Ozarks Environmental and Water Resources Institute (OEWRI)
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Year 2 Data Report for:

Post-Harvest Activity Assessment using the U.S. Forest Service's Forest Soil Disturbance Monitoring Protocol (FSDMP), Mark Twain National Forest, Missouri

DRAFT

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PURPOSE AND SCOPE

The United States Forest Service (USFS) has contracted the Ozarks Environmental and Water Resources Institute (OEWRI) to perform the Forest Soil Disturbance Monitoring Protocol (FSDMP) within the Mark Twain National Forest (MTNF) in southern Missouri. The FSDMP is a national monitoring program designed to assess the extent of ground disturbance during timber harvest activity and to quantify changes to the landscape that may affect long-term sustainability of the site (Page-Dumroese et al. 2009[1]). This is the first time this type of monitoring has been performed within the MTNF and results of this study will be used to refine the FSDMP to adequately access the impact of timber harvest on variable Ozarks landscapes. The overall goal of this project is to use the FSDMP to monitor different areas within the MTNF and assess the effectiveness of the FSDMP as a monitoring tool.

Specific objectives of Year 1 monitoring activities are:

1. Implement FSDMP on MTNF lands based on forest management units selected by MTNF soils program manager.

2. Complete pre-activity data collection at six timber sale sites between 2017 and 2018.

3. Enter pre-activity data into provided database and provide a quality control review.

4. Provide a photo location representative for each transect line and spatial data associated with transects and points along transects.

5. Summarize findings, results, and analysis.

6. Provide a review of the protocol and recommendations or modifications (if any) to maximize effectiveness of the protocol for use in forest types and management systems in southern Missouri, following the first year of the agreement.

Specific objectives of Year 2 monitoring activities are:

1. Implement FSDMP on MTNF lands based on forest management units selected by MTNF soils program manager.

2. Complete post-harvest activity data collection at six timber sale sites in 2019.

3. Enter post-activity data into FSDMP database and provide a quality control review.

4. Provide a photo location representative for each transect line and spatial data associated with transects and points along transects.

5. Summarize findings, results, and analysis.

6. Provide a review of the protocol and recommendations or modifications (if any) to maximize effectiveness of the protocol for use in forest types and management systems in southern Missouri, following the first year of the agreement.

STUDY AREA

The MTNF consists of six ranger districts in southern Missouri (Figure 1). Three districts were chosen for this project: Doniphan/Eleven Point, Ava/Cassville/Willow Springs, and the Poplar Bluff Districts. Two sites were assessed within each district and range from 5.7-38.6 ha in size (Table 1). The Warthog and Monterey sites are located in the Doniphan/Eleven Point Ranger District in Carter and Oregon Counties. The Sterling Hollow and Fox Hollow sites are located in the Ava/Cassville/Willow Springs Ranger District in Howell and Douglas Counties. Finally, the Swayback and Coyote sites are located in the Poplar Bluff Ranger District in Butler and Wayne Counties.

The MTNF is located in the southern Missouri Ozarks region that is characterized by a dissected plain grading from broad, gently rolling uplands to steep, highly dissected hillslopes when closer to major river valleys (USDA 2006). In general, the region is underlain by soluble Ordovician and Mississippian age cherty limestone and dolomite, with remnant Pennsylvanian age sandstone and shale along ridgetops (Adamski et al. 1995). The area is a karst landscape where sinkholes, losing streams, and springs are common. Upland soils are formed from cherty residuum and colluvium capped by a thin layer of loess, fragipans are common on the broad, flat divides (USDA 2006). The forest is dominated by Oak and Oak-mixed hardwood forest communities with smaller areas of native shortleaf pines (Nigh and Schroeder 2002).

METHODS

Geospatial Methods

USFS staff selected sites for the FSDMP and provided maps highlighting several payment units at each site (Appendix A). The maps were rectified in ArcGIS and each payment unit was

digitized to create polygon areas of each unit. For each unit, a best-fit "zig-zag" transect including 68 total sampling points at equally-spaced intervals was created by visual judgement to cover all areas of the payment unit (see layout patterns of sampling points in Figures 2-7). The uniform use of 68 total sampling points at each site, regardless of differences in payment unit area, is based on criteria to collect the maximum number of points needed to quantify the maximum variability at the 90% confidence limit with a margin of error at +/- 10% (Page-Dumroese et al. 2009[2]). These points were transferred to a Trimble 7x global positioning system (GPS) unit for navigation in the field (Photo 1).

Field Methods

Each transect was sampled by starting at monitoring point #1 and performing the FSDMP at every other sample point (odd numbers). This resulted in a minimum of 34 monitoring points being sampled across the entire unit. As data were entered into the Excel based FSDMP datasheet, site variability is updated continuously by the software. The FSDMP spreadsheet specifies the minimum number of points to be evaluated based on the chosen confidence interval. For this project a 90% confidence limit with a margin of error at +/- 10% was chosen. Therefore, if there was low variability in the data, a total of 30 locations would be enough to satisfy the minimum number of pits needed per the assessment. Alternatively, if the unit was highly variable, a total of 68 pits would be needed to satisfy the chosen confidence interval. If this occurred, the evaluators would backtrack along the transect and fill in with more sampling pits at the even numbered monitoring points to meet the requirement. For this project, a minimum of 34 points were evaluated, which exceeds the minimum required, to make sure the entire site was assessed.

At each pit location, a 6" ring has laid down at the predetermined location and a photo was taken to capture the condition of the forest floor to include the surrounding landscape (Photo 2). Forest floor depth was measured using a folding ruler and any notes of surrounding vegetation, woody debris, surface rocks, or bare earth were also recorded (Photo 3). A pit was then dug to a depth of 6-12" (15-30 cm) (Photos 4 and 5). The exposed soil was then evaluated using the FSDMP protocol using visual indicators in the soil such as rutting, compaction and platy, massive, or puddled structure (Photo 6). Results of the assessment were entered into the Excel spreadsheet on site using an iPad (Appendix B, Photo 7). Finally, a photo of the pit was taken for later reference.

Data Storage and Visualization

All photos and datasheets were joined with each soil pit location and stored in an ArcGIS Geodatabase. These data can then be bought into ArcMap and the photo and the data

collected at the individual pits can be observed by using the HTML Popup Tool to click on each point on the screen (Appendix C).

ASSESSMENT RESULTS

Site Descriptions

There was a total of six payment unit sites identified for assessment for this project. The location, sampling layout, and brief description of the soils with each site are given below.

Fox Hollow

The Fox Hollow site (38.6 ha) is located within the Ava/Cassville/Willow Springs Ranger District in Douglas County. The total length of the transect line is 3,276 m and points are spaced 49 m apart along the summit and upper side slope of a narrow ridgetop (Figure 2). The soil series mapped along the ridgetop is the Scholten-Tonti (3-8% slope), Scholten-Poynor (3-8% slope), and the Scholten-Poynor (8-15% slope). The Scholten and Tonti soil series have fragipans and all three series have between 15-40% rock fragments in the upper soil. Moving downhill to the steeper side slope the soils are mapped as the Poynor extremely gravelly silt loam (8-15% slope) and Coulstone-Bender complex (3-8% slope). The Poynor soil series is formed in colluvium with 15-40% chert fragments in the upper portions of the profile.

Monterey

The Monterey site (28 ha) is located within the Doniphan/Eleven Point Ranger District in Oregon County. The transect is 2,493 m in length with points spaced 37 m apart along the summit and shoulder of a broad upland landscape (Figure 3). The soil series mapped along the summit is the Macedonia silt loam (3-8% slope) with smaller areas of Coulstone gravelly sandy loam (3-8% slopes) and Poynor very gravelly silt loam (1-8% slopes). The Macedonia soil series is formed from residuum of the underlying bedrock and capped by a thin layer of loess with 2-6% chert fragments in the upper 35 cm of the profile. Moving downslope the Clarksville very gravelly silt loam 8-15% is mapped on the side slope with 20-30% rock fragments in the upper 30 cm of the profile.

Sterling Hollow

The Sterling Hollow site (7.9 ha) is located within the Ava/Cassville/Willow Springs Ranger District in Howell County. The length of the transect is 1,218 m and points spaced 18 m apart along the summit and side slope of a relatively narrow ridgetop (Figure 4). The soil series mapped along the ridgetop is the Tick very gravelly silt loam (3-5% slope). Moving downhill to

the steep side slope, the soils are mapped as the Tick extremely gravelly silt loam (15-50% slope). The Tick soil series is formed in gravelly colluvium and the underlying mudstone with 15-35% chert fragments in the upper 25 cm. At the base of the slope there is a small area of Cedargap very gravelly silt loam (0-3% slope) mapped near the drainage way.

Swayback

The Swayback site (5.8 ha) is located within the Poplar Bluff Ranger District in Douglas County. The transect line is 1,557 m in length with points spaced 23 m apart along the summit and shoulder of a ridge (Figure 5). The soil series mapped along the ridgetop is the Captina-Scholten complex (3-8% slope) and the Clarksville-Scholten complex (15-45% slope) mapped along the side slope. The Captina soil series has a fragipan and is typically free of rock fragments in the upper 30 cm of the profile.

Warthog

The Warthog site (22 ha) is located within the Doniphan/Eleven Point Ranger District in Carter County. The transect line length is 2,066 m and points are spaced 31 m apart along the summit and steep side slope of a narrow ridge (Figure 6). The Coulstone gravelly sandy loam (3-8% slope) is mapped on the ridgetop and Coulstone sandy loam (15-35% slopes) is mapped on the side slope (USDA 2018a). Coulstone is formed from colluvium and sandstone residuum with 40-50% rock fragments in the upper 28 cm of the soil profile (USDA 2018b). There is also a small area of Midco very gravelly loam mapped at the base of the slope.

Wild Coyote

The Wild Coyote site (6.4 ha) is in the Poplar Bluff Ranger District in Wayne County. The transect line is 1,082 m long and points are spaced 16 m apart along a side slope below the summit of a ridge and includes a headwater drainage (Figure 7). The soil series mapped along the ridgetop is the Captina silt loam (3-8% slope) and the Yelton-Scholten (8-15% slope) was mapped further downhill along the side slope. The Yelton soil series has a fragipan and the upper soil is generally rock-free. At the base of the slope there is a small area of the Tilk-Secesh complex mapped which is formed in alluvium along floodplains, terraces, and alluvial fans.

Pre-Activity Evaluation

Six pre-activity sites were assessed between April 5th and September 27th, 2018. The results of the pre-activity assessment are given below.

Fox Hollow

The Fox Hollow site had signs of storm damage with several trees laying on the ground either by snapping near the base or from tree throw. Forest floor depth ranged from 0.0-6.0 cm and averaged 3.0 cm (Table 2). There was a relatively high number of sampling points (6%) with bare ground noted within the sampling ring compared to the other sites evaluated. Also, there was a number of trees that were laying on the ground from storm damage at this site, but the amount of coarse and fine woody debris observed was less than at Sterling Hollow (Photo 8 and 9). Overall, the Fox Hollow site was given a soil disturbance class of "0" for no impact observed using the FSDMP protocol.

Monterey

There was evidence of past disturbance at the Monterey site, but overall the site was classified as undisturbed. There were signs of recent prescribed fire in the area with charred pieces of woody debris present across the site. However, the forest floor depth still ranged from 1.0-8.0 cm and averaged 4.0 cm at this site (Table 2). The Monterey site also had the highest amount of live plants of all sites (35% of the sampling points). A sampling point did land on an ATV trail and one shallow rut point was recorded, however, there was no evidence of compaction or platy structure (Photo 10). Overall, the Monterey site was given a soil disturbance class of "0" for no impact observed using the FSDMP protocol.

Sterling Hollow

The Sterling Hollow site was rocky with forest floor depths ranging from 0.05-6.0 cm with an average of 3.0 cm (Table 2). Around 20% of the sampling points had coarse and fine woody debris identified within the sampling ring, as there was evidence of storm damage that toppled several trees within the site. Additionally, around 6% of sampling points had at least some bare ground within the sampling ring. Overall the Sterling Hollow site was given a soil disturbance class of "0" for no impact observed using the FSDMP protocol.

Swayback

The soils within the Swayback site were less rocky than the other sites that could make the unit more susceptible to disturbance impacts during timber harvest due to lower substrate support compared to the rockier sites. Forest floor depth was 0.5-3.0 cm and averaged 2.0 cm (Table 2). This site had the lowest occurrences of live plants, woody debris, and bare soil among the six evaluated. While there were some pits that contained a few rocks within the upper profile, the majority of the pits evaluated at this site had a relatively thick layer of rock-free loess. This rock-free loess material may be more susceptible to compaction during timber harvest as compared to the rocky soils at the other sites. Overall, the Swayback site was given a soil disturbance class of "0" for no impact observed using the FSDMP protocol.

Warthog

There were no disturbance indicators recorded at this site using the FSDMP protocol. The forest floor depth at this site ranged from 1.0-12 cm and averaged 4.9 cm (Table 2). The site was fairly rocky with almost a quarter of the sampling points having a rock identified on the surface (Photos 11 and 12). There was an old road along the top of the ridge, but our preselected site locations did not fall on the road. An intermittent stream was also noted during the assessment (Photo 13). Overall, the Warthog site was given a soil disturbance class of "0" for no impact observed using the FSDMP protocol.

Wild Coyote

Similar to the Swayback Site, the Wild Coyote site was less rocky than the other sites, which could make the unit more susceptible to disturbance impact during timber harvest. Forest floor depth was 0.5-3.0 cm and averaged 2.0 cm (Table 2). About 10% of the pits evaluated at this site had live plants and 6% had fine woody debris. There was no coarse woody, bare earth, or rock observed at the surface of any of the pit locations at this site. In addition, pits evaluated at this site had a relatively thick layer of rock-free loess in the upper part of the soil profile (Photos 14 and 15). As with the Swayback site, this material may be more susceptible to compaction during timber harvest as compared to the rocky soils at the other sites. Overall, the Wild Coyote site was given a soil disturbance class of "0" for no impact observed using the FSDMP protocol.

Post-Activity Evaluation

The six pre-activity sites were reassessed between November 14th and December 16th, 2019 after harvest activities were completed for five of the six sites. The exception was the Monterey site that was not harvested as of December 16, 2019. However, the site was still reevaluated. For the remaining five sites, the post-activity assessments occurred 3-12 months after harvest was completed. Results of the post-activity assessment are given below.

Fox Hollow

The most disturbance identified during the post-activity assessment was found at the Fox Hollow payment unit that was mostly due to the amount of compaction observed at the site. The post-activity assessment was conducted about 2 months after harvest on November 14, 2019. The average forest floor depth was similar during both assessment periods, while the number of sample points with live plants and woody debris was significantly higher during the post-activity assessment (Table 2). The increase in woody debris in the post-activity assessment is likely due to the amount of slash being left on the ground post-harvest. The amount of disturbance observed at the site ranged from shallow rutting with little forest floor impact, to

large ruts with no forest floor and significant compaction in the upper 30 cm of the soil profile (Photos 16 and 17, Tables 2 and 3). Of the 52 points sampled, 10 were in disturbance class "1", 3 in disturbance class "2", and 1 in disturbance class "3".

The amount of disturbance observed at this site is at least somewhat influenced by the size and shape of the payment unit. Fox Hollow is the largest site evaluated and it's situated along a ridge in a "horseshoe" around a small stream valley. The main haul road is relatively long as it is situated generally along the crest of the ridgeline. Therefore, it is likely this road also had to be traversed multiple times to move all of the harvested timber off the site. This suggests the size of the site, and perhaps the shape of the site, can impact the amount of disturbance observed within a payment unit.

Monterey

At the time the post-activity assessment was performed this site was not yet harvested, however, the assessment was still conducted. The post-activity assessment was conducted on December 16, 2019. The average forest floor depth was 2.3 cm compared to 4.0 cm during the pre-activity assessment (Table 2). While the number of live plants observed were similar, there were some differences in the observations of woody debris and rock at the surface between the pre and post-activity assessments. This may be due to the interpretation of how a sample point is evaluated with a new set of evaluators performing the assessment. There was some evidence of very light disturbance with shallow rutting be observed in 2 of the 30 sampling points but were all within the disturbance class "1" (Table 2 and 3). These light disturbances may be due to preparations to harvest the site.

Sterling Hollow

The post-activity assessment at Sterling Hollow showed only light disturbance that was likely due to the main haul road being located outside the payment unit boundary. The post-activity assessment was conducted about 2.5 months after harvest on December 11, 2019.
Average forest floor depths were 3.0 cm during both assessment periods, while the amount of live plants, woody debris, and rock at the surface was higher in the post-activity assessment (Table 2). The increase in woody debris in the post-activity assessment is likely due to the amount of slash being left on the ground post-harvest (Photo 18). There was some evidence of light disturbance with shallow rutting observed in 3 of the 30 sampling points, but they were all within the disturbance class "1" (Table 2 and 3). However, it was noted that the main haul road was not located within the payment unit. Generally, the most disturbance observed at a sight is typically along the main haul road.

Swayback

Swayback is one of the more disturbed sites evaluated during the post-harvest activity period, despite being one of the smaller sites. The post-activity assessment was conducted about 7 months after harvest on December 5, 2019. Average forest floor depths were 2.0 cm during both assessment periods, while the amount of live plants, woody debris, rock, and bare soil at the surface was significantly higher in the post-activity assessment (Table 2). A total of 60 sampling points were evaluated at this site, with 14 being classified as disturbance class "1" or "2" (Table 3). There was evidence of rutting observed in 33% of the sampling points, but compaction was only detected at 6.7% of the sampling points. While this site is relatively small, the main haul road was within the payment unit and the most disturbance observed at a site is typically along the main haul road (Photo 19).

Warthog

This site was slightly disturbed according to the protocol, however there was considerable disturbance noted along the major haul road at the top of the ridge and a large amount of slash left on the site. The post-disturbance evaluation was performed on December 16, 2019 which was about one year after harvest on December 28, 2018 (Figure 1). The average forest floor depth at this site during the post-activity assessment was 5.4 cm, which was similar to the pre-activity average forest floor depth (Table 2). There were more live plants, woody debris and less rock at the surface noted in the post-activity assessment. Some of this is because of the large amount of slash left on the site, but it may also be due to the interpretation of how a sample point is evaluated (Photo 20). The site was very rocky in the upper 10 cm of the majority of the pits to be colluvial that was also noted in the pre-harvest assessment (Photos 21). There was an old road along the top of the ridge that was noted in the pre-activity assessment, but the preselected site locations did not fall on the road during either assessment period. This road appears to be have been used as the major haul road for the site where rutting, soil erosion, and soil displacement were observed off the transect line (Photo 22).

Wild Coyote

Wild Coyote was very similar to the Sterling Hollow site where there was very little post-harvest disturbance observed within the payment unit. The post-activity assessment was conducted about 3 months after harvest on December 11, 2019. Average forest floor depths were 2.0 cm during both assessment periods, while the amount of live plants, woody debris, and bare soil at the surface was higher in the post-activity assessment (Table 2). There was some evidence of light disturbance with shallow rutting observed in only 2 of the 34 sampling points, but they were all within the disturbance class "1" (Table 3). However, the main haul road was not located within the payment unit. Generally, the most disturbance observed at a sight is typically along the main haul road. Additionally, the number of trees harvested per acre

appeared low at this site compared to the other sites that may be reason so little disturbance was noted.

OBSERVATIONS AND RECOMMENDATIONS

Pre-Activity Assessment

Overall the FSDMP protocol was easy to understand and implement for the pre-activity portion of this project. Sampling bias and errors associated with in-the-field judgements during point selection were likely reduced by pre-determining sampling locations and using objective GPS locations to locate sampling points. Additionally, using georeferenced photos at each sampling point to log the conditions at the time of the assessment is a good way to catalog temporal changes at each site. Furthermore, this allows other Forest Service personnel not present at the time of the assessment to visualize the site conditions. However, the applicability of the protocol cannot be fully evaluated until the post-activity assessment is completed.

Digging a 15-30 cm pit at each sampling point adds significantly more time to the overall assessment process. Perhaps it would be more efficient to only dig pits where there is an indicator of disturbance. Within the protocol the evaluator looks for indicators of disturbance such as skid trials, ruts, and other signs of activity. Therefore, an excavated pit may not be needed if the sample point does not show an indication of disturbance. Limiting pit sampling to disturbed points would allow more sites to be included in the program or more sampling points to be assessed at a site with improved confidence.

Another drawback is that sometimes the points do not land on a disturbance indicator, such as a road, which has been observed by the evaluator. Such conditions could necessitate additional pits to be evaluated that are effected by the disturbance. Therefore, if the predetermined points do not land on a disturbance indicator, additional pits should be added and the soil evaluated in these areas. Furthermore, it may also be beneficial to identify sensitive areas that are found within the unit, such as streams, and use photos to document any changes that may occur post-harvest. Possibly, adding a site mapping component to the assessment which locates pre-activity disturbance areas (i.e., roads) or excluded areas from sampling (i.e., streams) may help to focus sampling to better evaluate recent activity effects while maintaining sampling confidence requirements.

Post-Activity Assessment

There are five main observations and/or recommendations after the post-activity assessment period conducted in the fall of 2019:

1. Assessments were conducted in the late fall during leaf-off conditions. Leaf-off conditions allow evaluators more visibility to be able to access forest conditions more effectively. Another aspect of performing the FSDMP during this part of the year is that the antecedent soil moisture conditions are relatively wet at undisturbed sites. This actually helps the evaluator detect compacted soils that will often be hard and dry since they do not allow water to infiltrate. In contrast, antecedent soil moisture conditions during the summer are relatively dry and soils naturally can be dry and hard therefore making it more difficult to identify compaction in those conditions.

2. Size of the payment unit may have an influence on the amount of disturbance found in the payment unit. For two of the three sites less than 10 ha, the main haul road was located outside the unit perimeter. As a result, very little disturbance was detected at these two sites. Additionally, if the site is very large, like Fox Hollow, the main haul road tends to be longer and likely must be used more to pull the larger number of logs off the site thereby increasing the amount of disturbance. The type of equipment used to harvest logs and the number of trees removed per acre can also influence the amount of disturbance identified at these sites. These factors should be explored further.

3. The presence of the "O" horizon, or "duff" layer on the surface was a key indicator of the severity of disturbance at each sampling point for sites evaluated for this project. Generally, if the surface "O" horizon is missing, the soils at that sampling point show at least some degree of disturbance (Photo 23). However, if the "O" horizon remains intact, despite evidence of shallow rutting, the soil typically shows little or no signs of compaction (Photo 24).

4. High rock content in the surface layers may negate some of the compaction observed in less rocky soils. The amount of rock, and the size of the rock fragments, in the soil profile can make detecting compaction difficult. Just digging a 30 cm pit in very rocky soils can distort the soil profile. However, less disturbance was detected in the soil profile at sites selected for this project with high rock content despite having surficial evidence of disturbance.

5. A preliminary flow chart was developed to help describe the typical disturbance conditions that were observed at each site and how the disturbance classes were assigned for this

project (Figure 8). This chart reflects the observations made at the six sites evaluated for this project and can be revised as needed. The first thing is to determine if there is evidence of rutting, or if machinery has moved over the area. If there was no evidence of rutting, the sample point was designated as disturbance class 0. The next step was to determine if the "O" horizon was still present. If "O" horizon was present and there was surficial evidence of rutting, generally there was little to no compaction, and the sampling point was designated as disturbance class 1. If there was no "O" horizon present and compaction was identified in the soil profile to a depth of <30 cm the sample point was designated as disturbance class 2. Finally, if there was no "O" horizon present and compaction was identified in the soil profile to a depth of >30 cm, the sample point was designated as disturbance class 3.

CONCLUSIONS

Pre-Activity Assessment

OEWRI implemented the USFS FSDMP at six pre-harvest activity payment units within the MTNF in southern Missouri. For this protocol, sampling locations were determined using a systematic, spatially-scaled, "zig-zag" transect method with a total of 68 equally spaced pit locations created in ArcGIS prior to going into the field. Transect length and the pit spacing were based on the size of the payment unit that ranged from 5.8-38.6 ha for the six sites evaluated for this study. These data were uploaded to a GPS that was used to navigate to the pit locations in the field. At each site the ground surface was evaluated prior to digging a 15-30 cm pit to assess the soil for signs of compaction. Ultimately, none of the sites evaluated using this protocol were considered impacted prior to timber harvest or other disturbances. However, in some cases the predetermined sample pit locations did not land on disturbance indicators (like a road). Therefore, additional points may need to be collected in future assessments to more effectively evaluate observed disturbances that were under-sampled. Finally, this report addresses the results and observations of the pre-activity portion of the protocol and cannot be fully evaluated until the post-activity assessment is completed.

Post-Activity Assessment

OEWRI implemented the USFS FSDMP at six post-harvest activity payment units within the MTNF in southern Missouri in November and December of 2019 during leaf-off conditions. These sites were evaluated about 3-12 months after harvest activities had concluded. For the post-harvest activity monitoring period, the same 68 sampling locations identified in the pre-

harvest activity evaluations performed in 2018 were used and reevaluated. Post-harvest activity results showed increases in the amount of woody debris, rutting, and compaction at the harvested sites. The severity of the disturbance appears to be due to several factors including the size of the payment unit, the presence of a main haul road within the payment unit, and the amount of rock content within the soil profile. A preliminary flowchart was developed to better understand the three specific disturbance indicators identified at these six sites and how these indicators were used to assign disturbance class values. These disturbance indicators are: 1) the presence of rutting at the surface; 2) the presence of the "O" horizon at the surface; and 3) the depth of compaction in the soil profile. These indicators were identified as the most important for these six sites, however, these can be revised as needed.

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TABLES

Table 1. Summary of sites evaluated for this project

Site	MTNF District	County	Area (ha)	Pre-Date Assessed	Harvest Date	Post-Date Assessed
Fox Hollow	Ava/Cassville/Willow Springs	Douglas	38.6	August 2, 2018	September 9, 2019	November 14, 2019
Monterey	Doniphan/Eleven Point	Oregon	27.8	May 11, 2018	NA	December 16, 2019
Sterling Hollow	Ava/Cassville/Willow Springs	Howell	7.9	July 31, 2018	September 23, 2019	December 11, 2019
Swayback	Poplar Bluff	Butler	5.8	September 26, 2018	April 25, 2019	December 5, 2019
Warthog	Doniphan/Eleven Point	Carter	22.3	April 5, 2018	December 28, 2018	December 16, 2018
Wild Coyote	Poplar Bluff	Wayne	6.4	September 27, 2018	August 20, 2019	December 4, 2019

Table 2. Forest Floor Depth and Percentage of Observations

Site	Pre-Activity Survey						Post-Activity Survey							
	Avg. Forest Floor Depth (cm)	Present in Sample Point Observations (%)					Avg. Forest Floor Depth (cm)	Present in Sample Point Observations (%)						
		Live Plants	Coarse Woody Debris (>7 cm Dia.)	Fine Woody Debris (>7 cm Dia.)	Rock	Bare Soil		Live Plants	Coarse Woody Debris (>7 cm Dia.)	Fine Woody Debris (>7 cm Dia.)	Rock	Bare Soil	Rutting	Compaction
Fox Hollow	3	5.9	11.8	5.9	0	5.9	2.5	26.9	34.6	76.9	1.9	5.8	15.4	17.3
Monterey	4	35.3	5.9	5.9	17.6	0	2.3	40	16.7	76.7	3.3	0	6.7	0
Sterling Hollow	3	8.8	20.6	20.6	2.9	5.9	3	26.5	61.8	97.1	11.8	2.9	8.8	0
Swayback	2	2.9	0	2.9	2.9	0	2	65	46.7	81.7	8.3	8.3	33.3	6.7
Warthog	4.9	8.8	8.8	14.7	23.5	2.9	5.4	37.5	57.5	100	5	2.5	17.5	2.5
Wild Coyote	2	9.1	0	6.1	0	0	2	20.6	44.1	47.1	0	5.9	8.8	0

Table 3. Number of post-harvest sample points evaluated at each site by disturbance class

Site	Total	Class 0		Class 1		Class 2		Class 3	
Fox Hollow	52	38	73%	10	19%	3	6%	1	2%
Monterey	30	28	93%	2	7%	0	0	0	0
Sterling Hollow	34	31	91%	3	9%	0	0	0	0
Swayback	60	46	77%	10	17%	4	7%	0	0
Warthog	40	32	80%	8	20%	0	0	0	0
Wild Coyote	34	32	94%	2	6%	0	0	0	0

FIGURES

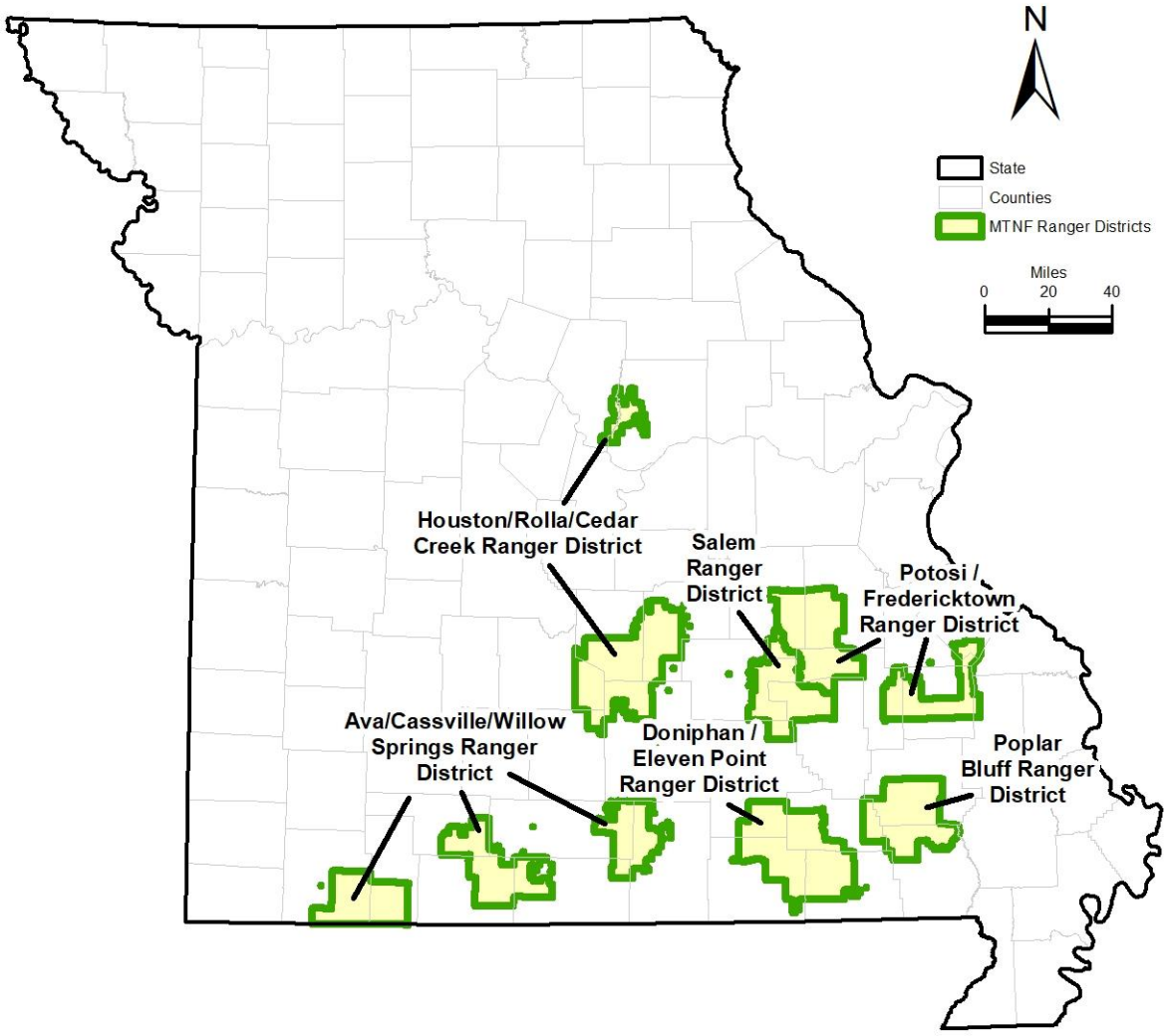

Figure 1. Mark Twain National Forest (MTNF) Ranger Districts in Southern Missouri.

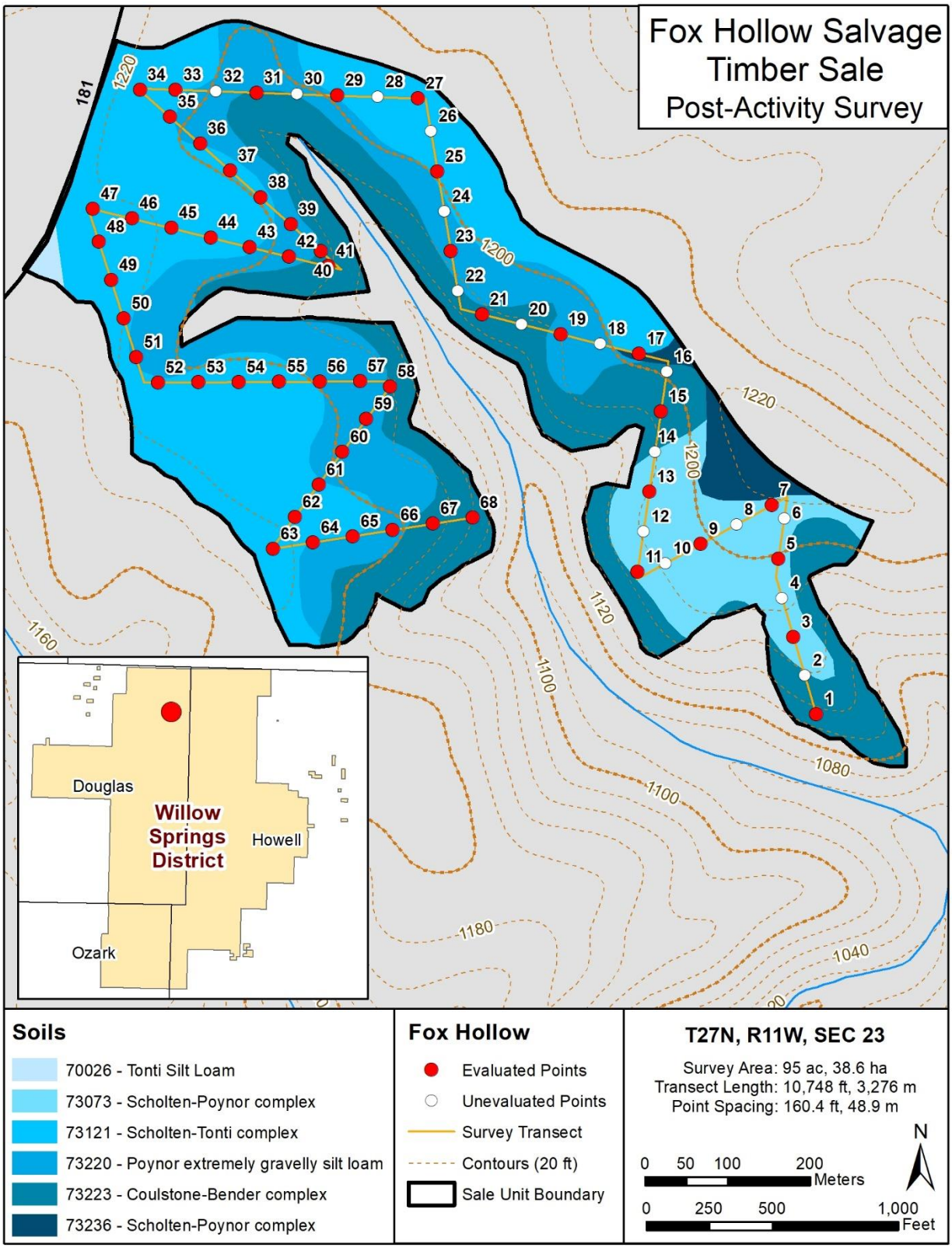

Figure 2. Fox Hollow Site Map.

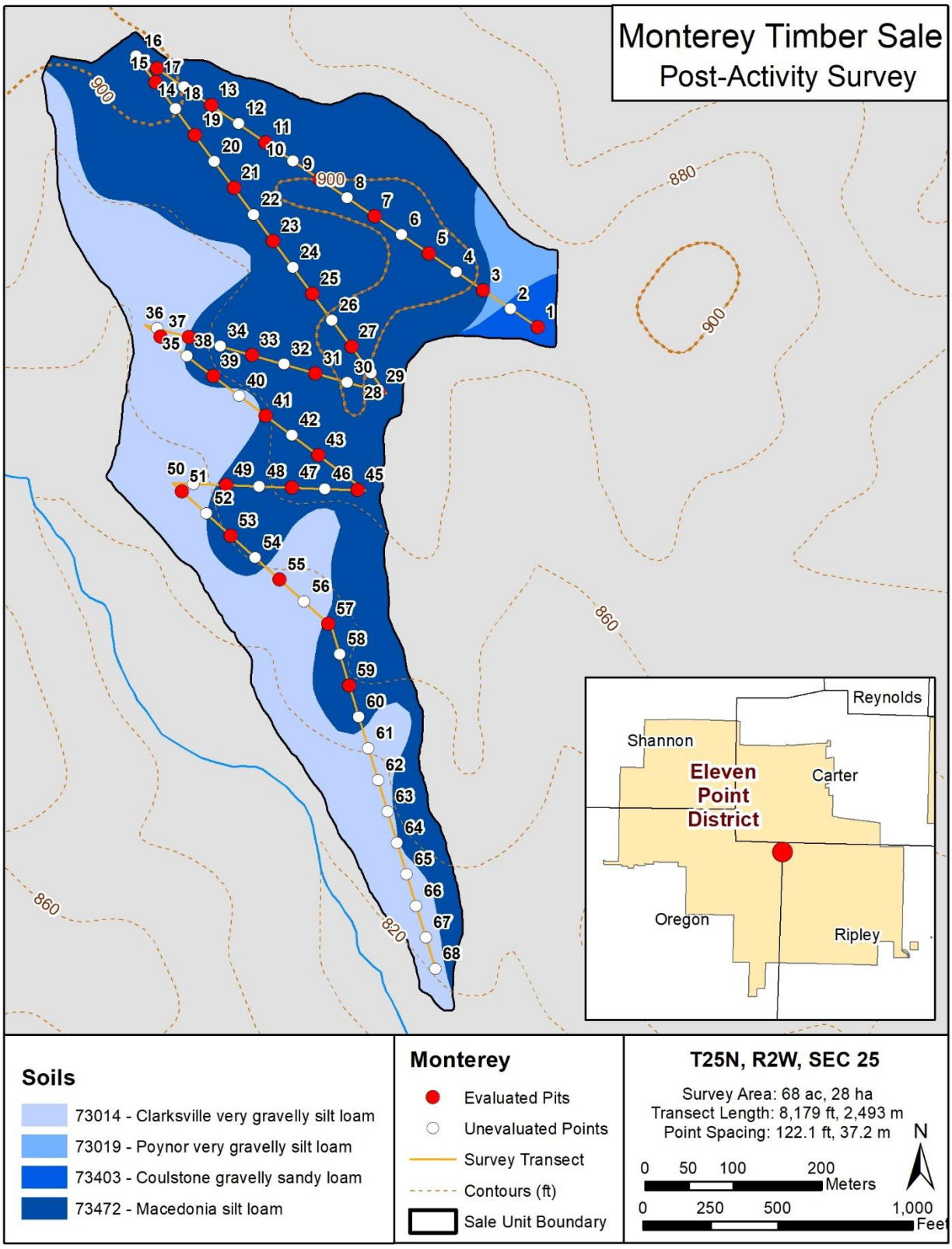

Figure 3. Monterey Site Map (Not harvested yet).

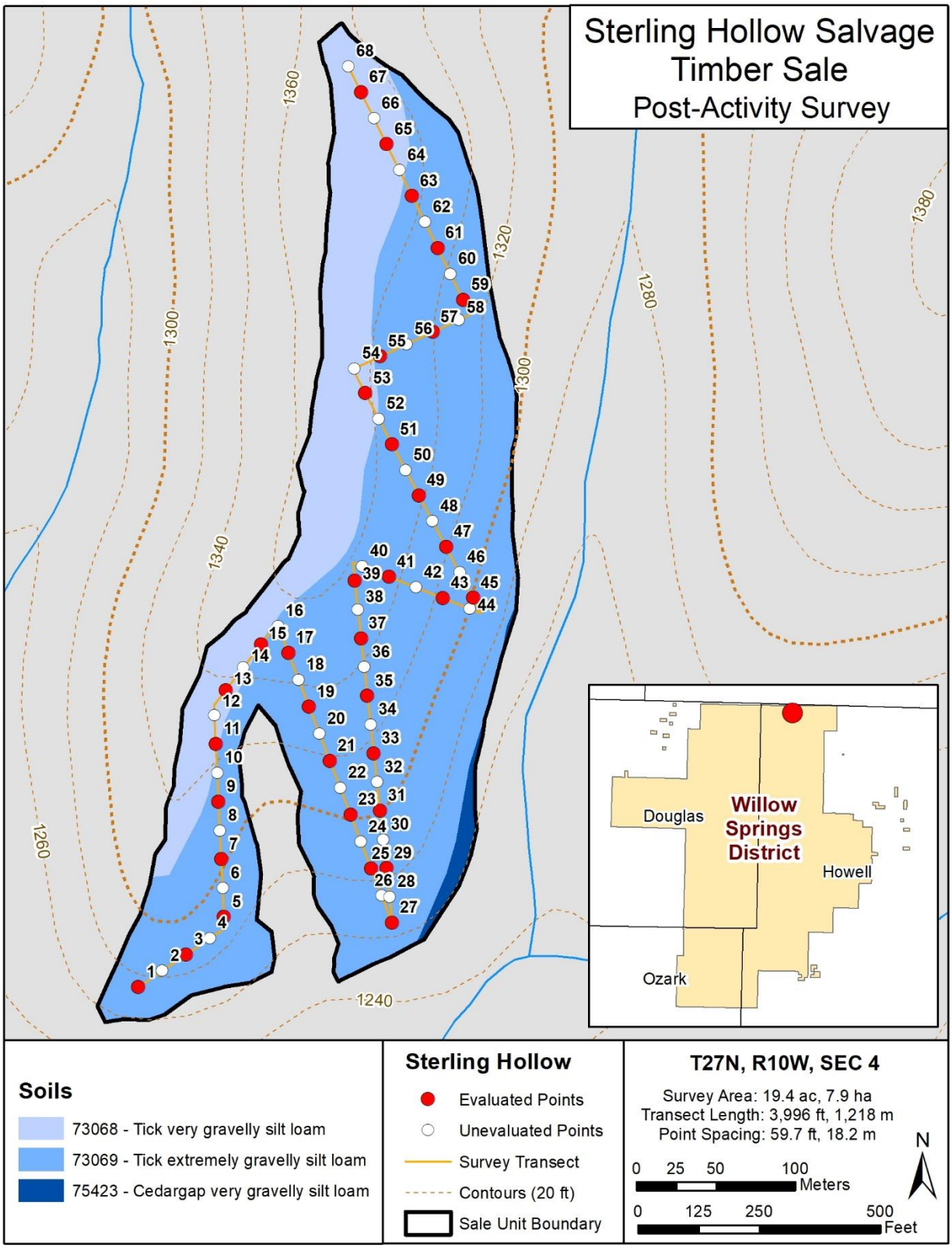

Figure 4. Sterling Hollow Site Map.

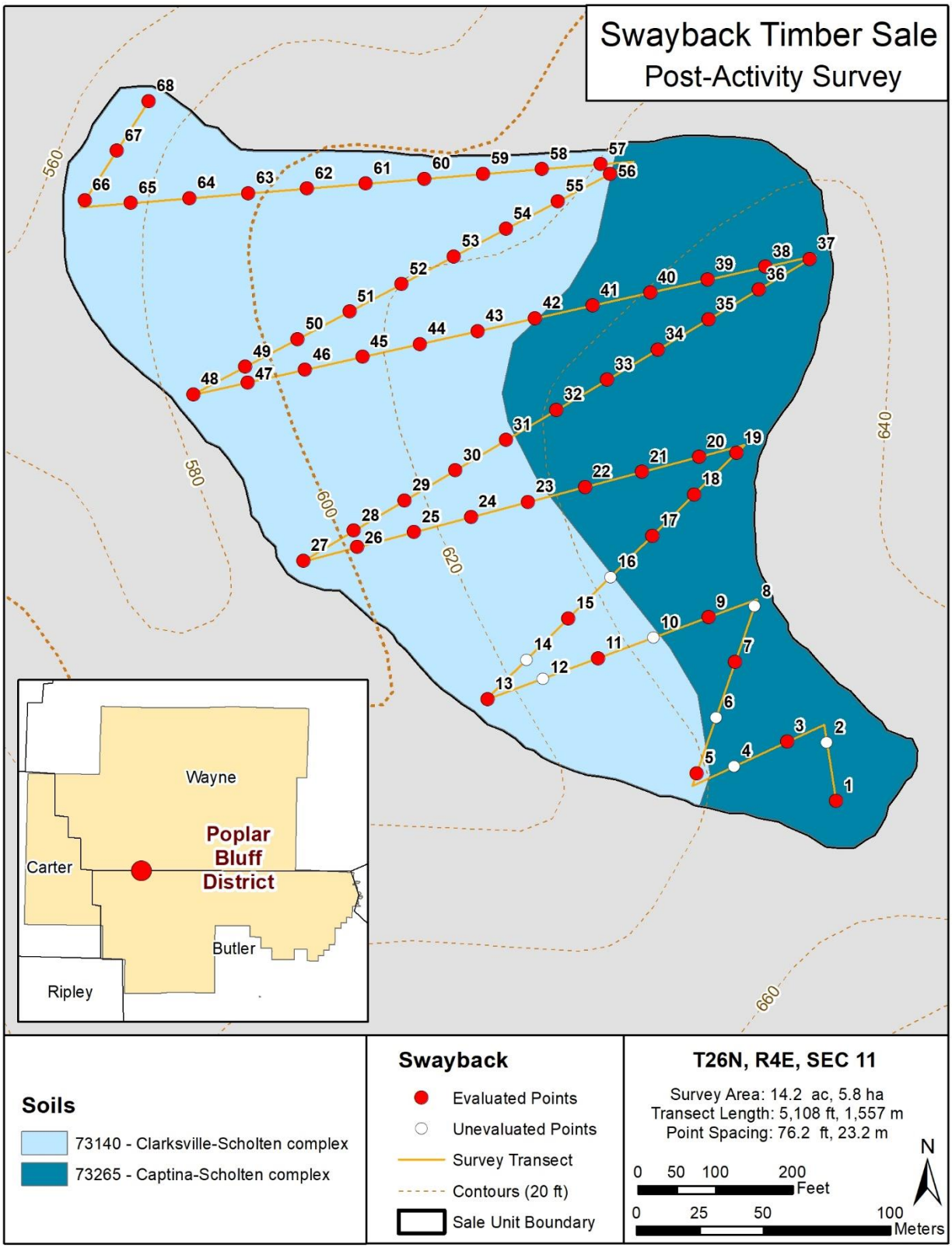

Figure 5. Swayback Site Map.

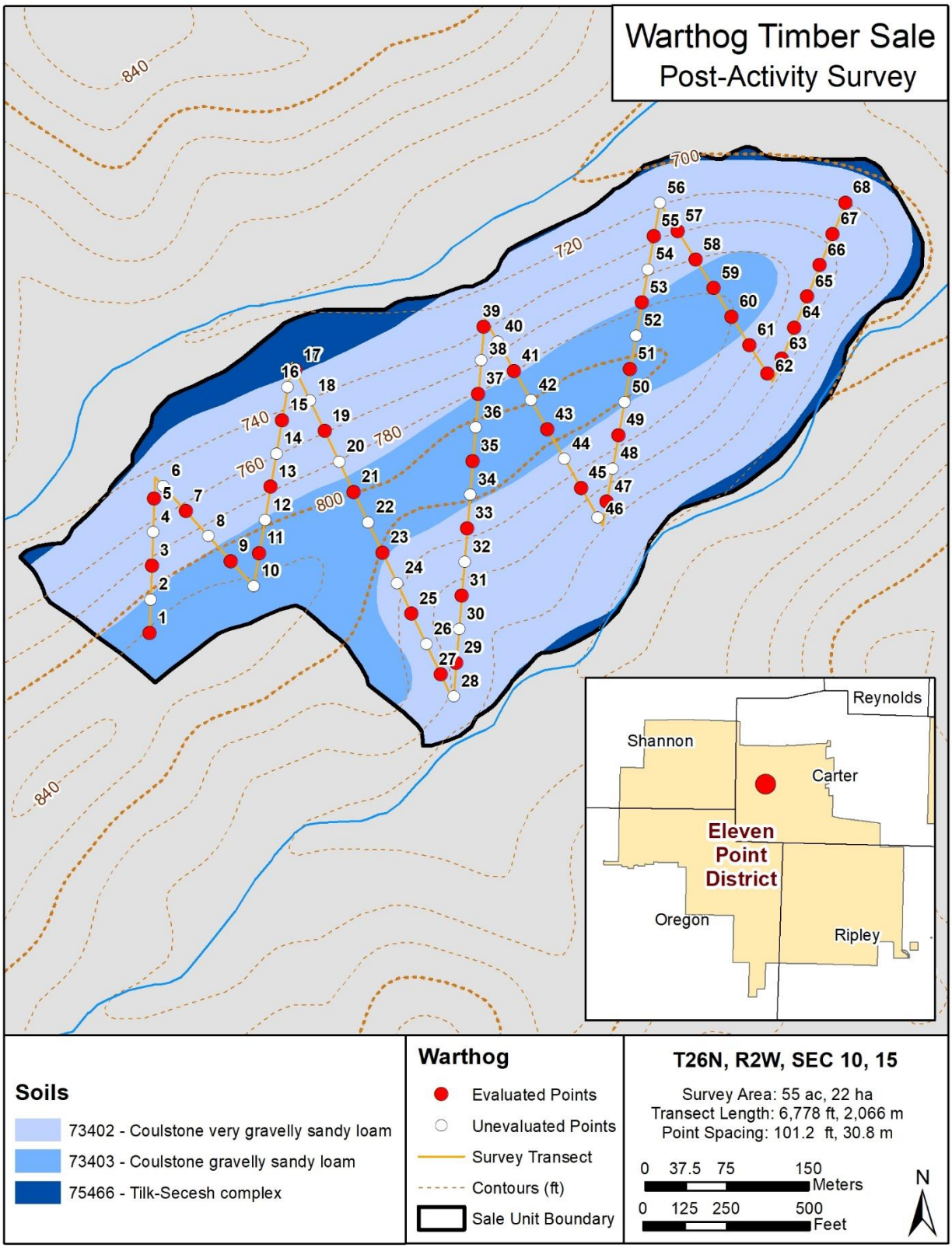

Figure 6. Warthog Site Map.

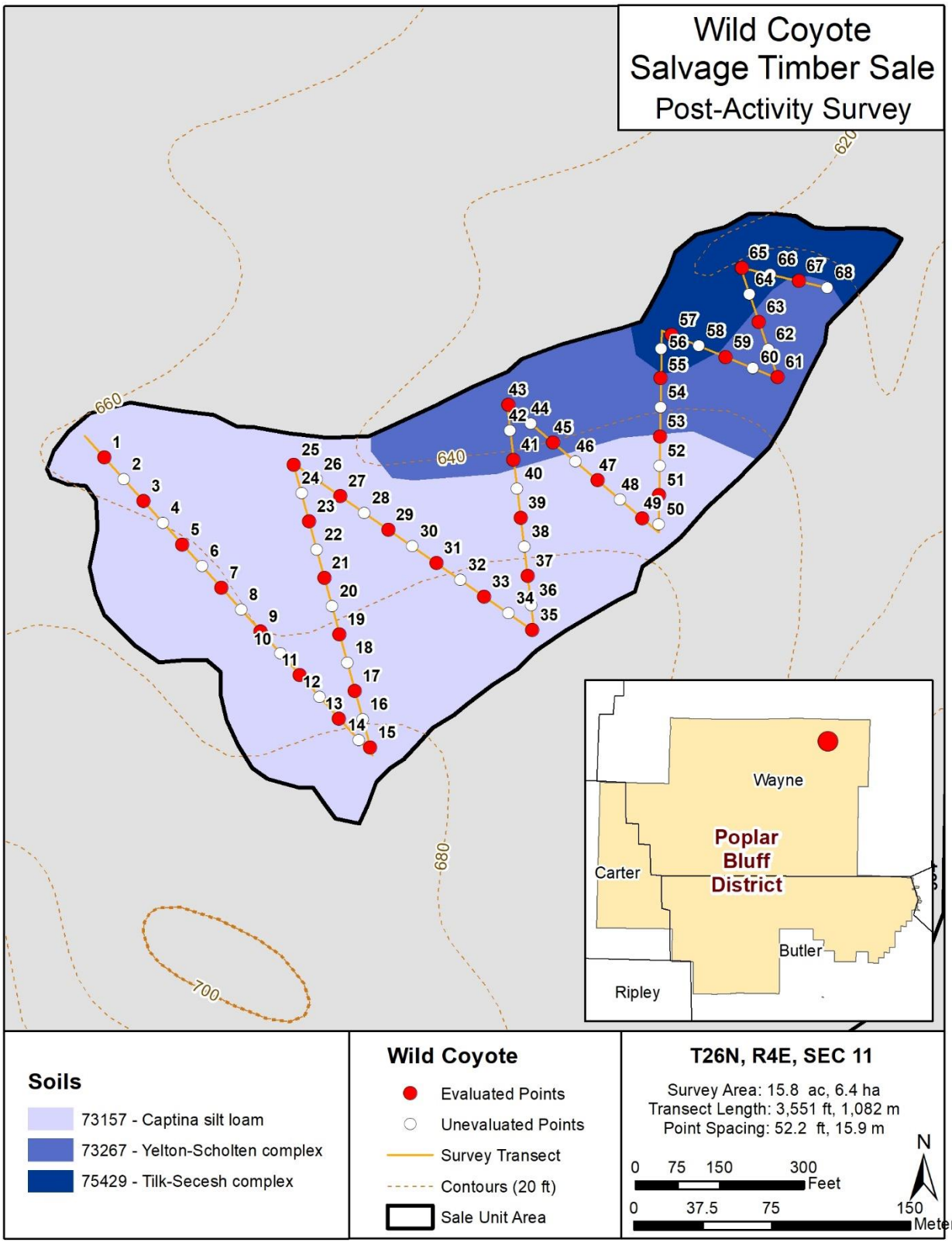

Figure 7. Wild Coyote Site Map.

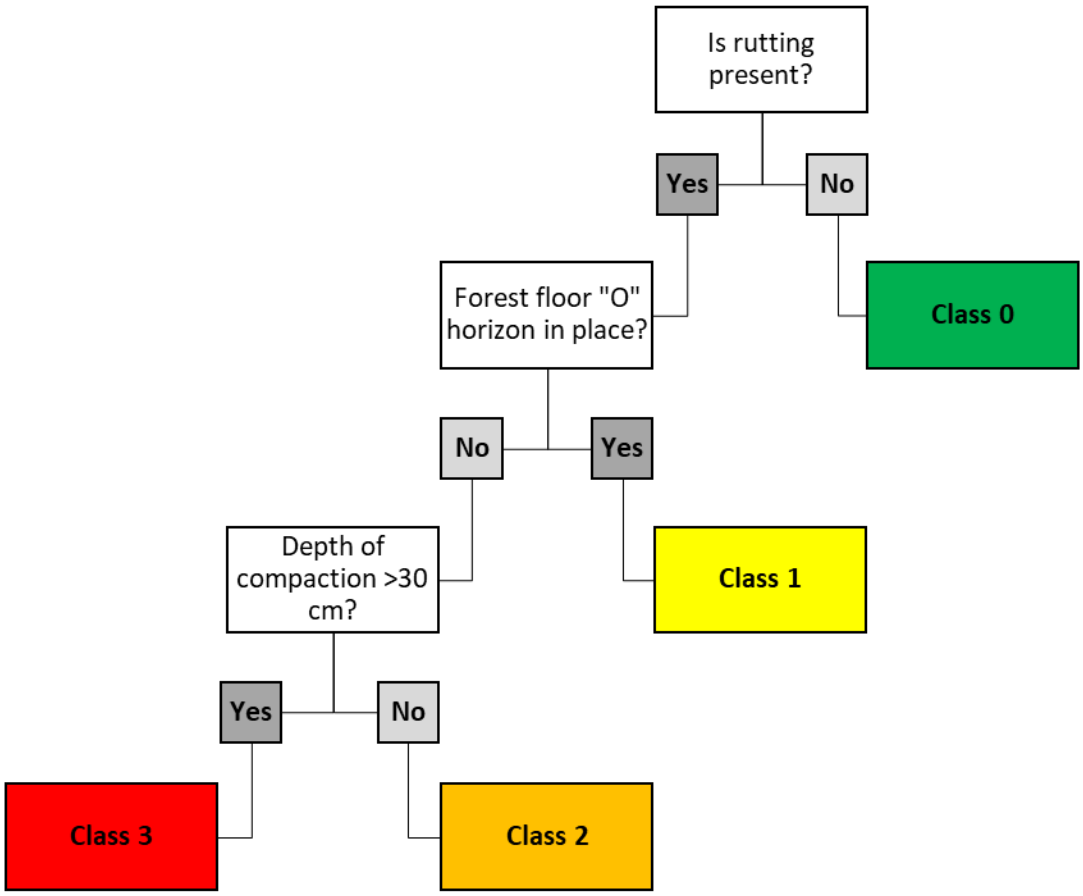

Figure 8. Preliminary flow chart showing typical disturbances found in the post-activity monitoring period and how disturbance class values were designated at the six sites selected for this project.

PHOTOS

Photo 1. Using GPS navigation to locate pre-selected pit locations (Swayback: Sept. 26, 2018).

Photo 2. Pit location and ring where forest floor is evaluated prior to digging a pit (Monterey: May 11, 2018).

Photo 3. Measuring forest floor depth (Sterling Hollow: July 31, 2018).

Photo 4. Pits are dug to a depth of 15-30 cm (Warthog: April 5, 2018).

Photo 5. Measuring pit depth (Coyote: Sept. 27, 2018).

Photo 6. IPADs are used to enter data to FSDMP datasheet (Coyote: Sept. 27, 2018).

Photo 7. Using an example of platy structure to help field workers identify it in the field (Monterey: May 11, 2018).

Photo 8. Wind damage was observed at some of the sites (Fox Hollow: August 2, 2018).

Photo 9. Tree throw was common at most sampling sites (Fox Hollow: August 2, 2018).

Photo 10. ATV trail located within the monitoring site (Monterey: May 11, 2018).

Photo 11. Very rocky conditions were observed at some sites (Warthog: April 5, 2018).

Photo 12. Rocky colluvium material above loamy A horizon (Warthog: April 5, 2018).

Photo 13. Stream channels were located within some of the sites (Warthog April 5, 2018).

Photo 14. Loess parent material (Wild Coyote: Sept. 27, 2018) NOTE: Horizontal lines are not platy structure but are from scraping with a soil knife.

Photo 15. Weathered loess parent material (Wild Coyote: Sept. 27, 2018).

Photo 16. Main haul road within the sale site (Fox Hollow: November 14, 2019).

Photo 17. Sample pit with an example of compaction (Fox Hollow: November 15, 2019).

Photo 18. Sample points located in dense brush left over from harvest (Sterling Hollow: December 11, 2019).

Photo 19. Rutting observed along the main haul road (Swayback: December 5, 2019).

Photo 20. Large amount of slash left on site significantly increases woody debris observations during post-activity evaluation (Warthog: December 16, 2019).

Photo 21. Steep sites tend to have high rock at the surface (Warthog: December 18, 2019).

Photo 22. Main haul road along the ridge line (Warthog: December 16, 2019).

Photo 23. Example of a soil sampling point with no “O” horizon present (Fox Hollow: November 14, 2019).

Photo 24. Example of a soil sampling point with the “O” horizon present (Wild Coyote: December 6, 2019).

APPENDIX A - TIMBER SALE MAPS

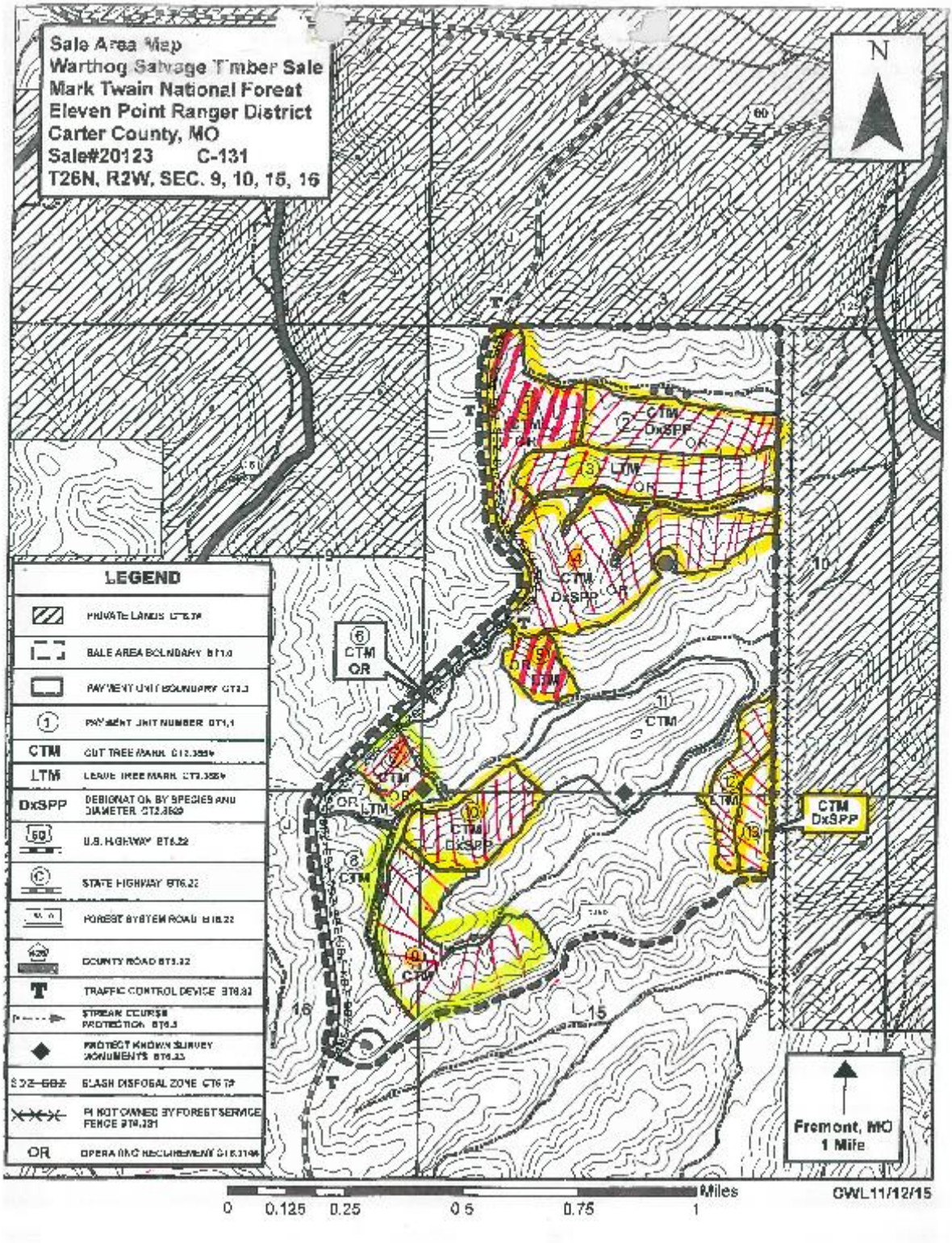

Figure 9. Warthog Timber Sale Map.

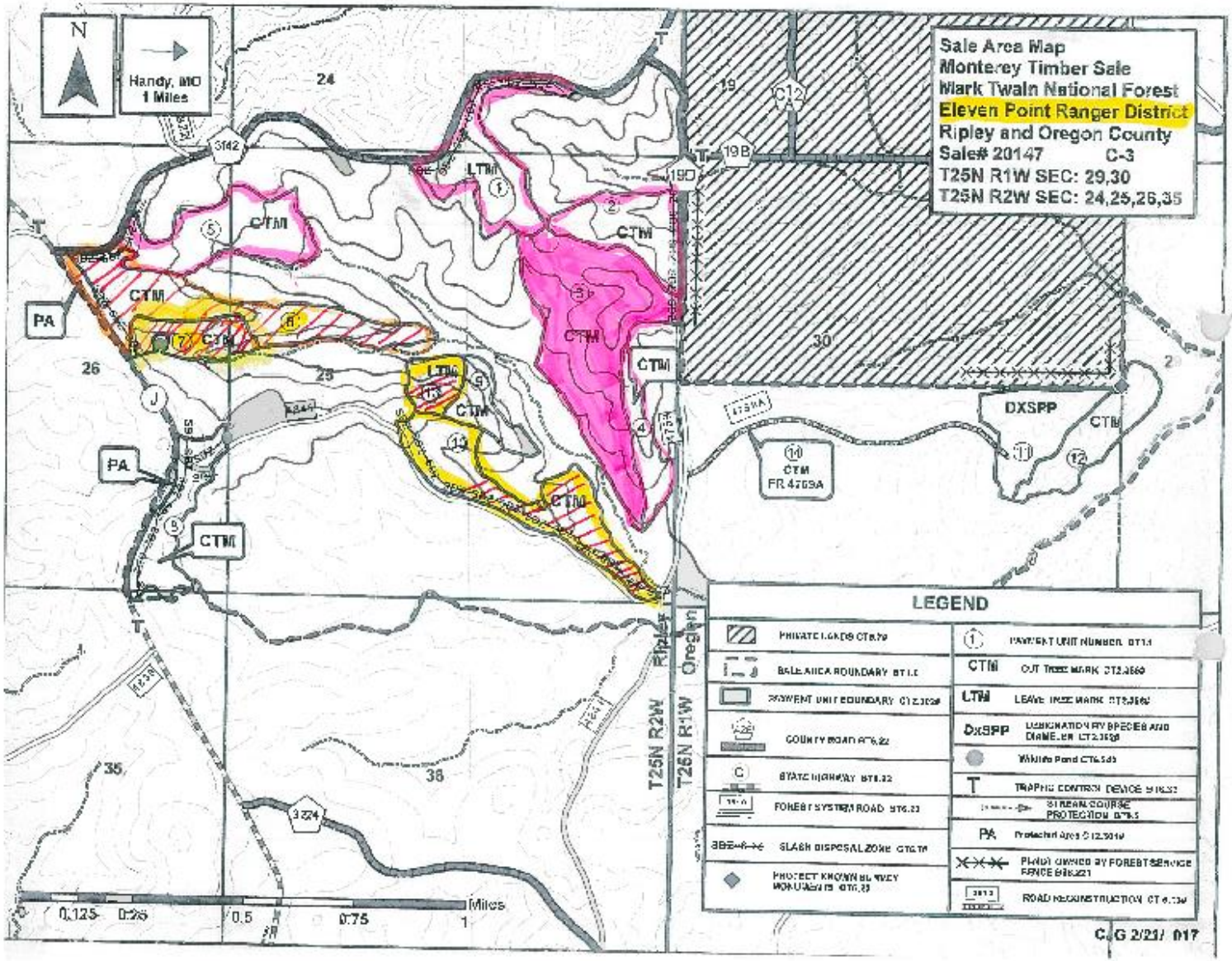

Figure 10. Monterey Timber Sale Map.

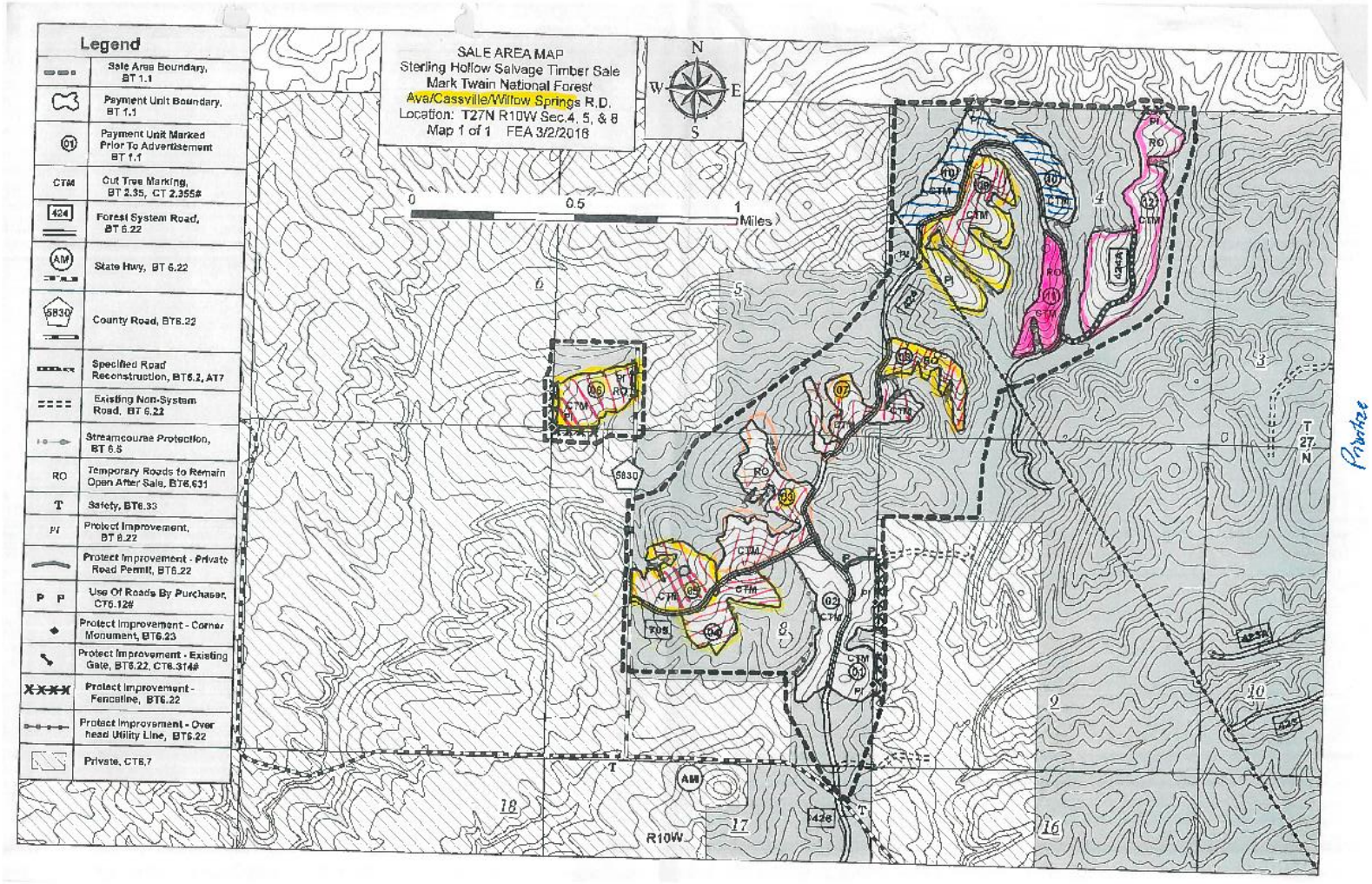

Figure 11. Sterling Hollow Timber Sale Map.

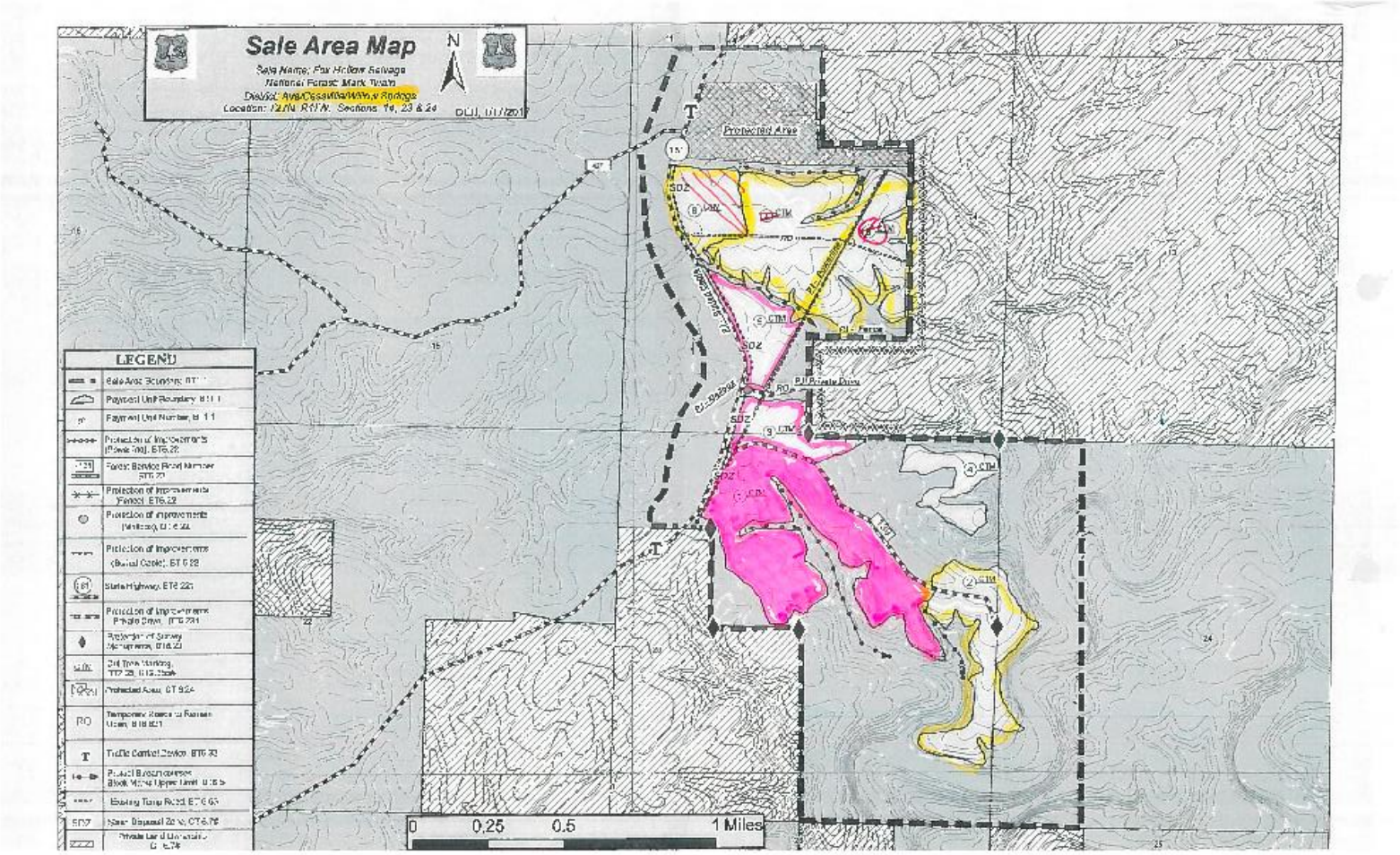

Figure 12. Fox Hollow Timber Sale Map.

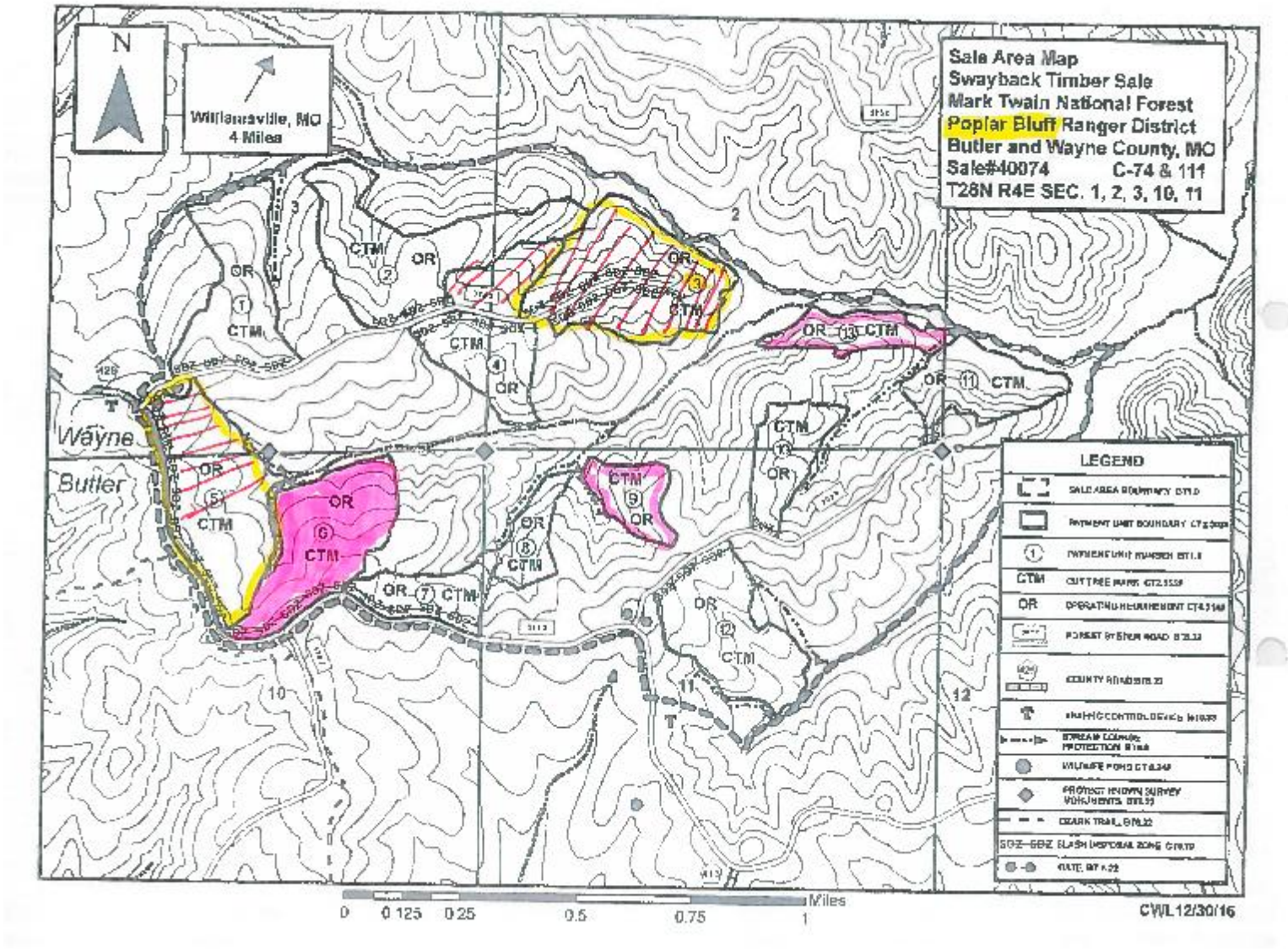

Figure 13. Swayback Timber Sale Map.

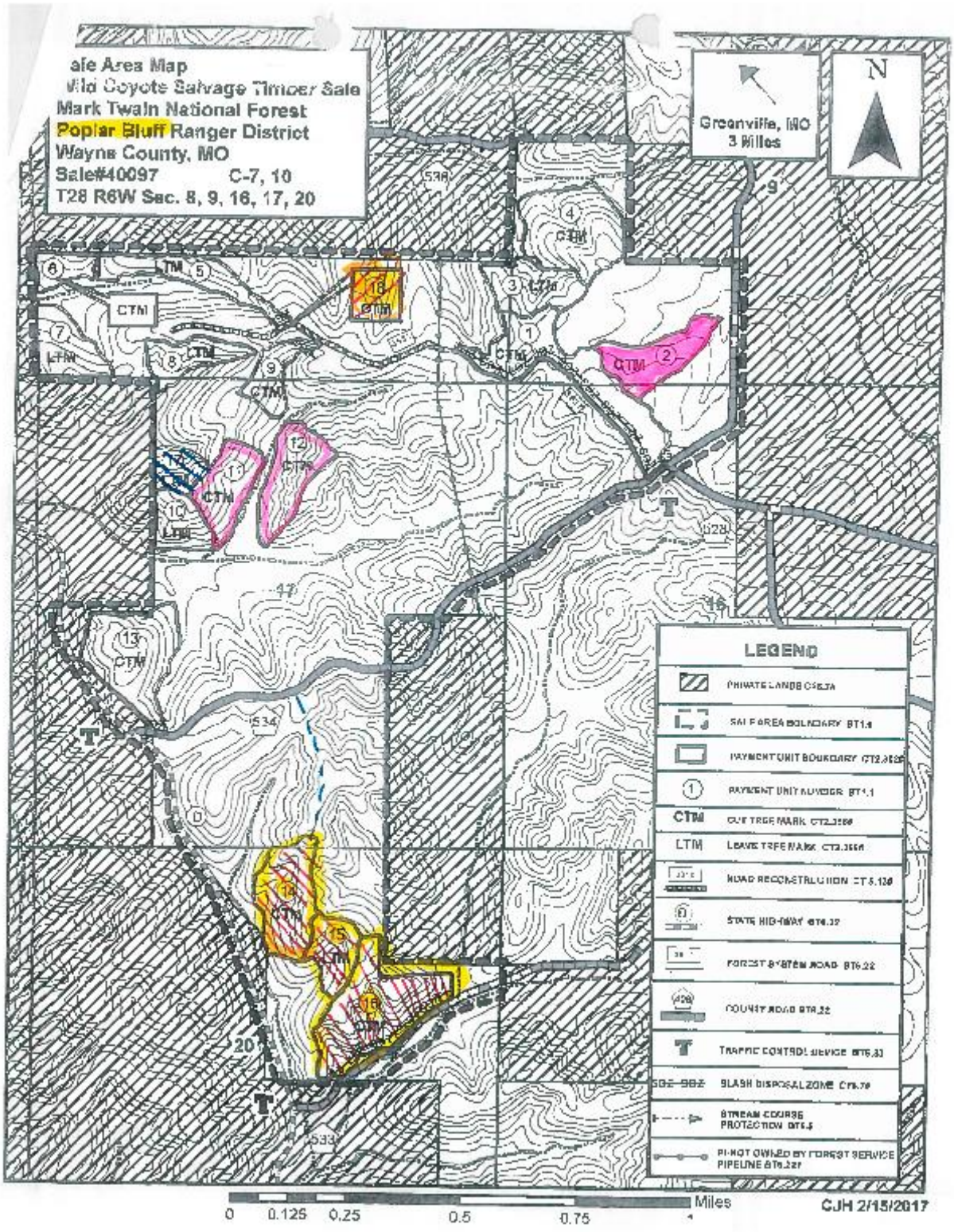

Figure 14. Coyote Timber Sale Map.

APPENDIX B – EXCEL DATASHEETS

Table 3. Fox Hollow Data Entry Forms

Fox Hollow Pre-Activity	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67
f. floor depth (cm):	3.5	3	0	1.5	4	4	3.5	2	1.5	2	2	<1	5	2	6	3	4	4	3.5	3	2.5	4	4	4.5	5	6	4	5	6	4	4	3	<1	5
Forest floor Impacted?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Live Plant?	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Invasive Plant?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fine Woody? <7 cm	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Coarse Woody? >7cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
Bare Soil?	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Rock?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Topsoil displacement?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erosion?, comment!	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rutting? <5cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rutting? 5-10cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rutting? >10cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction? 0-10 cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction? 10-30 cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction? >30cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mixed topsoil/subsoil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Estimated Soil Disturbance Class	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Fox Hollow Post-Activity	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68
f. floor depth (cm):	2	0	1	4	3	2	2	1	3	3	2	1	0.5	4	3	3	3	2	3	1	3	1	3	5	3	3	0	0	2	4	2	2	3	2	3	1	2	3	3	3	2	2	3	4	3	4	3	0	3	5	2	5
Forest floor Impacted?	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
Live Plant?	0	0	1	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	1	0	1	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	1	0	0	0
Invasive Plant?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fine Woody? <7 cm	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	0	1	1	1	0	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1
Coarse Woody? >7cm	1	0	0	0	0	1	0	0	1	0	1	0	0	1	0	0	0	0	1	1	1	1	0	1	1	0	1	0	0	0	0	0	1	0	0	0	0	1	1	1	0	1	0	0	0	1	0	0	0	0	0	0
Bare Soil?	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Rock?	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Topsoil displacement?	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Erosion?, comment!	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rutting? <5cm	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
Rutting? 5-10cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rutting? >10cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction? 0-10 cm	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
Compaction? 10-30 cm	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Compaction? >30cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mixed topsoil/subsoil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Estimated Soil Disturbance Class	0	2	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	2	3	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	2	0	1	0	0
Detrimental? Enter 1 if Yes, 0 if No	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0

Table 4. Monterey Data Entry Forms

Monterey Pre-Activity	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67
f. floor depth (cm):	6	3	5	4	5	4	2.5	3	4	4	4	3	7	3	4	5	4	3	4	3	1	7	4	2	3	3	4	3	3	3	8	1	5	2
Forest floor Impacted?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Live Plant?	0	0	1	0	1	0	0	0	1	0	0	1	1	1	0	0	1	1	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1
Invasive Plant?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fine Woody? <7 cm	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coarse Woody? >7cm	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bare Soil?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rock?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	1	0	0	0	1	1	0	0	0	0	0
Topsoil displacement?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erosion?, comment!	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rutting? <5cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rutting? 5-10cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rutting? >10cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction? 0-10 cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction? 10-30 cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction? >30cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mixed topsoil/subsoil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Estimated Soil Disturbance Class	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Monterey Post-Activity	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59
f. floor depth (cm):	1	0	0	2	3	2	2	2	2	3	1	2	3	3	1	1	2	2	3	2	2	10	1	1	1	2	2	2	9	1
Forest floor Impacted?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Live Plant?	1	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1	1	0	1	0	1	1	0	1	0
Invasive Plant?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fine Woody? <7 cm	1	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Coarse Woody? >7cm	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0
Bare Soil?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rock?	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Topsoil displacement?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erosion?, comment!	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rutting? <5cm	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rutting? 5-10cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rutting? >10cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction? 0-10 cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction? 10-30 cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction? >30cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mixed topsoil/subsoil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Estimated Soil Disturbance Class	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Detrimental? Enter 1 if Yes, 0 if No	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 5. Sterling Hollow Data Entry Forms

Sterling Hollow Pre-Activity	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67
f. floor depth (cm):	2.5	1.5	1	4	2	2.5	3.5	<1	1	<1	5	1	2	3.5	3	5	2	<1	3	3.5	3.5	6	4	5	2	2	3	<1	4	2	2	4	1	>1
Forest floor Impacted?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Live Plant?	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Invasive Plant?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fine Woody? <7 cm	0	0	1	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0
Coarse Woody? >7cm	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	1	0
Bare Soil?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Rock?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Topsoil displacement?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erosion?, comment!	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rutting? <5cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rutting? 5-10cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rutting? >10cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction? 0-10 cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction? 10-30 cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction? >30cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mixed topsoil/subsoil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Estimated Soil Disturbance Class	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Sterling Hollow Post-Activity	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67
f. floor depth (cm):	2	6	4	4	6	7	6	2	3	0	1	2	1	2	5	4	1	4	4	0	3	4	3	3	3	3	4	1	4	3	1	2	2	3
Forest floor Impacted?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Live Plant?	1	1	0	0	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Invasive Plant?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fine Woody? <7 cm	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Coarse Woody? >7cm	0	1	0	0	1	1	1	1	1	0	0	1	1	0	1	1	0	1	0	0	0	0	1	0	0	1	1	1	1	1	1	1	1	1
Bare Soil?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rock?	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Topsoil displacement?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erosion?, comment!	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rutting? <5cm	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Rutting? 5-10cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rutting? >10cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction? 0-10 cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction? 10-30 cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction? >30cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mixed topsoil/subsoil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Estimated Soil Disturbance Class	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Detrimental? Enter 1 if Yes, 0 if No	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6. Swayback Data Entry Forms

Swayback Pre-Activity	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67
f. floor depth (cm):	0.5	3	2	2	2	2.5	3	<1	1	<1	<1	3	3	3	<1	2	<1	3	1	2	2	3	5	2	3	3	2	<1	2	<1	2	2	2	2
Forest floor Impacted?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Live Plant?	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0
Invasive Plant?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fine Woody? <7 cm	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coarse Woody? >7cm	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bare Soil?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rock?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Topsoil displacement?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erosion?, comment!	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rutting? <5cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rutting? 5-10cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rutting? >10cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction? 0-10 cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction? 10-30 cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction? >30cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mixed topsoil/subsoil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Estimated Soil Disturbance Class	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Swayback Post-Activity	1	3	5	7	9	11	13	15	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68
f. floor depth (cm):	2	2	3	0	3	2	3	3	2	2	3	1	0	1	0	3	1	3	5	2	3	0	2	2	0	0	1	2	4	3	2	2	2	0	1	2	3	2	3	2	2	1	3	1	1	2	3	1	4	0	4	2	4	2	2	2	2	2	0	2
Forest floor Impacted?	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Live Plant?	1	0	1	0	1	1	1	0	1	0	1	0	0	1	0	1	1	1	0	1	0	1	0	1	0	0	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	1	0	1	1	1	0	1	0	1	0	1	1	1	0	1	1	1	1	1
Invasive Plant?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Fine Woody? <7 cm	0	0	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1
Coarse Woody? >7cm	0	0	1	0	0	0	0	0	0	1	0	0	1	1	0	0	1	1	1	0	1	0	1	1	0	0	0	0	0	0	1	0	0	0	0	1	1	1	1	0	1	1	1	0	1	1	1	0	1	0	1	0	1	0	1	1	0	1	0	1
Bare Soil?	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rock?	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Topsoil displacement?	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erosion?, comment!	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rutting? <5cm	1	1	0	1	1	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0	0	0	0	1	0
Rutting? 5-10cm	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rutting? >10cm	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction? 0-10 cm	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction? 10-30 cm	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction? >30cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mixed topsoil/subsoil	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Estimated Soil Disturbance Class	1	1	0	2	2	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	1	0	0	2	1	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0
Detrimental? Enter 1 if Yes, 0 if No	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 7. Warthog Data Entry Form

Warthog Pre-Activity	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67
f. floor depth (cm):	2.5	10	4	4	7	3.5	5	5	5	0.5	4	4.5	3	4	5	3.5	2	12	6	6	3	7	1	6	7	7	5	7	5.5	2.5	4	6	7	1
Forest floor Impacted?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Live Plant?	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Invasive Plant?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fine Woody? <7 cm	1	0	0	0	1	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coarse Woody? >7cm	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Bare Soil?	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rock?	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	1	1	0	0	1		0	1
Topsoil displacement?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erosion?, comment!	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rutting? <5cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rutting? 5-10cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rutting? >10cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction? 0-10 cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction? 10-30 cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction? >30cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mixed topsoil/subsoil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Estimated Soil Disturbance Class	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Warthog Post-Activity	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	58	59	60	61	62	63	64	65	66	67	68
f. floor depth (cm):	0	10	4	5	5	5	10	4	2	2	4	4	1	5	2	8	5	7	6	6	12	8	8	4	4	6	7	4	12	6	5	3	7	6	3	6	3	1	8	6
Forest floor Impacted?	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Live Plant?	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0	1	1	1	1	0	0	1	1	0	1	1	0	1
Invasive Plant?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fine Woody? <7 cm	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Coarse Woody? >7cm	1	1	1	1	1	1	0	0	0	0	1	0	1	1	0	1	1	0	0	0	0	1	1	0	1	0	1	0	0	1	0	1	1	1	0	1	1	1	1	0
Bare Soil?	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rock?	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Topsoil displacement?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erosion?, comment!	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rutting? <5cm	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Rutting? 5-10cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rutting? >10cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction? 0-10 cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Compaction? 10-30 cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction? >30cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mixed topsoil/subsoil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Estimated Soil Disturbance Class	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Detrimental? Enter 1 if Yes, 0 if No	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 8. Wild Coyote Data Entry Forms

Wild Coyote Pre-Activity	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65
f. floor depth (cm):	2	2	<1	2	2	3	3	3	1	2	3	<1	0	3.5	1	2	2	2	2	2	2	<1	2	2	2	2	2	<1	2	<1	2	2	2
Forest floor Impacted?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Live Plant?	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	1	1
Invasive Plant?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fine Woody? <7 cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0
Coarse Woody? >7cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bare Soil?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rock?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Topsoil displacement?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erosion?, comment!	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rutting? <5cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rutting? 5-10cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rutting? >10cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction? 0-10 cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction? 10-30 cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction? >30cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mixed topsoil/subsoil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Estimated Soil Disturbance Class	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wild Coyote Post-Activity	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67
f. floor depth (cm):	2	2	3	3	3	2	2	2	1	3	0	2	3	3	1	2	3	2	0	2	1	2	3	2	2	3	3	4	1	2	1	0	1	2
Forest floor Impacted?	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Live Plant?	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0
Invasive Plant?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fine Woody? <7 cm	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	1	0	1	0	1	0	1	0	0	1	0	0	0	1	0	1	1	0	0
Coarse Woody? >7cm	0	0	0	0	0	1	1	1	0	1	0	1	0	0	0	1	0	1	0	1	1	0	1	1	0	0	1	1	0	0	0	1	0	1
Bare Soil?	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rock?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Topsoil displacement?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erosion?, comment!	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rutting? <5cm	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Rutting? 5-10cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rutting? >10cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction? 0-10 cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction? 10-30 cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction? >30cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mixed topsoil/subsoil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Estimated Soil Disturbance Class	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Detrimental? Enter 1 if Yes, 0 if No	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

APPENDIX C – ARCMAP GEODATABASE HTML POPUP TOOL

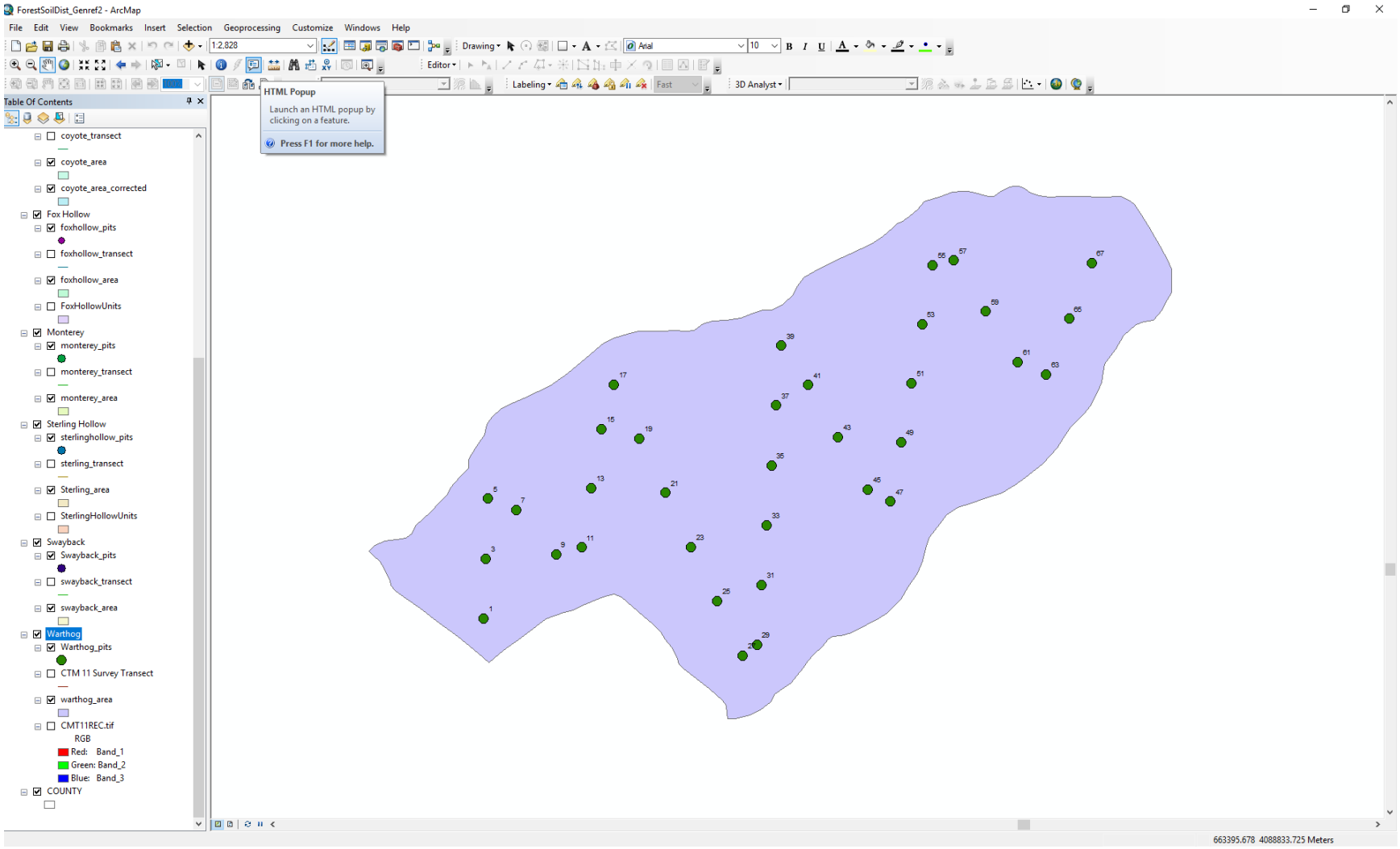

Figure 15. Select the HTML Popup Tool.

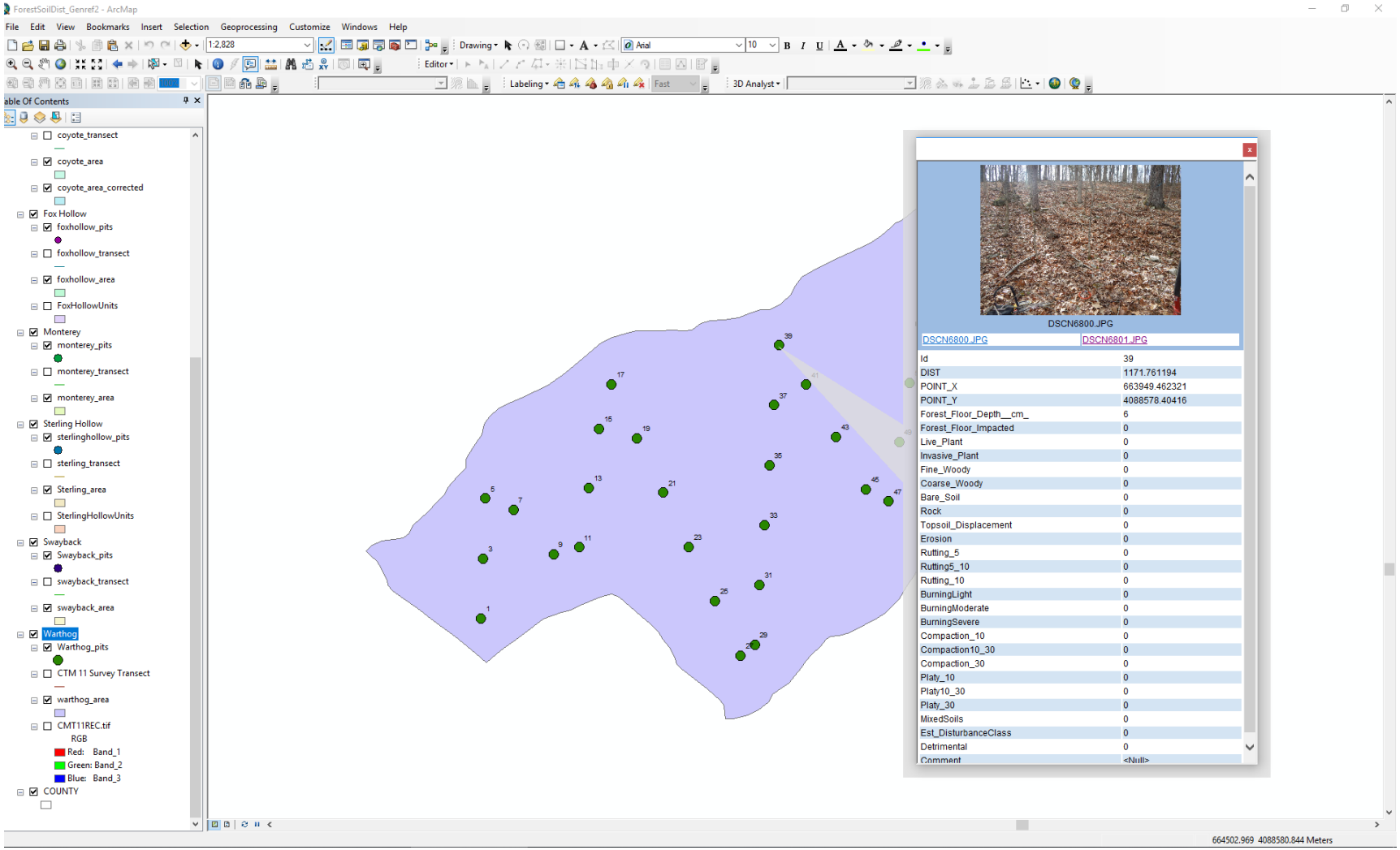

Figure 16. Click on the points using the HTML Popup Tool to see the photos and data collected at each pit.

APPENDIX D – SOIL SERIES BY SALE SITE

MU	Acres	% Area	Series Name	Landform	Slope % Range
Fox Hollow					
70026	0.5	0.5	Tonti silt loam	Uplands	1-3
73073	10.1	10.6	Scholten-Poynor complex	Uplands	8-15
73121	34.5	36.2	Scholten-Tonti complex	Uplands	3-8
73220	21.6	22.6	Poynor extremely gravelly silt loam	Uplands	8-15
73223	26.4	27.7	Coulstone-Bender complex	Uplands	15-50
73236	2.4	2.5	Scholten-Poynor complex	Uplands	3-8
Monterey					
73014	22.6	32.9	Clarksville very gravelly silt loam	Uplands	8-15
73019	1.5	2.2	Poynor very gravelly silt loam	Uplands	1-8
73403	1.1	1.6	Coulstone gravelly sandy loam	Uplands	3-8
73472	43.5	63.2	Macedonia silt loam	Uplands	3-8
Sterling Hollow					
73068	4.3	22.2	Tick very gravelly silt loam	Uplands	3-15
73069	14.8	76.2	Tick extremely gravelly silt loam	Uplands	15-50
75423	0.3	1.6	Cedargap very gravelly silt loam	Flood Plains	1-3
Swayback					
73140	8.7	61.4	Clarksville-Scholten complex	Uplands	15-45
73265	5.5	38.6	Captina-Scholten complex	Uplands	3-8
Warthog					
73402	37.3	67.2	Coulstone very gravelly sandy loam	Uplands	15-30
73403	14.4	26.0	Coulstone gravelly sandy loam	Uplands	3-8
76051	3.8	6.8	Tilk-Secesh complex	Flood Plains	1-3
Wild Coyote					
73157	11.1	70.4	Captina silt loam	Uplands	3-8
73267	3.1	19.9	Yelton-Scholten complex	Uplands	8-15
75429	1.5	9.7	Tilk-Secesh complex	Flood Plains	0-3