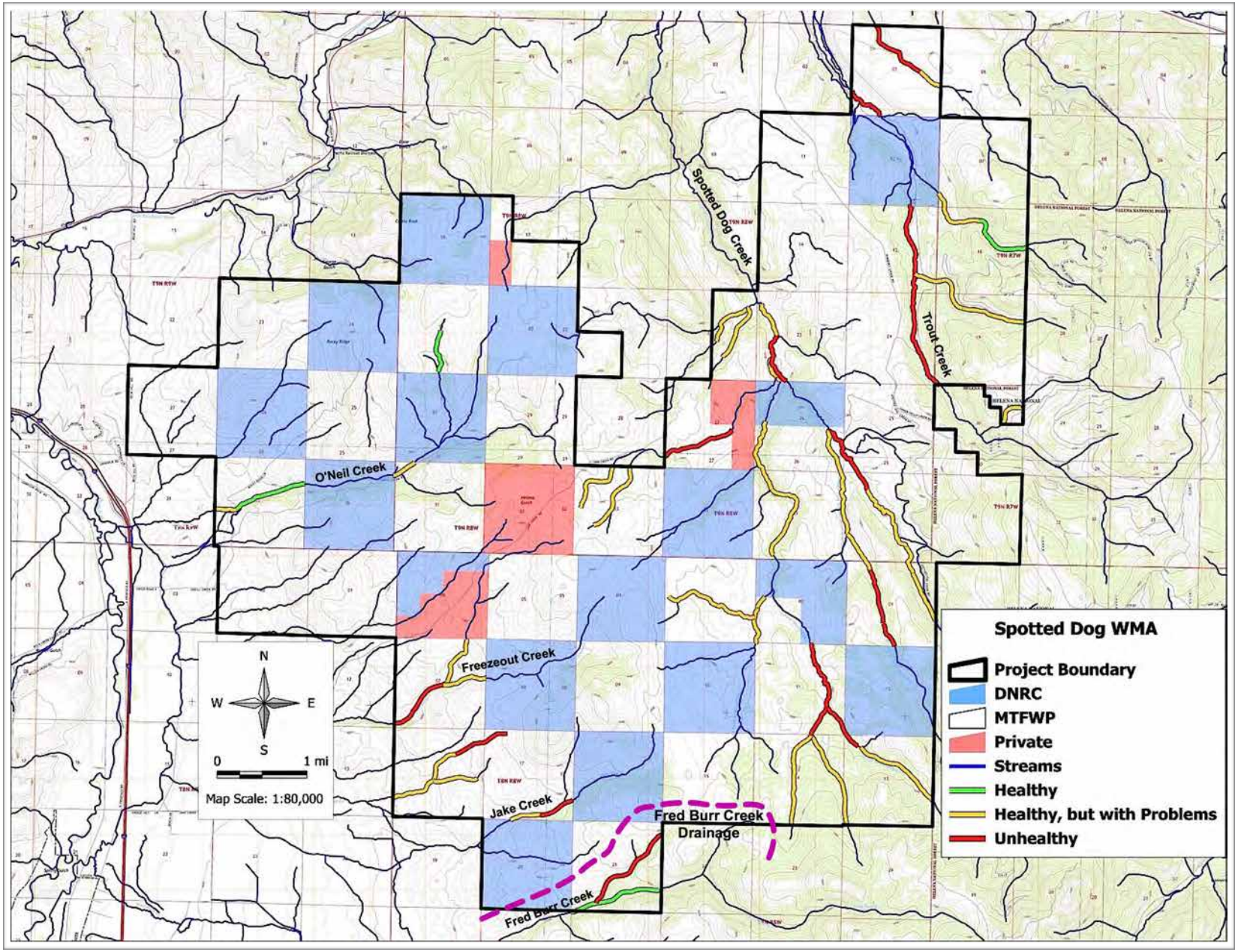


**Figure 9.** Overview topographic map of Fred Burr Creek and tributary showing its location in Spotted Dog WMA (dash lines approximate watershed boundaries)

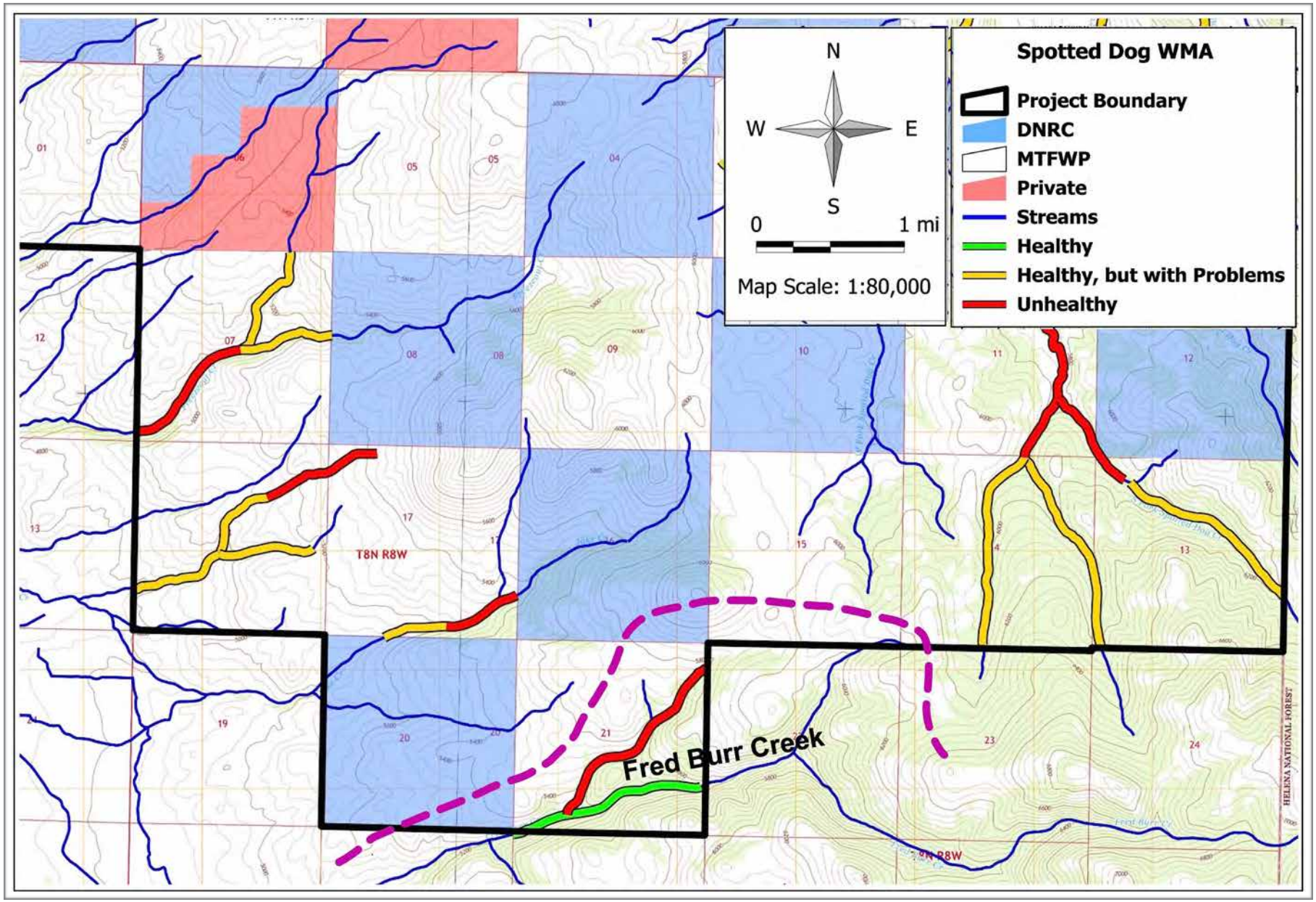


**Figure 10.** Close-up topographic map of Fred Burr Creek (dash lines approximate watershed boundaries)

The greatest difference in condition between the two polygons is seen on the physical side of the assessment, where the small tributary is more severely impacted (Photo 72). Signs of both livestock and wildlife use were evident along many portions of the tributary, including livestock trails and loafing areas, multiple species of wildlife pellets, and apparent moose (*Alces americanus*) browse pressure. The tributary is more impacted because it is more accessible to large animals along most of its length, than is the main stem of Fred Burr Creek (Photo 73), which is very densely covered with trees and tall shrubs within a steep sided narrow valley much of its length. There are indications that both livestock and wildlife spend extended time loafing in the shade near the bottom of the tributary, resulting in excessive bare ground and the disturbed state of understory vegetation. Much of the channel length along the tributary reach is moderately incised, which has reduced the ability of riparian vegetation to access the water table.

**Photo 72.** A typical view along the Unnamed tributary to Fred Burr Creek showing the altered and opened understory vegetation, as well as the moderately incised channel (Record ID 2043402) (2014 photo)

**Photo 73.** The main stem of Fred Burr Creek, showing a typical view of the dense cover of woody riparian vegetation and general difficulty of access for large animals (Record ID 2024159) (2011 photo)

***Freezeout Creek and Tributary***—Three polygons along Freezeout Creek and a tributary from the north were inventoried in Section 35 along the southwest edge of Spotted Dog WMA (Figures 11 and 12).

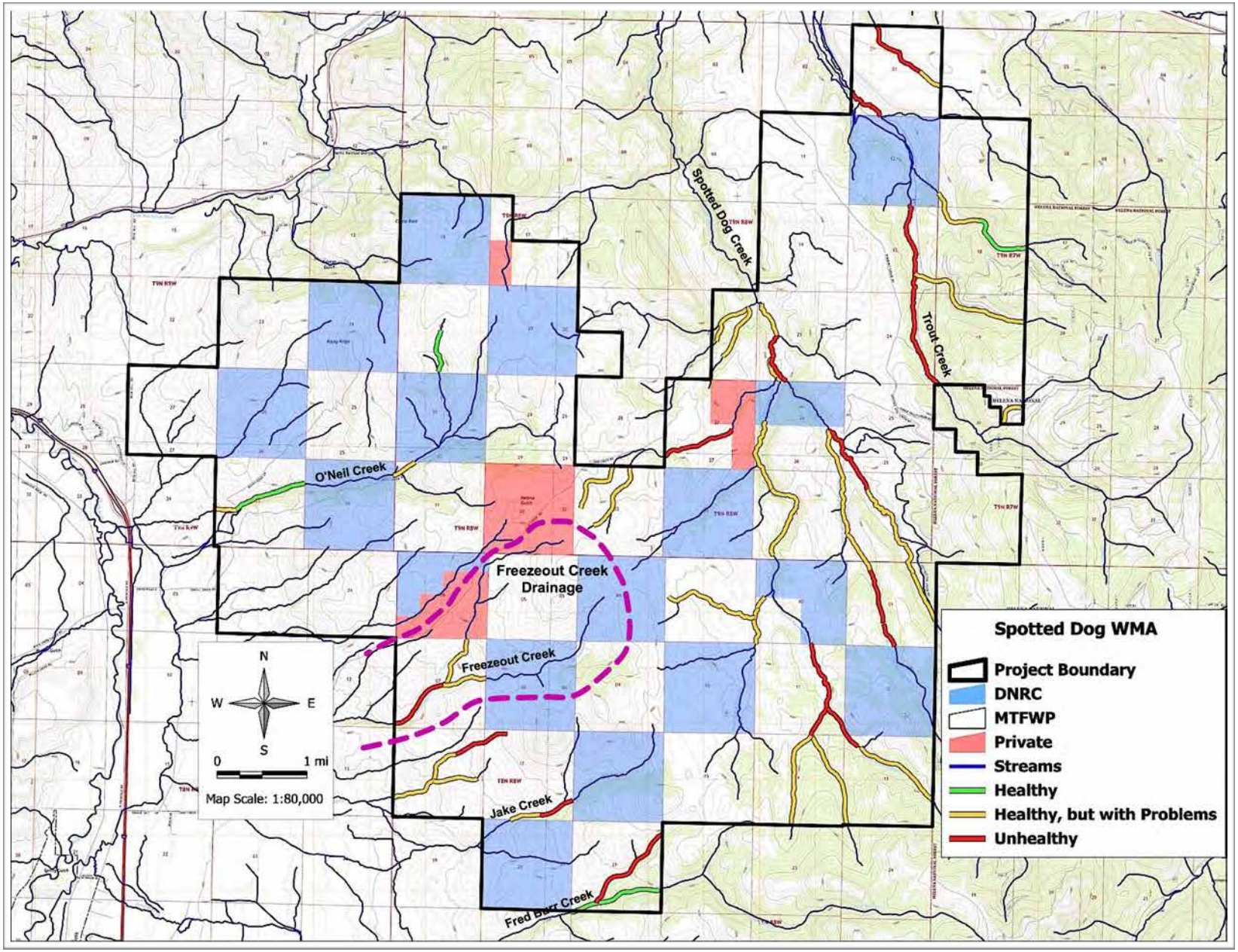


**Figure 11.** Overview topographic map of Freezeout Creek and tributary showing its location in Spotted Dog WMA (dash lines approximate watershed boundaries)

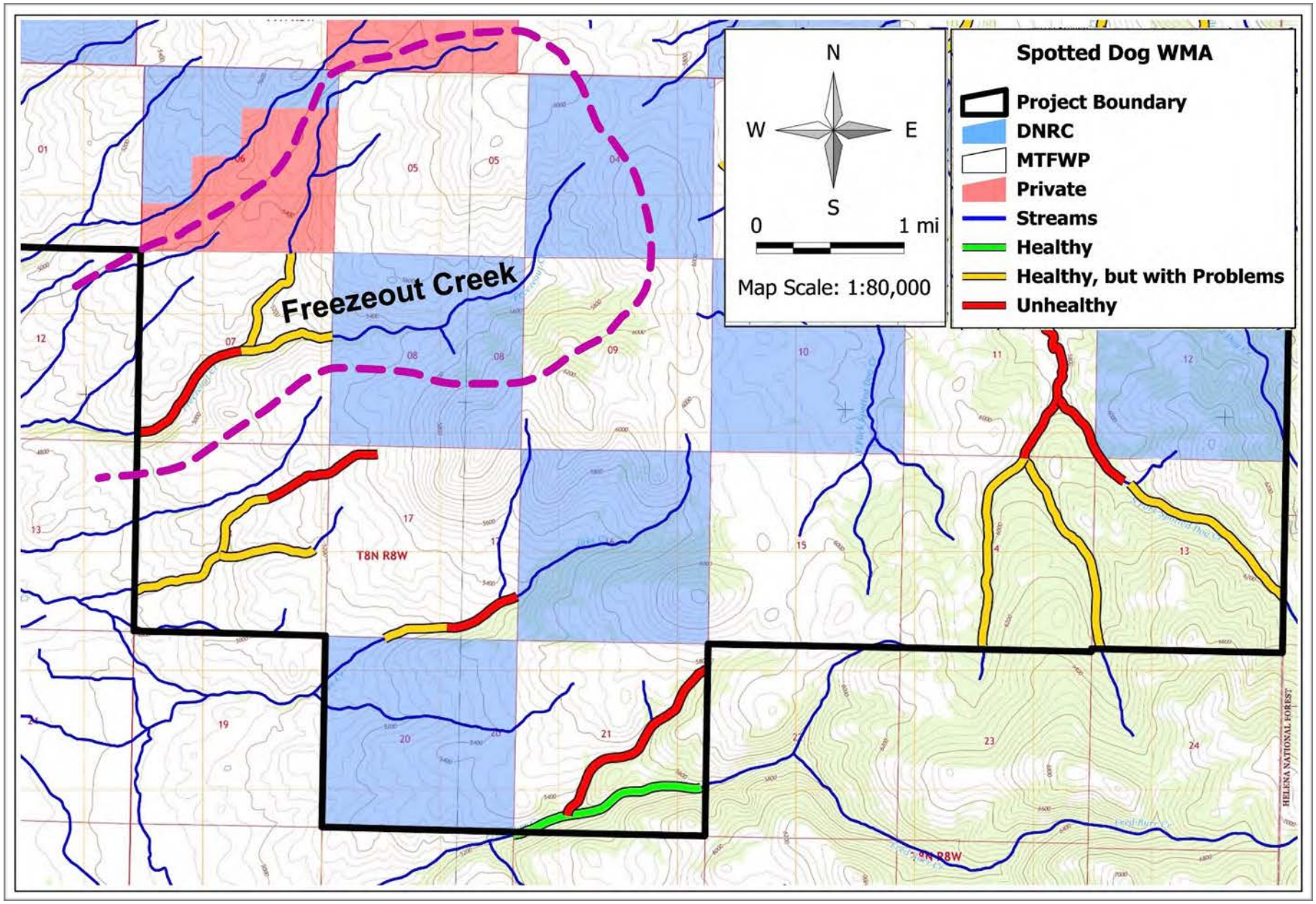


**Figure 12.** Close-up topographic map of Freezeout Creek and tributary (dash lines approximate watershed boundaries)

Table 11 summarizes the three polygons in the Freezeout Creek drainage. All three Freezeout Creek drainage polygons scored low on the vegetation side of the assessment. This is mainly due to infestations of invasive plant species (especially *Carduus nutans* [nodding plumeless thistle]), excessive amounts of introduced herbaceous species, and lack of adequate establishment of preferred woody species regeneration (especially on the lower polygon along the main stem of Freezeout Creek. Physical site factors also scored low, but each of the three polygons have different problems.

**Table 11.** Summary of riparian health ratings (weighted by polygon size) on the 3 lotic polygons inventoried along Freezeout Creek and its tributaries (health values given in percent ratings, where 100 percent represents perfect health rating)

| | Inventoried | | Percent Health Rating | | | Overall Health |
|---|---|---|---|---|---|---|
| Area (Polygons) | River Miles | Acres | Vegetation | Soil/Hydrology | Overall | Category[1] |
| Freezeout Creek and Tributaries (3 polygons) | | | | | | |
| | 1.83 | 8.81 | 62% | 68% | 65% | FAR |

[1]Health Categories:
PFC (Proper Functioning Condition [Healthy]) = score rating from 80 to 100 percent
FAR (Functional At Risk [Healthy, but with Problems]) = score rating from 60 to 80 percent
NF (Nonfunctional [Unhealthy]) = score rating below 60 percent

The upper polygon on Freezeout Creek is in good soil/hydrology health (Photo 74), but the downstream polygon and the tributary polygon both lack sufficient binding rootmass along the streambanks (Photo 75), show considerable structural alteration due to livestock hoof shear and trailing on areas away from the channel, and the channel itself is slightly to moderately incised on the tributary and the lower main stem polygon. Health ratings are uniformly low here, but there is excellent potential for rapid improvement. There is enough large rock in the channel to prevent further rapid downcutting, and all the vegetation components for a functional riparian system are still present, if livestock are not allowed to spend long periods here along the bottom. The electric utility company has felled several large *Populus balsamifera* (black cottonwood) trees where the large transmission line crosses overhead (Photo 76).

**Photo 74.** Typical view near the upper end of Freezeout Creek, showing adequate cover of plants with deep, binding roots along the channel (Record ID 2024156) (2011 photo)

**Photo 75.** Typical view near the lower end of Freezeout Creek, showing a lack of plants with deep, binding roots along the channel (Record ID 2024181) (2011 photo)

**Photo 76.** *Populus balsamifera* (black cottonwood) trees felled under the electric transmission line crossing the tributary to Freezeout Creek (Record ID 2024155) (2011 photo)

***Jake Creek and Tributary***—Six polygons were inventoried along Jake Creek and a tributary near the southwest corner of Spotted Dog WMA (Figures 13 and 14).

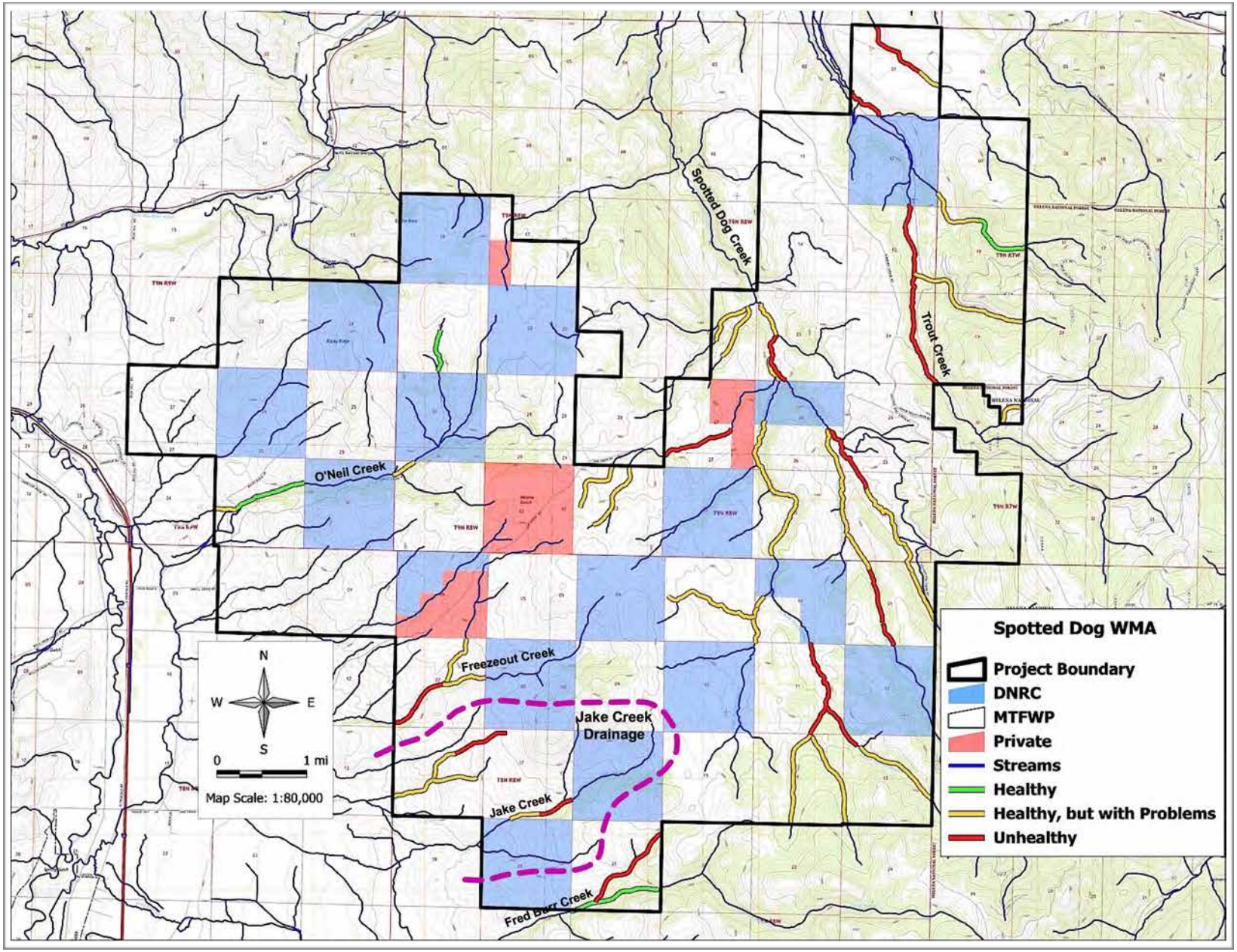


**Figure 13.** Overview topographic map of Jake Creek and tributaries showing its location in Spotted Dog WMA (dash lines approximate watershed boundaries)

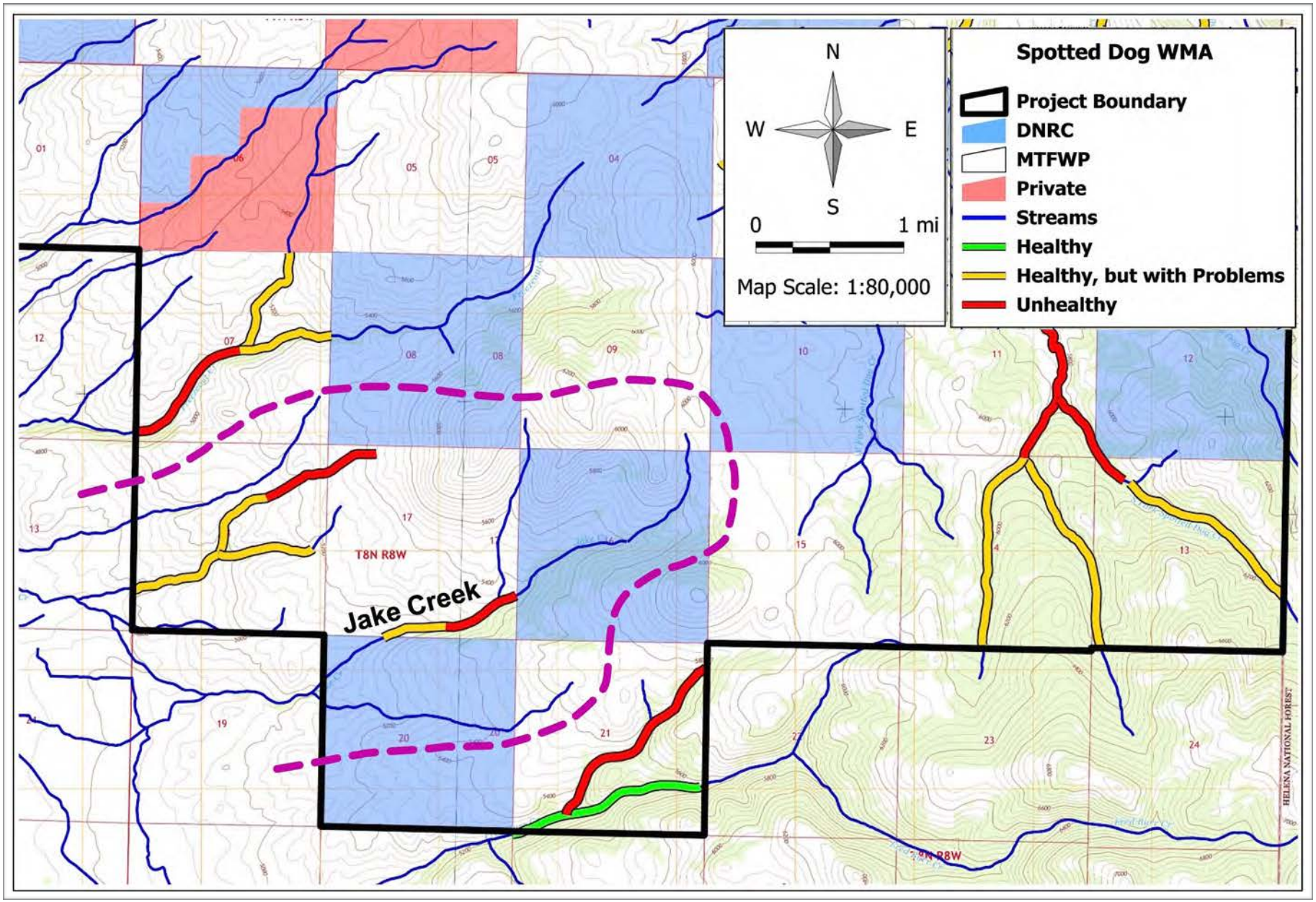


**Figure 14.** Close-up topographic map of Jake Creek and tributaries (dash lines approximate watershed boundaries)

Table 12 summarizes the six polygons from the Jake Creek drainage. The vegetation factors of the lotic ecological health assessment on all six polygons in the Jake Creek group reveal similar issues with invasive plant species, high browse utilization, excessive disturbance increaser species cover, some spots lacking adequate vegetation cover, and the removal by beaver of live woody plants.

**Table 12.** Summary of riparian health ratings (weighted by polygon size) on the 6 lotic polygons inventoried along Jake Creek and its tributaries (health values given in percent ratings, where 100 percent represents perfect health rating)

| | Inventoried | | Percent Health Rating | | | Overall Health |
|---|---|---|---|---|---|---|
| Area (Polygons) | River Miles | Acres | Vegetation | Soil/Hydrology | Overall | Category[1] |
| Jake Creek and Tributaries (6 polygons) | | | | | | |
| | 3.00 | 17.10 | 61% | 62% | 61% | FAR |

[1]Health Categories:
PFC (Proper Functioning Condition [Healthy]) = score rating from 80 to 100 percent
FAR (Functional At Risk [Healthy, but with Problems]) = score rating from 60 to 80 percent
NF (Nonfunctional [Unhealthy]) = score rating below 60 percent

The most consistently problematic physical site factor is the excessive amount of human-caused (e.g., livestock use) streambank alteration. Also of concern on some polygons is alteration to the rest of the polygon, excessive human-caused bare ground, and stream channel incisement (Photos 77 and 78). Most of the incisement downcutting occurred historically, and now only needs time free of further disturbance to recover and form a newly functional floodplain. This recovery process is now occurring in several areas. The recovery process timeframe depends greatly on the current level of disturbance, and future degree of disturbance, particularly livestock impacts to recovering floodplains which are vulnerable to degradation.

**Photo 77.** This reach of Jake Creek lacks deep, binding rootmass and appropriate streambank vegetation (Record ID 2024183) (2011 photo)

**Photo 78.** Jake Creek here lacks deep binding roots, shows altered banks and floodplain, and has a headcut starting to downcut the channel (Record ID 2024183) (2011 photo)

Much of the length of the main stem of Jake Creek was, until recently, hydrologically controlled by series of large beaver dams, that have now been abandoned and left unmaintained. It appears that the beaver colony exhausted their food supply when the *Populus tremuloides* (quaking aspen) were all gone, and there was no successful establishment of replacement trees (Photo 79).

**Photo 79.** Abandoned beaver dam pond on Jake Creek, with extensive beaver cutting of *Populus tremuloides* (quaking aspen), which almost entirely lacks successful regeneration (Record ID 2024182) (2011 photo)

***O'Neil Creek***—Four polygons were inventoried along O'Neil Creek. The upper two are separated by sections of MTDNRC land (Figures 15 and 16).

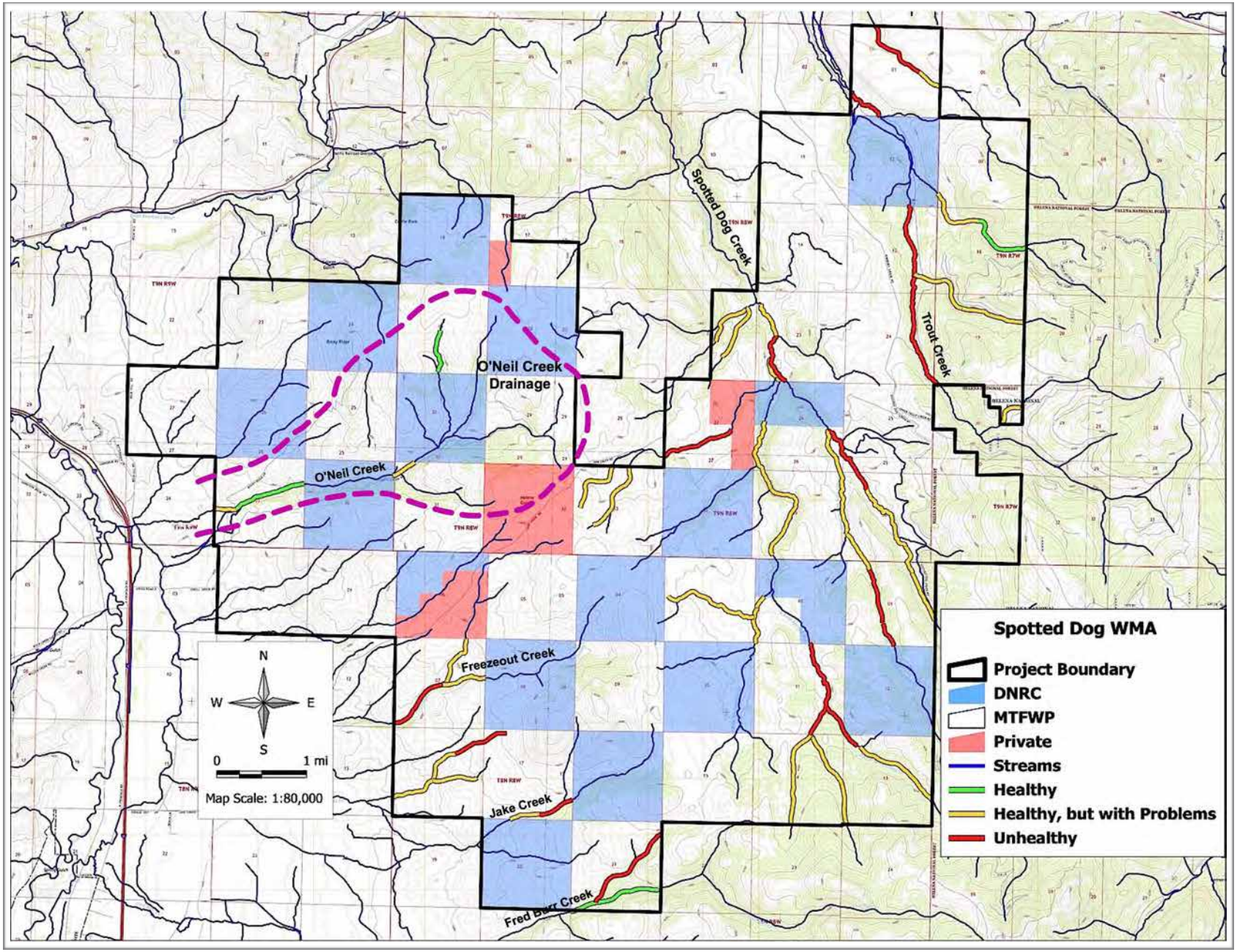


**Figure 15.** Overview topographic map of O'Neil Creek showing its location in Spotted Dog WMA (dash lines approximate watershed boundaries)

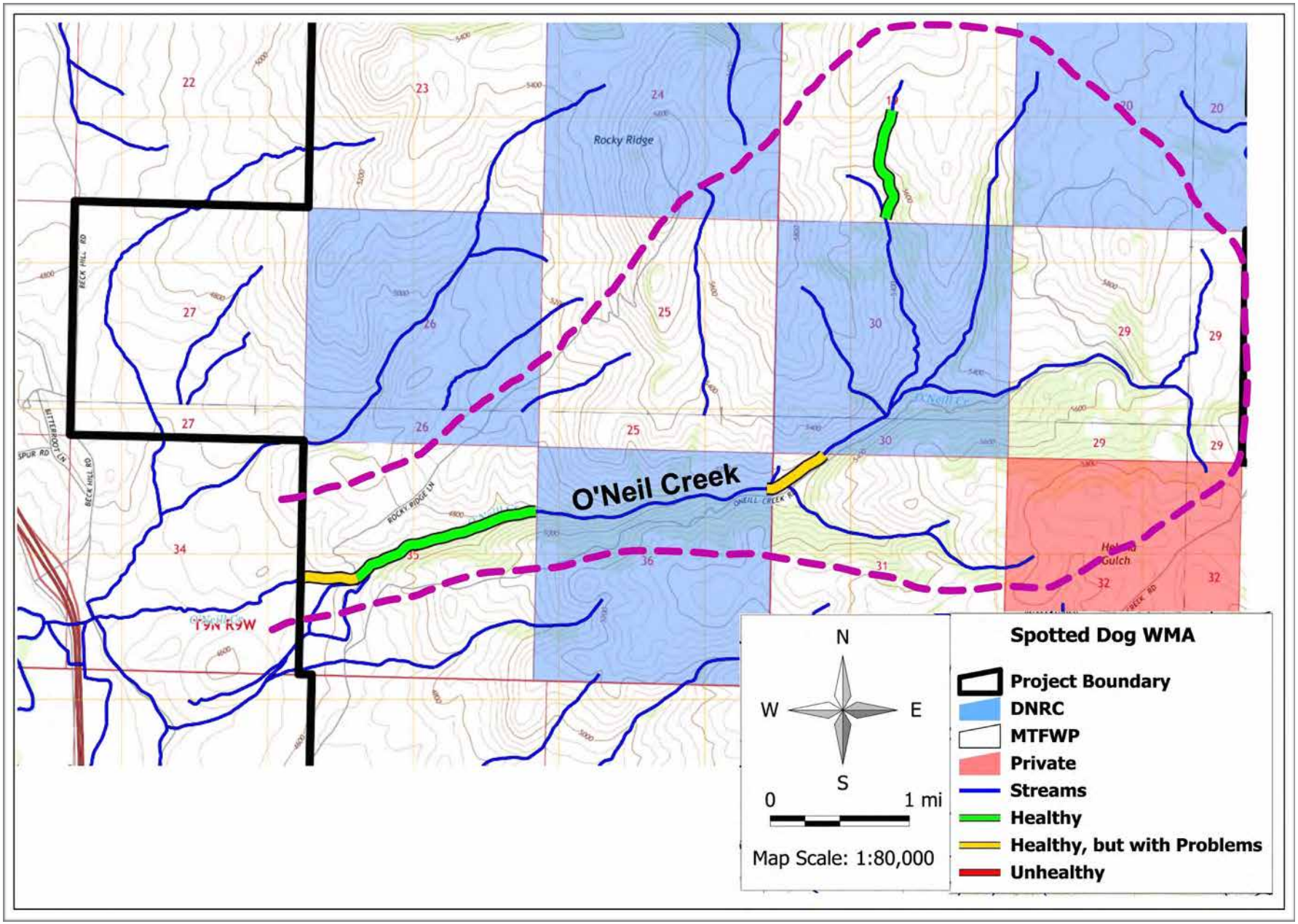


**Figure 16.** Close-up topographic map of O'Neil Creek (dash lines approximate watershed boundaries)

Table 13 summarizes the polygons in the O'Neil Creek drainage. The soil/hydrology side of the health assessment along O'Neil Creek is in excellent condition, but the vegetation is quite degraded.

**Table 13.** Summary of riparian health ratings (weighted by polygon size) on the 4 lotic polygons inventoried along O'Neil Creek and its tributaries (health values given in percent ratings, where 100 percent represents perfect health rating)

| | Inventoried | | Percent Health Rating | | | Overall Health |
|---|---|---|---|---|---|---|
| Area (Polygons) | River Miles | Acres | Vegetation | Soil/Hydrology | Overall | Category[1] |
| O'Neil Creek (4 polygons) | | | | | | |
| | 1.84 | 14.79 | 65% | 94% | 79% | FAR |

[1]Health Categories:
PFC (Proper Functioning Condition [Healthy]) = score rating from 80 to 100 percent
FAR (Functional At Risk [Healthy, but with Problems]) = score rating from 60 to 80 percent
NF (Nonfunctional [Unhealthy]) = score rating below 60 percent

The upper polygon, located at the stream headwaters in a grassland setting (Photo 80), is rated Healthy. The next lower polygon shows some impacts of its long history of livestock use, but is still rated only slightly below the threshold of Healthy (Photo 81). The lowest two polygons are near the ranch operations center at the west edge of Spotted Dog WMA. The upper and longer of the two is rated Healthy, but has a severe infestation of several invasive weed species—primarily *Centaurea maculosa* (spotted knapweed), *Cirsium arvense* (Canada thistle), and *Cynoglossum officinale* (houndstongue). The polygon at the lower end, where O'Neil Creek leaves the property, is severely impacted by livestock use, but even more severely impacted by beaver. The beaver have now abandoned their dams and ponds here; but before leaving, they felled most of the large *Populus balsamifera* (black cottonwood) and left down logs (Photo 82). Physically, this downstream polygon is properly functioning, but it has some serious vegetation issues. Primary among these is the worst *Centaurea maculosa* (spotted knapweed) infestation observed in Spotted Dog WMA. Other serious problems are the lack of sufficient regeneration of preferred woody species, the removal (by the beaver) of live woody material, and excessive disturbance induced herbaceous species cover.

**Photo 80.** The upper end, near the headwaters of O'Neil Creek, in a grassland setting (Record ID 2043403) (2014 photo)

**Photo 81.** A previously severely impacted site that is now healing after a season of rest from livestock grazing on O'Neil Creek (Record ID 2043385) (2014 photo)

**Photo 82.** Abandoned beaver pond on O'Neil Creek near the west edge of the WMA, with introduced *Bromus inermis* (smooth brome) and the invasive *Carduus nutans* (nodding plumeless thistle) (Record ID 2043387) (2014 photo)

***Spotted Dog Creek and Tributaries***—This large group of 28 polygons includes the higher elevation forested headwaters sites down to the wide, willow dominated meadow polygons, and on downstream to Spotted Dog Reservoir (Figures 17 and 18).

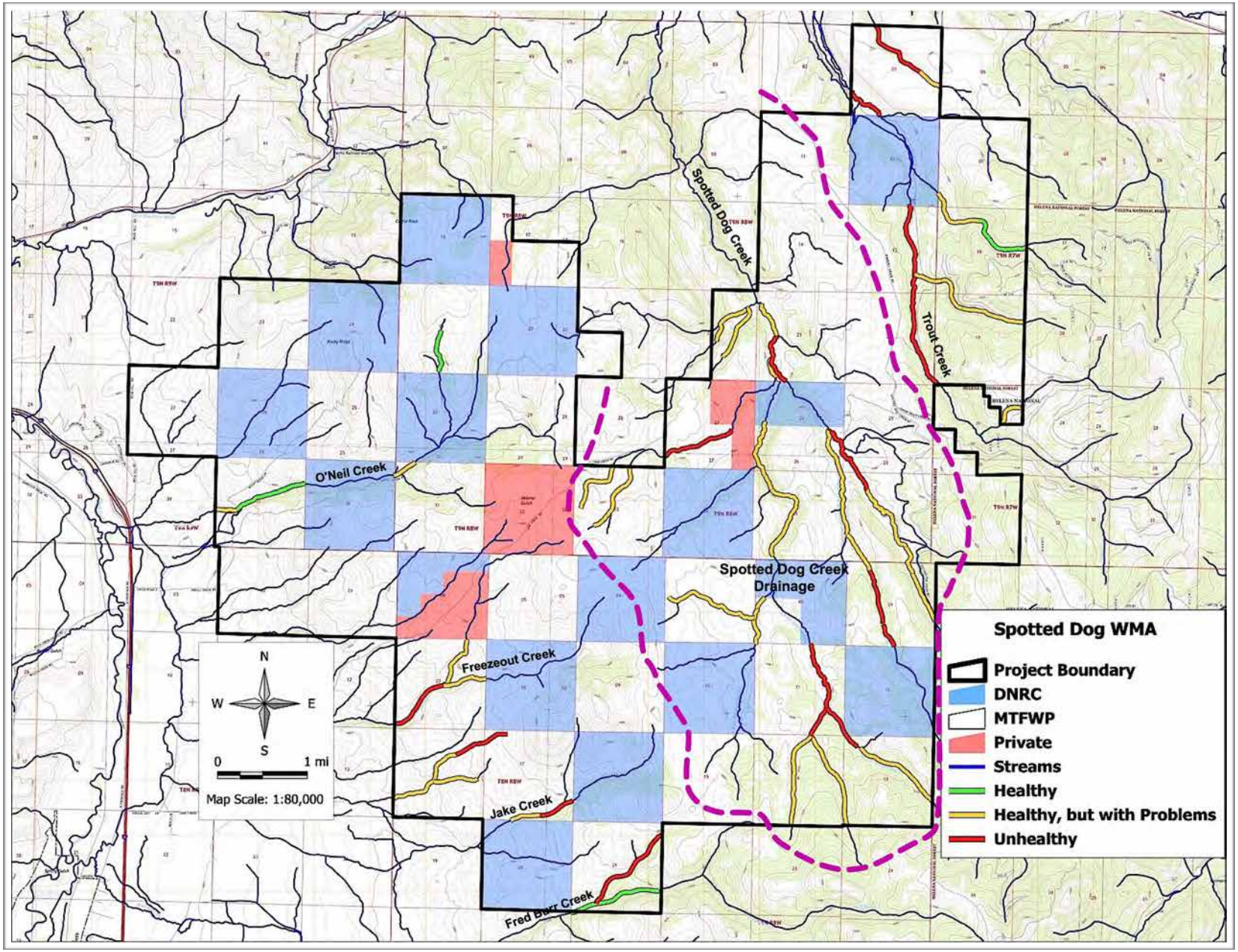


**Figure 17.** Overview topographic map of Spotted Dog Creek and tributaries showing its location in Spotted Dog WMA (dash lines approximate watershed boundaries)

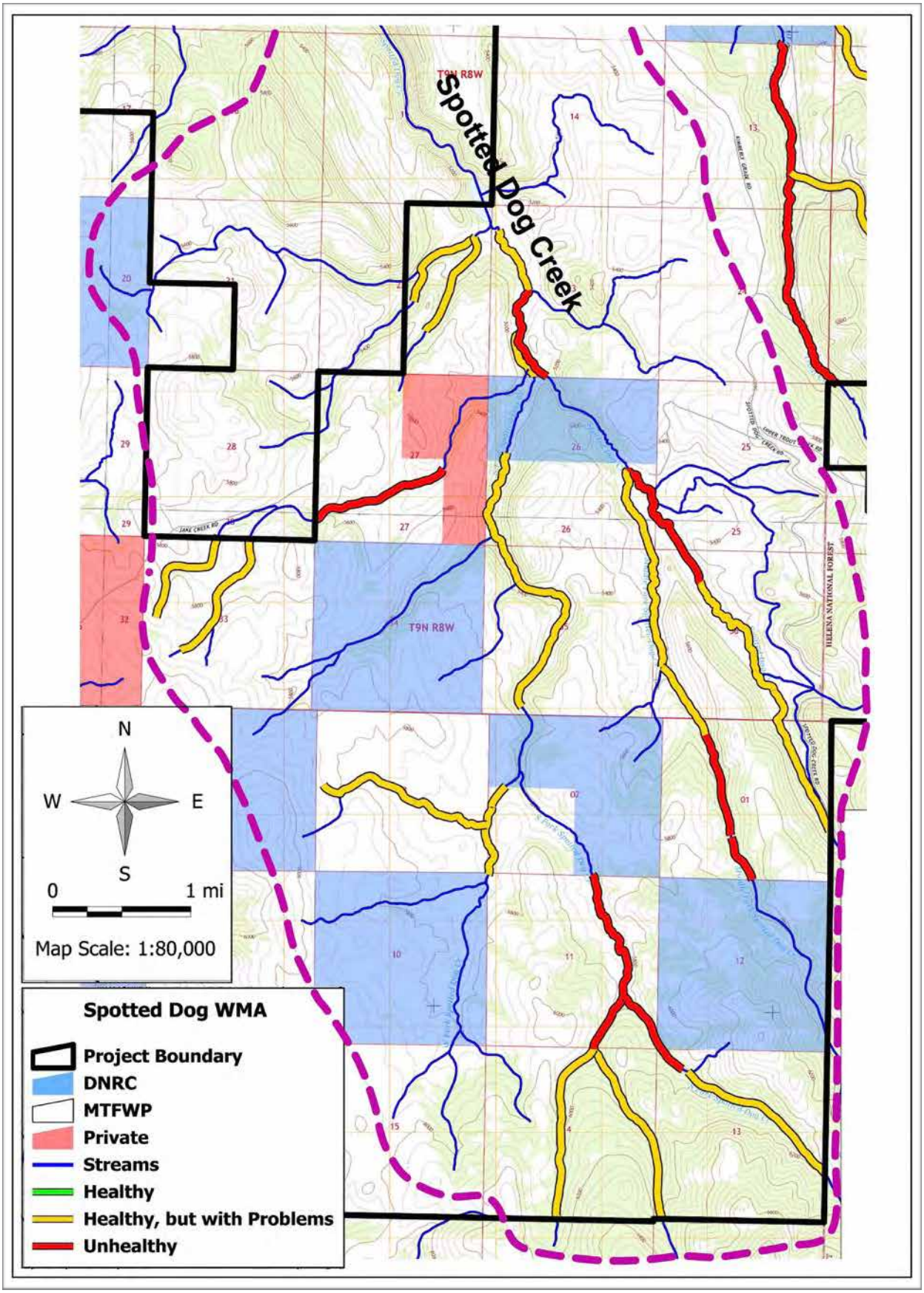


**Figure 18.** Close-up topographic map of Spotted Dog Creek and tributaries (dash lines approximate watershed boundaries)

Table 14 summarizes the 28 polygons in the Spotted Dog Creek drainage. Vegetation scores on the polygons are consistent, but low. These polygons exhibit the same issues common to most lotic riparian sites in Spotted Dog WMA: invasive weed species, intense browse utilization, excessive disturbance increaser species, and spotty problems with total vegetation cover, live woody removal and excessive standing dead woody material. Similarly with the physical site factors, there is a spectrum of problems, but no pattern of any certain factor being much worse than others was observed.

**Table 14.** Summary of riparian health ratings (weighted by polygon size) on the 28 lotic polygons inventoried along Spotted Dog Creek and its tributaries (health values given in percent ratings, where 100 percent represents perfect health rating)

| | Inventoried | | Percent Health Rating | | | Overall Health |
|---|---|---|---|---|---|---|
| Area (Polygons) | River Miles | Acres | Vegetation | Soil/Hydrology | Overall | Category[1] |
| Spotted Dog Creek and Tributaries (28 polygons) | | | | | | |
| | 19.84 | 361.17 | 64% | 60% | 62% | FAR |

[1]Health Categories:
PFC (Proper Functioning Condition [Healthy]) = score rating from 80 to 100 percent
FAR (Functional At Risk [Healthy, but with Problems]) = score rating from 60 to 80 percent
NF (Nonfunctional [Unhealthy]) = score rating below 60 percent

One subset of three polygons on the West Fork of Spotted Dog Creek scored better than most others. These sites are in a large complex of very old beaver ponds, now mostly filled in and converted to broad, wet meadows of mostly scattered willows and sedge stands on saturated soil. Within this relatively small complex of wetland sites, there remains one active colony of beaver (Photo 83), but most of the beaver are gone, and the evidence of beaver dams is mostly historic (Photo 84). It appears that these sites may have escaped being severely altered by livestock because they are inhibited from entering the soft, wet soil (Photo 85). However, at the time of this inventory and ecological health assessment (2011), cattle were on the sites and beginning to trample the slightly drier edges (Photo 86). The sites are now becoming drier, which allows the cattle to access previously unaltered sites. When livestock enter riparian sites with lush palatable vegetation and soft, wet soils, soil damage occurs quickly (Photos 87 and 88).

**Photo 83.** An active large beaver pond on South Fork Spotted Dog Creek (Record ID 2024179) (2011 photo)

**Photo 84.** Exposed evidence of historic beaver dam in the upper portion of the main stem of Spotted Dog Creek (Record ID 2024164) (2011 photo)

**Photo 85.** A large riparian wet meadow with scattered willows, formed as sediment and peat filled historic beaver ponds, on West Fork Spotted Dog Creek (Record ID 2024179) (2011 photo)

**Photo 86.** Soft, wet soil on West Fork Spotted Dog Creek, that has recently been damaged and exposed to erosion by livestock trampling (Record ID 2024180) (2011 photo)

**Photo 87.** A historic beaver dam that is being opened by livestock hoof shear to drain the wetland on a tributary to South Fork Spotted Dog Creek (Record ID 2024177) (2011 photo)

**Photo 88.** The erosion accelerates on a channel lacking deep, binding rootmass along Spotted Dog Creek (Record ID 2024166) (2011 photo)

***Trout Creek***—Twelve lotic polygons were inventoried in the Trout Creek drainage, four along the main stem and eight along unnamed tributaries (Figures 19 and 20).

Table 15 summarizes the 12 polygons in the Trout Creek drainage. The four polygons on the main stem of Trout Creek are in the poorest health of any group in the Spotted Dog WMA. Trout Creek shows the severe alteration and degradation resulting from a long history of intense grazing pressure and livestock concentration along the bottom. The woody vegetation canopy has been opened (Photo 89), the floodplain has been dried out, and the understory converted mostly to introduced disturbance increaser species and invasive weed species. The channel has been physically destabilized to erode vertically in spots (Photo 90) and laterally in other spots (Photo 91). The channel incisement (vertical erosion) has lowered the water table, further drying out the riparian zone and causing accelerated exit of water from the system.

**Table 15.** Summary of riparian health ratings (weighted by polygon size) in the 12 lotic polygons inventoried along Trout Creek and its tributaries (health values given in percent ratings, where 100 percent represents perfect health rating)

| | Inventoried | | Percent Health Rating | | | Overall Health |
|---|---|---|---|---|---|---|
| Area (Polygons) | River Miles | Acres | Vegetation | Soil/Hydrology | Overall | Category[1] |
| Trout Creek and Tributaries (12 polygons) | | | | | | |
| | 7.38 | 56.30 | 63% | 46% | 54% | NF |

[1]Health Categories:
PFC (Proper Functioning Condition [Healthy]) = score rating from 80 to 100 percent
FAR (Functional At Risk [Healthy, but with Problems]) = score rating from 60 to 80 percent
NF (Nonfunctional [Unhealthy]) = score rating below 60 percent

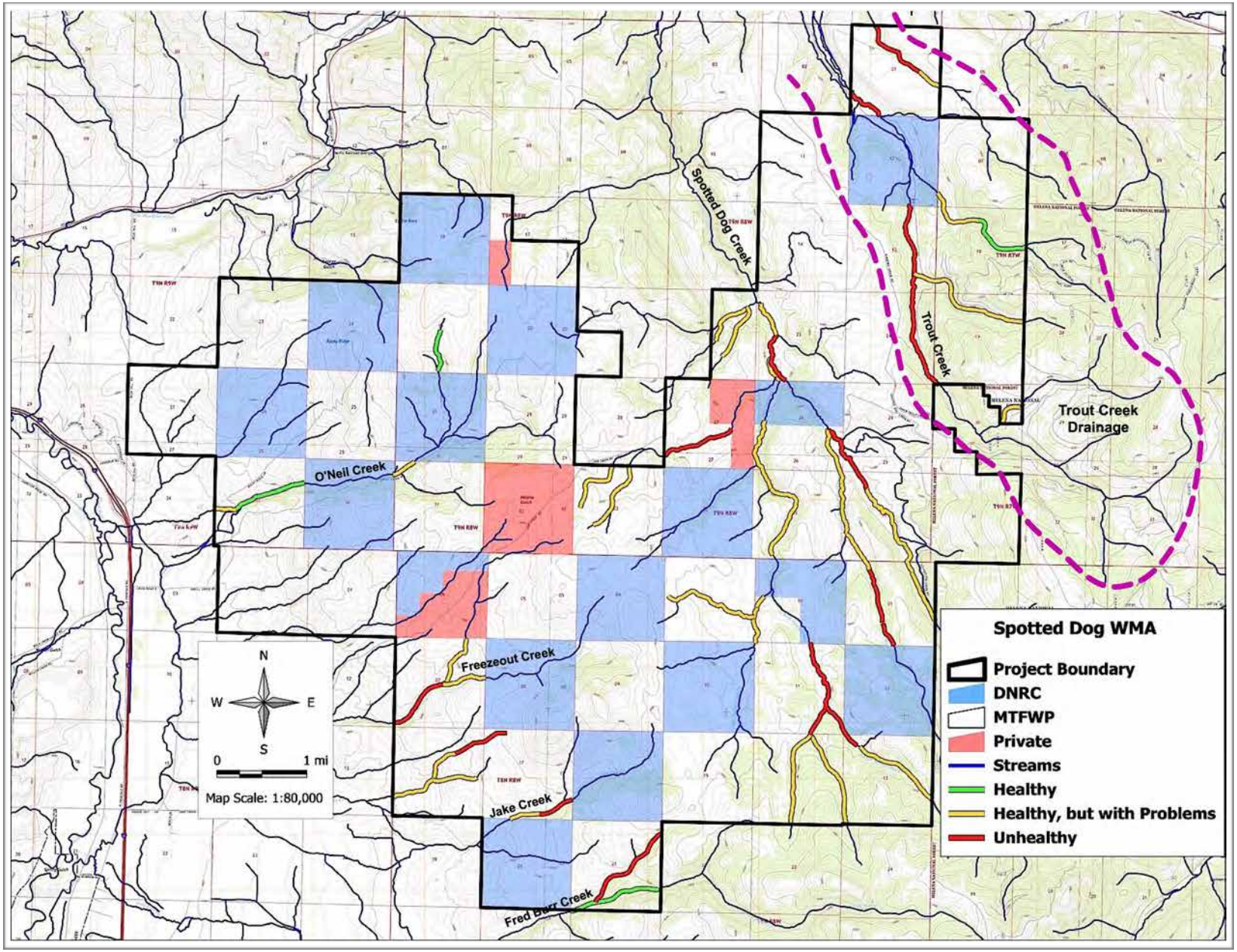


**Figure 19.** Overview topographic map of Trout Creek and tributaries showing its location in Spotted Dog WMA (dash lines approximate watershed boundaries)

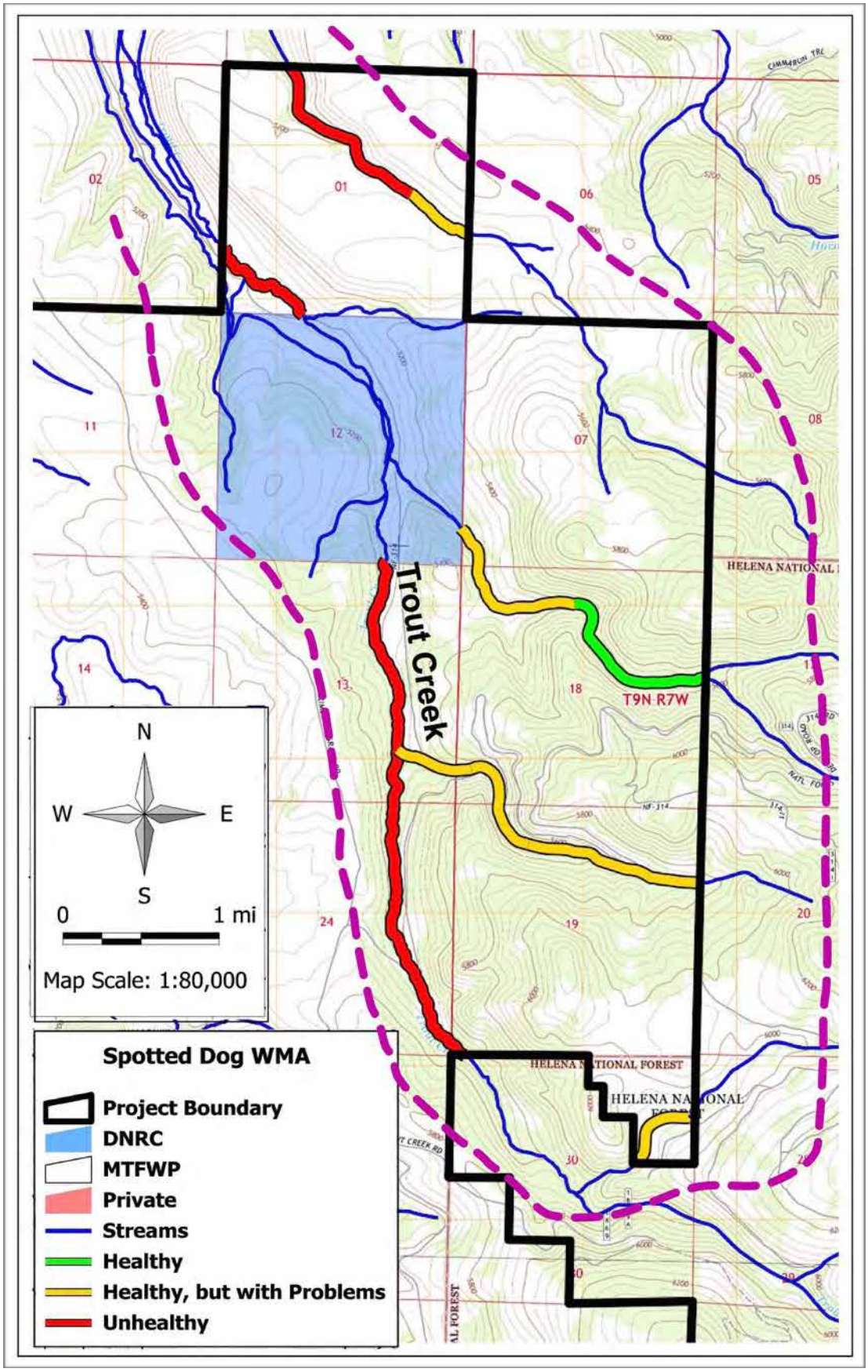


**Figure 20.** Close-up topographic map of Trout Creek and tributaries (dash lines approximate watershed boundaries)

**Photo 89.** A characteristic view of the degree to which the woody vegetation along Trout Creek has been removed and opened, due to livestock removal of tree and shrub regeneration (Record ID 2024170) (2011 photo)

**Photo 90.** One of several reaches of Trout Creek where vertical erosion is incising (downcutting) the channel and lowering the water table beyond access of the herbaceous vegetation roots (Record ID 2024162) (2011 photo)

**Photo 91.** A reach of Trout Creek with enough rock to prevent further rapid vertical erosion, but lacking the deep binding rootmass that would prevent lateral erosion of the streambanks (Record ID 2024162) (2011 photo)

The eight polygons inventoried along the tributaries of Trout Creek are less impaired than those along the main stem. These tributaries drain onto Spotted Dog WMA mostly from forested lands along the east side. Riparian health on these unnamed tributaries is impaired by a long history of livestock use, although much less severely than on the main stem of Trout Creek (Photo 92). Vegetation factors generally impaired on these tributary reaches, as elsewhere in Spotted Dog WMA, are infestation of invasive weeds, excessive amounts of disturbance increaser herbaceous species, and high browse use of preferred woody species (Photo 93). Infestations of *Cynoglossum officinale* (houndstongue), which is spread by both livestock and wildlife, are severe in several locations. The woody vegetation cover along these tributary reaches is much less impacted than along the main stem of Trout Creek, with ample remaining plants of preferred species (e.g., *Salix* [willows], *Cornus sericea* [red-osier dogwood], *Alnus incana* subsp. *tenuifolia* (thin-leaved alder), *Populus tremuloides* [quaking aspen], etc.) to quickly recover full structural functionality and habitat values (Photo 94).

**Photo 92.** Typical of many tributary riparian sites in the Trout Creek drainage, with somewhat impaired channel and reduced woody cover, but having intact potential for quick recovery (Record ID 2043409) (2014 photo)

**Photo 93.** An impacted site in the upper reaches of the Trout Creek drainage, showing high browsing on woody plants, but hydrologic integrity, and excellent potential for rapid recovery (Record ID 2043406) (2014 photo)

**Photo 94.** A small wet site with little recent negative impact beyond high browsing on some young woody plants (Record ID 2043405) (2014 photo)

**Lentic Ecological Health Assessment Scoring Summary**

Nine lentic sites were inventoried in Spotted Dog WMA (Figure 21), revealing a variety of kind, size, and health status of wetland.

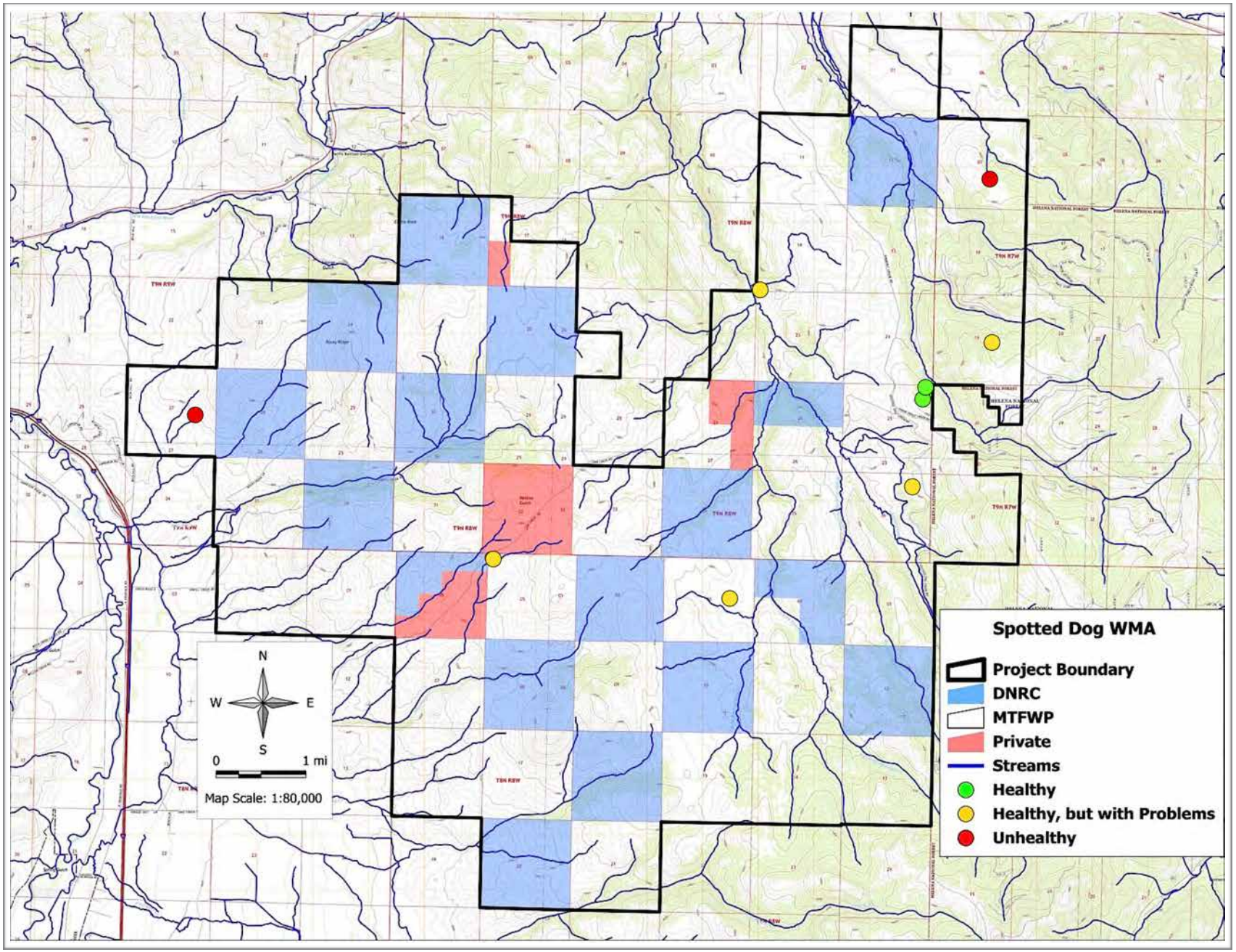


**Figure 21.** Topographic map of the nine lentic sites sampled in Spotted Dog WMA (lentic site dots are not to scale)

Five of the nine sites are spring/seeps, where ground water surfaces on a slope or a site not directly connected to a stream (Table 16). Three sites are small, human constructed ponds made for the purpose of watering livestock. One site is the wetland area surrounding the portion of Spotted Dog Reservoir that lies in Spotted Dog WMA land, and the others are a small fen/marsh area.

**Table 16.** Summary of health ratings (weighted by polygon size) in the nine lentic wetlands inventoried in Spotted Dog WMA (health values given in percent ratings, where 100 percent represents perfect health rating)

| Number of Polygons | Acres | Weighted[1] Average Vegetation Score[2] | Weighted[1] Average Physical Site Score[2] | Overall Weighted[1] Average Health Score[2] | Overall Health Category[2] | Range of Health Score[2] |
|---|---|---|---|---|---|---|
| 9 | 13.53 | 63% | 65% | 64% | FAR | 95% - 38% |

[1]Weighted average score = scores are weighted based upon the size (acres) of each polygon
[2]Health Categories:
PFC (Proper Functioning Condition [Healthy]) = score rating from 80 to 100 percent
FAR (Functional At Risk [Healthy, but with Problems]) = score rating from 60 to 80 percent
NF (Nonfunctional [Unhealthy]) = score rating below 60 percent

***Seep/Spring Wetlands***—The largest lentic site is a spring/seep located in Section 27 on the northwest edge of the WMA (Photo 95). This site has long been used to provide livestock water by piping the water out to nearby tanks. This practice has concentrated the animals in the vicinity of the wetland, and has severely impacted both the site vegetation and physical condition. The site is severely infested with several invasive weed species, especially *Cirsium arvense* (Canada thistle) and *Centaurea maculosa* (spotted knapweed) (Photo 96). A season of rest has allowed a lush covering of herbaceous vegetation to obscure severe hummocking and pugging that extend throughout the seven acre wetland (Photo 97). A developed spring box was once fenced, but this small exclosure is now in disrepair, and included only a small fraction of the wetted area. On a positive note, ample new regeneration of willows and other preferred woody plants was observed; and if the native wetland vegetation can successfully compete with the introduced invasive species, there is excellent potential and opportunity for recovery at this site.

**Photo 95.** Part of the large lentic spring/seep area in Section 27 showing the recent lush herbaceous growth, including *Centaurea maculosa* (spotted knapweed) (Record ID 2043391) (2014 photo)

**Photo 96.** Severe infestation of *Centaurea maculosa* (spotted knapweed) inside the spring box exclosure (Record ID 2043391) (2014 photo)

**Photo 97.** Excessive dead material and intense browse use on the *Salix bebbiana* (Bebb willow) (Record ID 2043391) (2014 photo)

Other spring/seep lentic wetlands were found to be in much better condition. A pair of such sites in excellent health are located in Section 25 on the east side of the WMA (Photo 98). These have not been developed, nor severely impacted by livestock. These wetlands are covered by appropriate native vegetation species (mostly *Typha latifolia* [common cattail], *Carex utriculata* [beaked sedge], and *Carex aquatilis* var. *aquatilis* [water sedge]). The only negative health factor observed was a small amount of the invasive *Cirsium arvense* (Canada thistle) around the outside edge, where soils may often dry out enough to not inhibit livestock access.

**Photo 98.** A spring/seep wetland in excellent health (Record ID 2043460) (2014 photo)

***Stock Pond Wetlands***—Three small human constructed stock watering ponds were inventoried as lentic wetlands. Although not naturally formed wetlands, these sites do have wetland functional value, and are utilized by a wide variety of wildlife. The three stock pond wetlands contrast starkly in health status, particularly in condition of the physical site. One in Section 36 located near the east edge of the WMA was physically in almost perfect condition, but severely lacking in appropriate vegetation (Photo 99). Another stock pond wetland, located in Section 7 at the northeast corner of the WMA, had more appropriate vegetation, but was is degraded physical condition (Photo 100).

**Photo 99.** A small stock pond wetland in relatively good physical condition, but severely lacking appropriate vegetation (Record ID 2043458) (2014 photo)

**Photo 100.** A small stock pond wetland in poorer health physically and vegetatively (Record ID 2043392) (2014 photo)

***Spotted Dog Reservoir***—Spotted Dog Reservoir is a fairly large water impoundment in Spotted Dog Creek, of which the upstream half (approximately) lies in Spotted Dog WMA. The lentic wetland polygon encompasses the broad expanse of emergent wetland vegetation around the perimeter of the reservoir (Photo 101). This season's lush growth obscures the evidence of intense levels of historic livestock use, but the health of this fairly large wetland rates only slightly below the threshold of Healthy. The greatest detriment to healthy vegetation here is the presence of four invasive weed species (*Cirsium arvense* [Canada thistle], *Bromus tectorum* [cheatgrass], *Cynoglossum officinale* [houndstongue], and *Carduus nutans* [(nodding plumeless thistle]).

**Photo 101.** A portion of the broad wetland around the upper end of Spotted Dog Reservoir, mostly covered by emergent graminoid species (Record ID 2043459) (2014 photo)

**Upland Ecological Health Assessment Scoring Summary and Discussion**

A total of 128 upland polygons were inventoried in Spotted Dog WMA. Effort was put into achieving a representative distribution of sample polygons across the study area (Figure 22).

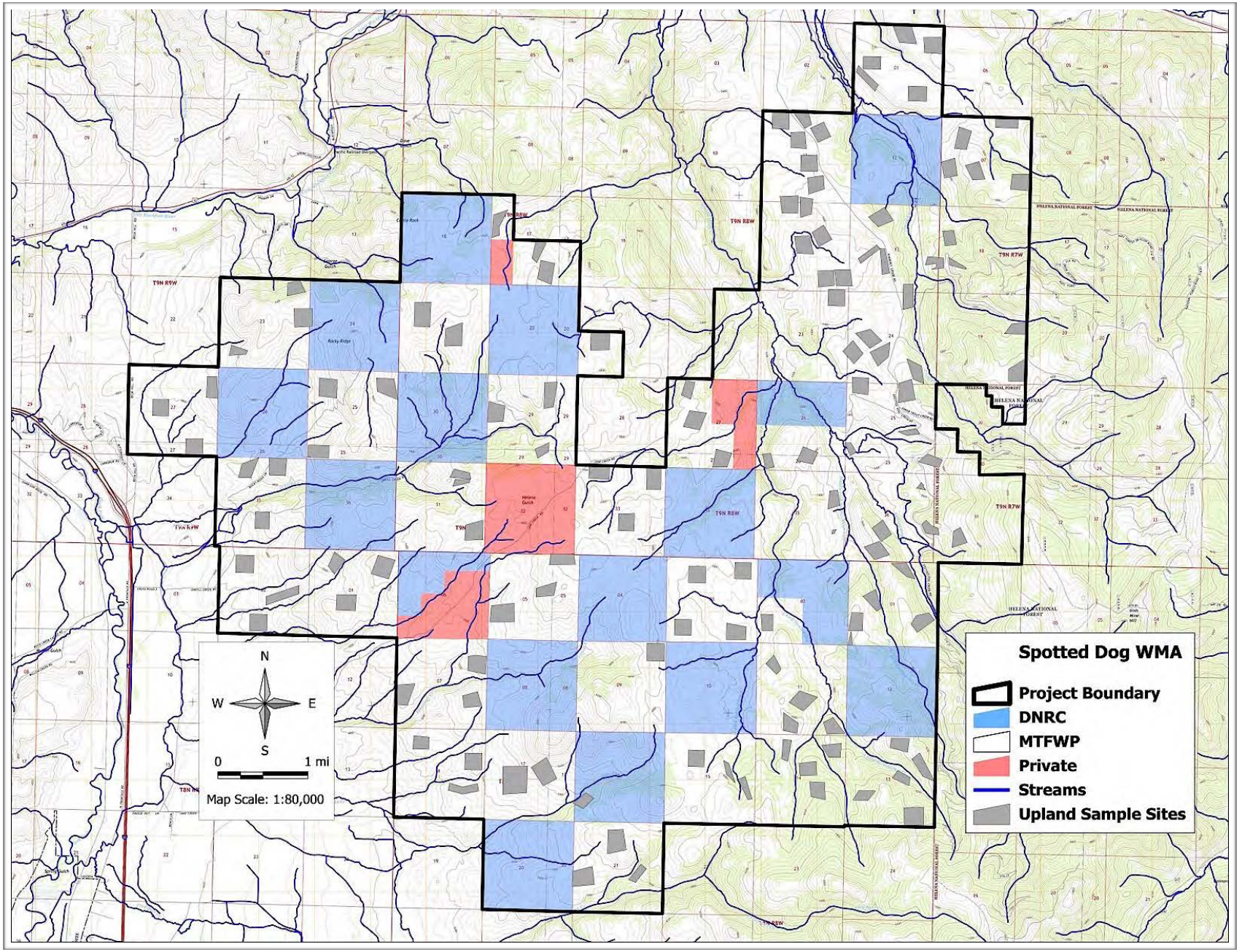


**Figure 22.** Topographic map of Spotted Dog WMA showing location of the 128 upland sampling sites

The data set is divided into five categories of vegetation type in approximate proportion to the area represented by each type (Table 17). The overall polygon health was found to be quite consistent across the various types, rating from the middle-to-upper range of the Healthy, but with Problems category. This property has been a working landscape for more than a century, used to graze livestock, produce timber, produce hay, as utility corridors, and for recreation. All these activities have left their mark on the vegetation and physical condition of the land. Certain activities have impacted particular kinds of site more than others. For example, timber harvesting has impacted the conifer forest sites, while grazing impacts have been focussed more on the grasslands and shrublands. By far the largest vegetation type in Spotted Dog WMA is the grassland, occupying approximately two-thirds of the WMA; whereas aspen woodlands and the modified site (hayfield) represent very small fractions of the area.

**Table 17.** Distribution of health ratings for upland sites among the various upland vegetation types in Spotted Dog WMA

| Vegetation Type[1] (No. of Polygons) | Acres Represented | Weighted[2] Average Vegetation Score[3] | Weighted[2] Average Soil/Landscape Score[3] | Overall Weighted[2] Average Health Score[3] | Range of Health Score[3] | Overall Health Category[3] |
|---|---|---|---|---|---|---|
| Conifer Forest (29) | 7,467.36 | 58% | 82% | 68% | 97% - 38% | HBP |
| Quaking Aspen Grove Woodland (3) | 99.36 | 60% | 97% | 76% | 83% - 68% | HBP |
| Shrubland (12) | 4,371.78 | 61% | 83% | 70% | 84% - 49% | HBP |
| Grassland (83) | 21,223.77 | 76% | 82% | 79% | 100% - 44% | HBP |
| Modified Site (1) | 103.00 | 68% | 77% | 73% | 73% - 73% | HBP |
| ***Totals/Averages (128)*** | ***33,265.27*** | ***70%*** | ***82%*** | ***75%*** | ***100% - 38%*** | ***HBP*** |

[1]Vegetation Type = Forest/Woodland, Shrubland, Grassland, or Modified Site

[2]Weighted average score = scores are weighted based upon the size (acres) of each polygon

[3]Health score categories:

100% to 80% = Healthy/Proper Functioning Condition

79% to 60% = Healthy, but with Problems/Functioning at Risk (HBP)

<60% = Unhealthy/Nonfunctional

***Conifer Forest Sites***—Conifer forest sites are widely distributed across Spotted Dog WMA, but the greatest concentration is along the eastern side of the WMA. Data review indicates that the forest cover type is present on 7,467.36 acres (21.97 percent) of the Spotted Dog WMA land base. Trees are found in all of the vegetation cover types with approximately 3,040.16 acres (9.00 percent) of actual tree cover of the total land area. Tree cover in the forest cover type alone is significantly higher and represents 2,767.30 acres (37.06 percent) of all plant cover. For the purpose of the conifer forest discussion, focus is on the conifer trees in the 29 polygons representing the forest cover type. These 29 polygons represent a 6 percent sample of the total area of forest cover vegetation type.

Three conifer tree species are well represented in the forest cover type: 2,111.54 acres of *Pseudotsuga menziesii* var. *glauca* (Douglas fir); 395.51 acres *Pinus contorta* var. *latifolia* (lodgepole pine); and 130.97 acres of *Picea engelmannii var. engelmannii* (Engelmann spruce) (Table 18). Generally, within the forested project area *Pseudotsuga menziesii* var. *glauca* (Douglas fir) occurs on drier sites and aspects, while *Pinus contorta* var. *latifolia* (lodgepole pine) is more prevalent on cool, moist, north facing slopes, and in drainage bottoms where it occurs along with *Picea engelmannii* var. *engelmannii* (Engelmann spruce). Other tree species present in the forest type include: *Populus tremuloides* (quaking aspen), *Pinus ponderosa* var. *scopulorum* (ponderosa pine), *Juniperus scopulorum* (Rocky Mountain juniper), and *Abies lasiocarpa* (subalpine fir).

**Table 18.** Acres of each tree species, broken out by age group, for the 29 conifer forest polygons inventoried in Spotted Dog WMA (total area of age groups may differ slightly from the area of species, due to rounding errors associated with the use of midpoints of canopy cover categories) (study area = 7,467.36 acres)

| Tree Species | Acres of Species | Seedling Acres (%) | Sapling Acres (%) | Pole Acres (%) | Mature Acres (%) | Dead Acres (%) |
|---|---|---|---|---|---|---|
| PSEMVG | 2,111.54 | 273.52 (12.95%) | 321.95 (15.25%) | 529.96 (25.10%) | 961.67 (45.54%) | 62.95 (2.98%) |
| PINCVL | 395.51 | 185.18 (46.82%) | 82.02 (20.74%) | 113.83 (28.78%) | 15.04 (3.80%) | 7.22 (1.83%) |
| PICEVE | 130.97 | 28.62 (21.85%) | 53.49 (40.84%) | 38.08 (29.08%) | 11.48 (8.77%) | 1.58 (1.21%) |
| POPTRE | 67.68 | 24.20 (35.76%) | 16.51 (24.39%) | 9.13 (13.49%) | 16.24 (1.00%) | 1.64 (2.42%) |
| PINPVS | 32.82 | 5.93 (18.07%) | 3.72 (11.33%) | 2.09 (6.37%) | 20.01 (60.97%) | 0.50 (0.00%) |
| JUNSCO | 20.85 | 3.68 (17.65%) | 10.20 (48.92%) | 3.40 (16.31%) | 3.96 (18.99%) | 0.00 (0.00%) |
| ABILAS | 7.93 | 6.76 (85.25%) | 1.11 (14.00%) | 0.00 (0.00%) | 0.00 (0.00%) | 0.00 (0.00%) |
| ***TOTALS*** | ***2,767.30*** | ***527.89*** | ***489.00*** | ***696.49*** | ***1,028.40*** | ***73.89*** |

PSEMVG = *Pseudotsuga menziesii* var. *glauca* (Douglas fir)
PINCVL = *Pinus contorta* var. *latifolia* (lodgepole pine)
PICEVE = *Picea engelmannii* var. *engelmannii* (Engelmann spruce)
POPTRE = *Populus tremuloides* (quaking aspen)
PINPVS = *Pinus ponderosa* var. *scopulorum* (ponderosa pine)
JUNSCO = *Juniperus scopulorum* (Rocky Mountain juniper)
ABILAS = *Abies lasiocarpa* (subalpine fire)

Though not included in the above tree cover totals and not falling within the forest cover type, trees were also present within the grassland and shrubland types and occur with somewhat limited coverage. *Pinus flexilis* (limber pine) was the only conifer not found in the forest type but found within the shrubland type, it has only 2.29 acres total canopy cover.

*Logging History.* Field observations and area history suggest the first logging entry into the forested sites in Spotted Dog WMA, likely occurred during the early 1900's, with two or three subsequent harvest entries occurring during the last 30 years. During the more recent harvests, while the lands were under the ownership of RY Timber Company, timber was harvested intensively. The driving factor during these forest entries was timber

volume extraction. Generally, tree selection favored removing the best formed trees and leaving phenotypically inferior trees to regenerate the site—a harvesting practice known as “high-grading” (Photo 102).

Key characteristics of the forest type likely changed because of the harvest method, resulting in a shift of the dominant tree size classes of trees to smaller size classes (seedling, sapling, and pole) on MTFWP managed forest (Table 18 above). Within Spotted Dog WMA, forested MTDNRC lands adjacent and interspersed (landownership checker board) generally retain greater forest cover and structure than MTFWP lands.

**Photo 102.** A stand that was “high-grade” harvested on the Spotted Dog WMA (Record ID 2043452) (2014 photo)

*Conifer Forest Site Health Scores.* Forest health is generally a concept used to describe the resiliency and productivity of forests in correlation to public values, needs, and expectations. Ultimately definitions of healthy forests are subjective and are based on values and management plans of the observers (Kolb and others 1995). The observations and methodology employed in developing a forest health score for this report are eco-centrically based and designed to discount land use or homo-centric expectation. Therefore, the forest health assessment done on Spotted Dog WMA was an ecological health assessment.

Overall weighted health scores ranged from 97 to 38 percent with an average weighted health score of 68 percent for the conifer forest cover type. The weighted average vegetation side of the score was 58 percent and the weighted average soil/landscape side of the score was 82 percent (Table 19). Health score ratings were generally reduced by negative impacts to the physical site through human caused site alteration and bare ground attributed

to logging, along with reductions in vegetation cover and increased incidence of invasive plant cover and distribution. Figure 23 shows the location and associated health score ranking for all 29 conifer forest polygons.

**Table 19.** Aggregate summary of health scores for the 29 conifer forested sites in Spotted Dog WMA (study area = 7,467.36 acres)

| Number of Polygons | Inventoried Polygon Acres | Weighted[1] Average Vegetation Score[2] | Weighted[1] Average Soil/Landscape Score[2] | Overall Weighted[1] Average Health Score[2] | Overall Health Category[2] | Range of Health Score[2] |
|---|---|---|---|---|---|---|
| 29 | 446.42 | 58% | 82% | 68% | HBP | 97% - 38% |

[1]Weighted average score = scores are weighted based upon the size (acres) of each polygon

[2]Health Categories:

Healthy = score rating from 80 to 100 percent

HBP (Healthy, but with Problems) = score rating from 60 to 80 percent

Unhealthy = score rating below 60 percent

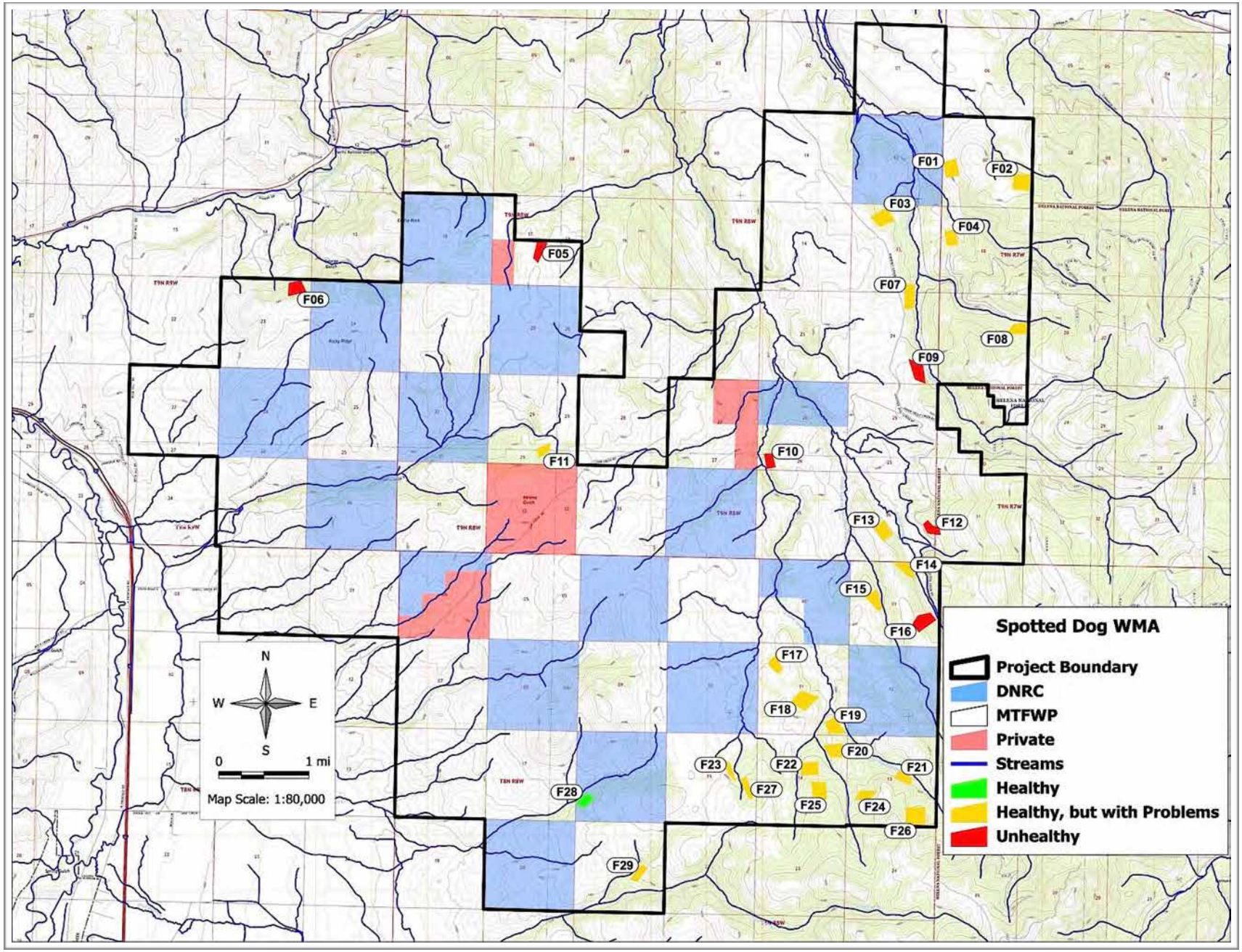


**Figure 23.** Topographic map of the 29 coniferous forest sites (along with polygon number) sampled in Spotted Dog WMA

*Tree Regeneration.* Although nearly all area covered by conifer forest was recently and heavily harvested, there is robust regeneration of conifer trees occurring. The largest amount of regeneration cover (seedling, sapling, and pole sizes combined) by a single species is attributed to *Pseudotsuga menziesii* var. *glauca* (Douglas fir) with 1,178.5 acres (53.2 percent of the total species cover). As mentioned previously, there has been an increase of the younger size classes overall. Insect damage has occurred in the *Pseudotsuga menziesii* var. *glauca* (Douglas fir) regeneration and will be discussed further in the following Insect and Disease Section.

Shorter lived tree species need to have a greater fraction of their population in the younger classes, to maintain a constant long term presence on the site. For instance, the relatively short lived *Populus tremuloides* (quaking aspen), with over half of its canopy cover acres in the younger ages appears to be doing well, whereas *Populus balsamifera* (balsam poplar) is much more in the mature/dead category, and therefore appears to be in decline. Examples in Table 20 illustrate these points:

- *Pinus contorta* var. *latifolia* (lodgepole pine) is increasing dramatically with far more young trees than mature or decadent trees. This phenomenon is likely due to the mountain pine beetle (*Dendroctonus ponderosae*) that could have killed many mature trees and extensive timber harvest that naturally favors removal of older trees. It appears that this species is beginning to recover in Spotted Dog WMA;
- *Juniperus scopulorum* (Rocky Mountain juniper) is increasing, with most of the species cover in the young size classes;
- *Pseudotsuga menziesii* var. *glauca* (Douglas fir), being a long lived species with over 53.2 percent of its cover in the Seedling/Sapling/Pole classes, is regenerating well from extensive timber harvest; and
- *Pinus flexilis* (limber pine) is increasing or invading into areas that have not had this species historically. This is indicated by the 100 percent canopy cover of young trees in the seedling/sapling/pole category.

**Table 20.** Area covered by tree species distributed between regeneration and mature groups for Spotted Dog WMA (acres of size classes may be different from the acres of species due to rounding errors associated with the use of midpoints of canopy cover categories) (total acres of trees = 3,040.16 acres)

| Tree Species | Acres of Species | Seedling/Sapling/Pole Acres (%) | Mature/Dead Acres (%) |
|---|---|---|---|
| *Pseudotsuga menziesii* var. *glauca* (Douglas fir) | 2,217.25 | 1,178.50 (53.2%) | 1,059.94 (47.8%) |
| *Pinus contorta* var. *latifolia* (lodgepole pine) | 396.81 | 381.47 (94.8%) | 22.92 (5.2%) |
| *Picea engelmannii* var. *engelmannii* (Engelmann spruce) | 163.46 | 127.58 (77.8%) | 36.58 (22.2%) |
| *Populus tremuloides* (quaking aspen) | 140.36 | 74.35 (53.0%) | 66.40 (47.0%) |
| *Juniperus scopulorum* (Rocky Mountain juniper) | 66.98 | 51.89 (78.2%) | 14.47 (21.8%) |
| *Pinus ponderosa* var. *scopulorum* (ponderosa pine) | 40.00 | 17.81 (45.2%) | 21.54 (54.8%) |
| *Abies lasiocarpa* (subalpine fir) | 9.31 | 8.20 (88.1%) | 1.11 (11.9%) |
| *Populus balsamifera* (balsam poplar) | 3.66 | 0.33 (9.0%) | 3.24 (91.0%) |
| *Pinus flexilis* (limber pine) | 2.29 | 2.29 (100.0%) | 0.00 (0.0%) |

*Insects and Disease.* There are a myriad of forest insects and diseases that occur in the forests of western Montana. During the field visits only one of these agents was clearly identified and noteworthy. In recent years the insect defoliator *Choristoneura occidentalis* (western spruce budworm) has infected *Pseudotsuga menziesii var. glauca* (Douglas fir) in patches across the WMA. The infestation has occurred in limited pockets throughout the project area and has resulted in defoliation of trees in all size classes in these areas, though the greatest impacts are to the smaller sizes. Trees under 5 ft tall and less than 1 to 2 inches in diameter are most susceptible to mortality due to this pest. These young trees are especially vulnerable when growing beneath mature trees since larvae disperse from the overstory and feed on the small trees below (Photo 103**)**. These smaller trees have relatively small volume of canopy to survive defoliation and can be seriously impacted or killed by only a few larva (Fellon and Dewey 1982). *Picea engelmannii* var. *engelmannii* (Engelmann spruce) may also be susceptible hosts for *Choristoneura occidentalis* (western spruce budworm), however impacts to this tree species was not observed during the field work.

Chronic infestations of *Choristoneura occidentalis* (western spruce budworm) can cause decreases in growth of mature trees because of defoliation and may cause significant problems for *Pseudotsuga menziesii* var. *glauca* (Douglas fir) regeneration. The dead trees in the seedling/sapling/pole class also pose a fuel problem and can act as ladder fuel in a wildfire (Photo 103). Continuing absence of fire may be implicated as a factor that has allowed budworm to develop into a chronic epidemic status (Carlson and others 1983).

**Photo 103.** *Choristoneura occidentalis* (western spruce budworm) infection of pole size *Pseudotsuga menziesii* var. *glauca* (Douglas fir)(Record ID 2024208) (2014 photo)

No other significant insect presence or damage from insect was noted during the inventory and ecological health assessment though mountain pine beetle (*Dendroctonus ponderosae*) is present in close proximity of the WMA.

The primary tree disease, observed on the WMA, was *Arceuthobium douglasii* (Douglas fir dwarf-mistletoe) which has infected *Pseudotsuga menziesii* var. *glauca* (Douglas fir). Limited incidence of *Arceuthobium douglasii* (Douglas fir dwarf-mistletoe) diseased trees was noted and impacts to the infected trees was relatively minor at this time. *Arceuthobium douglasii* (Douglas fir dwarf-mistletoe) affects the living tissue of the host and will in time deplete the growth and economic value of the tree's fiber, though the disease branches can be of value for nesting bird habitat (Photo 104).

**Photo 104.** *Arceuthobium douglasii* (Douglas fir dwarf-mistletoe) infection of mature *Pseudotsuga menziesii* var. *glauca* (Douglas fir) leave trees (Record ID 2043424) (2014 photo)

*Fire Ecology.* The forests and wildlife of western Montana evolved and adapted to natural wildfire that intermittently burned the landscape throughout history. Fire return intervals in grassland/Douglas fir ecotones in southwestern Montana are estimated at 35 to 40 years, although the interval may be shorter in grasslands proper (Arno and Gruell 1983). Natural fire in these systems is described as moderate frequency, with low to mixed severity (Arno 2000). Little evidence of wildfire occurrence was observed with only 7 of 29 forest plots containing charred trees or logs that may have been associated with timber harvest residue burning. In general it has been estimated that the vicinity of Spotted Dog WMA has missed two to three fire cycles, and may not have experienced natural fire for 90 years or longer (Powell County CWPP 2005).

In spite of the fact that fire may provide many benefits to these forested habitats, management considerations should be made regarding any use of controlled burning in the forest cover type because of the altered species composition, fuel load, and fire regime. Accumulations of ladder fuels, overstocked forest conditions, and dead/ downed woody material may lead to unnatural fire severity that result in long term damage to the physical site (Photos 105 and 106).

**Photo 105.** Old fire scare on the bole of a *Pseudotsuga menziesii* var. *glauca* (Douglas fir) (to the right) and a rotted stump of a tree harvested in the early 1900's (center) (Record ID 2024270) (2011 photo)

**Photo 106.** A late seral stand of *Pseudotsuga menziesii/Arnica cordifolia* (Douglas fir/heart-leaf arnica) habitat type with closed canopy and high fuel loading at greater risk to fire (on MTDNRC land) (2014 photo)

Ladder fuels, such as the ones pictured in Photo 107 caused by insect defoliation and subsequent tree mortality lead to a raised risk of ground-fire elevating to a crown dominated wildfire.

**Photo 107.** *Choristoneura occidentalis* (western spruce budworm) mortality in sapling size *Pseudotsuga menziesii* var. *glauca* (Douglas fir) may act as fire ladder fuels (Record ID 2024219) (2014 photo)

*Tree Health.* The health of individual trees in a forested polygon was not directly sampled during the inventory and ecological health assessment, although the health score of the stand observed in a polygon is descriptive of the ecological health of trees as a population.

A large number of the overstory *Pseudotsuga menziesii* var. *glauca* (Douglas fir) trees remaining after timber harvest have epicormic branching along their boles, below their crown, indicating release from an over-stocked site condition (Photo 108). Previously suppressed by high stocking levels these trees now have resources available for tree growth (i.e., sunlight, water, etc.). Previously, these trees were only able to sustain a canopy in the upper reaches of their form.

**Photo 108.** Heavily harvested site with the few trees that were left exhibiting epicormic branching (Record ID 2043424) (2014 photo)

The following photos illustrate the various types forest health conditions present in Spotted Dog WMA following timber harvest practices through the years (Photo 109 through Photo 112).

**Photo 109.** A stand of healthy, chest high *Populus tremuloides* (quaking aspen) seedling/sapling regeneration released by forest overstory removal and intense browse pressure (Record ID 2043424) (2014 photo)

**Photo 110.** Limited understory seedling/sapling regeneration in a logged area (Record ID 2043427) (2014 photo)

**Photo 111.** Poor leave tree selection (Record ID 2043430) (2014 photo)

**Photo 112.** Good wildlife hiding cover in a pocket of *Pseudotsuga menziesii* var. *glauca* (Douglas fir) regeneration (Record ID 2043430) (2014 photo)

A single plot was inventoried on MTDNRC managed land. This observation is not intended to represent MTDNRC forest health, but rather was inventoried to ensure that the complete range of variability in forested area on the WMA was captured (Photo 113). This polygon had less grass, forb, and shrub understory cover and tree regeneration than the other forested plots. The forested plot installed on MTDNRC has not been intensively harvested, and is considered successionally closer to its vegetation climax. Other areas that have been logged multiple times have more openings, that have allowed the release of greater numbers of regenerating trees, and a more diverse understory plant community because of the logging disturbance.

**Photo 113.** Late serial *Pseudotsuga menziesii/Arnica cordifolia* (Douglas fir/heart-leaf arnica) habitat type with closed canopy (Record ID 2024270) (2011 photo)

*Forest Encroachment.* Forest and grassland and/or shrubland cover come together and adjoin each other in an area referred to as an ecotone. The ecotone is of special importance because of its significant wildlife habitat value. There is evidence in Spotted Dog WMA of the forest slowly encroaching into the grassland. This continued encroachment may, over time, reduce the area of grassland and ecotone, while increasing the area of conifer forest on the WMA.

Grasslands cover extensive areas on the broad upper slopes of the main ridges of the Spotted Dog WMA. Conifer forest tends to generally be found on the cooler slopes extending into valley bottoms. Plentiful seed crops may have coincided during the last decade with favorable climate conditions supporting establishment of *Pseudotsuga menziesii* var. *glauca* (Douglas fir) regeneration in the grassland cover type. Currently, there are 71.11 acres of *Pseudotsuga menziesii* var. *glauca* (Douglas fir) (all size classes) in the grassland type (Photo 114).

**Photo 114.** *Pseudotsuga menziesii* var. *glauca* (Douglas fir) encroaching on the grassland (Record ID 2043384) (2014 photo)

This proportionately represents 1 percent of the total grassland cover type but it is important to recognize that there is disproportionately less cover of grassland that occurs within the grassland-forest ecotone. The mosaic that is created between the forest and grassland and fingered edge that corresponds to undulating terrain changes in slope and aspect drive present cover types offer a unique habitat only found where the grassland and forest conjoin. It is within these areas that the forest edge is uniquely important for wildlife. This is the zone in which the encroaching conifers are of concern. Over time if regeneration continues to invade and establish within the grassland forage production and the amount of forest edge will decrease and correspondingly habitat opportunities for wildlife will decrease.

Research indicates that in southwestern Montana *Pseudotsuga menziesii* var. *glauca* (Douglas fir) forests have expanded and thickened near the lower timberlines (Arno and Gruell 1983). “Data suggests that in the past, fire was important in creating heterogeneous landscapes of savannas, mountain big sagebrush and grasslands. In the continued absence of fire, these landscapes are likely to become more homogeneous as trees dominate much of the landscape” (Heyerdahl 2006). “Land managers and the public often fail to recognize that large areas of grasslands in the Rocky Mountains have been invaded by Douglas fir” (Arno and Gruell 1983).

The forest encroachment that may be taking place in the Spotted Dog WMA is not necessarily considered negative to the health of the ecosystem, but is important when considering management goals.

*Invasive (Weed) Species*. Timber harvest activities disturb the soil surface, creating opportunities for invasive species to invade. Logging equipment often brings weed seeds from other locations. The results of this are evident on several harvested sites, especially along haul roads and slash burn sites (Photos 115 and 116).

**Photo 115.** Typical appearance of a harvested stand with the invasive *Carduus nutans* (nodding plumeless thistle) spreading along the disturbance of a timber haul road (Record ID 2043433) (2014 photo)

**Photo 116.** A timber harvest slash pile burn site, now dominated by the invasive *Carduus nutans* (nodding plumeless thistle) (Record ID 2043437) (2014 photo)

***Aspen Woodland Sites***—Upland groves of *Populus tremuloides* (quaking aspen) are especially important as habitat for many species of big game and non-game wildlife (Hansen and others 1995, Howard 1996). Upland groves of *Populus tremuloides* (quaking aspen) represent a very small fraction of Spotted Dog WMA, but three small stands were located for inventory and ecological health assessment (Figure 24**)**. Some additional very small stands of *Populus tremuloides* (quaking aspen) are scattered throughout the WMA, but many were inclusions within other sampled polygons.

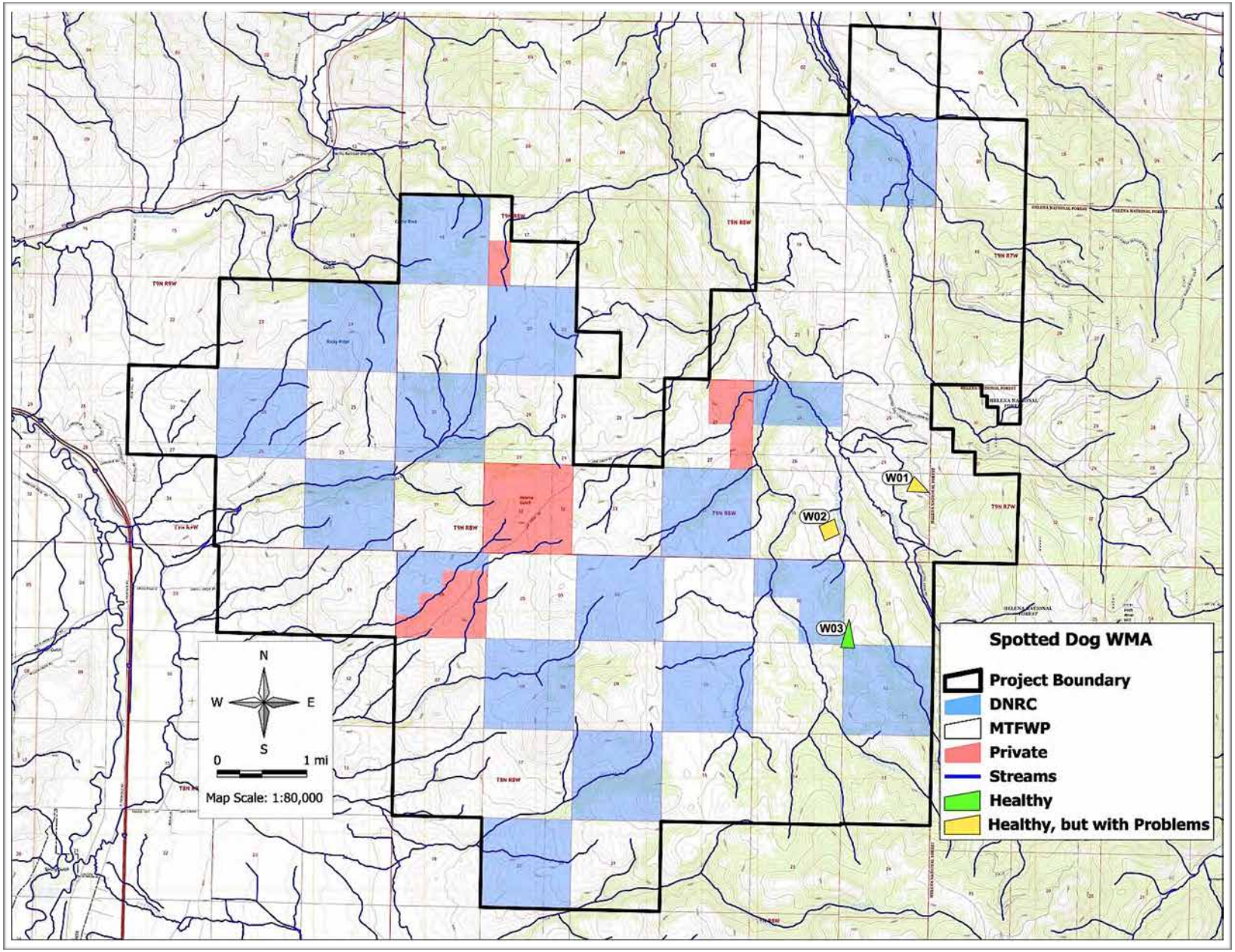


**Figure 24.** Topographic map of the three woodland (*Populus tremuloides* [quaking aspen]) sites (along with polygon number) sampled in Spotted Dog WMA (sites shown at slightly exaggerated scale)

The sampled stands of *Populus tremuloides* (quaking aspen) all have considerable conifer tree presence (Photo 117), mostly younger seedling and sapling size class *Pseudotsuga menziesii* var. *glauca* (Douglas fir), which indicate the actual conifer forest potential of these sites. The conifer trees will eventually gain dominance of these stands, shading out the heliophytic (sun loving) *Populus tremuloides* (quaking aspen), unless a fire, or other disturbance agent, periodically removes them.

**Photo 117.** A *Populus tremuloides* (quaking aspen) stand with conifer trees *Pseudotsuga menziesii* var. *glauca* (Douglas fir) rapidly approaching dominance (Record ID 2043446) (2014 photo)

Other stands of *Populus tremuloides* (quaking aspen) are dominated by young seedling/sapling size classes. These stands are typically very small and included within other sampled polygons. Many of these very small stands exhibit vigorous leader growth with exposure to sunlight after timber removal, and a significant reduction in livestock browse pressure, allowing for a “released” architecture form (Keigley and Frisina 1998) (Photo 118).

Livestock herbivory can be a major factor in reducing *Populus tremuloides* (quaking aspen) recruitment because the young shoots are highly palatable to livestock, and livestock tend to spend a high proportion of time in areas with *Populus tremuloides* (quaking aspen) (Beschta and others 2014). They concluded that where *Populus tremuloides* (quaking aspen) recruitment is impaired or lacking, eliminating or minimizing the effects of livestock may be required to improve recruitment.

**Photo 118.** A stand of healthy, chest high *Populus tremuloides* (quaking aspen) seedling/sapling regeneration released by forest overstory removal and browse pressure reduction(Record ID 2043424) (2014 photo)

Overall site health on the three inventoried stands ranged from the middle range of Healthy, but with Problems up to the lower range of Healthy (Table 21). Soil/Landscape factors rated Healthy on all three sites, but the vegetation factors brought scores down on all sites. In common with most other forest and woodland sites in Spotted Dog, it was invasive weed infestation, excessive non-native species presence, abundance of disturbance increaser species, and the disruption of community structure (Photo 119) that brought health scores down.

**Table 21.** Summary of health scores of *Populus tremuloides* (quaking aspen) groves in Spotted Dog WMA

| Vegetation Type[1] (No. of Polygons) | Acres Represented | Weighted[2] Average Vegetation Score[3] | Weighted[2] Average Soil/Landscape Score[3] | Overall Weighted[2] Average Health Score[3] | Range of Health Score[3] | Overall Health Category[3] |
|---|---|---|---|---|---|---|
| Quaking Aspen Grove Woodland (3) | | | | | | |
| | 99.36 | 60% | 97% | 76% | 83% - 68% | HBP |

[1]Vegetation Type = Forest/Woodland, Shrubland, Grassland, or Modified Site
[2]Weighted average score = scores are weighted based upon the size (acres) of each polygon
[3]Health score categories:
100% to 80% = Healthy/Proper Functioning Condition
79% to 60% = Healthy, but with Problems/Functioning at Risk (HBP)
<60% = Unhealthy/Nonfunctional

**Photo 119.** A *Populus tremuloides* (quaking aspen) stand lacking successful regeneration, due to browsing of all regrowth by browsing animals (Record ID 2043425) (2014 photo)

***Shrubland Sites***—The only extensive shrub dominated stands in Spotted Dog WMA are the *Purshia tridentata* (antelope bitterbrush) communities on the western portion of the WMA (Figure 25).

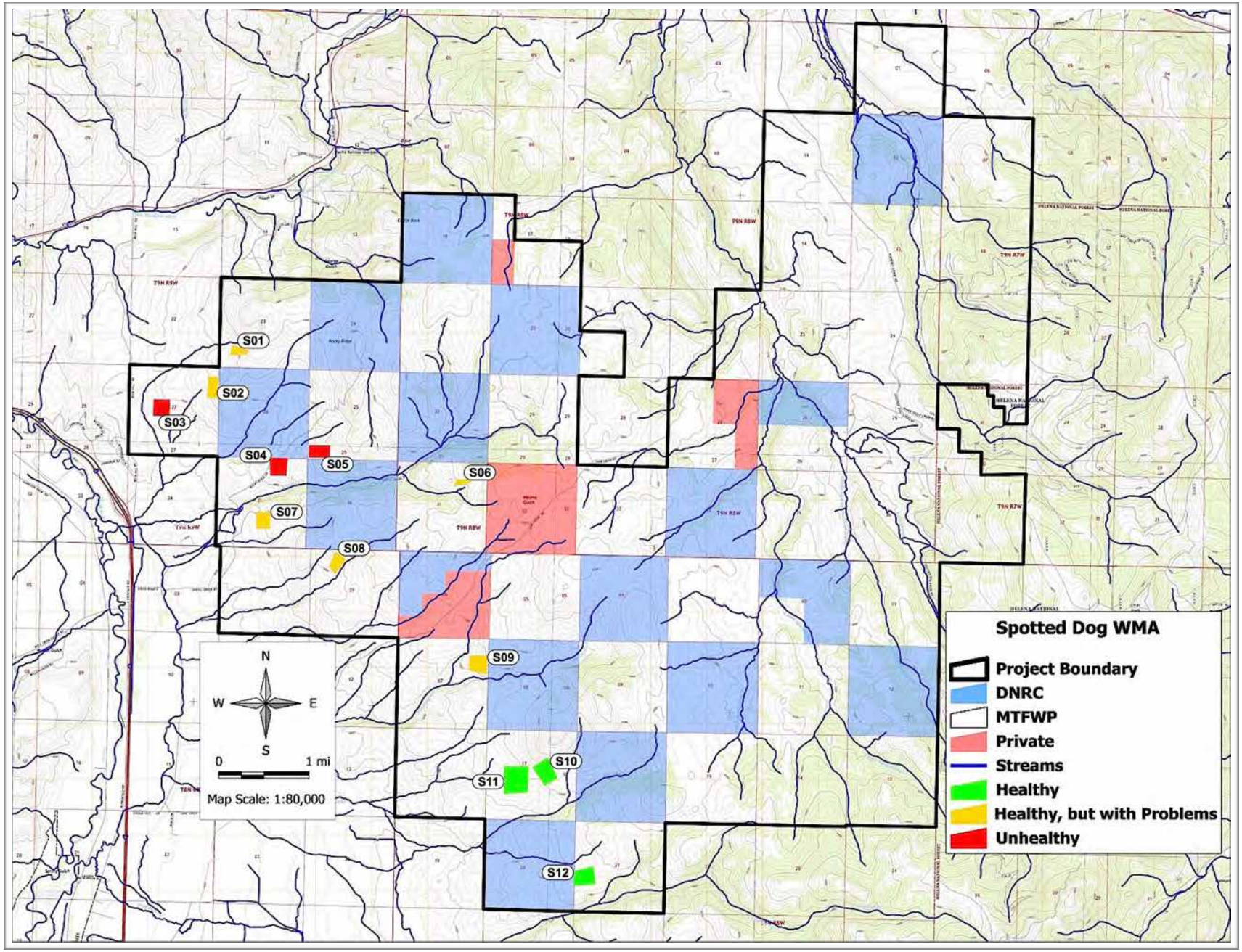


**Figure 25.** Topographic map of the 12 shrubland sites (along with polygon number) sampled in Spotted Dog WMA

*Purshia tridentata* (antelope bitterbrush) stands are extremely valuable to many wildlife species, as well as a preferred browse species for livestock (Mueggler and Stewart 1980). These stands reflect the impacts from many years of high use by both livestock and wildlife. Site health ratings for these shrublands in Spotted Dog WMA ranged from the low end of Healthy down to Unhealthy.

Most shrubland polygons received very good rating for soil/landscape factors, but many scored low on vegetation factors. Table 22 summarizes the shrubland polygons.

**Table 22.** Summary of health scores of shrubland sites in Spotted Dog WMA

| Vegetation Type[1] (No. of Polygons) | Acres Represented | Weighted[2] Average Vegetation Score[3] | Weighted[2] Average Soil/Landscape Score[3] | Overall Weighted[2] Average Health Score[3] | Range of Health Score[3] | Overall Health Category[3] |
|---|---|---|---|---|---|---|
| Shrubland (12) | 4,371.78 | 61% | 83% | 70% | 84% - 49% | HBP |

[1]Vegetation Type = Forest/Woodland, Shrubland, Grassland, or Modified Site
[2]Weighted average score = scores are weighted based upon the size (acres) of each polygon
[3]Health score categories:
100% to 80% = Healthy/Proper Functioning Condition
79% to 60% = Healthy, but with Problems/Functioning at Risk (HBP)
<60% = Unhealthy/Nonfunctional

Overall site health on shrubland polygons is better at the southern end of the distribution of polygons, and quite poor at the north end. We speculate that this is due to a historic difference in livestock distribution, and perhaps also because of differential distribution of elk winter use. The more northern polygons are in the areas which historically had the greatest concentrations of livestock use, and the polygons to the south may have received less concentrated livestock use over the years (Photos 120 and 121). Many of the polygons near the northwest corner of the WMA are severely infested with *Bromus tectorum* (cheatgrass) (Photos 122) and *Centaurea maculosa* (spotted knapweed).

**Photo 120.** A moderately browsed, but overall healthy stand of *Purshia tridentata* (antelope bitterbrush) (Record ID 2024200) (2011 photo)

**Photo 121.** An intensely utilized stand of *Purshia tridentata* (antelope bitterbrush) with palatable forage plants beneath the protection of the shrubs (Record ID 2024221) (2011 photo)

**Photo 122.** A browsed *Purshia tridentata* (antelope bitterbrush) plant with as much *Bromus tectorum* (cheatgrass) as *Agropyron spicatum* (bluebunch wheatgrass) (Record ID 2024223) (2011 photo)

***Grassland Sites***—The grasslands vegetation type covers approximately two thirds of Spotted Dog WMA. This vegetation type is generally distributed throughout the WMA, with only the eastern edge having more area covered by forest/woodland types. A total of 83 grassland polygons were inventoried across the project area (Figure 26). (***Note:*** *A second map [Figure 27] is provided with sample polygons numbered.)*

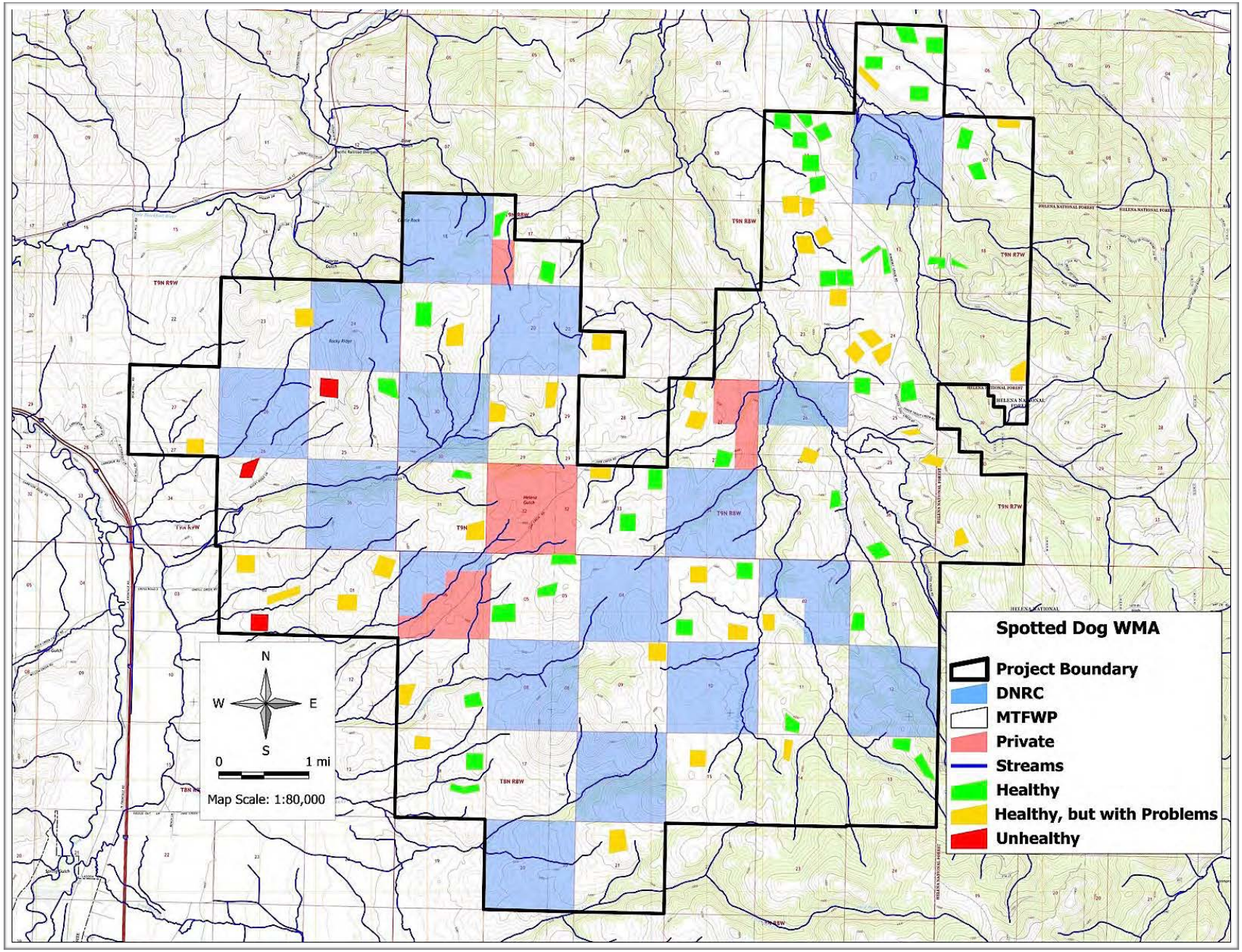


**Figure 26.** Topographic map of the 83 grassland sites sampled in Spotted Dog WMA

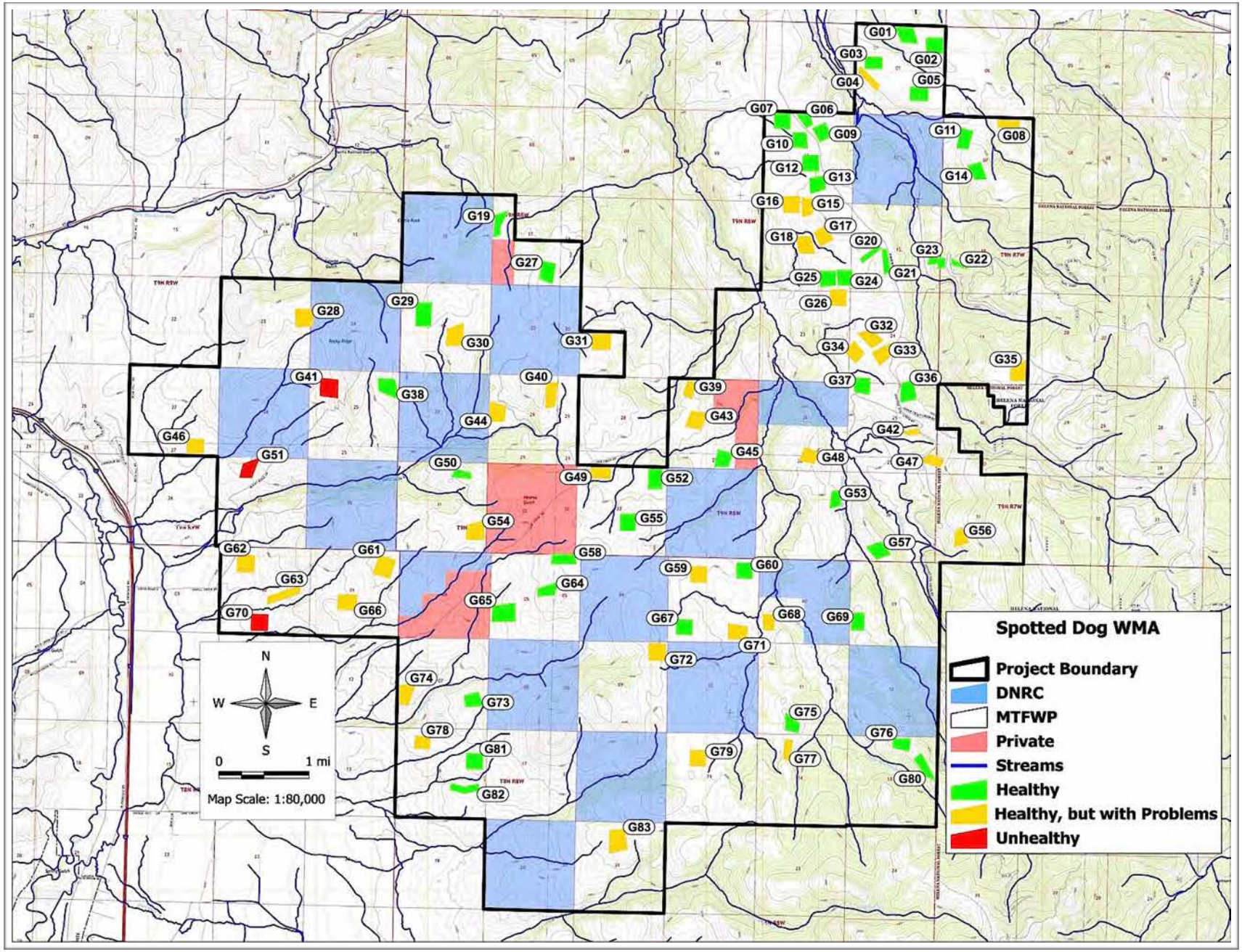


**Figure 27.** Topographic map of the 83 grassland sites (along with polygon number) sampled in Spotted Dog WMA

These grassland sites support robust populations of some of the most palatable and nutritious native bunchgrasses found in the intermountain region. Even after more than a century of livestock grazing on these grasslands, site health is generally quite good. There is a fairly wide range of individual site ratings, but the average rating of all 83 sites is in the Healthy, but with Problems category (Table 23).

**Table 23.** Summary of health scores of grassland sites in Spotted Dog WMA

| Vegetation Type[1] (No. of Polygons) | Acres Represented | Weighted[2] Average Vegetation Score[3] | Weighted[2] Average Soil/Landscape Score[3] | Overall Weighted[2] Average Health Score[3] | Range of Health Score[3] | Overall Health Category[3] |
|---|---|---|---|---|---|---|
| Grassland (83) | 21,223.77 | 76% | 82% | 79% | 100% - 44% | HBP |

[1]Vegetation Type = Forest/Woodland, Shrubland, Grassland, or Modified Site
[2]Weighted average score = scores are weighted based upon the size (acres) of each polygon
[3]Health score categories:
100% to 80% = Healthy/Proper Functioning Condition
79% to 60% = Healthy, but with Problems/Functioning at Risk (HBP)
<60% = Unhealthy/Nonfunctional

As further indication of the excellent state of health of many of the grassland sites in Spotted Dog WMA, eight polygons received perfect health score ratings (Figure 28) (Photo 123). A perfect health score is generally quite rare. It means, among other things, that not a single invasive weed plant was found on the polygon.

The grassland sites with a perfect score are:

- Polygon G01 (Record ID 2043346);
- Polygon G02 (Record ID 2043375);
- Polygon G05 (Record ID 2043395);
- Polygon G06 (Record ID 2043350);
- Polygon G12 (Record ID 2043354);
- Polygon G14 (Record ID 2043377);
- Polygon G20 (Record ID 2043361); and
- Polygon G64 (Record ID 2024214).

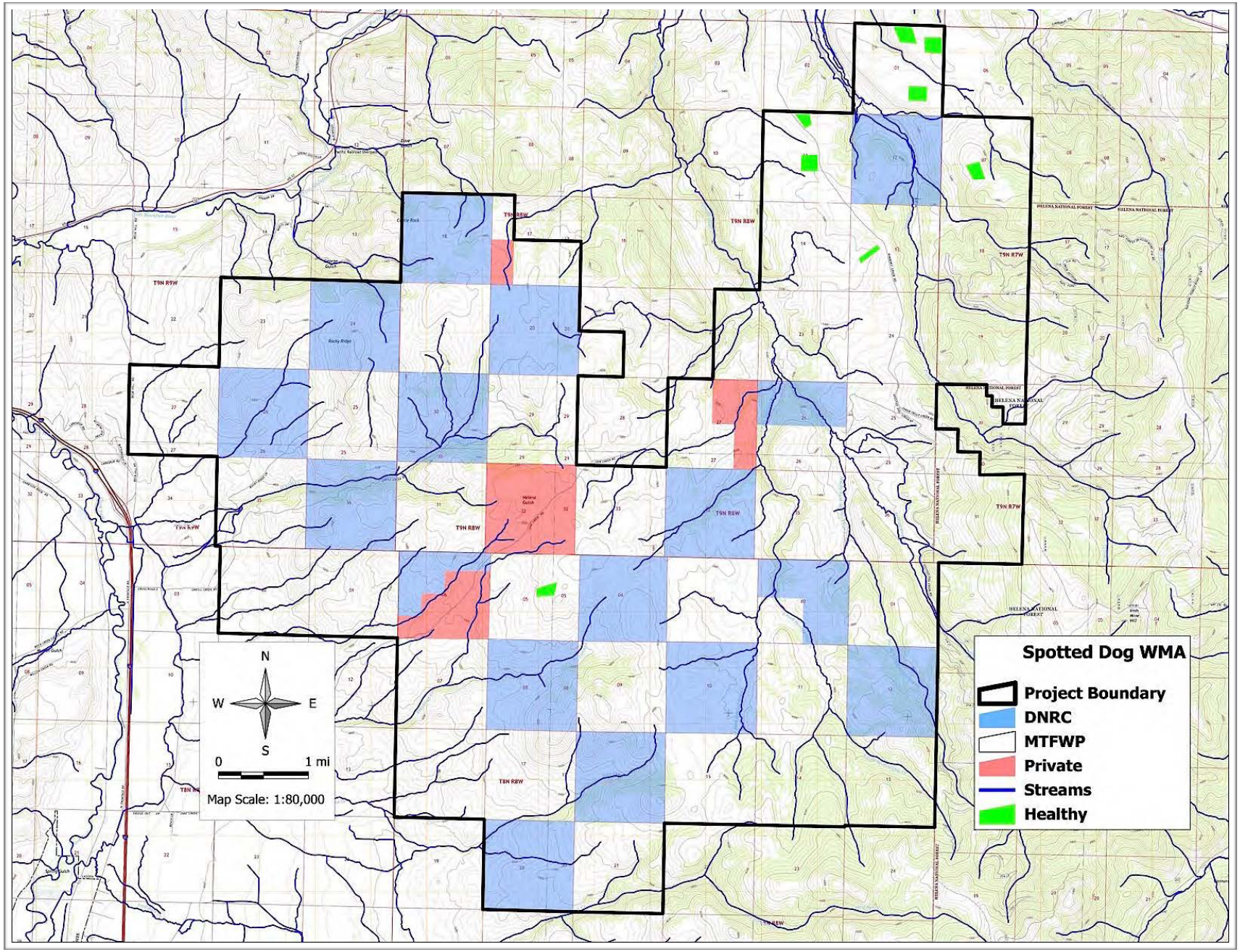


**Figure 28.** Topographic map of the eight grassland sites sampled in Spotted Dog WMA with a perfect health score (i.e., 100 percent health score)

**Photo 123.** A lush, healthy, stand of the *Festuca scabrella/Festuca idahoensis* (rough fescue/Idaho fescue) habitat type on a site that earned a perfect (100 percent) health rating score (Record ID 2043361) (2014 photo)

*Festuca campestris* (rough fescue) is very productive and highly palatable forage for wildlife and livestock throughout its range (Mueggler and Stewart 1980, Tirmenstein 2000). Plants are used throughout the growing season by a number of big game species including mule deer, and elk. The species is heavily used by elk on winter ranges in Montana, and is a preferred winter range grass in west-central Montana (Tirmenstein 2000). Of the 83 grassland polygons inventoried, 52 have at least 20 percent canopy cover of *Festuca campestris* (rough fescue) (Figure 29). Polygons located farther from a source of livestock water tend to have the least disturbance and higher health ratings, whereas polygons near a water source typically have the most disturbance (Photo 124 through Photo 127). Figure 30 shows the location of the three grassland sites that rated Unhealthy.

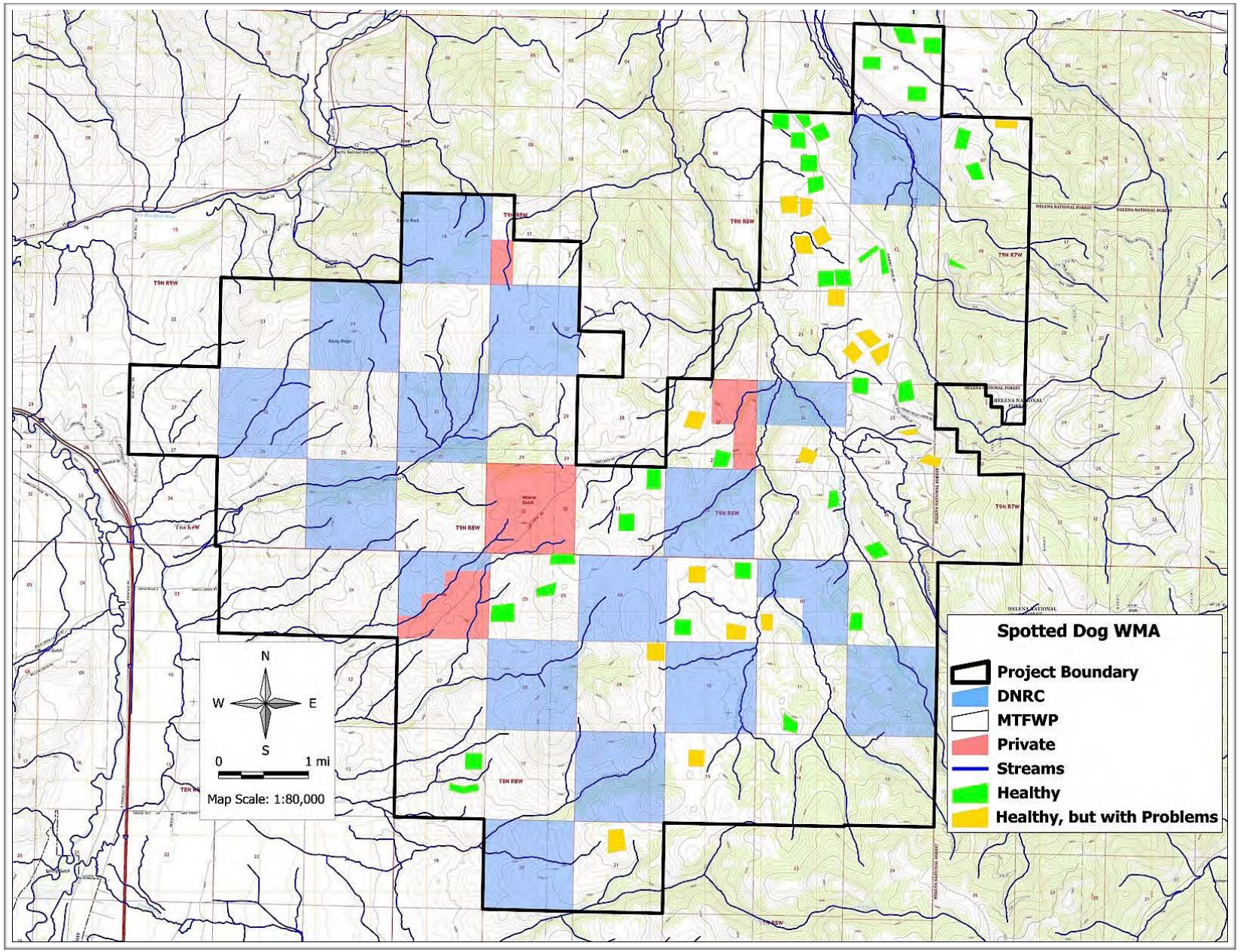


**Figure 29.** Topographic map of the 52 grassland sites sampled in Spotted Dog WMA with over 20 percent canopy cover of the polygon by *Festuca campestris* (rough fescue)

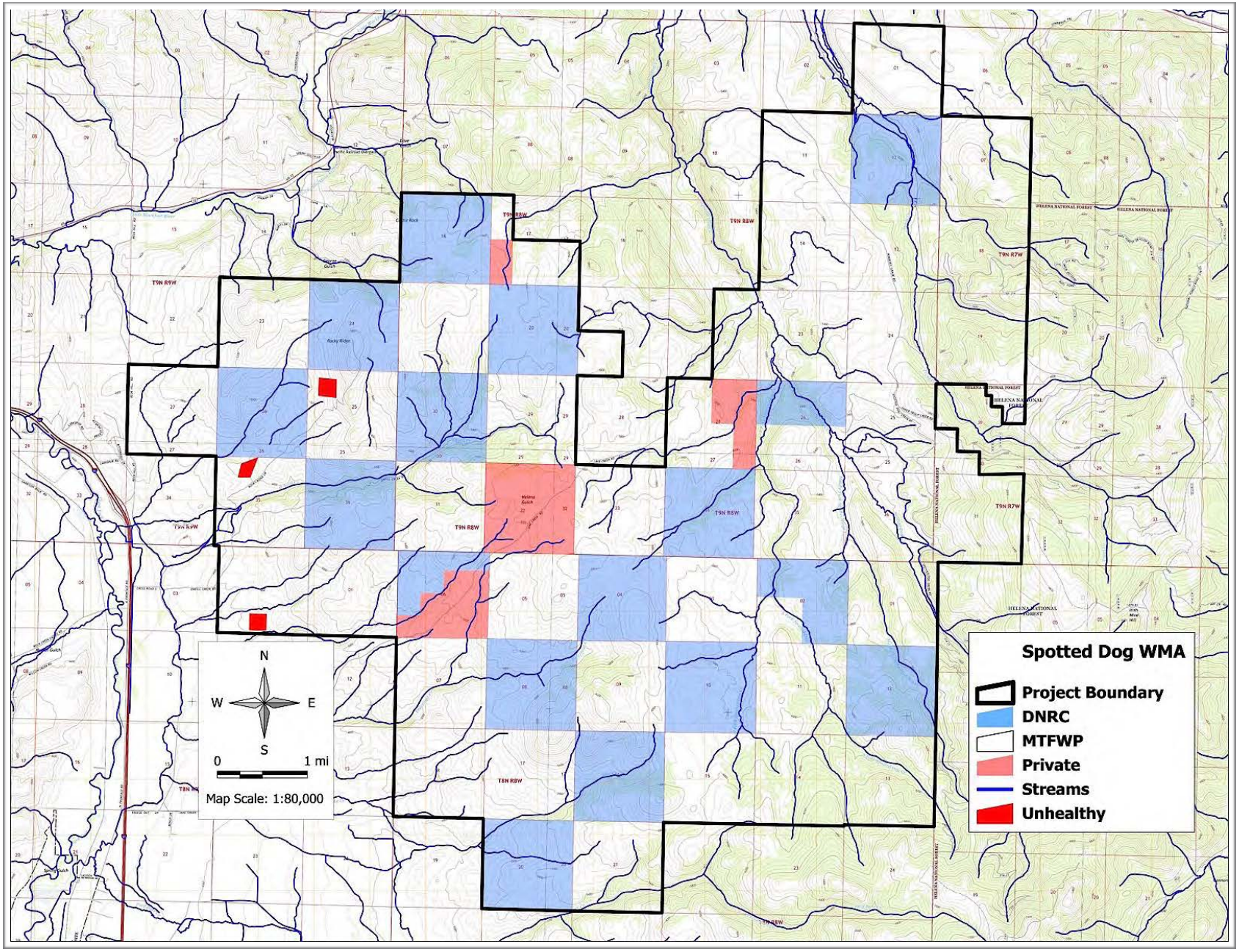


**Figure 30.** Topographic map of the three grassland sites sampled in Spotted Dog WMA that are unhealthy (score below 60 percent)

**Photo 124.** A moderately to heavily impacted grassland site showing two-track road disturbance, lack of sufficient litter, and excessive bare ground (Record ID 2043381) (2014 photo)

**Photo 125.** Close up view of a highly disturbed spot with excessive bare ground, pedestaled plants indicating surface erosion, and lack of litter (Record 2043380) (2014 photo)

**Photo 126.** Linear disturbance of a buried utility pipeline, with introduced *Agropyron intermedium* (intermediate wheatgrass) and the invasive *Centaurea maculosa* (spotted knapweed) Record ID 2042380) (2014 photo)

**Photo 127.** A very nice stand of the *Festuca scabrella/Festuca idahoensis* (rough fescue/Idaho fescue) habitat type Record ID 2042352) (2014 photo)

**Modified Sites**—The only area of modified site found in Spotted Dog WMA is the irrigated hayfield of approximately 103 acres along the Spotted Dog Creek bottom near the Pauly Place (Figure 31).

This area was converted some years ago from native species to dominance by *Phleum pratense* (timothy) and *Poa pratensis* (Kentucky bluegrass) (Photo 128). A few years have now passed since the field has been irrigated, and the introduced grass species are showing the effects by reduced cover and increased bare ground. An unfortunate consequence of leaving this field of *Phleum pratense* (timothy) uncut, is that the seeds are spread by animals onto the surrounding native grasslands. Although *Phleum pratense* (timothy) is not considered a noxious invasive species in Montana, it does have the ability to spread to adjoining vegetation communities under the right conditions (Ogle and others 2011). Esser (1993) describes *Phleum pratense* (timothy) as an exotic of great concern because it can establish quickly, spread vigorously, often dominates an area, and often is not detected early. Reproductive traits contributing to the plants' ardent capacity to spread include seeds that remain viable for four to five years in dry, cool site conditions and the capability to vegetatively root tiller (Esser 1993). Favoring disturbed areas, *Phleum pratense* (timothy) has escaped cultivation and become established at moderate to high elevations, and can be found in moist grasslands, *Populus tremuloides* (quaking aspen) stands, and conifer forests (Esser 1993). It is also of note that *Phleum pratense* (timothy) is found across all cover types inventoried on the Spotted Dog WMA where an average cover of 6.9 percent is observed (Appendix C).

**Photo 128.** The old irrigated hayfield dominated by *Phleum pratense* (timothy) and *Poa pratensis* (Kentucky bluegrass), with the Pauly Place buildings visible (Record ID 2042453) (2014 photo)

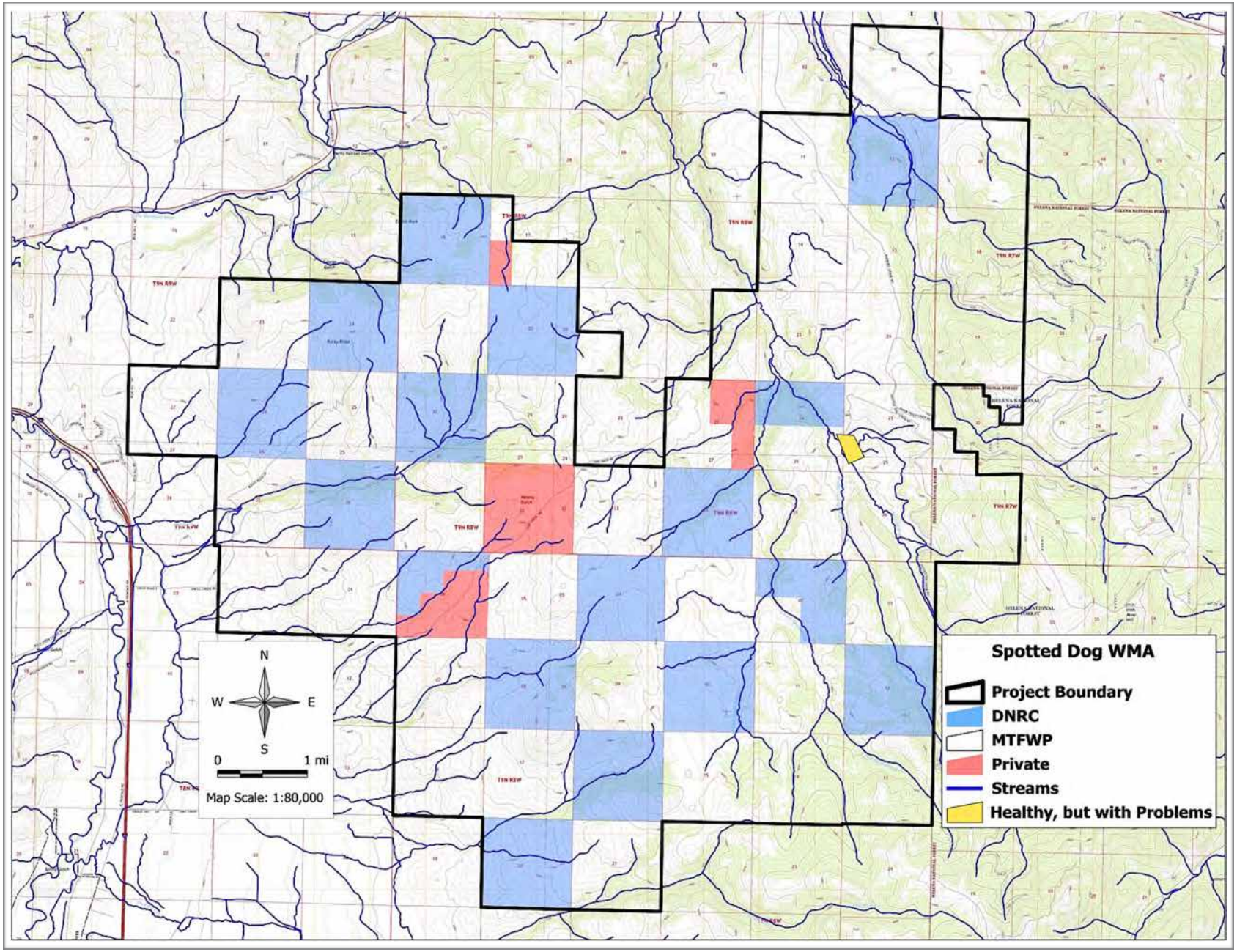


**Figure 31.** Topographic map of the one modified (i.e., hayfield) site sampled in Spotted Dog WMA (size of the polygon is not to scale)

**Invasive Plant Species (Weeds)**

For the purposes of this inventory and ecological health assessment work, invasive plants (noxious weeds) are introduced species whose introduction does, or is likely to cause environmental or economic harm. The official Montana Noxious Weed List (current as of 2013) was used, augmented by additional species considered noxious weeds by Powell County, Montana. Invasive species (weeds) are a serious problem on many portions of Spotted Dog WMA. Other areas are mostly free of weed species. Of the 192 inventoried polygons, 55 had at least 10 percent of the polygon area covered by weed canopy (Figure 32), 26 were entirely free of invasive weeds, and one polygon (O'Neil Creek Record ID 2043387) had nine different weed species recorded. On polygons which did have invasive plant species, the average number of invasive plant species was 2.7, and the average total invasive weed canopy cover per polygon (all species together) was 5.6 percent, ranging from a low of 0.5 percent up to 50.0 percent of the polygon area (Table 24).

It should be noted that the invasive plant species scoring item on ecological health assessments begins to lose points with the first invasive weed recorded on the polygon, and ***loses all points*** when weed canopy cover reaches 15 percent of the polygon.

**Table 24.** Summary of invasive plant species (weeds) for the 192 lotic, lentic, and upland polygons inventoried in Spotted Dog WMA

| Category | Average | Range |
|---|---|---|
| Number of invasive plant species per polygon | 2.7 | 0 to 9 |
| Canopy cover of invasive plant species per polygon (of those polygons with invasive plant species) | 5.6% | 0.5% to 50.0% |

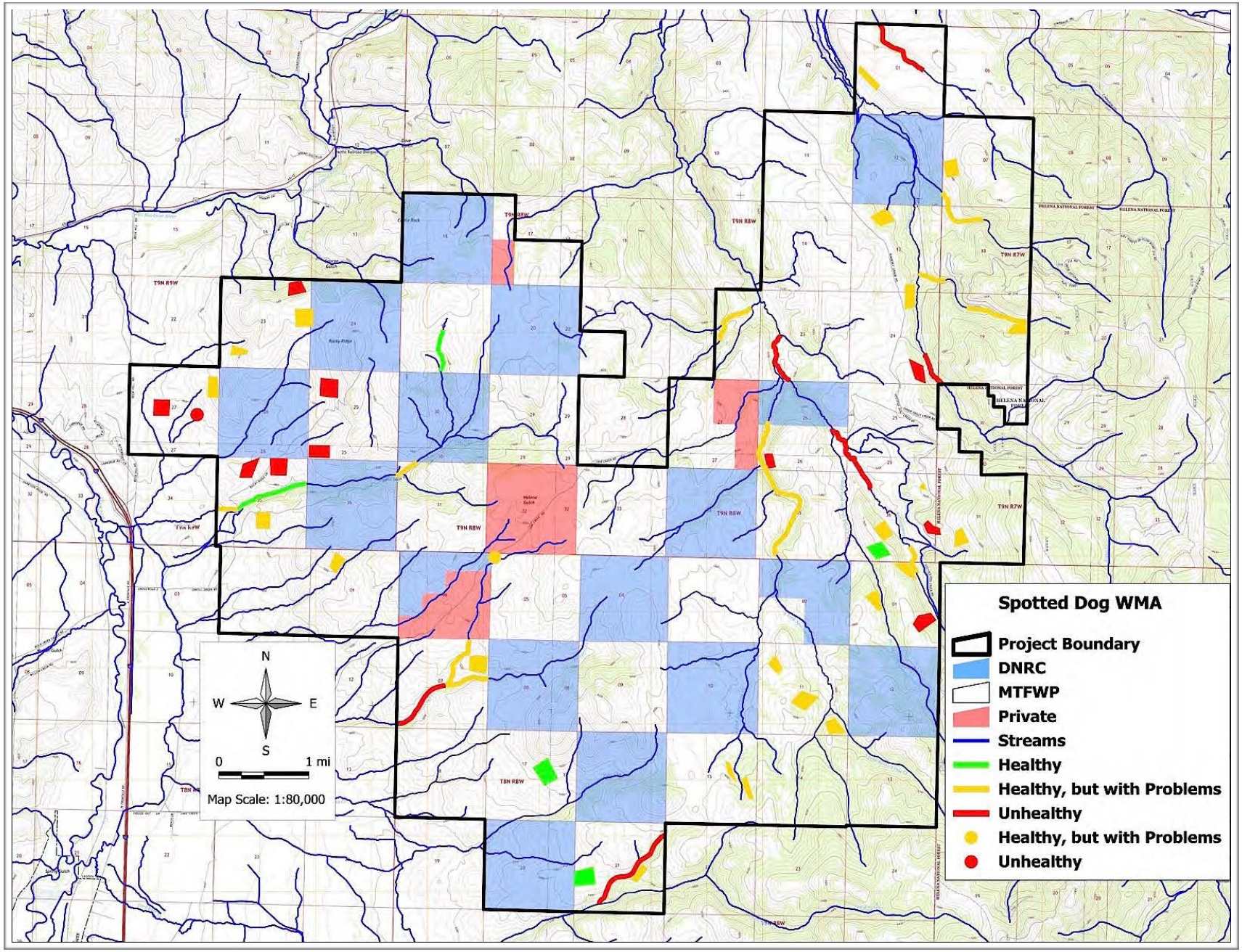


**Figure 32.** Topographic map of the 55 sites sampled in Spotted Dog WMA with invasive plant species (i.e., weeds) canopy cover exceeding 10 percent

***Lotic Sites***—On lotic sites in Spotted Dog WMA, 26.37 acres out of a total of 469.99 lotic acres inventoried (approximately 5.61 percent), were occupied by invasive plant species (Table 25). Although present in small amounts, several invasive plant species represent very serious threats of rapid increase and disruption of ecologic function. By far the most common invasive plant species on the lotic sites is *Cynoglossum officinale* (houndstongue), which occurs on 38 of 55 polygons, and has infested approximately 9.48 acres. *Centaurea maculosa* (spotted knapweed), *Ranunculus acris* (tall buttercup), *Cirsium arvense* (Canada thistle), *Carduus nutans* (nodding plumeless thistle), *Cirsium vulgare* (bull thistle), and *Bromus tectorum* (cheatgrass) also all individually infest more than two acres each on lotic areas, and all have great potential to severely degrade the health and habitat values on these sites.

**Table 25.** Invasive plant species (weeds) (number = 16) on the 55 lotic polygons inventoried in Spotted Dog WMA, sorted by abundance(see the Lotic Polygon Data Set Summary in Appendix D) (constancy is the percent of all polygons in which the species was recorded) (total inventoried lotic acres = 469.99)

| Invasive Plant Species (Weeds) | Acres | Percent of Lotic Area | Constancy |
|---|---|---|---|
| *Cynoglossum officinale* (houndstongue) | 9.48 | 2.02% | 69% |
| *Centaurea maculosa* (spotted knapweed) | 3.27 | 0.70% | 38% |
| *Ranunculus acris* (tall buttercup) | 3.24 | 0.69% | 31% |
| *Cirsium arvense* (Canada thistle) | 2.95 | 0.63% | 67% |
| *Carduus nutans* (nodding plumeless thistle) | 2.21 | 0.47% | 65% |
| *Cirsium vulgare* (bull thistle) | 2.19 | 0.47% | 20% |
| *Bromus tectorum* (cheatgrass) | 2.04 | 0.43% | 42% |
| *Tanacetum vulgare* (common tansy) | 0.52 | 0.11% | 2% |
| *Arctium minus* (lesser burdock) | 0.27 | 0.06% | 5% |
| *Leucanthemum vulgare* (oxeye daisy) | 0.06 | 0.01% | 5% |
| *Hyoscyamus niger* (black henbane) | 0.05 | 0.01% | 4% |
| *Linaria vulgaris* (butter and eggs) | 0.04 | 0.01% | 2% |
| *Hypericum perforatum* (St. John's wort) | 0.02 | 0.00% | 4% |
| *Centaurea solstitialis* (yellow starthistle) | 0.01 | 0.00% | 2% |
| *Lepidium draba* (whitetop) | 0.01 | 0.00% | 2% |
| *Lepidium latifolium* (broadleaved pepperweed) | 0.01 | 0.00% | 2% |
| ***TOTAL*** | ***26.37*** | ***5.61%*** | |

***Lentic Sites***—On lentic sites in Spotted Dog WMA, approximately 14.29 percent, representing 1.89 acres out of a total of 13.23 lentic acres, were occupied by invasive plant species (Table 26). Although present in relatively small amounts, several invasive plant species represent very serious threats of rapid increase and disruption of ecologic function. *Cirsium arvense* (Canada thistle) and *Centaurea maculosa* (spotted knapweed) are the most abundant invasive plant species, and both cover more than five percent of the lentic areas. *Cynoglossum officinale* (houndstongue) is also well represented, and together these three species all have great potential to severely degrade the habitat values on these lentic sites. The lentic areas had a significantly higher percentage of weeds

when compared to upland and lotic wetland areas. This high percentage of invasive species is likely a direct result of many years of concentrated livestock use around these water sources.

**Table 26.** Invasive plant species (weeds) (number = 8) on the nine lentic polygons inventoried in Spotted Dog WMA, sorted by abundance (see the Lentic Polygon Data Set Summary in Appendix D) (constancy is the percent of all polygons in which the species was recorded) (total lentic acres = 13.23)

| Invasive Plant Species (Weeds) | Acres | Percent of Study Area | Constancy |
|---|---|---|---|
| *Cirsium arvense* (Canada thistle) | 0.78 | 5.90% | 78% |
| *Centaurea maculosa* (spotted knapweed) | 0.71 | 5.37% | 33% |
| *Cynoglossum officinale* (houndstongue) | 0.28 | 2.12% | 56% |
| *Carduus nutans* (nodding plumeless thistle) | 0.06 | 0.45% | 56% |
| *Bromus tectorum* (cheatgrass) | 0.05 | 0.38% | 22% |
| *Hypericum perforatum* (St. John's wort) | 0.01 | 0.08% | 11% |
| *Cirsium vulgare* (bull thistle) | 0.00 | 0.00% | 11% |
| *Ranunculus acris* (tall buttercup) | 0.00 | 0.00% | 11% |
| ***TOTAL*** | ***1.89*** | ***14.29%*** | |

***Upland Sites***—On upland sites in Spotted Dog WMA, approximately 5.94 percent, (1,976.87 acres out of a total of 33,265.27 upland acres), is occupied by invasive plant species (Table 27). Although only present in small amounts, several invasive plant species represent very serious threats of rapid increase and disruption of ecologic function. *Bromus tectorum* (cheatgrass) and *Centaurea maculosa* (spotted knapweed) are the most abundant invasive plant species, and together cover a total of approximately 1,063.03 upland acres. *Carduus nutans* (nodding plumeless thistle), *Cirsium arvense* (Canada thistle), *Cynoglossum officinale* (houndstongue), and *Bromus japonicus* (field brome) are all also well represented, and all have great potential to severely degrade the habitat values on these uplands. The total acreage of invasive plants covering the uplands appears relatively high because the upland areas cover a much greater area of the total WMA than the lotic and lentic areas. On a percentage of invasive species basis by site type (i.e. lotic, lentic, upland), the uplands closely resemble the invasive species cover as Spotted Dog WMA as a whole.

**Table 27.** Invasive plant species (weeds) (number = 16) on the 128 upland polygons inventoried in Spotted Dog WMA, sorted by abundance (see the Upland Polygon Data Set Summary in Appendix D) (constancy is the percent of all polygons in which the species was recorded) (total upland acres = 33,265.27)

| Invasive Plant Species (Weeds) | Acres | Percent of Study Area | Constancy |
|---|---|---|---|
| *Bromus tectorum* (cheatgrass) | 630.35 | 1.89% | 45% |
| *Centaurea maculosa* (spotted knapweed) | 432.68 | 1.30% | 43% |
| *Carduus nutans* (nodding plumeless thistle) | 287.33 | 0.86% | 52% |
| *Cirsium arvense* (Canada thistle) | 247.24 | 0.74% | 27% |
| *Cynoglossum officinale* (houndstongue) | 181.45 | 0.55% | 34% |
| *Bromus japonicus* (field brome) | 156.58 | 0.47% | 7% |
| *Cirsium vulgare* (bull thistle) | 13.88 | 0.04% | 5% |
| *Sonchus arvensis* (field sowthistle) | 9.51 | 0.03% | 5% |
| *Hyoscyamus niger* (black henbane) | 4.40 | 0.01% | 2% |
| *Linaria vulgaris* (butter and eggs) | 2.53 | 0.01% | 2% |
| *Euphorbia esula* (leafy spurge) | 2.03 | 0.01% | 1% |
| *Linaria dalmatica* (dalmatian toadflax) | 2.01 | 0.01% | 1% |
| *Potentilla recta* (sulphur cinquefoil) | 2.01 | 0.01% | 1% |
| *Lepidium latifolium* (broadleaved pepperweed) | 1.88 | 0.01% | 1% |
| *Kochia scoparia* (burningbush) | 1.78 | 0.01% | 1% |
| *Ranunculus acris* (tall buttercup) | 1.21 | 0.00% | 1% |
| ***TOTAL*** | ***1,976.87*** | ***5.94%*** | |

***Lotic, Lentic, and Upland Sites Combined***—In Spotted Dog WMA as a whole, approximately 5.94 percent (2,005.16 out of a total of 33,985.65 acres), are occupied by invasive plant species (Table 28). Although currently present only in small amounts, several of the invasive plant species represent very serious threats of rapid increase and disruption of ecologic function. *Bromus tectorum* (cheatgrass) and *Centaurea maculosa* (spotted knapweed) are the most abundant invasive plant species, and together cover approximately 1,069.10 acres of Spotted Dog WMA. *Carduus nutans* (nodding plumeless thistle), *Cirsium arvense* (Canada thistle), *Cynoglossum officinale* (houndstongue), and *Bromus japonicus* (field brome) are all also well represented, and all have great potential to severely degrade the habitat values on the WMA. Although *Carduus nutans* (nodding plumeless thistle) covers only approximately 0.86 percent of the total WMA area, it occurs on 108 of 192 total polygons (56 percent constancy).

*Bromus tectorum* (cheatgrass), *Centaurea maculosa* (spotted knapweed), *Carduus nutans* (nodding plumeless thistle), *Cirsium arvense* (Canada thistle), *Cynoglossum officinale* (houndstongue), and *Bromus japonicus* (field brome) all have great potential to severely degrade the habitat values on these sites.

**Table 28.** Invasive plant species (weeds) (number = 22) on the 192 polygons (lotic, lentic, and upland combined) inventoried in Spotted Dog WMA, sorted by abundance (see the Lotic, Lentic, and Upland Polygon Data Set Summary in Appendix D) (constancy is the percent of all polygons in which the species was recorded) (total WMA acres = 33,985.65)

| Invasive Plant Species (Weeds) | Acres | Percent of Study Area | Constancy |
|---|---|---|---|
| *Bromus tectorum* (cheatgrass) | 632.43 | 1.87% | 43% |
| *Centaurea maculosa* (spotted knapweed) | 436.67 | 1.29% | 41% |
| *Carduus nutans* (nodding plumeless thistle) | 289.60 | 0.86% | 56% |
| *Cirsium arvense* (Canada thistle) | 250.98 | 0.74% | 41% |
| *Cynoglossum officinale* (houndstongue) | 191.21 | 0.57% | 45% |
| *Bromus japonicus* (field brome) | 156.58 | 0.46% | 5% |
| *Cirsium vulgare* (bull thistle) | 16.07 | 0.05% | 10% |
| *Sonchus arvensis* (field sowthistle) | 9.51 | 0.03% | 3% |
| *Hyoscyamus niger* (black henbane) | 4.46 | 0.01% | 2% |
| *Ranunculus acris* (tall buttercup) | 4.45 | 0.01% | 10% |
| *Linaria vulgaris* (butter and eggs) | 2.57 | 0.01% | 2% |
| *Euphorbia esula* (leafy spurge) | 2.03 | 0.01% | 1% |
| *Linaria dalmatica* (dalmatian toadflax) | 2.01 | 0.01% | 1% |
| *Potentilla recta* (sulphur cinquefoil) | 2.01 | 0.01% | 1% |
| *Lepidium latifolium* (broadleaved pepperweed) | 1.90 | 0.01% | 1% |
| *Kochia scoparia* (burningbush) | 1.78 | 0.01% | 1% |
| *Tanacetum vulgare* (common tansy) | 0.52 | 0.00% | 1% |
| *Arctium minus* (lesser burdock) | 0.27 | 0.00% | 2% |
| *Leucanthemum vulgare* (oxeye daisy) | 0.06 | 0.00% | 2% |
| *Hypericum perforatum* (St. John's wort) | 0.03 | 0.00% | 2% |
| *Centaurea solstitialis* (yellow starthistle) | 0.01 | 0.00% | 1% |
| *Lepidium draba* (whitetop) | 0.01 | 0.00% | 1% |
| ***TOTAL*** | ***2,005.16*** | ***5.94%*** | |

**Species Diversity and Native vs. Introduced (Species Origin)**

A great or small diversity of species on a site by itself does not tell much about the ecological status of that site. Some sites have vegetative potential to produce a monospecific stand of one species when undisturbed (e.g., a *Typha latifolia* [common cattail] or *Carex utriculata* [beaked sedge] stand). If such a stand is disturbed, such as by opening it up with livestock trampling, and all kinds of pioneering and opportunistic (often weedy) species enter the newly available site. Therefore, a more telling measure of displacement of the plant community away from good ecological health, or from a seral trajectory toward climax potential, is the amount of introduced species present.

***Lotic Sites***—Healthy lotic systems are often some of the most botanically diverse sites in western North America. However, simple species diversity means little without some knowledge of the proportions of native and introduced species. Table 29 shows the total number of species by lifeform and by species origin (i.e., whether native, introduced, or with elements of both) for the 55 lotic polygons in Spotted Dog WMA. A total of 410 individual plant species were identified, with 329 (80.2 percent) of them native to North America. The vast majority of the introduced species in the lotic areas are forbs and graminoids, typical of lifeforms that tend to invade or increase on areas of disturbance. The lotic areas in Spotted Dog WMA had a slightly lower percentage of native species than the upland areas. Lotic sites are often susceptible to introduced, invasive species because they are often disturbed naturally and anthropogenically, particularly by livestock use. In disturbed lotic settings, moving water often erodes banks, creating bare ground and fresh soil deposits downstream, with plenty of moisture. Such sites are very susceptible to introduced plant invasion or expansion.

**Table 29.** Total number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) for the 55 lotic polygons inventoried in Spotted Dog WMA

| Lifeform | Number of Species | Species in Each Origin Category | | |
|---|---|---|---|---|
| | | Native[1] | Introduced[2] | Both[3] |
| Trees | 8 | 8 | 0 | 0 |
| Shrubs | 51 | 49 | 1 | 1 |
| Graminoids | 82 | 66 | 16 | 0 |
| Forbs | 262 | 199 | 46 | 17 |
| Ferns and Allies | 7 | 7 | 0 | 0 |
| ***TOTAL*** | ***410 (100.0%)*** | ***329 (80.2%)*** | ***63 (15.4%)*** | ***18 (4.4%)*** |

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

***Lentic Sites***—Healthy lentic systems are often some of the most botanically diverse sites in western North America, although occasionally lentic sites may have limited diversity due to monospecific stands of one species when undisturbed (e.g., a *Typha latifolia* [common cattail] or *Carex utriculata* [beaked sedge] stand). However, simple species diversity means little without some knowledge of the proportions of native and introduced species. Table 30 shows the total number of species by lifeform and by species origin (i.e., whether native, introduced, or with elements of both) for the nine lentic polygons in Spotted Dog WMA. A total of 161 individual plant species were identified, with 124 (77.0 percent) of them native to North America. The total number of species is much lower than was found in the lotic and upland polygons primarily because of the very few total lentic polygons and limited total lentic acreages in Spotted Dog WMA. However, the lentic polygons had the lowest percentage of native species when compared to lotic and upland polygons. A reason for this is that many of the lentic polygons in the Spotted Dog WMA were developed or manipulated as watering sources for livestock grazing and have had

more intense historic livestock use associated with them. This intense livestock use often creates disturbances that favor introduced species, and livestock themselves often transport introduced and invasive plant species.

**Table 30.** Total number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) for the nine lentic polygons inventoried in Spotted Dog WMA

| Lifeform | Number of Species | Species in Each Origin Category | | |
|---|---|---|---|---|
| | | Native[1] | Introduced[2] | Both[3] |
| Trees | 4 | 4 | 0 | 0 |
| Shrubs | 20 | 20 | 0 | 0 |
| Graminoids | 47 | 39 | 8 | 0 |
| Forbs | 89 | 60 | 26 | 3 |
| Ferns and Allies | 1 | 1 | 0 | 0 |
| ***TOTAL*** | ***161 (100.0%)*** | ***124 (77.0%)*** | ***34 (21.1%)*** | ***3 (1.9%)*** |

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

***Lotic and Lentic Sites***—Healthy wetland systems (both lotic and lentic combined) are often some of the most botanically diverse sites in western North America. However, simple species diversity means little without some knowledge of the proportions of native and introduced species. Table 31 shows the total number of species by lifeform and by species origin (i.e., whether native, introduced, or with elements of both) for the 64 wetland polygons in Spotted Dog WMA. A total of 426 individual plant species were identified, with 343 (80.5 percent) of them native to North America. The wetland areas in Spotted Dog WMA had a slightly lower percentage of native species than the upland areas. These wetland sites are often susceptible to introduced, invasive species because they are often disturbed naturally and anthropogenically, particularly from livestock use. In disturbed lotic settings, moving water often erodes banks, creating bare ground and fresh soil deposits downstream, with plenty of moisture. Such sites are very susceptible to introduced plant invasion or expansion. Also, many of the lentic polygons in the Spotted Dog WMA were created or manipulated as watering sources for livestock grazing and have had very high historic use associated with them. This intense livestock use often creates disturbances that favor introduced species, and livestock themselves often transport introduced and invasive plant species.

**Table 31.** Total number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) for the 64 lotic and lentic polygons combined inventoried in Spotted Dog WMA

| Lifeform | Number of Species | Species in Each Origin Category | | |
|---|---|---|---|---|
| | | Native[1] | Introduced[2] | Both[3] |
| Trees | 8 | 8 | 0 | 0 |
| Shrubs | 51 | 49 | 1 | 1 |
| Graminoids | 88 | 72 | 16 | 0 |
| Forbs | 272 | 207 | 47 | 18 |
| Ferns and Allies | 7 | 7 | 0 | 0 |
| ***TOTAL*** | ***426 (100.0%)*** | ***343 (80.5%)*** | ***64 (15.0%)*** | ***19 (4.5%)*** |

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

***Upland Sites***—Healthy upland systems are typically comprised of botanically diverse sites across a varied landscape, and the upland polygons in Spotted Dog WMA are no exception. However, simple species diversity means little without some knowledge of the relative proportions of native and introduced species. Table 32 shows the total number of species by lifeform and by species origin (i.e., whether native, introduced, or with elements of both) for the 128 upland polygons in Spotted Dog WMA. A total of 481 individual plant species were identified, with 407 (84.6 percent) of them native to North America. This dominance of native plant species is a positive factor in determining upland health on the WMA. The high number of species indicates that Spotted Dog WMA has a wide mosaic of features that allow for high species richness across the varied landscape. The introduced species were typically located in recently disturbed areas and, with proper management, may decrease over several growing seasons.

**Table 32.** Total number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) for the 128 upland polygons inventoried in Spotted Dog WMA

| Lifeform | Number of Species | Species in Each Origin Category | | |
|---|---|---|---|---|
| | | Native[1] | Introduced[2] | Both[3] |
| Trees | 8 | 8 | 0 | 0 |
| Shrubs | 52 | 51 | 0 | 1 |
| Graminoids | 85 | 69 | 13 | 3 |
| Forbs | 331 | 275 | 42 | 14 |
| Ferns and Allies | 5 | 4 | 0 | 1 |
| ***TOTAL*** | ***481 (100.0%)*** | ***407 (84.6%)*** | ***55 (11.4%)*** | ***19 (4.0%)*** |

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

***Lotic, Lentic, and Upland Sites Combined***—Spotted Dog WMA is comprised of a mosaic of lotic streams, lentic wetlands, and upland sites which include extensive areas dominated by grasslands, some large forested areas, and sites dominated by shrub species. When the landscape mosaic is viewed as a whole, the WMA has a very high species diversity. However, simple species diversity means little without some knowledge of the proportions of native and introduced species. Table 33 shows the total number of species by lifeform and by species origin (i.e., whether native, introduced, or with elements of both) for the 192 total polygons in Spotted Dog WMA. A total of 637 individual plant species were identified, with 532 (83.5 percent) of them native to North America. Although there is a significant number and cover of native plant species in Spotted Dog WMA, measures should be taken to eradicate or significantly reduce cover of introduced species where abundant in order to preserve native species.

**Table 33.** Total number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) for the 192 total polygons (lotic, lentic, and upland combined) inventoried in Spotted Dog WMA

| Lifeform | Number of Species | Species in Each Origin Category | | |
|---|---|---|---|---|
| | | Native[1] | Introduced[2] | Both[3] |
| Trees | 9 | 9 | 0 | 0 |
| Shrubs | 69 | 66 | 1 | 2 |
| Graminoids | 125 | 105 | 17 | 3 |
| Forbs | 425 | 344 | 57 | 24 |
| Ferns and Allies | 9 | 8 | 0 | 1 |
| ***TOTAL*** | ***637 (100.0%)*** | ***532 (83.5%)*** | ***75 (11.8%)*** | ***30 (4.7%)*** |

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

***Forest/Woodland Upland Sites***—Healthy forests and woodlands in western North America are often comprised of botanically diverse sites. However, simple species diversity means little without some knowledge of the relative proportions of native and introduced species. Table 34 shows the total number of species by lifeform and by species origin (i.e., whether native, introduced, or with elements of both) for the 32 forest and woodland polygons in Spotted Dog WMA. A total of 354 individual plant species were identified, with 299 (84.5 percent) of them native to North America. Many of the introduced species were observed in areas that have been impacted by timber harvest, both historically and more recently. When trees are removed from a site and soil is disturbed, a rapid change in the physical site characteristics occurs. Introduced species are often brought in with timber

harvest, and are often better suited to this rapid change and can proliferate under higher disturbance while the native species struggle to compete. Given time and proper management, some of the introduced species may disappear or reduce abundance as the site matures into a later seral forested state.

**Table 34.** Total number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) for the 32 forest and woodland polygons inventoried in Spotted Dog WMA

| Lifeform | Number of Species | Species in Each Origin Category | | |
|---|---|---|---|---|
| | | Native[1] | Introduced[2] | Both[3] |
| Trees | 7 | 7 | 0 | 0 |
| Shrubs | 44 | 43 | 0 | 1 |
| Graminoids | 63 | 51 | 10 | 2 |
| Forbs | 237 | 196 | 32 | 9 |
| Ferns and Allies | 3 | 2 | 0 | 1 |
| ***TOTAL*** | ***354 (100.0%)*** | ***299 (84.5%)*** | ***42 (11.9%)*** | ***13 (3.7%)*** |

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

***Shrubland Upland Sites***—Healthy shrublands in western North America are often comprised of botanically diverse sites. However, simple species diversity means little without some knowledge of the relative proportions of native and introduced species. Table 35 shows the total number of species by lifeform and by species origin (i.e., whether native, introduced, or with elements of both) for the 12 shrubland polygons in Spotted Dog WMA. A total of 185 individual plant species were identified, with 155 (83.8 percent) of them native to North America. The total number of plant species observed in Spotted Dog WMA is relatively low simply because of the lower number of shrubland polygons, and the limited acreage of total shrublands on the WMA. There was only one major shrub type in the WMA, so we would expect to find lower diversity than on a landscape with multiple types. Although there is a majority of native species in Spotted Dog WMA shrublands, there were some areas that have been impacted by livestock and wildlife. Several introduced species were found in these areas of greater disturbance.

**Table 35.** Total number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) for the 12 shrubland polygons inventoried in Spotted Dog WMA

| Lifeform | Number of Species | Species in Each Origin Category | | |
|---|---|---|---|---|
| | | Native[1] | Introduced[2] | Both[3] |
| Trees | 3 | 3 | 0 | 0 |
| Shrubs | 14 | 14 | 0 | 0 |
| Graminoids | 35 | 25 | 9 | 1 |
| Forbs | 131 | 112 | 17 | 2 |
| Ferns and Allies | 2 | 1 | 0 | 1 |
| ***TOTAL*** | ***185 (100.0%)*** | ***155 (83.8%)*** | ***26 (14.1%)*** | ***4 (2.2%)*** |

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

***Grassland Upland Sites***—Healthy grasslands in western North America are often comprised of botanically diverse sites. However, simple species diversity means little without some knowledge of the relative proportions of native and introduced species. Table 36 shows the total number of species by lifeform and by species origin (i.e., whether native, introduced, of with elements of both) for the 83 grassland polygons in Spotted Dog WMA. A total of 344 unique plant species were identified, with 290 (84.3 percent) of them native to North America. Grasslands make up a major portion of Spotted Dog WMA. Although most of the plant species observed on these extensive grassland areas are native, several species are introduced and invasive. Intense historic livestock impacts may have facilitated several of the introduced species to move into the area. Many of the native plant species found on Spotted Dog WMA can compete with introduced species, and given time and rest from livestock grazing, some of the introduced species may decrease.

**Table 36.** Total number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) for the 83 grassland polygons inventoried in Spotted Dog WMA

| Lifeform | Number of Species | Species in Each Origin Category | | |
|---|---|---|---|---|
| | | Native[1] | Introduced[2] | Both[3] |
| Trees | 5 | 5 | 0 | 0 |
| Shrubs | 21 | 21 | 0 | 0 |
| Graminoids | 61 | 49 | 11 | 1 |
| Forbs | 263 | 212 | 30 | 11 |
| Ferns and Allies | 4 | 3 | 0 | 1 |
| ***TOTAL*** | ***344 (100.0%)*** | ***290 (84.3%)*** | ***41 (11.9%)*** | ***13 (3.8%)*** |

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

***Modified Upland Site***—Sites purposefully modified for human purposes, such as hay or crop production areas, typically have limited species diversity. However, species diversity means little without some knowledge of the relative proportions of native and introduced species. Table 37 shows the total number of species by lifeform and by species origin (i.e., whether native, introduced, or with elements of both) for the single modified polygon in Spotted Dog WMA. A total of 19 unique plant species were identified, with 10 (52.6 percent) of them native to North America. As expected, the percentage of native species in this site is very low compared to all of the other types (wetland, grassland, forest and woodland, shrubland). However, there are a surprising number of native species still present in this altered community. Modified sites have usually been altered to favor tame, agronomic species for crop or forage production. With several growing seasons and a shift of management that favors native species, the number and abundance of native species on this site is likely to increase. Management activities which either significantly dry the area (such as draining, or ceasing to irrigate), or which inundate the area (such as beaver activity) will favor the native plant species over the agronomic species.

**Table 37.** Total number of species by lifeform and species origin (i.e., whether native, introduced, and both categories) for the 1 modified polygon inventoried in Spotted Dog WMA

| Lifeform | Number of Species | Species in Each Origin Category | | |
|---|---|---|---|---|
| | | Native[1] | Introduced[2] | Both[3] |
| Trees | 0 | 0 | 0 | 0 |
| Shrubs | 0 | 0 | 0 | 0 |
| Graminoids | 8 | 4 | 4 | 0 |
| Forbs | 11 | 6 | 5 | 0 |
| Ferns and Allies | 0 | 0 | 0 | 0 |
| ***TOTAL*** | ***19 (100.0%)*** | ***10 (52.6%)*** | ***9 (47.4%)*** | ***0 (0.0%)*** |

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

**Acres of Plant Canopy Cover by Lifeform**

The physical structure of the plant community provides great insight into its value for wildlife habitat to many species for nesting, security, and thermal cover. A good general measure of the complexity of plant community structure is gained from examining the lifeform layers present on a particular site, or the project area overall. The tables provided below present this data for the various groups of sites inventoried on Spotted Dog WMA.

***Lotic and Lentic Sites***—The combined lotic and lentic wetland areas in Spotted Dog WMA have the highest degree of introduced plant canopy cover disturbance of all of the land types across the WMA. Introduced plant species comprise approximately 237.85 acres of canopy cover, making up approximately 30.1 percent of the total canopy cover on wetland areas (Table 38). The shift towards exotic species is almost entirely in the graminoid and forb categories. Approximately 57.0 percent of graminoid canopy cover is made up of introduced species, and 30.5 percent of forb canopy cover is of introduced species. In contrast, tree and shrub canopy cover is almost entirely made up of native species.

**Table 38.** Distribution of plant species canopy cover among lifeforms and origin categories (total acres can exceed 100 percent of the study area, due to lifeform overlap for the 64 lotic and lentic polygons inventoried in the Spotted Dog WMA) (lotic and lentic combined study area = 483.22 acres)

| Lifeform | Total | Native[1] | Introduced[2] | Both[3] |
|---|---|---|---|---|
| Trees | 62.09 (7.8%) | 62.09 (100.0%) | 0.00 (0.0%) | 0.00 (0.0%) |
| Shrubs | 200.83 (25.4%) | 199.15 (99.2%) | 0.13 (0.1%) | 1.55 (0.8%) |
| Graminoids | 311.12 (39.3%) | 133.78 (43.0%) | 177.34 (57.0%) | 0.00 (0.0%) |
| Forbs | 198.23 (25.1%) | 133.99 (67.6%) | 60.38 (30.5%) | 3.87 (2.0%) |
| Ferns and Allies | 18.95 (2.4%) | 18.95 (100.0%) | 0.00 (0.0%) | 0.00 (0.0%) |
| ***TOTAL*** | ***791.22 (100.0%)*** | ***547.96 (69.3%)*** | ***237.85 (30.1%)*** | ***5.42 (0.7%)*** |

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

***Upland Sites***—The upland areas in Spotted Dog WMA are a mosaic of extensive grasslands, some large forested areas, and smaller sites dominated by shrub species. When viewed as a whole, these areas have significantly less disturbance by introduced plant species compared to wetland areas on the WMA. On the upland areas, introduced plant species comprise approximately 6,211.93 acres of canopy cover, making up approximately 13.3 percent of the total canopy cover (Table 39). The exotic species canopy cover is entirely in the graminoid and forb categories. Approximately 16.5 percent of graminoid canopy cover is made up of introduced species, and 14.3 percent of forb canopy cover is of introduced species. In contrast, tree and shrub canopy cover is entirely made up of native species.

**Table 39.** Distribution of plant species canopy cover among lifeforms and origin categories (total acres can be more than 100 percent of the area due to overlap for the 128 upland polygons inventoried in the Spotted Dog WMA) (study area = 33,265.27 acres)

| Lifeform | Total | Native[1] | Introduced[2] | Both[3] |
|---|---|---|---|---|
| Trees | 2,978.07 (6.4%) | 2,978.07 (100.0%) | 0.00 (0.0%) | 0.00 (0.0%) |
| Shrubs | 3,527.63 (7.5%) | 3,526.70 (100.0%) | 0.00 (0.0%) | 0.93 (0.1%) |
| Graminoids | 23,935.29 (51.2%) | 19,906.30 (83.2%) | 3,946.92 (16.5%) | 82.07 (0.3%) |
| Forbs | 15,808.26 (33.8%) | 13,340.02 (84.4%) | 2,265.01 (14.3%) | 203.23 (1.3%) |
| Ferns and Allies | 531.72 (1.1%) | 520.21 (97.8%) | 0.00 (0.0%) | 11.52 (2.2%) |
| ***TOTAL*** | ***46,780.97 (100.0%)*** | ***40,271.30 (86.1%)*** | ***6,211.93 (13.3%)*** | ***297.75 (0.6%)*** |

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

***Lotic, Lentic, and Upland Sites Combined***—Rangelands in much of western North America have been impacted by historic land use, particularly by livestock grazing. Many areas of western Montana have a high degree of disturbance, reflected in large portions of vegetation canopy cover dominated by introduced species. When viewed as a whole landscape, Spotted Dog WMA is currently dominated by native plant species, which make up approximately 85.8 percent of the total plant canopy cover (Table 40). However, introduced plant species do make up a significant portion of the canopy cover. Across the WMA as a whole, introduced plant species comprise approximately 6,449.77 acres of canopy cover on the WMA, making up approximately 13.6 percent of the total canopy cover. The shift towards exotic species is almost entirely in the graminoid and forb categories. Approximately 17.0 percent of graminoid canopy cover is made up of introduced species, and 14.5 percent of forb canopy cover is of introduced species. In contrast, tree and shrub canopy cover is almost entirely made up of native species.

**Table 40.** Distribution of plant species canopy cover among lifeforms and origin categories (total acres can be more than 100 percent of the area due to overlap for the 192 upland, lotic, and lentic polygons inventoried in the Spotted Dog WMA) (study area = 33,748.79 acres)

| Lifeform | Total | Native[1] | Introduced[2] | Both[3] |
|---|---|---|---|---|
| Trees | 3,040.16 (6.4%) | 3,040.16 (100.0%) | 0.00 (0.0%) | 0.00 (0.0%) |
| Shrubs | 3,728.45 (7.8%) | 3,725.85 (99.9%) | 0.13 (0.1%) | 2.47 (0.1%) |
| Graminoids | 24,246.41 (51.0%) | 20,040.08 (82.7%) | 4,124.26 (17.0%) | 82.07 (0.3%) |
| Forbs | 16,006.49 (33.7%) | 13,474.01 (84.2%) | 2,325.38 (14.5%) | 207.10 (1.3%) |
| Ferns and Allies | 550.68 (1.2%) | 539.16 (97.9%) | 0.00 (0.0%) | 11.52 (2.1%) |
| ***TOTAL*** | ***47,572.19 (100.1%)*** | ***40,819.26 (85.8%)*** | ***6,449.77 (13.6%)*** | ***303.16 (0.6%)*** |

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

***Forest/Woodland Upland Sites***—Within the various upland vegetation types in Spotted Dog WMA, the forest and woodland areas have the most severe degree of disturbance by introduced species, although still less severe when compared to the wetland sites. On the forest and woodland areas, introduced plant species comprise approximately 2,794.14 acres of canopy cover, making up approximately 20.3 percent of the total canopy cover (Table 41). The exotic species canopy cover is entirely in the graminoid and forb categories. Approximately 35.9 percent of graminoid canopy cover is made up of introduced species, and 24.2 percent of forb canopy cover is of introduced species. In contrast, tree and shrub canopy cover is almost entirely made up of native species.

**Table 41.** Distribution of plant species canopy cover among lifeforms and origin categories (total acres can be more than 100 percent of the area due to overlap for the 32 forest and woodland polygons inventoried in the Spotted Dog WMA) (study area = 7,566.72 acres)

| Lifeform | Total | Native[1] | Introduced[2] | Both[3] |
|---|---|---|---|---|
| Trees | 2,841.90 (20.6%) | 2,841.90 (100.0%) | 0.00 (0.0%) | 0.00 (0.0%) |
| Shrubs | 1,762.41 (12.8%) | 1,761.48 (99.9%) | 0.00 (0.0%) | 0.93 (0.1%) |
| Graminoids | 4,927.29 (35.8%) | 3,080.00 (62.5%) | 1,770.08 (35.9%) | 77.21 (1.6%) |
| Forbs | 4,228.43 (30.7%) | 3,155.39 (74.6%) | 1,024.06 (24.2%) | 48.97 (1.2%) |
| Ferns and Allies | 11.97 (0.1%) | 9.38 (78.4%) | 0.00 (0.0%) | 2.59 (21.6%) |
| ***TOTAL*** | ***13,772.00 (100.0%)*** | ***10,848.15 (78.8%)*** | ***2,794.14 (20.3%)*** | ***129.70 (0.9%)*** |

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

***Shrubland Upland Sites***—Within the various upland vegetation types in Spotted Dog WMA, the shrubland areas have a moderate degree of disturbance by introduced species. On shrubland areas, introduced plant species comprise approximately 851.99 acres of canopy cover, making up approximately 14.9 percent of the total canopy cover (Table 42). The exotic species canopy cover is entirely in the graminoid and forb categories. Approximately 19.2 percent of graminoid canopy cover is made up of introduced species, and 17.3 percent of forb canopy cover is of introduced species. In contrast, tree and shrub canopy cover is entirely made up of native species.

**Table 42.** Distribution of plant species canopy cover among lifeforms and origin categories (total acres can be more than 100 percent of the area due to overlap for the 12 shrubland polygons inventoried in the Spotted Dog WMA) (study area = 4,371.78 acres)

| Lifeform | Total | Native[1] | Introduced[2] | Both[3] |
|---|---|---|---|---|
| Trees | 27.65 (0.5%) | 27.65 (100.0%) | 0.00 (0.0%) | 0.00 (0.0%) |
| Shrubs | 1,028.11 (18.0%) | 1,028.11 (100.0%) | 0.00 (0.0%) | 0.00 (0.0%) |
| Graminoids | 2,807.22 (49.2%) | 2,262.86 (80.6%) | 540.07 (19.2%) | 4.29 (0.2%) |
| Forbs | 1,804.17 (31.6%) | 1,489.75 (82.6%) | 311.92 (17.3%) | 2.50 (0.1%) |
| Ferns and Allies | 40.31 (0.7%) | 39.52 (98.0%) | 0.00 (0.0%) | 0.79 (2.0%) |
| ***TOTAL*** | ***5,707.46 (100.0%)*** | ***4847.89 (84.9%)*** | ***851.99 (14.9%)*** | ***7.58 (0.1%)*** |

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

***Grassland Upland Sites***—Within the various upland vegetation types in Spotted Dog WMA, grassland areas cover the most area of the landscape, but have the least severe degree of disturbance by introduced species. On the grassland areas, introduced plant species comprise approximately 2,420.57 acres of canopy cover, making up approximately 8.9 percent of the total canopy cover (Table 43). The exotic species canopy cover is entirely in the graminoid and forb categories. Approximately 9.3 percent of graminoid canopy cover is made up of introduced species, and 9.4 percent of forb canopy cover is of introduced species. In contrast, tree and shrub canopy cover is entirely made up of native species.

**Table 43.** Distribution of plant species canopy cover among lifeforms and origin categories (total acres can be more than 100 percent of the area due to overlap for the 83 grassland polygons inventoried in the Spotted Dog WMA) (study area = 21,223.77 acres)

| Lifeform | Total | Native[1] | Introduced[2] | Both[3] |
|---|---|---|---|---|
| Trees | 108.52 (0.4%) | 108.52 (100.0%) | 0.00 (0.0%) | 0.00 (0.0%) |
| Shrubs | 737.11 (2.7%) | 737.11 (100.0%) | 0.00 (0.0%) | 0.00 (0.0%) |
| Graminoids | 16,063.80 (59.2%) | 14,561.38 (90.6%) | 1,501.84 (9.3%) | 0.57 (0.1%) |
| Forbs | 9,739.62 (35.9%) | 8,669.13 (89.0%) | 918.73 (9.4%) | 151.76 (1.6%) |
| Ferns and Allies | 479.44 (1.8%) | 471.31 (98.3%) | 0.00 (0.0%) | 8.13 (1.7%) |
| ***TOTAL*** | ***27,128.50 (100.0%)*** | ***24,547.45 (90.5%)*** | ***2,420.57 (8.9%)*** | ***160.46 (0.6%)*** |

[1]Native = native to pre-Columbian North America

[2]Introduced = introduced by post-Columbian human immigrants

[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

**Acres of Non-Native Plant Species**

When all layers of vegetation canopy cover are viewed together, approximately 14.2 percent of all canopy cover in Spotted Dog WMA has been replaced by introduced species (Table 44), such as *Poa pratensis* (Kentucky bluegrass), *Phleum pratense* (timothy), *Taraxacum officinale* subsp. *officinale* (common dandelion), invasive weed species.

**Table 44.** Summary of non-native plant species canopy cover in Spotted Dog WMA (total acres can be greater than 100 percent of the area due to overlap by the various lifeforms) (Spotted Dog WMA = 33,985.65 acres)

| Location | Total Acres of Plant Species Canopy Cover | Acres of Canopy Cover by Non-Native | Percent of Total Canopy Cover Non-Native |
|---|---|---|---|
| Spotted Dog WMA | 47,572.19 | 6,752.93 | 14.2% |

[1]Native = native to pre-Columbian North America

Introduced = introduced by post-Columbian human immigrants

Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

**Number of Species per Polygon**

Table 45 provides a breakout of plant species into the average number of species per polygon by lifeform and by category of origin for all 192 polygons inventoried in Spotted Dog WMA. On average overall, each polygon had approximately 65 species. Of those, approximately 54 (84 percent) were native, and 11 (16 percent) were either introduced or both.

**Table 45.** Summary of the number of species per polygon distributed among lifeform and origin category for the 192 lotic, lentic, and upland polygons inventoried in Spotted Dog WMA

| Lifeform | Species per Polygon | Species per Polygon in Each Origin Category | | |
|---|---|---|---|---|
| | | Native[1] | Introduced[2] | Both[3] |
| Trees | 1.85 | 1.85 | 0.00 | 0.00 |
| Shrubs | 7.48 | 7.46 | 0.01 | 0.02 |
| Graminoids | 14.31 | 11.28 | 2.99 | 0.05 |
| Forbs | 40.66 | 33.03 | 6.80 | 0.83 |
| Ferns and Allies | 0.68 | 0.64 | 0.00 | 0.05 |
| ***TOTAL*** | ***64.99 (100.00%)*** | ***54.26 (83.49%)*** | ***9.80 (15.08%)*** | ***0.94 (1.15%)*** |

[1]Native = native to pre-Columbian North America
[2]Introduced = introduced by post-Columbian human immigrants
[3]Both = species contains native and introduced elements (***NOTE:*** Those plant specimens only identified to genus and the genus includes both native and introduced species, were identified as Both.)

**Prominent Plant Species**

Most inventory and ecological health assessment polygons on Spotted Dog WMA, whether greatly, or not at all disturbed, have very diverse natural vegetation. Some polygons had as many as 80 to over 100 species recorded. However, even on the most vegetatively diverse site, a few species will typically dominate the cover, while most are only minutely represented. Therefore, it is useful to quantify the relative abundance of species as a way of characterizing the site and as a tool for assessing how much the community is removed from its natural potential. The index of relative prominence used here is the numerical product of multiplying the average canopy cover of a species by its constancy of occurrence (i.e., the percent of polygons having it present).

Greater prominence value goes to species with large average cover ***and*** high constancy. Moderate prominence value goes to those that have ***either*** high average cover ***or*** high constancy, but not both; and low values go to the multitude of species that occur only in small amounts and with sporadic frequency. The great majority of plant cover on most polygons is dominated by only a few species, but normally also present are a great number of species (mostly the forbs) represented by only a few widely spaced individuals.

***Lotic Sites***—Although lotic sites in Spotted Dog WMA are generally dominated by trees and shrubs that are nearly all native to North America, by far the overall most prominent plant species on lotic sites is the introduced grass *Poa pratensis* (Kentucky bluegrass) (Table 46). This introduced grass is on all 55 lotic polygons, has the highest average canopy cover of all species, and covers almost twice as many acres as any other individual species in Spotted Dog WMA lotic areas. *Poa pratensis* (Kentucky bluegrass) is also more than three times as prominent across the lotic areas as the second most prominent species, *Salix boothii* (Booth willow).

**Table 46.** The five most prominent plant species among the five lifeforms in Spotted Dog WMA lotic polygons (number = 55) (acres listed is the canopy cover area of the species)

| Species | Prominence Value[1] | Acres | Origin Status[2] |
|---|---|---|---|
| **Trees** | | | |
| *Picea engelmannii* var. *engelmannii* (Engelmann spruce) | 3.84 | 31.19 | Native |
| *Populus tremuloides* (quaking aspen) | 0.99 | 11.84 | Native |
| *Pseudotsuga menziesii* var. *glauca* (Douglas fir) | 0.82 | 10.50 | Native |
| *Populus balsamifera* (black cottonwood) | 0.11 | 3.65 | Native |
| *Abies lasiocarpa* (subalpine fir) | 0.01 | 1.38 | Native |
| **Shrubs** | | | |
| *Salix boothii* (Booth willow) | 9.26 | 48.80 | Native |
| *Alnus incana* subsp. *tenuifolia* (thin-leaved alder) | 6.09 | 38.15 | Native |
| *Salix drummondiana* (Drummond willow) | 3.05 | 31.02 | Native |

**Table 46. (cont.)**

| Species | Prominence Value[1] | Acres | Origin Status[2] |
|---|---|---|---|
| *Rosa woodsii* (woods rose) | 0.80 | 13.15 | Native |
| *Salix geyeriana* (Geyer willow) | 0.71 | 13.08 | Native |
| **Graminoids** | | | |
| *Poa pratensis* (Kentucky bluegrass) | 33.24 | 85.69 | Introduced |
| *Carex utriculata* (beaked sedge) | 7.01 | 41.61 | Native |
| *Phleum pratense* (timothy) | 3.75 | 29.04 | Introduced |
| *Alopecurus pratensis* (meadow foxtail) | 3.29 | 5.92 | Introduced |
| *Juncus balticus* (Baltic rush) | 2.87 | 26.98 | Native |
| **Forbs** | | | |
| *Taraxacum officinale* (common dandelion) | 0.37 | 9.06 | Introduced |
| *Cynoglossum officinale* (houndstongue) | 0.36 | 9.48 | Introduced |
| *Fragaria virginiana* (wild strawberry) | 0.25 | 7.87 | Native |
| *Geum macrophyllum* var. *perincisum* (large-leaved avens) | 0.23 | 7.30 | Native |
| *Trifolium pratense* (red clover) | 0.23 | 8.52 | Introduced |
| **Ferns and Allies** | | | |
| *Equisetum arvense* (common horsetail) | 1.48 | 14.53 | Native |
| *Equisetum fluviatile* (water horsetail) | 0.02 | 3.51 | Native |
| *Cystopteris fragilis* (fragile fern) | 0.01 | 0.04 | Native |
| *Dryopteris* spp. (shield-fern; wood-fern) | 0.01 | 0.02 | Native |
| *Equisetum hyemale* (scouring rush) | 0.01 | 0.04 | Native |

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

***Lentic Sites***——Lentic sites in Spotted Dog WMA are typically associated with springs and ponds, and are generally dominated by herbaceous species, although trees and shrubs are well represented in several locations. By far the most prominent plant species overall in Spotted Dog WMA lentic polygons is the native sedge *Carex utriculata* (beaked sedge) (Table 47). This native sedge is on seven of the nine lentic polygons, has the highest average canopy cover of all species, and covers more acres than any other species in Spotted Dog WMA lentic areas. *Carex utriculata* (beaked sedge) is also more than twice as prominent across the lentic sites on the WMA as the second most prominent species, *Carex nebrascensis* (Nebraska sedge).

**Table 47.** The five most prominent plant species among the five lifeforms in Spotted Dog WMA lentic polygons (number = 9) (acres listed is the canopy cover area of the species)

| Species | Prominence Value[1] | Acres | Origin Status[2] |
|---|---|---|---|
| **Trees** | | | |
| *Populus tremuloides* (quaking aspen) | 2.16 | 0.52 | Native |
| *Pseudotsuga menziesii* var. *glauca* (Douglas fir) | 0.03 | 0.04 | Native |
| *Picea engelmannii* var. *engelmannii* (Engelmann spruce) | 0.01 | 0.00 | Native |
| *Pinus contorta* var. *latifolia* (lodgepole pine) | 0.01 | 0.00 | Native |
| **Shrubs** | | | |
| *Salix bebbiana* (Bebb willow) | 2.55 | 0.75 | Native |
| *Salix boothii* (Booth willow) | 0.69 | 0.56 | Native |
| *Rosa woodsii* (woods rose) | 0.56 | 0.40 | Native |
| *Alnus incana* subsp. *tenuifolia* (thin-leaved alder) | 0.13 | 0.18 | Native |
| *Cornus sericea* subsp. *sericea* (red-osier dogwood) | 0.08 | 0.21 | Native |
| **Graminoids** | | | |
| *Carex utriculata* (beaked sedge) | 21.82 | 2.17 | Native |
| *Carex nebrascensis* (Nebraska sedge) | 9.06 | 1.51 | Native |
| *Phleum pratense* (timothy) | 8.73 | 1.20 | Introduced |
| *Poa pratensis* (Kentucky bluegrass) | 8.34 | 1.35 | Introduced |
| *Carex aquatilis* var. *aquatilis* (water sedge) | 6.16 | 0.80 | Native |
| **Forbs** | | | |
| *Cirsium arvense* (Canada thistle) | 2.79 | 0.78 | Introduced |
| *Typha latifolia* (common cattail) | 2.28 | 0.70 | Native |
| *Centaurea maculosa* (spotted knapweed) | 1.38 | 0.71 | Introduced |
| *Epilobium ciliatum* (common willow-herb) | 1.30 | 0.54 | Native |
| *Mentha arvensis* (field mint) | 1.15 | 0.57 | Native |
| **Ferns and Allies** | | | |
| *Equisetum arvense* (common horsetail) | 1.53 | 0.76 | Native |

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

***Lotic and Lentic Sites***—Although the combined lotic and lentic wetland sites in Spotted Dog WMA are generally dominated by trees and shrubs that are nearly all native to North America, by far the overall most prominent plant species is the introduced grass *Poa pratensis* (Kentucky bluegrass) (Table 48). This introduced grass is on 62 of the 64 combined wetland polygons, has the highest average canopy cover of all species, and covers almost twice as many acres as any other species in Spotted Dog WMA wetland sites. *Poa pratensis* (Kentucky bluegrass) is

also more than three times as prominent across the combined wetland sites on the WMA as the second most prominent species, *Salix boothii* (Booth willow).

**Table 48.** The five most prominent plant species among the five lifeforms in Spotted Dog WMA lotic and lentic polygons combined (number = 64) (acres listed is the canopy cover area of the species)

| Species | Prominence Value[1] | Acres | Origin Status[2] |
|---|---|---|---|
| **Trees** | | | |
| *Picea engelmannii* var. *engelmannii* (Engelmann spruce) | 3.48 | 31.19 | Native |
| *Populus tremuloides* (quaking aspen) | 0.94 | 12.37 | Native |
| *Pseudotsuga menziesii* var. *glauca* (Douglas fir) | 0.73 | 10.54 | Native |
| *Populus balsamifera* (black cottonwood) | 0.09 | 3.65 | Native |
| *Abies lasiocarpa* (subalpine fir) | 0.01 | 1.38 | Native |
| **Shrubs** | | | |
| *Salix boothii* (Booth willow) | 8.25 | 49.36 | Native |
| *Alnus incana* subsp. *tenuifolia* (thin-leaved alder) | 5.31 | 38.33 | Native |
| *Salix drummondiana* (Drummond willow) | 2.63 | 31.03 | Native |
| *Rosa woodsii* (woods rose) | 0.75 | 13.55 | Native |
| *Salix bebbiana* (Bebb willow) | 0.64 | 12.57 | Native |
| **Graminoids** | | | |
| *Poa pratensis* (Kentucky bluegrass) | 31.46 | 87.04 | Introduced |
| *Carex utriculata* (beaked sedge) | 7.27 | 43.78 | Native |
| *Phleum pratense* (timothy) | 3.91 | 30.24 | Introduced |
| *Juncus balticus* (Baltic rush) | 2.86 | 28.06 | Native |
| *Alopecurus pratensis* (meadow foxtail) | 2.75 | 39.07 | Introduced |
| **Forbs** | | | |
| *Cynoglossum officinale* (houndstongue) | 0.35 | 9.76 | Introduced |
| *Taraxacum officinale* (common dandelion) | 0.33 | 9.10 | Introduced |
| *Fragaria virginiana* (wild strawberry) | 0.23 | 7.98 | Native |
| *Geum macrophyllum* var. *perincisum* (large-leaved avens) | 0.20 | 7.35 | Native |
| *Trifolium pratense* (red clover) | 0.20 | 8.53 | Introduced |
| **Ferns and Allies** | | | |
| *Equisetum arvense* (common horsetail) | 1.42 | 15.29 | Native |
| *Cystopteris fragilis* (fragile fern) | 0.01 | 0.04 | Native |
| *Dryopteris* spp. (shield-fern; wood-fern) | 0.01 | 0.02 | Native |
| *Equisetum fluviatile* (water horsetail) | 0.01 | 3.51 | Native |
| *Equisetum hyemale* (scouring rush) | 0.01 | 0.04 | Native |

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

***Upland Sites***—The upland areas in Spotted Dog WMA are a mosaic of extensive areas of grasslands, some large forested areas, and smaller sites dominated by shrub species. All of the upland areas are dominated by plant species native to North America. Two native grass species, *Festuca idahoensis* (Idaho fescue) and *Festuca campestris* (rough fescue), are by far the most prominent species, and cover very similar acreages across the upland sites (Table 49). *Festuca idahoensis* (Idaho fescue) occurs on 111 of the 128 upland polygons, and *Festuca campestris* (rough fescue) occurs on 118 of the 128 upland polygon, and both also have the highest average canopy covers of all species. *Festuca idahoensis* (Idaho fescue) and *Festuca campestris* (rough fescue) are also each almost twice as prominent as the third most prominent species, *Agropyron spicatum* (bluebunch wheatgrass). The most prominent tree species in the forested areas is *Pseudotsuga menziesii* var. *glauca* (Douglas fir), and it is the fourth most prominent species across all upland sites.

**Table 49.** The five most prominent plant species among the five lifeforms in Spotted Dog WMA upland polygons (number = 128) (acres listed is the canopy cover area of the species)

| Species | Prominence Value[1] | Acres | Origin Status[2] |
|---|---|---|---|
| **Trees** | | | |
| *Pseudotsuga menziesii* var. *glauca* (Douglas fir) | 4.74 | 2,206.77 | Native |
| *Pinus contorta* var. *latifolia* (lodgepole pine) | 0.14 | 395.91 | Native |
| *Picea engelmannii* var. *engelmannii* (Engelmann spruce) | 0.02 | 132.23 | Native |
| *Populus tremuloides* (quaking aspen) | 0.02 | 127.99 | Native |
| *Abies lasiocarpa* (subalpine fir) | 0.01 | 7.93 | Native |
| **Shrubs** | | | |
| *Purshia tridentata* (antelope bitterbrush) | 0.51 | 854.52 | Native |
| *Arctostaphylos uva-ursi* (kinnikinnick) | 0.11 | 330.27 | Native |
| *Ericameria nauseosa* (rubber rabbitbrush) | 0.07 | 292.08 | Native |
| *Rosa arkansana* (prairie rose) | 0.03 | 202.72 | Native |
| *Rosa woodsii* (woods rose) | 0.03 | 163.45 | Native |
| **Graminoids** | | | |
| *Festuca idahoensis* (Idaho fescue) | 18.97 | 4,524.25 | Native |
| *Festuca campestris* (rough fescue) | 18.66 | 4,538.86 | Native |
| *Agropyron spicatum* (bluebunch wheatgrass) | 10.13 | 3,396.60 | Native |
| *Koeleria macrantha* (prairie Junegrass) | 1.72 | 1,407.12 | Native |
| *Poa pratensis* (Kentucky bluegrass) | 1.49 | 1,333.54 | Introduced |
| **Forbs** | | | |
| *Lupinus argenteus* (silvery lupine) | 1.42 | 1,282.31 | Native |
| *Phlox hoodii* (Hood's phlox) | 0.22 | 552.81 | Native |
| *Antennaria microphylla* (rosy pussytoes) | 0.21 | 454.39 | Native |
| *Eriogonum umbellatum* (sulfur buckwheat) | 0.21 | 470.92 | Native |

**Table 49. (cont.)**

| Species | Prominence Value[1] | Acres | Origin Status[2] |
|---|---|---|---|
| *Heterotheca villosa* (hairy golden-aster) | 0.21 | 481.98 | Native |
| **Ferns and Allies** | | | |
| *Selaginella densa* (compact selaginella) | 0.25 | 515.22 | Native |
| *Equisetum arvense* (common horsetail) | 0.01 | 1.21 | Native |
| *Equisetum hyemale* (scouring rush) | 0.01 | 1.75 | Native |
| Moss spp. (moss) | 0.01 | 11.52 | Both |
| *Woodsia oregana* subsp. *oregana* (Oregon woodsia) | 0.01 | 2.03 | Native |

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

***Lotic, Lentic, and Upland Sites Combined***—Spotted Dog WMA as a whole is comprised of a landscape mosaic of lotic streams, lentic wetlands, and upland sites which include extensive areas dominated by grasslands, some large forested areas, and smaller sites dominated by shrub species. The WMA is dominated by plant species which are nearly all native to North America, although some introduced herbaceous species are well represented. Two native grass species, *Festuca idahoensis* (Idaho fescue) and *Festuca campestris* (rough fescue), are by far the most prominent species (Table 50). *Festuca campestris* (rough fescue) occurs on 120 of the 192 polygons, and *Festuca idahoensis* (Idaho fescue) occurs on 113 of the 192 polygons, both also have the highest average canopy covers of all species, and both cover very similar acreages across the WMA. *Festuca idahoensis* (Idaho fescue) and *Festuca campestris* (rough fescue) are also each approximately twice as prominent as the third most prominent species, *Agropyron spicatum* (bluebunch wheatgrass). The most prominent tree species in the forested areas is *Pseudotsuga menziesii* var. *glauca* (Douglas fir), and it is the fourth most prominent species across the entire WMA.

**Table 50.** The five most prominent plant species among the five lifeforms in Spotted Dog WMA polygons (lotic, lentic, and upland combined) (number = 192) (acres listed is the canopy cover area of the species)

| Species | Prominence Value[1] | Acres | Origin Status[2] |
|---|---|---|---|
| **Trees** | | | |
| *Pseudotsuga menziesii* var. *glauca* (Douglas fir) | 4.72 | 2,217.32 | Native |
| *Pinus contorta* var. *latifolia* (lodgepole pine) | 0.17 | 396.82 | Native |
| *Picea engelmannii* var. *engelmannii* (Engelmann spruce) | 0.04 | 163.42 | Native |
| *Populus tremuloides* (quaking aspen) | 0.03 | 140.35 | Native |
| *Abies lasiocarpa* (subalpine fir) | 0.01 | 9.31 | Native |

**Table 50. (cont.)**

| Species | Prominence Value[1] | Acres | Origin Status[2] |
|---|---|---|---|
| **Shrubs** | | | |
| *Purshia tridentata* (antelope bitterbrush) | 0.35 | 854.55 | Native |
| *Arctostaphylos uva-ursi* (kinnikinnick) | 0.10 | 330.45 | Native |
| *Rosa woodsii* (woods rose) | 0.06 | 177.00 | Native |
| *Ericameria nauseosa* (rubber rabbitbrush) | 0.05 | 292.10 | Native |
| *Rubus idaeus* (red raspberry) | 0.03 | 130.30 | Native |
| **Graminoids** | | | |
| *Festuca idahoensis* (Idaho fescue) | 12.68 | 4,524.31 | Native |
| *Festuca campestris* (rough fescue) | 12.47 | 4,538.87 | Native |
| *Agropyron spicatum* (bluebunch wheatgrass) | 6.66 | 3,396.59 | Native |
| *Poa pratensis* (Kentucky bluegrass) | 1.85 | 1,420.58 | Introduced |
| *Phleum pratense* (timothy) | 1.72 | 1,243.69 | Introduced |
| **Forbs** | | | |
| *Lupinus arbustus* (spurred lupine) | 1.01 | 1,282.92 | Native |
| *Achillea millefolium* (common yarrow) | 0.17 | 452.46 | Native |
| *Solidago missouriensis* (Missouri goldenrod) | 0.17 | 498.79 | Native |
| *Antennaria microphylla* (rosy pussytoes) | 0.15 | 454.94 | Native |
| *Eriogonum umbellatum* (sulfur buckwheat) | 0.15 | 471.58 | Native |
| **Ferns and Allies** | | | |
| *Selaginella densa* (compact selaginella) | 0.17 | 515.21 | Native |
| *Cystopteris fragilis* (fragile fern) | 0.01 | 0.04 | Native |
| *Dryopteris* spp. (shield-fern; wood-fern) | 0.01 | 0.02 | Native |
| *Equisetum arvense* (common horsetail) | 0.01 | 16.50 | Native |
| *Equisetum fluviatile* (water horsetail) | 0.01 | 3.51 | Native |

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

***Forest/Woodland Upland Sites***—The forest and woodland areas in Spotted Dog WMA are dominated by trees and shrubs that are nearly all native to North America, but introduced herbaceous species are well represented. By far the overall most prominent plant species in forest and woodland areas is the native tree *Pseudotsuga menziesii* var. *glauca* (Douglas fir) (Table 51). This native tree is on all 32 forest and woodland polygons, has the highest average canopy cover of all species, and covers approximately three times as many acres as any other species. The herbaceous understory in the forest and woodland sites is dominated mainly by graminoids, of which the two most prominent species are the introduced grasses *Poa pratensis* (Kentucky bluegrass) and *Phleum pratense*

(timothy), followed by the native sedge *Carex geyeri* (elk sedge). *Populus tremuloides* (quaking aspen) is an ecologically important species, especially for wildlife, but the species has a very low prominence value, and covers relatively few acres. *Populus tremuloides* (quaking aspen) is generally found in small isolated stands, with young *Pseudotsuga menziesii* var. *glauca* (Douglas fir) coming in.

**Table 51.** The five most prominent plant species among the five lifeforms in Spotted Dog WMA forest and woodland polygons (number = 32) (acres listed is the canopy cover area of the species)

| Species | Prominence Value[1] | Acres | Origin Status[2] |
|---|---|---|---|
| **Trees** | | | |
| *Pseudotsuga menziesii* var. *glauca* (Douglas fir) | 79.15 | 2,128.72 | Native |
| *Pinus contorta* var. *latifolia* (lodgepole pine) | 2.42 | 395.73 | Native |
| *Picea engelmannii* var. *engelmannii* (Engelmann spruce) | 0.28 | 132.23 | Native |
| *Populus tremuloides* (quaking aspen) | 0.28 | 123.32 | Native |
| *Pinus ponderosa* var. *scopulorum* (ponderosa pine) | 0.02 | 32.81 | Native |
| **Shrubs** | | | |
| *Arctostaphylos uva-ursi* (kinnikinnick) | 1.87 | 330.27 | Native |
| *Spiraea betulifolia* var. *lucida* (shiny-leaf spiraea) | 0.53 | 180.84 | Native |
| *Symphoricarpos albus* var. *laevigatus* (white coralberry) | 0.52 | 173.46 | Native |
| *Rosa woodsii* (woods rose) | 0.46 | 159.77 | Native |
| *Shepherdia canadensis* (Canada buffaloberry) | 0.38 | 145.41 | Native |
| **Graminoids** | | | |
| *Poa pratensis* (Kentucky bluegrass) | 8.50 | 693.43 | Introduced |
| *Phleum pratense* (timothy) | 7.88 | 679.78 | Introduced |
| *Carex geyeri* (elk sedge) | 6.62 | 634.78 | Native |
| *Calamagrostis rubescens* (pine reedgrass) | 2.71 | 399.75 | Native |
| *Festuca idahoensis* (Idaho fescue) | 2.37 | 366.62 | Native |
| **Forbs** | | | |
| *Fragaria virginiana* (wild strawberry) | 1.31 | 273.79 | Native |
| *Cirsium arvense* (Canada thistle) | 1.01 | 243.69 | Introduced |
| *Galium boreale* (northern bedstraw) | 0.97 | 230.95 | Native |
| *Carduus nutans* (nodding plumeless thistle) | 0.75 | 214.63 | Introduced |
| *Arnica cordifolia* (heart-leaf arnica) | 0.64 | 196.38 | Native |
| **Ferns and Allies** | | | |
| *Equisetum arvense* (common horsetail) | 0.01 | 8.16 | Native |
| Moss spp. (moss) | 0.01 | 2.59 | Both |
| *Selaginella densa* (compact selaginella) | 0.01 | 1.21 | Native |

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

***Shrubland Upland Sites***—Although shrublands do not make up large portions of Spotted Dog WMA, they are ecologically important, particularly for wildlife habitat values. In Spotted Dog WMA, shrubland sites are dominated by shrub and herbaceous species which are native to North America, although some introduced herbaceous species are well represented in some locations. The most prominent plant species on shrubland polygons is the native grass *Agropyron spicatum* (bluebunch wheatgrass), followed closely by the native shrub species *Purshia tridentata* (antelope bitterbrush) (Table 52). Although the most prominent species on the shrubland polygons is a grass, *Purshia tridentata* (antelope bitterbrush) is the dominant shrub species, and is found on all 12 shrubland polygons, typically as scattered plants and patches throughout each polygon. *Agropyron spicatum* (bluebunch wheatgrass) has the highest average canopy cover and covers the most polygon acreage, again followed closely by *Purshia tridentata* (antelope bitterbrush) in both categories. *Agropyron spicatum* (bluebunch wheatgrass) is also approximately four times as prominent as the third most prominent species, *Festuca idahoensis* (Idaho fescue).

**Table 52.** The five most prominent plant species among the five lifeforms in Spotted Dog WMA shrubland polygons (number = 12) (acres listed is the canopy cover area of the species)

| Species | Prominence Value[1] | Acres | Origin Status[2] |
|---|---|---|---|
| **Trees** | | | |
| *Juniperus scopulorum* (Rocky Mountain juniper) | 0.02 | 18.45 | Native |
| *Pseudotsuga menziesii* var. *glauca* (Douglas fir) | 0.01 | 6.90 | Native |
| *Pinus flexilis* (limber pine) | 0.01 | 2.30 | Native |
| **Shrubs** | | | |
| *Purshia tridentata* (antelope bitterbrush) | 35.09 | 818.91 | Native |
| *Ericameria nauseosa* (rubber rabbitbrush) | 0.16 | 54.79 | Native |
| *Artemisia frigida* (fringed sagewort) | 0.07 | 37.77 | Native |
| *Rosa arkansana* (prairie rose) | 0.07 | 35.64 | Native |
| *Gutierrezia sarothrae* (broom snakeweed) | 0.03 | 26.65 | Native |
| **Graminoids** | | | |
| *Agropyron spicatum* (bluebunch wheatgrass) | 48.00 | 957.76 | Native |
| *Festuca idahoensis* (Idaho fescue) | 11.94 | 485.54 | Native |
| *Bromus tectorum* (cheatgrass) | 3.58 | 270.12 | Introduced |
| *Poa secunda* (Sandberg bluegrass) | 2.29 | 208.83 | Native |
| *Koeleria macrantha* (prairie Junegrass) | 2.03 | 196.98 | Native |
| **Forbs** | | | |
| *Centaurea maculosa* (spotted knapweed) | 1.47 | 167.40 | Introduced |
| *Phlox hoodii* (Hood's phlox) | 1.44 | 165.49 | Native |
| *Lupinus argenteus* (silvery lupine) | 1.02 | 139.80 | Native |
| *Heterotheca villosa* (hairy golden-aster) | 0.54 | 94.65 | Native |

**Table 52. (cont.)**

| Species | Prominence Value[1] | Acres | Origin Status[2] |
|---|---|---|---|
| *Erigeron compositus* (cut-leaf daisy) | 0.41 | 88.78 | Native |
| **Ferns and Allies** | | | |
| *Selaginella densa* (compact selaginella) | 0.05 | 39.52 | Native |
| Moss spp. (moss) | 0.01 | 0.79 | Both |

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

***Grassland Upland Sites***—The grassland sites in Spotted Dog WMA are typically extensive open areas of grassland dominated by herbaceous species which are nearly all native to North America. Two native grass species, *Festuca campestris* (rough fescue) and *Festuca idahoensis* (Idaho fescue), are by far the most prominent species on the grassland polygons (Table 53). *Festuca campestris* (rough fescue) occurs on 77 of the 83 grassland polygons, and *Festuca idahoensis* (Idaho fescue) occurs on 75 of the 83 grassland polygons. *Festuca campestris* (rough fescue) covers the most acres of all species, followed closely by *Festuca idahoensis* (Idaho fescue). *Festuca campestris* (rough fescue) is also over three times as prominent as the third most prominent species, *Agropyron spicatum* (bluebunch wheatgrass). The prominence values between the two dominant grass species are reversed when compared to the values in the total upland sites and to the WMA as a whole due to the greater amount of *Festuca idahoensis* (Idaho fescue) in forest and woodland sites, which are not figured into the prominence values for grassland sites.

**Table 53.** The five most prominent plant species among the five lifeforms in Spotted Dog WMA grassland polygons (number = 83) (acres listed is the canopy cover area of the species)

| Species | Prominence Value[1] | Acres | Origin Status[2] |
|---|---|---|---|
| **Trees** | | | |
| *Juniperus scopulorum* (Rocky Mountain juniper) | 0.01 | 26.26 | Native |
| *Pinus contorta* var. *latifolia* (lodgepole pine) | 0.01 | 0.17 | Native |
| *Pinus ponderosa* var. *scopulorum* (ponderosa pine) | 0.01 | 6.27 | Native |
| *Populus tremuloides* (quaking aspen) | 0.01 | 4.66 | Native |
| *Pseudotsuga menziesii* var. *glauca* (Douglas fir) | 0.01 | 71.15 | Native |
| **Shrubs** | | | |
| *Ericameria nauseosa* (rubber rabbitbrush) | 0.10 | 213.57 | Native |
| *Rosa arkansana* (prairie rose) | 0.05 | 151.29 | Native |
| *Artemisia frigida* (fringed sagewort) | 0.02 | 93.73 | Native |

**Table 53. (cont.)**

| Species | Prominence Value[1] | Acres | Origin Status[2] |
|---|---|---|---|
| *Gutierrezia sarothrae* (broom snakeweed) | 0.02 | 85.99 | Native |
| *Amelanchier alnifolia* (Saskatoon serviceberry) | 0.01 | 25.83 | Native |
| **Graminoids** | | | |
| *Festuca campestris* (rough fescue) | 37.73 | 4,080.28 | Native |
| *Festuca idahoensis* (Idaho fescue) | 30.94 | 3,672.10 | Native |
| *Agropyron spicatum* (bluebunch wheatgrass) | 10.85 | 2,217.63 | Native |
| *Koeleria macrantha* (prairie Junegrass) | 2.61 | 1,087.62 | Native |
| *Carex filifolia* var. *filifolia* (threadleaf sedge) | 2.36 | 1,038.16 | Native |
| **Forbs** | | | |
| *Lupinus argenteus* (silvery lupine) | 2.27 | 1,014.91 | Native |
| *Eriogonum umbellatum* (sulfur buckwheat) | 0.38 | 404.28 | Native |
| *Antennaria microphylla* (rosy pussytoes) | 0.31 | 348.72 | Native |
| *Solidago missouriensis* (Missouri goldenrod) | 0.29 | 359.11 | Native |
| *Heterotheca villosa* (hairy golden-aster) | 0.28 | 358.08 | Native |
| **Ferns and Allies** | | | |
| *Selaginella densa* (compact selaginella) | 0.55 | 467.53 | Native |
| *Equisetum hyemale* (scouring rush) | 0.01 | 1.75 | Native |
| Moss spp. (moss) | 0.01 | 8.13 | Both |
| *Woodsia oregana* subsp. *oregana* (Oregon woodsia) | 0.01 | 2.03 | Native |

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

***Modified Upland Site***—The only modified site sampled in Spotted Dog WMA is in an old hay production area near the historic Pauly Place in the main Spotted Dog Creek drainage. This area is dominated by introduced grass species with some native and introduced forb species. By far the most prominent plant species is the introduced grass *Phleum pratense* (timothy) (Table 54). This introduced grass has the highest average canopy cover of all species, and covers more than twice as many acres as any other species in the modified area. *Phleum pratense* (timothy) is also more than five times as prominent in this location than the second most prominent species, the introduced grass *Poa pratensis* (Kentucky bluegrass), and over 20 times as prominent as the third most prominent species *Potentilla gracilis* (slender cinquefoil).

**Table 54.** The five most prominent plant species among the five lifeforms in Spotted Dog WMA modified polygon (number = 1) (acres listed is the canopy cover area of the species)

| Species | Prominence Value[1] | Acres | Origin Status[2] |
|---|---|---|---|
| **Trees** | | | |
| No tree species were observed | | | |
| **Shrubs** | | | |
| No shrub species were observed | | | |
| **Graminoids** | | | |
| *Phleum pratense* (timothy) | 810.00 | 92.70 | Introduced |
| *Poa pratensis* (Kentucky bluegrass) | 160.00 | 41.20 | Introduced |
| *Agrostis stolonifera* (redtop) | 0.03 | 0.52 | Introduced |
| *Bromus inermis* (smooth brome) | 0.03 | 0.52 | Introduced |
| *Carex aquatilis* var. *aquatilis* (water sedge) | 0.03 | 0.52 | Native |
| **Forbs** | | | |
| *Potentilla gracilis* (slender cinquefoil) | 40.00 | 20.60 | Native |
| *Achillea millefolium* (common yarrow) | 0.90 | 3.09 | Native |
| *Taraxacum officinale* (common dandelion) | 0.90 | 3.09 | Introduced |
| *Thlaspi arvense* (field pennycress) | 0.90 | 3.09 | Introduced |
| *Trifolium repens* (white clover) | 0.90 | 3.09 | Introduced |
| **Ferns and Allies** | | | |
| No fern or ally species were observed | | | |

[1]Prominence indicates species dominance on a site. Prominence value is the product of constancy (percent frequency of occurrence in polygons in the set) and average canopy cover on those polygons in the set having it present.

[2]Origin Status: Native = native to pre-Columbian North America; Introduced = introduced by post-Columbian human immigrants; Both = contains native and introduced species

**Rosgen Stream Classification and Management Interpretations**

Table 55 provides classification of the stream channel in each lotic polygon inventoried (Rosgen 1996), where such classification was applicable. Two sites, one on Jake Creek and one on West Fork Spotted Dog Creek, consisted of series of beaver dams and ponds, and lacked defined channels. On these polygons the classification was not applicable. The stream type of a channel informs the manager of certain strengths and weaknesses of the system, and gives land managers insight on management implications for physical stability and how the channel morphology is likely to respond to management change (Rosgen 2006).

**Table 55.** Rosgen stream type by lotic polygon (Rosgen 2006) (number = 55)

| Stream Name | Polygon Number | Polygon Record ID | Stream Type[1] |
|---|---|---|---|
| Fred Burr Creek | 1 | 2024159 | B3 |
| Freezeout Creek | 1 | 2024156 | B4 |
| Freezeout Creek | 2 | 2024181 | B4 |
| Jake Creek | 2 | 2024182 | A6 |
| Jake Creek | 1 | 2024183 | F4 |
| Middle Fork Spotted Dog Creek | 4 | 2024184 | E6, F5 |
| Middle Fork Spotted Dog Creek | 1 | 2024185 | F5, A4 |
| Middle Fork Spotted Dog Creek | 2 | 2024186 | F6, B4 |
| Middle Fork Spotted Dog Creek | 3 | 2024187 | F5, B4 |
| O'Neil Creek | 2 | 2043385 | B4 |
| O'Neil Creek | 3 | 2043386 | B4 |
| O'Neil Creek | 4 | 2043387 | B5, B6 |
| O'Neil Creek | 1 | 2043403 | A3 |
| South Fork Spotted Dog Creek | 4 | 2024167 | B3, C4 |
| South Fork Spotted Dog Creek | 5 | 2024168 | B3 |
| South Fork Spotted Dog Creek | 6 | 2024175 | B3, F4 |
| South Fork Spotted Dog Creek | 2 | 2024188 | B4, E5, F5 |
| South Fork Spotted Dog Creek | 3 | 2024189 | B5, F5D |
| South Fork Spotted Dog Creek | 1 | 2024190 | C4, C5, E6 |
| Spotted Dog Creek | 1 | 2024163 | C3 |
| Spotted Dog Creek | 2 | 2024164 | C4 |
| Spotted Dog Creek | 3 | 2024165 | C4 |
| Spotted Dog Creek | 4 | 2024166 | C4, G4 |
| Spotted Dog Creek | 5 | 2024174 | F3 |
| Spotted Dog Creek | 6 | 2024173 | C4, F4 |
| Trout Creek | 1 | 2024161 | B3, C4 |
| Trout Creek | 2 | 2024162 | B4, C4 |
| Trout Creek | 3 | 2024170 | F4 |
| Trout Creek | 4 | 2024169 | C5, C3 |
| Unnamed North Tributary to Spotted Dog Creek | 1 | 2024171 | F4, A3 |
| Unnamed South Tributary to Spotted Dog Creek | 1 | 2024157 | B6 |
| Unnamed Tributary to Fred Burr Creek | 1 | 2043402 | A3 |
| Unnamed Tributary to Freezeout Creek | 1 | 2024155 | B4 |
| Unnamed Tributary to Jake Creek | 1 | 2024192 | F5, B5 |
| Unnamed Tributary to Jake Creek | 2 | 2024193 | B3, F6 |
| Unnamed Tributary to Jake Creek | 3 | 2024194 | B4, C5 |
| Unnamed Tributary to North Tributary to Spotted Dog Creek | 1 | 2024172 | A3, B4 |
| Unnamed Tributary to South Fork Spotted Dog Creek | 1 | 2024177 | B4, E6 |

**Table 55. (cont.)**

| Stream Name | Polygon Number | Polygon Record ID | Stream Type[1] |
|---|---|---|---|
| Unnamed Tributary to South Fork Spotted Dog Creek | 2 | 2024178 | B4, G6 |
| Unnamed Tributary to South Tributary to Spotted Dog Creek | 1 | 2024158 | B6 |
| Unnamed Tributary to Spotted Dog Creek | 1 | 2043390 | B4 |
| Unnamed Tributary to Tributary to Jake Creek | 1 | 2024195 | B5, F6 |
| Unnamed Tributary to Tributary to South Fork Spotted Dog Creek | 1 | 2024176 | B3, F4 |
| Unnamed Tributary to Trout Creek | 1 | 2043389 | E6b |
| Unnamed Tributary to Trout Creek | 1 | 2043404 | A3, A4 |
| Unnamed Tributary to Trout Creek | 2 | 2043388 | A4 |
| Unnamed Tributary to Trout Creek | 2 | 2043405 | B4 |
| Unnamed Tributary to Trout Creek | 2 | 2043407 | A4 |
| Unnamed Tributary to Trout Creek | 3 | 2043406 | A4 |
| Unnamed Tributary to Trout Creek | 1 | 2043408 | A4 |
| Unnamed Tributary to Trout Creek | 1 | 2043409 | B4 |
| Unnamed Tributary to West Fork Spotted Dog Creek | 1 | 2024191 | E5 |
| Unnamed Tributary to West Fork Spotted Dog Creek | 2 | 2024180 | E6 |
| West Fork Spotted Dog Creek | 1 | 2024179 | E6 |
| West Fork Spotted Dog Creek | 2 | 2024160 | B3, A2 |

[1]Stream type general descriptions (Rosgen 1996):

A = Steep, entrenched cascading, step/pool streams. High energy/debris transport associated with depositional soils. Very stable if a bedrock or boulder dominated channel.

B = Moderately entrenched, moderate gradient, riffle dominated channel, with infrequently spaced pools. Very stable plan and profile. Stable banks.

C = Low gradient, meandering, point-bar, riffle pool, alluvial channels with broad, well defined floodplains.

D = raided channel with longitudinal and transverse bars. Very wide channel with eroding banks.

E = Low gradient, meandering riffle/pool stream with low width/depth ratio and little deposition. Very efficient and stable. High meander width ratio.

F = Entrenched meandering riffle/pool channel on low gradients with high width/depth ratio.

NA = Reaches on which the stream type classification is not applicable due to beaver dam complexes and the lack of a defined channel.

Table 56 summarizes the stream types (Rosgen 1996) found in Spotted Dog WMA.

**Table 56.** Distribution of Spotted Dog WMA lotic polygons among the Rosgen stream types (Rosgen 1996) (number = 55)

| Stream Type[1] | Number of Polygons with the Stream Type |
|---|---|
| A | 9 |
| B | 24 |
| C | 7 |
| D | 1 |
| E | 4 |
| F | 8 |
| NA | 2 |
| ***TOTAL*** | 55 |

[1]Stream type general descriptions (Rosgen 1996):

A = Steep, entrenched cascading, step/pool streams. High energy/debris transport associated with depositional soils. Very stable if a bedrock or boulder dominated channel.

B = Moderately entrenched, moderate gradient, riffle dominated channel, with infrequently spaced pools. Very stable plan and profile. Stable banks.

C = Low gradient, meandering, point-bar, riffle pool, alluvial channels with broad, well defined floodplains.

D = Braided channel with longitudinal and transverse bars. Very wide channel with eroding banks.

E = Low gradient, meandering riffle/pool stream with low width/depth ratio and little deposition. Very efficient and stable. High meander width ratio.

F = Entrenched meandering riffle/pool channel on low gradients with high width/depth ratio.

NA = Reaches on which the stream type classification is not applicable due to beaver dam complexes and the lack of a defined channel.

The stream type of a channel informs the manager of certain strengths and weaknesses of the system, and gives land managers insight on management implications for physical stability and how the channel morphology is likely to respond to management change (Rosgen 2006). This reference information follows in Table 57.

**Table 57.** Broad level, generalized, management interpretations by stream type (Rosgen 2006)

| Stream Type | Sensitivity to Disturbance | Recovery Potential | Sediment Supply | Streambank Erosion Potential | Vegetation Controlling Influence |
|---|---|---|---|---|---|
| A1 | Very Low | Excellent | Very Low | Very Low | Negligible |
| A2 | Very Low | Excellent | Very Low | Very Low | Negligible |
| A3 | Very Low | Very Poor | Very High | Very High | Negligible |
| A4 | Extreme | Very Poor | Very High | Very High | Negligible |
| A5 | Extreme | Very Poor | Very High | Very High | Negligible |
| A6 | High | Poor | High | High | Negligible |

**Table 57. (cont.)**

| Stream Type | Sensitivity to Disturbance | Recovery Potential | Sediment Supply | Streambank Erosion Potential | Vegetation Controlling Influence |
|---|---|---|---|---|---|
| B1 | Very Low | Excellent | Very Low | Very Low | Negligible |
| B2 | Very Low | Excellent | Very Low | Very Low | Negligible |
| B3 | Low | Excellent | Low | Low | Moderate |
| B4 | Moderate | Excellent | Moderate | Low | Moderate |
| B5 | Moderate | Excellent | Moderate | Moderate | Moderate |
| B6 | Moderate | Excellent | Moderate | Low | Moderate |
| C1 | Low | Very Poor | Very Low | Low | Moderate |
| C2 | Low | Very Poor | Low | Low | Moderate |
| C3 | Moderate | Good | Moderate | Moderate | Very High |
| C4 | Very High | Good | High | Very High | Very High |
| C5 | Very High | Fair | Very High | Very High | Very High |
| C6 | Very High | Good | High | High | Very High |
| D3 | Very High | Poor | Very High | Very High | Moderate |
| D4 | Very High | Poor | Very High | Very High | Moderate |
| D5 | Very High | Poor | Very High | Very High | Moderate |
| D6 | High | Poor | High | High | Moderate |
| DA4 | Moderate | Good | Very Low | Low | Very High |
| DA5 | Moderate | Good | Low | Low | Very High |
| DA6 | Moderate | Good | Very Low | Very Low | Very High |
| E3 | High | Good | Low | Moderate | Very High |
| E4 | Very High | Good | Moderate | High | Very High |
| E5 | Very High | Good | Moderate | High | Very High |
| E6 | Very High | Good | Low | Moderate | Very High |
| F1 | Low | Fair | Low | Moderate | Low |
| F2 | Low | Fair | Moderate | Moderate | Low |
| F3 | Moderate | Poor | Very High | Very High | Moderate |
| F4 | Extreme | Poor | Very High | Very High | Moderate |
| F5 | Very High | Poor | Very High | Very High | Moderate |
| F6 | Very High | Fair | High | Very High | Moderate |
| G1 | Low | Good | Low | Low | Low |
| G2 | Moderate | Fair | Moderate | Moderate | Low |
| G3 | Very High | Poor | Very High | Very High | High |

**Table 57. (cont.)**

| Stream Type | Sensitivity to Disturbance | Recovery Potential | Sediment Supply | Streambank Erosion Potential | Vegetation Controlling Influence |
|---|---|---|---|---|---|
| G4 | Extreme | Good | Very High | Very High | High |
| G5 | Extreme | Very Poor | Very High | Very High | High |
| G6 | Very High | Poor | High | High | High |

**Browse Assessment**

Intense utilization of browse forage on three particular species, or groups of species, is especially noteworthy on Spotted Dog WMA, due to the great importance of these species for their wildlife habitat values, and due to the high level of utilization noted on them:

- *Purshia tridentata* (antelope bitterbrush) stands on upland slopes along the west of the WMA;
- Riparian preferred woody species on all lotic and lentic wetland sites throughout the WMA (e.g., *Salix* spp. [willows], *Cornus sericea* subsp. *sericea* [red-osier dogwood], *Amelanchier alnifolia* [Saskatoon serviceberry], etc.); and
- *Populus tremuloides* (quaking aspen) populations, whether associated with lotic or lentic wetland sites, or a upland groves.

These inventory and ecological health assessment methods do not separate livestock browse use from that of wildlife. However, livestock grazing was officially discontinued after the 2013 season, so future trends in the level of browse utilization should shed some light on how much impact the livestock were causing on the three main browse forage groups listed above. Although livestock were not officially permitted on Spotted Dog WMA in 2014, trespass cattle were noted on the property during July 2014 in the northeast portion of the WMA.

***Purshia tridentata*** **(antelope bitterbrush)**—Stands of this species represent crucial winter range forage for elk (Mueggler and Stewart 1980). The health of these stands has been compromised by the long term continued stress of high utilization (presumably) by both wildlife and livestock (Photos 129 and 130).

**Photo 129.** An intensely browsed, and decadent, stand of *Purshia tridentata* (antelope bitterbrush) in the west central portion of Spotted Dog WMA (Record ID 2024221) (2011 photo)

**Photo 130.** An intensely browsed and decadent *Purshia tridentata* (antelope bitterbrush) shrub in the west central portion of Spotted Dog WMA (Record ID 2024211) (2011 photo)

***Riparian Preferred Woody Species***—In virtually every lotic or lentic wetland site on Spotted Dog WMA that is physically accessible to livestock, preferred riparian woody species (e.g., *Salix* spp. [willows], *Cornus sericea* subsp. *sericea* [red-osier dogwood], *Amelanchier alnifolia* [Saskatoon serviceberry], etc.) are very intensely utilized. Certain species (e.g., *Cornus sericea* subsp. *sericea* [red-osier dogwood] and *Salix geyeriana* [Geyer willow]) (Photos 131 and 132) are greatly reduced in their presence. The red-osier dogwood has become quite scarce, often found only within the protection of a dense thicket or other physical feature that inhibits animals access. The *Salix geyeriana (*Geyer willow) is also reduced on most sites to much less cover than its less palatable associate, *Salix boothii* (Booth willow). Many plants among the taller preferred shrub species have the characteristic "arrested" architecture (Keigley and Frisina 1998), which have had intense browsing most of their lives and are hedged down from the top.

**Photo 131.** A heavily browsed *Cornus sericea* subsp. *sericea* [red-osier dogwood) plant with arrested architecture type along an Unnamed Tributary to South Fork Spotted Dog Creek (Record ID 2024178) (2011 photo)

**Photo 132.** Heavily browsed *Salix geyeriana* (Geyer willow) with arrested architecture type along Spotted Dog Creek (Record ID 2024173) (2011 photo)

***Populus tremuloides*** **(quaking aspen)**—This important tree species regenerates replacement stems mostly by sending up sprouts from existing root systems (Howard 1996). These young shoots are sought out by almost all browsing animals, and due to the relative ease of access into most *Populus tremuloides* (quaking aspen) stands, few replacement shoots survive to make it beyond the reach of the animals. It will be of some interest to see whether the removal of livestock grazing will change the degree of survival of young *Populus tremuloides* (quaking aspen) shoots. Already, after just a single year of the absence of livestock, robust growth is observed on young sprouts within inventoried stands of *Populus tremuloides* (quaking aspen) and on some recently logged areas (Photos 133 and 134).

**Photo 133.** *Populus tremuloides* (quaking aspen) replacement shoots only lightly to moderately browsed after a growing season free from livestock presence (Record ID 2043445) (2014 photo)

**Photo 134.** *Populus tremuloides* (quaking aspen) shoots in a logged area, only lightly to moderately browsed after a year free from livestock presence (Record ID 2043424) (2014 photo)

**Wildlife Observations on Spotted Dog WMA**

***Elk***—Spotted Dog WMA is considered prime elk (*Cervus canadensis*) winter range habitat. Although we conducted this work during the summer months, we did observe one herd of approximately 30 head of cows and calves in the northwest corner of the WMA near the head of O'Neil Creek. Numerous other areas held copious amounts of sign (e.g., fecal pellets, tracks, antler rubbed trees, etc.). Site inventory and ecological health assessment data contains notes of casual sightings of these signs of elk presence, and a map of the distribution of polygons containing such notation is presented in Figure 33.

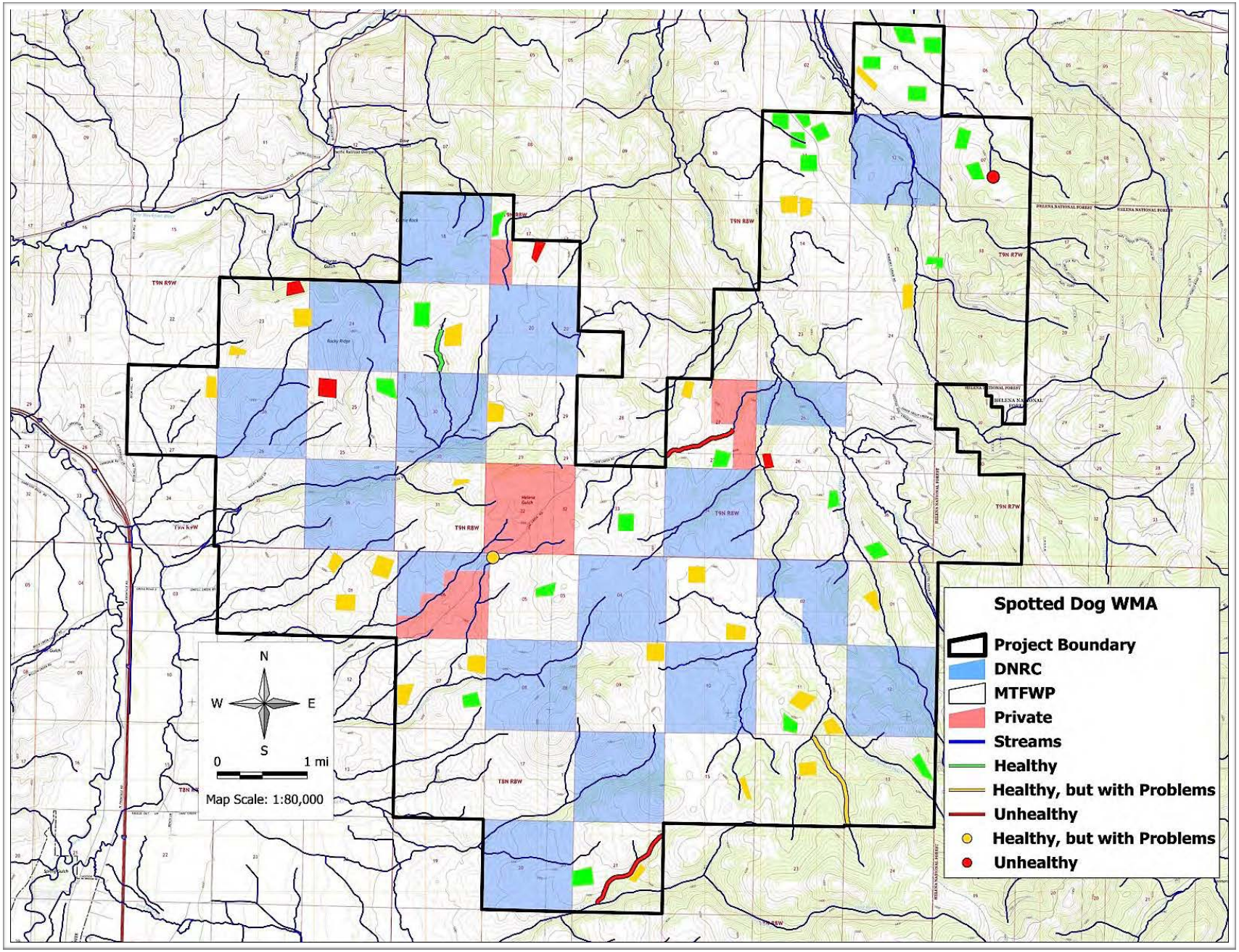


**Figure 33.** Topographic map of the 59 sites sampled in Spotted Dog WMA where either elk or elk pellets were observed

***Moose***—Several moose (*Alces americanus*) were observed during the conduct of field work for this project (Photo 135). Sign of moose (fecal pellets) were observed in several wetland sites, but also in the upland *Purshia tridentata* (antelope bitterbrush) shrublands on the western side of Spotted Dog WMA.

**Photo 135.** A cow moose (*Alces americanus*) observed at a small lentic pond (Record ID 2043458) (2014 photo)

***Mule Deer***—Several mule deer (*Odocoileus hemionus*) were during the conduct of this inventory and ecological health assessment work (Photo 136).

**Photo 136.** A mule deer (*Odocoileus hemionus*) buck in velvet on a MTDNRC parcel within the boundary of Spotted Dog WMA (2014 photo)

***Beaver***—The historic work of beaver (*Castor canadensis*) is obvious at many locations in Spotted Dog WMA, but very little sign of current beaver presence is now found. There is plenty evidence that in both the recent and distant past, beaver were very active throughout Spotted Dog WMA (Photo 137). During this study, only one active colony was observed to be maintaining a dam and pond (Photo 138), although several abandoned dams, historic dams, and landforms created by beaver in the distant past were observed on several drainages (Photos 139 and 140). These streams are biologically and functionally incomplete without beaver present to control the rapid discharge of water from the system.

A likely explanation for the relative lack of beaver presence now, compared to the historic numbers suggested by the evidence, is simply lack of a sustained food source. Historic trapping likely reduced numbers greatly during the 19th century, but it was the introduction of livestock grazing that prevented the repopulation of many areas by beaver. Young plants of *Salix* and *Populus* species (willows, quaking aspen, and cottonwoods) are preferred by most browsing ungulates, including cattle. As beaver harvest the mature plants of those species, the regenerating shoots are too often completely consumed, and are seldom allowed to reach maturity. Therefore, stands die out, and wooded sites are opened and converted from beaver habitat to pasture.

**Photo 137.** Beaver were quite active along lower O'Neil Creek just a few years ago (Record ID 2043387) (2011 photo)

**Photo 138.** Beaver pond along West Fork Spotted Dog Creek, the only currently active beaver colony found on the WMA (Record ID 2024179) (2011 photo)

**Photo 139.** Abandoned beaver pond along Jake Creek, with extensive beaver cut *Populus tremuloides* (quaking aspen), but no evidence of current beaver presence (Record ID 2024182) (2011 photo)

**Photo 140.** Large abandoned beaver dam along Jake Creek lacking recent maintenance or any sign of recent beaver presence (Record ID 2024182) (2011 photo)

**Fire as a Management Tool**

Although no evidence of recent wildfire occurrence in Spotted Dog WMA was observed, the following considerations should be made regarding any use of controlled burning on the WMA:

- Existing infestations of annual brome species (*Bromus tectorum* [cheatgrass] and *Bromus japonicus* [field brome]) would very likely increase dramatically, if areas where these species are present were burned (both species increase their extent following a burn);
- The important wildlife habitat species, *Purshia tridentata* (antelope bitterbrush), does not tolerate fire (Mueggler and Stewart 1980), and can be eliminated from a site by burning; and
- Declining stands of decadent and dying *Populus tremuloides* (quaking aspen) might be rejuvenated by careful burning.

**Recreation and Other Uses**

Spotted Dog WMA is used by the public for recreation, particularly during big game hunting season. The WMA is accessible by public road south from Avon, Montana, and by controlled access 2-track trails criss-crossing through much of the property. Other access routes previously accessible to the public have been closed to public access by adjacent land owners. These roads currently are, and have been, used by private grazing users, timber harvest operations, utility infrastructure maintenance, as well as sporting activities. Multiple major utility corridors (electric power lines and gas pipelines) cross the property, and a major communications relay facility is located on a high point near the northwest corner of the property.