Forest Practices Technical Guidance

Harvesting on Steep Slopes - Identifying Slope Retention Areas

Effective January 1, 2024

Objective

Forest Practices Technical Guidance is advisory guidance, developed by the State Forester through a stakeholder process, to assist landowners and resource professionals to implement the Oregon Forest Practices Act and forest practices rules. OAR 629-630-0910 (5) requires landowner representatives delineating final boundaries for slope retention areas for commercial timber harvests on steep slopes in Western Oregon to have completed certified steep slopes training.

This Technical Guidance addresses timber harvesting on steep slopes in Western Oregon including the identification of slope retention areas (SRA). This Technical Guidance does not address designated debris flow traversal areas or stream adjacent failures.

Note: Small forestland owners who qualify to manage their forestlands under the minimum option are exempt from the rules and Technical Guidance for timber harvesting on designated sediment source areas (DSSA) and SRA (OAR 629-630-0920(6)). This Technical Guidance does not replace division 623 rules or Technical Guidance for high landslide hazard locations that have downslope public safety risk.

Background

In 2022, Senate Bill 1501 directed the Board of Forestry to adopt rules to apply the 2022 Private Forest Accord Report. The Report memorializes the agreements between authors of a conservation coalition and working forest coalition. This was mediated by Governor Brown and sanctioned in 2020 by Senate Bill 1602. They negotiated to modify Oregon's forest practice regulations in support of developing an acceptable habitat conservation plan (HCP). The HCP would provide the means to seek an Incidental Take Permit under Section 10 of the U.S. Endangered Species Act for the covered species identified in the Report.

As directed by SB 1501, a "slopes model" (model) was developed to identify areas on private forestlands in Western Oregon with a higher probability of initiating landslides and debris flows that deliver to fish-bearing streams (TerrainWorks 2022). The model ranks potential debris flow initiation source areas and debris flow runout to fish-bearing streams. Modeling used U.S. Geologic Survey Hydrologic Unit Code 4th field (8-digit) basins. The model identifies DSSAs with and without Trigger Sources. At least 50 percent of the modeled DSSAs in a harvest unit will be identified and flagged as SRAs. Certain priorities apply when selecting an SRA.

The model did not consider land ownership. Stream classification for fish use was mapped based on a model developed for Western Washington (Fransen et al. 2006). Future changes to the fish-use classification based on field survey protocol (OAR 629-635-0200) will not immediately change the department's maps of modeled DSSAs.

An overarching purpose of the timber harvesting on steep slopes rules, is to retain trees in designated areas to provide the beneficial elements of landslides while mitigating the potential negative effects of forest management activities on unstable slopes. Trees retained in an SRA reduce the timber-harvest related increases in the number and volume of sediment delivered to fish-bearing streams. The retained trees also have the potential to contribute large wood to fish-bearing streams during naturally occurring landslides.

Terminology

"Certified Steep Slopes Training" means the State Forester has certified that a trainee has completed training and demonstrated sufficient knowledge to determine the field delineation of the final boundaries for slope retention areas. OAR 629-600-0100.

"**Debris Flow**" means a rapidly moving slurry of rock, soil, wood, and water, which is most often initiated by a landslide that delivers to and travels through steep, confined stream channels, as used in the slopes model. OAR 629-600-0100.

"Debris Flow Traversal Area Sub-basins" means catchments within U.S. Geological Survey Hydrologic Unit Code 4th field basins that contain debris flow traversal areas that have a probability of traversal in the upper 20 percent. OAR 629-600-0100.

"Designated Sediment Source Areas" (DSSA) means areas that the slopes model identifies as most likely to experience landslides that initiate debris flows that will likely deliver to Type F or Type SSBT streams. These areas, as identified by the slopes model, may or may not contain Trigger Sources. The slopes model identifies the hillslope areas greater than ¼ acre in size within debris flow traversal area sub-basins that provide the top 33 percent of the landslide-derived sediment to Type F or Type SSBT streams. OAR 629-600-0100.

"FERNS" is the department's electronic notification and reporting system, also called, "E-Notification system."

"Headwall" means steep, concave slopes that can concentrate subsurface water, which can lead to increased landslide susceptibility. Headwalls are typically located at the head of stream channels, draws, or swales. Headwalls have slope gradients of 65 percent or greater in the Tyee Core Area and 70 percent or greater in the rest of the state, as measured in the axis of the headwall. Landslides that occur in headwalls are more likely to initiate channelized debris flows that can travel down streams (also known as debris torrents) than landslides that occur in other

areas of the slope. OAR 629-600-0100. DSSAs are not necessarily headwalls, though many DSSAs do encompass or overlap most headwall-like features.

"**Slope Retention Areas**" means the 50 percent, at a minimum, of Designated Sediment Source Areas in each harvest unit that will be left unharvested. OAR 629-600-0100. Slope Retention Areas encompass field verified headwalls or most headwall-like features.

"Slopes Model" means the department's computer-generated model that identifies designated debris flow traversal areas, designated sediment sources areas, and trigger sources.

"**Trigger Sources**" means areas within designated sediment source areas that the slopes model identifies as most likely to trigger a high-volume debris flow. These areas have the top 20 percent likelihood of triggering a top 33 percent high-volume debris flow. OAR 629-600-0100.

"Tyee Core Area" (OAR 629-600-0100) means a location with geologic conditions including thick sandstone beds with few fractures. These sandstones weather rapidly and concentrate water in shallow soils creating a higher shallow, rapidly moving landslide hazard. The Tyee Core Area is located within coastal watersheds from the Siuslaw watershed south to and including the Coquille watershed, and that portion of the Umpqua watershed north of Highway 42 and west of Interstate 5. Within these boundaries, locations where bedrock is not of sedimentary origin as determined in the field by a geotechnical specialist are not subject to the Tyee Core Area slope steepness thresholds. OAR 629-600-0100.

Overview

This Technical Guidance describes the four-step process to identify SRAs prior to commercial harvesting on certain steep slopes. All modeled DSSAs are marked on department maps and identified with a Tigger Source (red slope polygon) or without a Trigger Source (blue slope polygon). The first step is to determine if one or more modeled DSSAs are present in the proposed harvest unit. If so, in the second step, the landowner representative will initially select as a map-based exercise at least 50 percent of the modeled DSSAs as SRAs within the proposed harvest unit. The selection criteria prioritize the DSSAs with one or more Trigger Sources (red) over those without a Trigger Source (blue), and larger slope polygons over smaller. The landowner representative may adjust the selection priority to decrease risks to worker safety or resource impacts. See Appendix B, Table 1, and Figures 1-9.

In the third step, the State Forester trained landowner representative will finalize the map-based selection of SRAs from DSSAs after evaluating and flagging the boundaries of SRAs in the field. As the final step, the landowner representative must submit the written plan to the State Forester after completing the field work for any harvest unit containing a DSSA.

Office Screening, Field Layout, Written Plan

STEP 1. Map-based Review – OFFICE ACTIVITY

Landowner representatives will have access to the outputs of the department's slopes model for planning harvest unit layout. When a notification of operation for a harvest unit includes one or more modeled DSSA, the landowner representative continues to step 2, otherwise this Technical Guidance does not apply. **Note:** There may still be a need to conduct a down slope public safety risk evaluation. Modeled DSSAs will be either:

a. DSSAs identified with Trigger Sources (red slope polygons), or
b. DSSAs identified without Trigger Sources (blue slope polygons)

STEP 2. Initial Selection of the DSSAs – OFFICE ACTIVITY

The landowner representative must select 50 percent of modeled DSSAs from the department's map or FERNS as potential SRAs for each harvest unit. When the modeled DSSA in the harvest unit is divided by a property line or harvest unit boundary and is at least ¼ acre, the landowner representative must include it in the count of DSSAs. If there are an odd number of DSSAs in a unit, add 1 to the count, then divide it by 2 to determine how many DSSAs to retain as SRAs.

When a modeled DSSA polygon encompasses more than one most headwall-like feature, the polygon is still considered to be one DSSA and its total acreage is what should be considered in the selection prioritization described below. When field adjustments of such a DSSA are made which might break the modeled location into multiple leave areas, they are still to be considered part of one DSSA.

The landowner representative may consider other resources when selecting which modeled DSSAs to initially consider as potential SRAs and for identifying any headwall like characteristics within the DSSAs. Potential headwalls can be identified by considering, for example, LiDAR derived slope class, contours, and aerial and satellite imagery. Landowner representatives may not propose non-modeled headwalls or steep slopes areas for selection as SRAs. See Appendix B, Figures 2, 3, 6 and 8.

<u>Selection Priorities:</u> Prioritize the selection of at least 50 percent of the DSSAs by:

a. Slope polygons with Trigger Sources (red) over those without Trigger Sources (blue), and
b. Larger sized slope polygons over smaller

<u>Eligible Adjustments to the Selection Priorities:</u> The landowner representative may adjust the distribution and location of SRAs. The rationale to adjust the selection priorities must be justified in the written plan. The eligible concerns that may justify selection of non-priority areas are when selection priorities areas would:

a. Clearly reduce worker safety; or
b. Cause more resource impact, such as more road or landing construction, excessive sidehill yarding, or other yarding practices that clearly increase ecological impacts.

Note: The SRAs without Trigger Sources may include cable yarding corridors. The number, size and location of the yarding corridors shall be designed to minimize soil and vegetation disruptions that may increase slope instability. Where cable yarding corridors are used, the trees may be felled but not removed, unless deemed safety hazards. The trees within SRAs, with or without Trigger Sources, may be used as tailholds or intermediate supports, but the trees may not be removed unless deemed safety hazards. Ground-based equipment is not allowed in SRAs.

STEP 3. Final Selection and Flagging of SRAs – FIELD ACTIVITY

The landowner representative trained by the State Forester will determine the SRAs based on the Selection Priorities and Eligible Adjustments to the Selection Priorities in Step 2. The landowner representative will then field verify the presence of headwall(s) or most headwall-like features and flag the boundary of the SRAs. The landowner representative may adjust and smooth the edges of the SRA boundary to encompass the headwall or most headwall-like feature. Adjusting and smoothing may require filling in "donut holes," "bays" or cutting off "peninsulas." The SRA should encompass the field identified headwall or most headwall-like feature, while more or less approximating the modeled polygon acres. The SRA may include non-forested areas, for example, slope failures, rocky areas, brush, road prism, etc.

The landowner representative may use a combination of headwall field indicators described below to help determine the final SRA boundary. See Appendix B, Figures 7 and 9.

Headwall Field Indicators

The descriptors of headwall characteristics are described below:

1. Topographic Indicators:
    - Steep slopes of 65 percent or greater in the Tyee Core Area and 70 percent or greater in Western Oregon, as measured in the axis of the headwall.
    - Slopes with strong convergence near ridge tops. Slope convergence indicates potential for significant concentration of groundwater within the headwall before reaching a defined channel.
    - Typically un-channelized areas located at the head of stream channels, draws, or swales.
    - Commonly spoon-shaped, and typically 50-100 feet wide.
    - Lower parts of headwalls usually terminate where a distinct channel begins, but a recent failure may expose surface water or a channel within the headwall. In those cases, the channel will have poorly defined bed and bank.
    - Often roll-over upslope into less steep topography, or the more stable planar or divergent planform shapes.
    - May have bare or raw, exposed, or non-vegetated soil. This may mark the location of a previous debris flow, headwall, sidewall, or active movement.
    - See Appendix B, Figures 1 through 4

2. Hydrologic Indicators:
   - Seepage lines, springs and groundwater piping often mark the contact between high and low permeable soils.
   - The above water indicators could mark the difference of flow along bedding surfaces.
3. Vegetative Indicators:
   - Split trees and split stumps are generally associated with failing slopes.
   - Hydrophytic or water-loving vegetation such as horse tail, sedge, salmonberry, devil's club, and maidenhair fern, may indicate groundwater seeps and saturated soil. The geographic region, stand conditions, and other factors influence the presence or absence of these plants.
   - Recent or historic slope failure will create patterns of disturbed vegetation, such as changes in stand composition – early seral stage or lack of mature trees within a hillslope – or small groupings of alder in a conifer-dominated forest.

STEP 4. Written Plan – OFFICE ACTIVITY

The written plan must include the person's name who marked the SRAs boundaries in the field. Include the date when certified steep slopes training was completed by that person.
The written plan (OAR 629-630-0915) must also include:

1. A unit map that shows:
   a. Part(s) of the harvest unit containing modeled DSSAs, with Trigger Sources (red slope polygons) and those without Trigger Sources (blue slope polygons);
   b. Locations and boundaries of SRAs flagged in the field; and
   c. Approximate locations of yarding corridors relative to DSSAs and SRAs.

2. Appropriate documentation and rationale for:
   a. Selecting the SRAs, including using the Eligible Adjustments to the Selection Priorities to meet the 50 percent DSSAs requirement. For example, a proposed harvest unit containing a DSSA with Trigger Sources was not picked as an SRA to avoid road building on a full-bench, end-haul slope. The landowner representative selected a DSSA without Trigger Sources as an SRA and proposes to harvest a DSSA with Trigger Sources.
   b. How the number, size, and location of the yarding corridors were designed to minimize soil and vegetation disruptions that may increase slope instability in SRAs. For example, the operator will minimize ground disturbance by locating landings to minimize the number of yarding corridors and where appropriate, limit the number of logs in yarding turns.

3. Include related information when required by rule or the State Forester.

References

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Chatwin, S.C., D.E. Howes, J.W. Schwab, and D.N. Swanston. 1994. A Guide for Management on Landslide-prone Terrain in the Pacific Northwest. Land Management Handbook 18. ISSN 0229-1622. British Columbia Ministry of Forests.

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Grieve, S.W.D., Hales, T.C., Parker, R., Mudd, S.M., & Clubb, F.J. 2018. Controls on zero-order basin morphology. Journal of Geophysical Research: Earth Surface, 123, 3269-3291.

Oregon Department of Forestry. 2019. Technical Note 2, version 2. High Landslide Hazard Locations, Shallow, Rapidly Moving Landslides and Public Safety: Screening and Practices. 11 p.

Oregon Department of Forestry. 2003. Technical Note 6. Determination of Rapidly Moving Landslide Impact Rating. 12 p.

Oregon Lidar Viewer, http://www.oregongeology.org/lidar/

Private Forest Accord Report, February 2, 2022. Chapter 3 and Appendix C., 196 pages, https://www.oregon.gov/odf/aboutodf/documents/2022-odf-private-forest-accord-report.pdf

Robison, G.E., Mills, K.A., Paul, J., Dent, L., Skaugset, A., 1999. Storm Impacts and Landslides of 1996: Final Report. Oregon Department of Forestry, Salem, OR. 145 p.

Spiesschaert, D., D. Carleson, G. Carter, S. Duncan, B. Madison, R. Mason, and M. Pyles. 1982. Minimizing Debris Avalanches on Forest Land-A Report to the State Forester. 18 p.

TerrainWorks, May 8, 2022. Delineating Landslide and Debris Flow Susceptibility in Western Oregon in Support of the Private Forest Accord

Washington Dept. of Natural Resources. 2016. Section 16, Guidelines for Evaluating Potentially Unstable Slopes and Landforms.

Oregon Department of Forestry Field Offices

For more information on the Oregon Forest Practices Act and Forest Practice Rules, please contact your local ODF office at http://www.oregon.gov/ODF/Working/Pages/FindAForester.aspx *or the headquarters office at 2600 State Street, Salem, Oregon 97310. 503-945-7200.*

Appendix A. Rules

OAR 629-630-0910
Standard Practice, Western Oregon Harvesting; Designated Sediment Source Areas and Slope Retention Areas

(1) Slope retention areas encompass field identified headwalls. The State Forester shall publish Forest Practices Technical Guidance to explain how to implement this rule.

(2) Changes in stream classification for a stream, based on field surveys for fish-use consistent with OAR 629-635-0200, shall not change the department's maps used for notifications of operations that identify designated sediment source areas.

(3) Landowner representatives shall identify at least 50 percent of the designated sediment source areas as slope retention areas for timber harvesting in Western Oregon as follows:

(a) If the number of designated sediment source areas is an odd number, the landowner representative shall round up to the next even number and identify half of the number as slope retention areas.

(b) Prioritize designated sediment source areas for selection of slope retention areas as follows:

(A) Designated sediment source areas with trigger sources; and

(B) Larger designated sediment source areas.

(4) The landowner representative may adjust the distribution and location of slope retention areas, notwithstanding section (3) of this rule, if the selected slope retention areas:

(a) Clearly reduce worker safety, as described in OAR chapter 437, division 7, Forest Activities; or

(b) Cause more resource impact, such as additional road or landing construction, excessive sidehill yarding, or other yarding practices that clearly increase ecological impacts.

(5) The landowner representative shall have received certified steep slopes training to determine the field delineation of the final boundaries for slope retention areas. The department shall develop and provide certification training opportunities to landowner representatives when the model has been added to the department reporting and notification system.

(6) After clearly marking in the field the boundaries of the slope retention areas, the landowner representative shall submit a written plan, described in OAR 629-630-0925, for timber harvest units containing designated sediment source areas and slope retention areas.

(7) Operators shall not harvest timber located in the slope retention areas.

(8) Cable yarding, which may require cutting, but not removal, of trees, is permitted only through slope retention areas that do not contain trigger sources, but the number, size, and location of yarding corridors shall be designed to minimize soil and vegetation disruptions that may increase slope instability. The operator shall not remove trees cut for yarding corridors unless these are deemed safety hazards.

(9) Operators shall not construct skid roads or operate ground-based equipment in slope retention areas.

OAR 629-630-0925

Written Plans to Evaluate Harvesting on Features Identified in the Slopes Model

To evaluate timber harvesting on features identified by the model, operators shall submit a written plan that describes how the operation is planned to be conducted in sufficient detail to allow the State Forester to evaluate and comment on the likelihood that the operation will comply with the Forest Practices Act or administrative rules. The written plan shall include at a minimum:

(1) A unit map including, where applicable:

(a) Locations of modeled designated debris flow traversal areas;

(b) Locations of modeled designated sediment source areas and those selected as slope retention areas; and

(c) Identification of approximate yarding corridors relative to (1)(a) and (b).

(2) Description of the rationale and appropriate documentation for the following that apply:

(a) Selection of the 50 percent designated debris flow traversal areas for Western Oregon forestlands that are managed under the small forestland owner minimum option;

(b) Selection of slope retention areas, including justification for choosing areas to satisfy the minimum 50 percent designated sediment source area requirement, as described in OAR 629-630-0910(3) and (4);

(c) How the number, size, and location of yarding corridors were designed to minimize impacts to the designated debris flow traversal areas; and

(d) How the number, size, and location of yarding corridors were designed to minimize soil and vegetation disruptions that may increase slope instability in slope retention areas.

(3) Additional administrative information related to the operation as required by individual rules or as requested by the State Forester.

Appendix B., Table 1. and Figures 1-9

Table 1. Summary Table of Technical Guidance: Identifying Slope Retention Areas		
Applies to forestlands not managed under the Small Forestland Minimum Option		
Step 1. Map-based Review	• Modeled DSSAs **with Trigger Source** (red slope polygons)	• Modeled DSSAs **without Trigger Source** (blue slope polygons)
Slopes Model	• Areas most likely to trigger a high-volume debris flow that delivers material to a fish-bearing stream	• Areas less likely to trigger a high-volume debris flow
Step 2. Initial Selection of DSSAs	• At least 50 percent of DSSAs for each harvest unit to become SRAs. • If an odd number count, add one then divide by two.	
Selection Priorities of DSSAs	• Red slope polygons prioritized over blue and • Larger sized slope polygons prioritized over smaller	
Eligible Adjustments to the Selection Priorities	• Selection priorities for DSSAs clearly reduce worker safety or cause more resource impacts. • May adjust Selection Priorities but must justified in written plan.	
Yarding Corridors in SRAs	• No, SRAs with Trigger Sources	• Yes, SRAs without Trigger Sources, but must retain cut trees unless a safety hazard
Step 3. Final selection of SRAs	• State Forester will train the landowner representatives that field identify and flag SRAs boundaries.	
Slope Retention Areas	• Trained landowner representative will adjust the SRAs to include the headwall and smooth the boundary edges.	
Field Identification and Flagging	• Trained landowner representative will mark the SRAs in the field, before submitting the written plan.	
Step 4. Written Plan	• Name of person who identified and flagged the SRAs. • Provide unit harvest map with DSSAs, flagged SRAs, and location of yarding corridors relative to DSSAs and SRAs. • Describe the selection of SRAs and the rationale to use the Eligible Adjustments to the Selection Priorities. • Describe how the number, size and location of yarding corridors minimize increasing slope instability.	

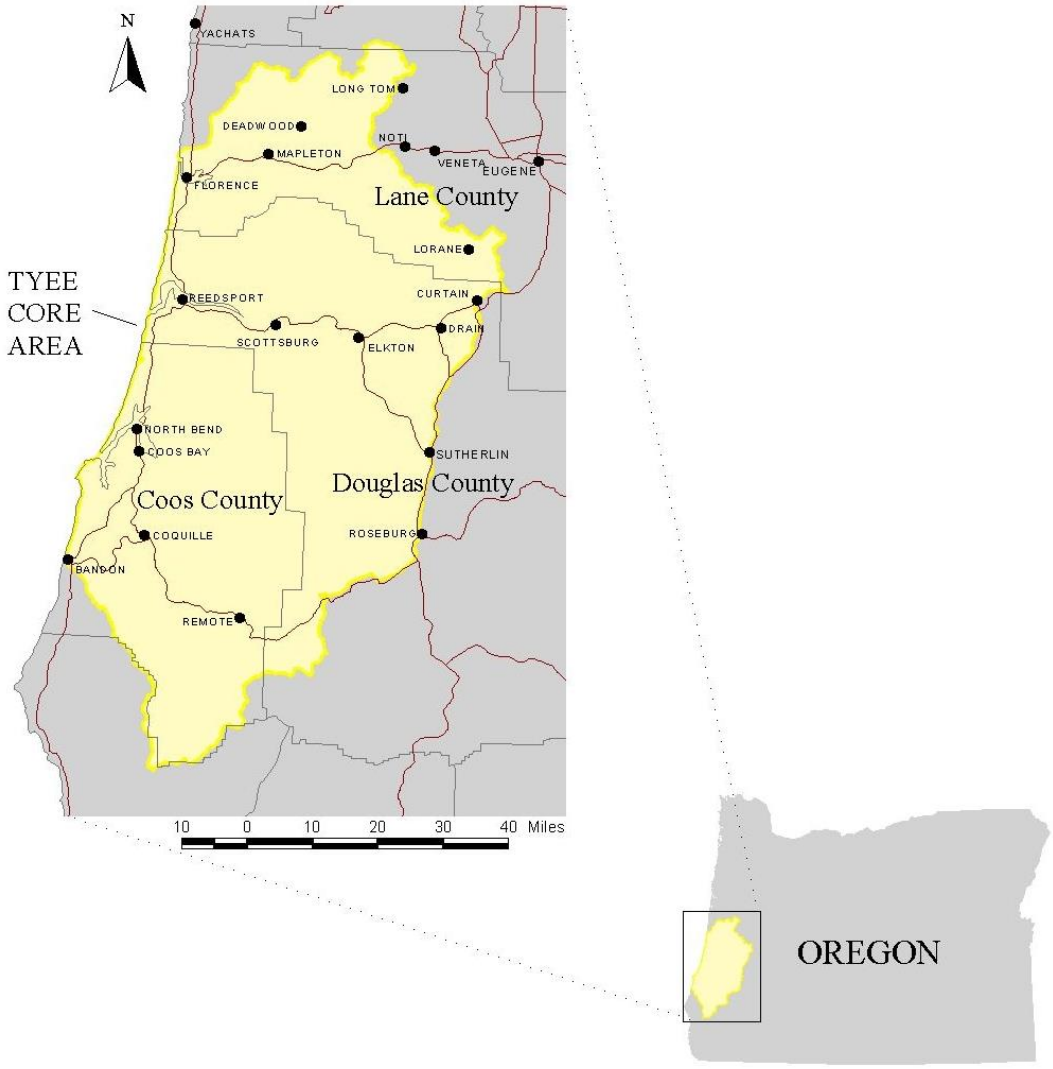

Figure 1. Location of the Tyee Core Area.

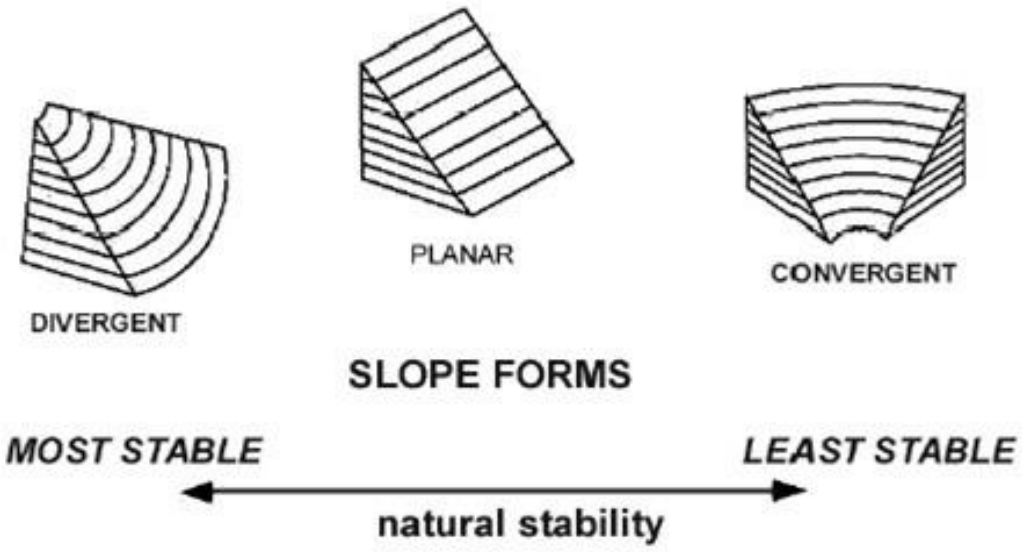

Figure 2. Slope configurations as observed in map view.

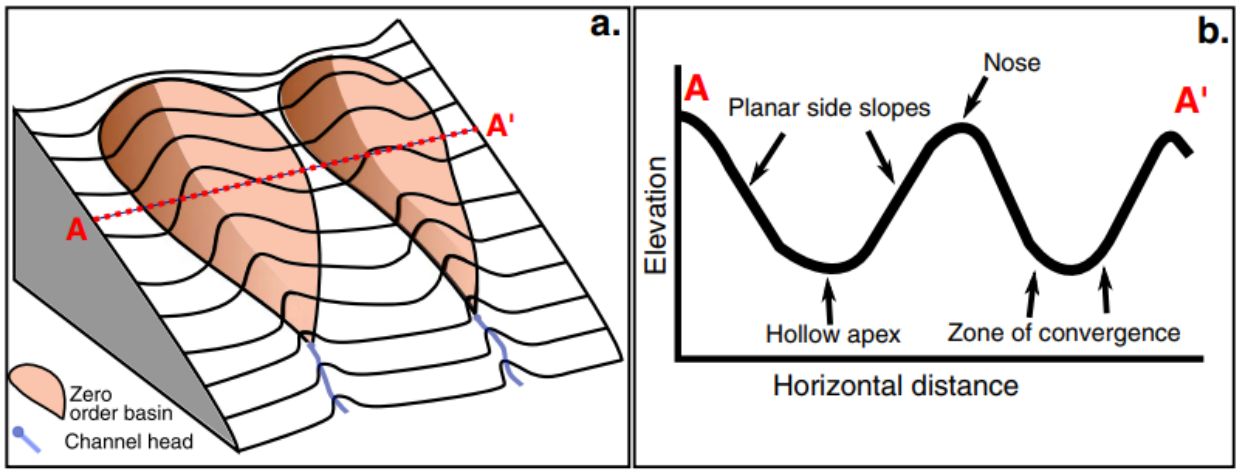

Figure 3. (a) Schematic diagram of a pair of zero-order basins or headwalls on a hillslope, showing the location of the channel head in relation to the basin. (b) Schematic topographic profile, with vertical exaggeration, to show the distinct topographic forms, defined by Hack and Goodlett (1960), which are used to define a zero-order basin (composed of a hollow, planar side slopes, and divergent noses) in a landscape. Profile follows the path of the red dashed line (A-A') in (a).
Modified from Grieve, S.W. D., Hales, T.C. Parker, R., Mudd, S.M., & Clubb, F.J. (2018) Controls on zero-order basin morphology. Journal of Geophysical Research: Earth Surface, 123, 3269-3291.

Figure 4. Aerial photo of visible headwalls, some are indicated with arrows.

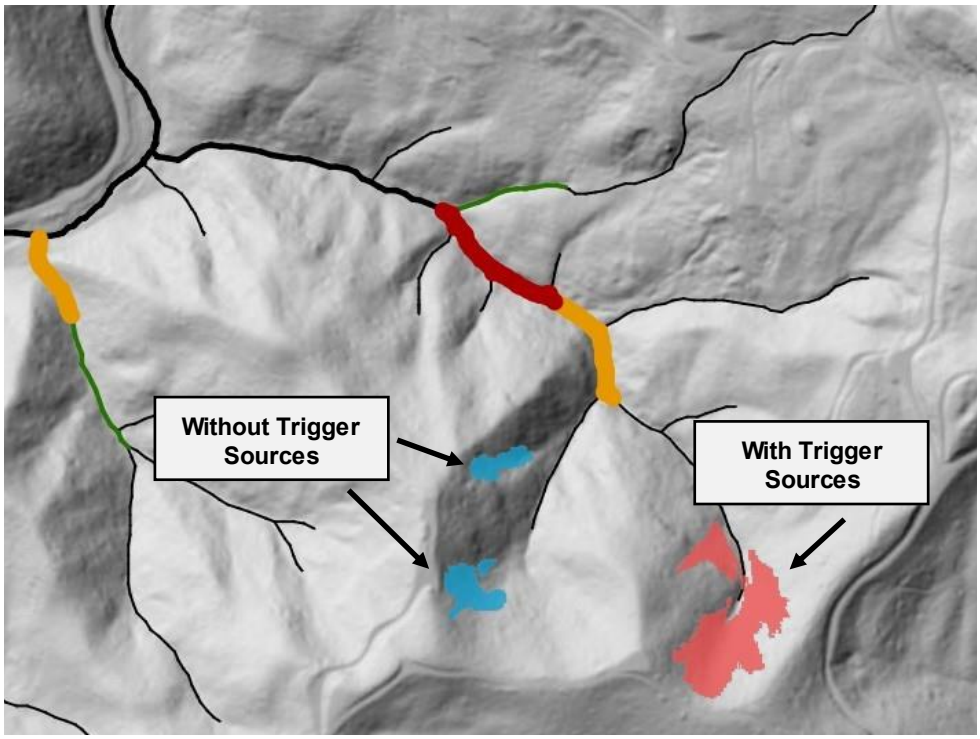

Figure 5. Modeled Designated Sediment Source Areas (DSSAs) with Trigger Sources (red) and without Trigger Sources (blue).

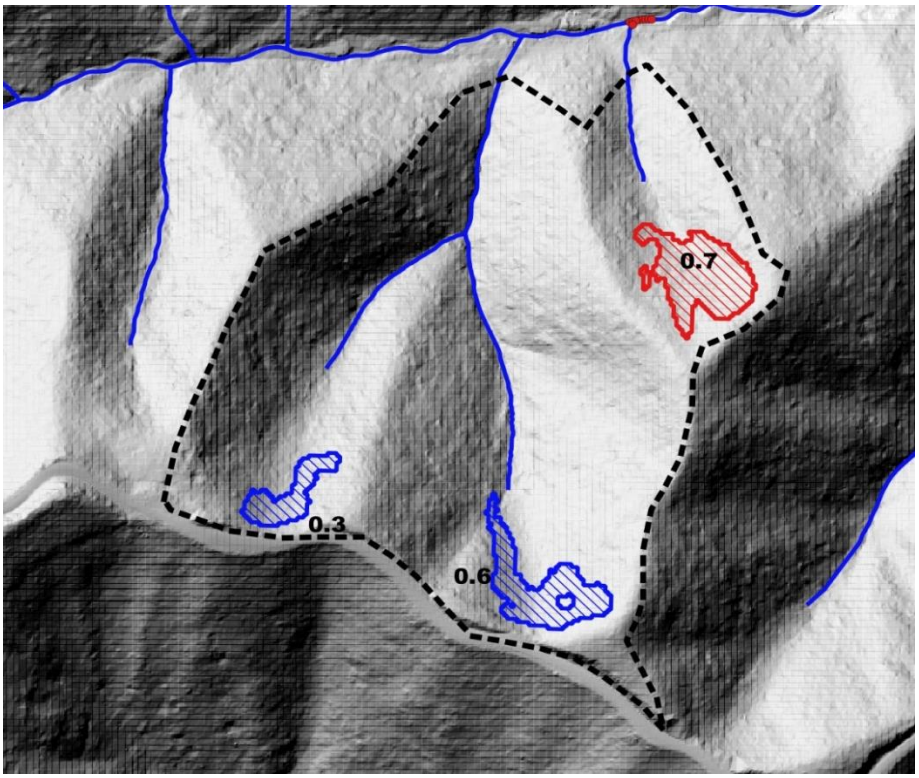

Figure 6. Modeled slopes polygons in planned harvest unit. Three Designated Sediment Source Areas present (two Blue and one Red polygon). Modeled polygons shapes and sizes (acres) are shown.

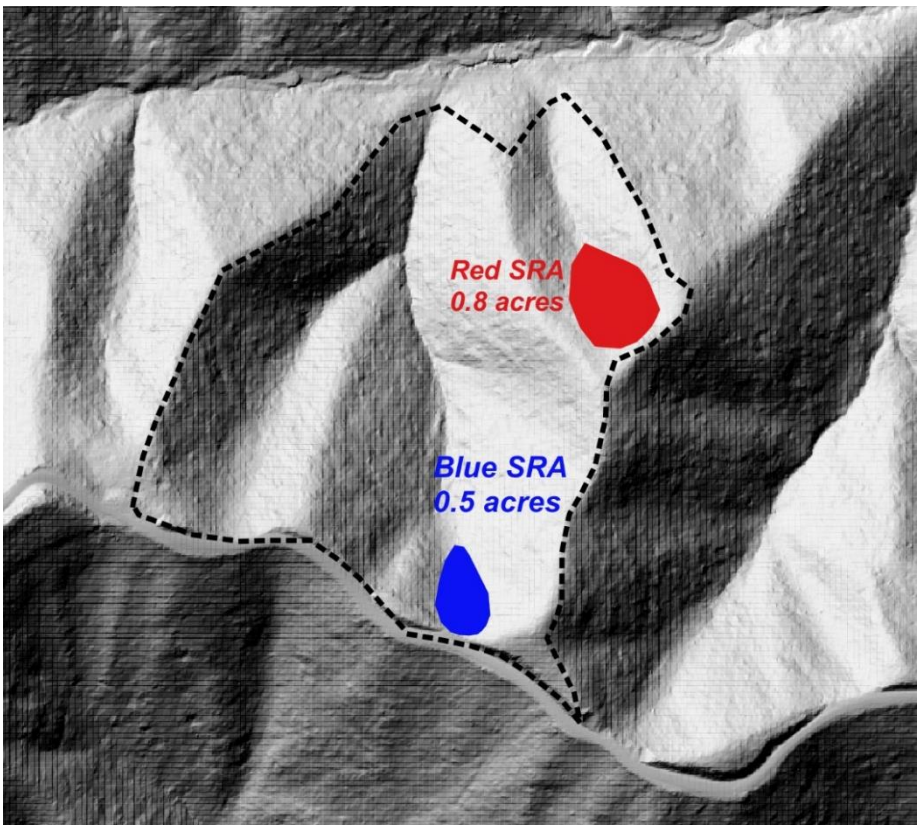

Figure 7. Selected field verified Slope Retention Areas. Priorities are Red over Blue polygons, followed by larger sized polygons over smaller. The size of the SRA as verified in the field may be larger or smaller than the modeled DSSA based on field verified headwall characteristics.

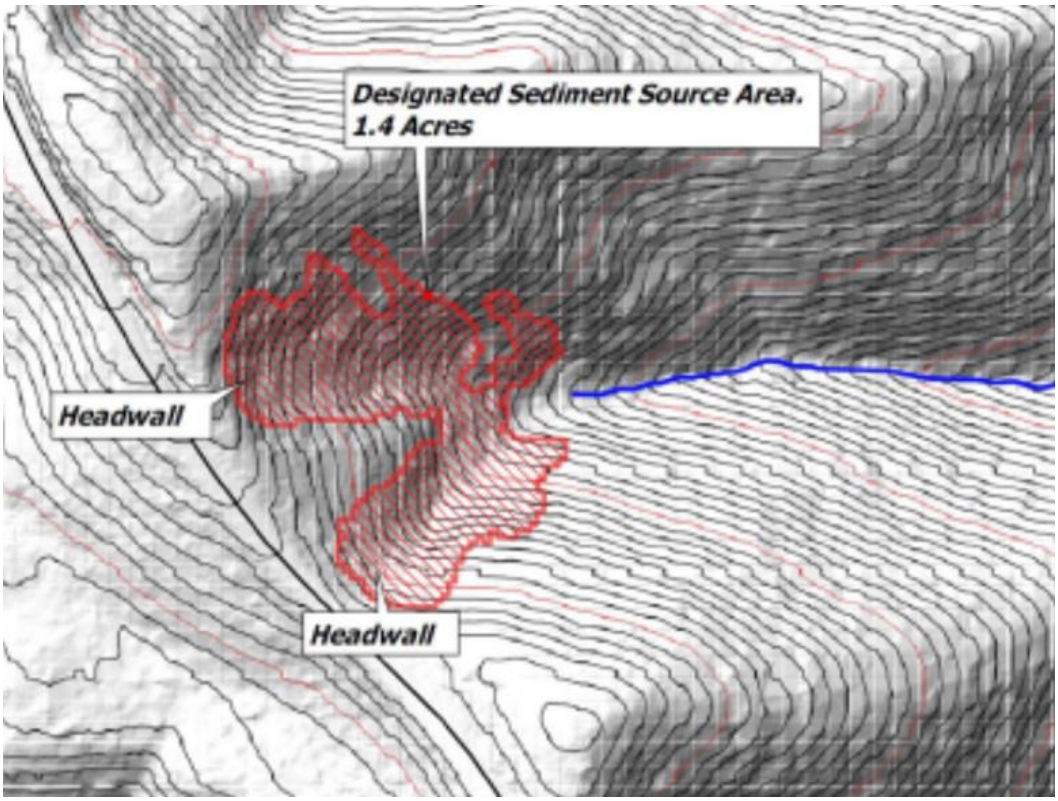

Figure 8. Modeled DSSA (red slope polygon) initially selected as SRA, 1.4 acres.

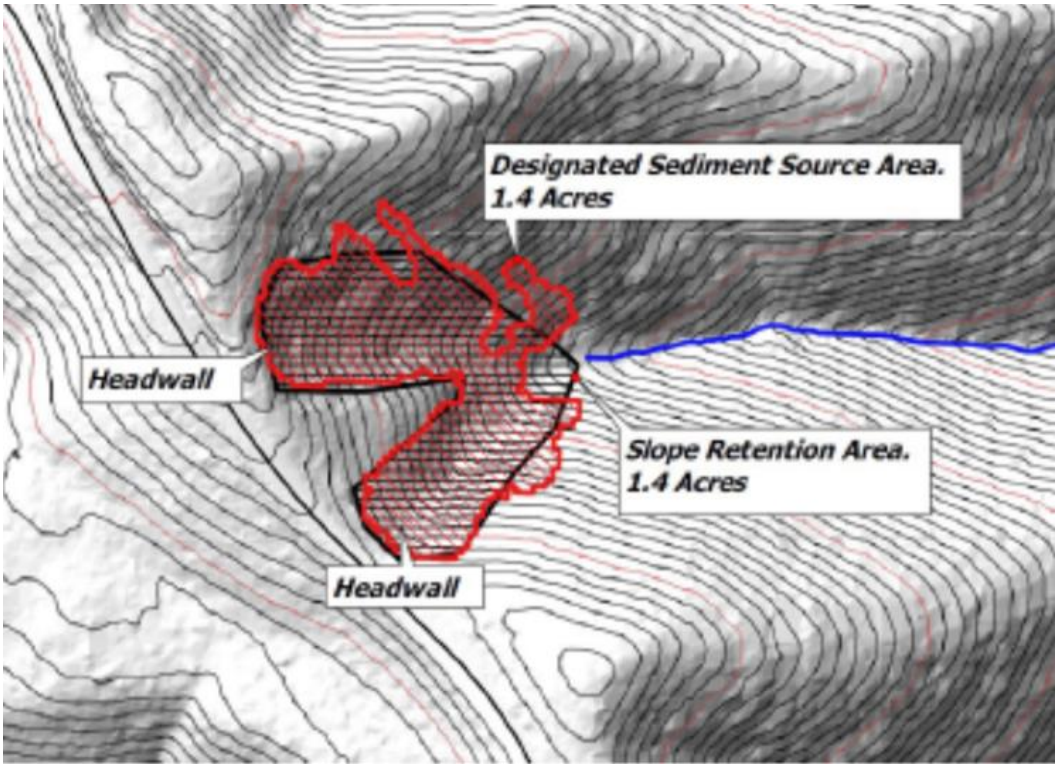

Figure 9. Final SRA field identified and flagged boundaries adjusted and smoothed, 1.4 acres.