Section VII. M.

Ecosystem Analysis, Wall Creek Analysis Area --
Site, Geology, Soil, and Forest Harvest Attributes in Relation to Sustainability of Vegetation

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Introduction

This paper addresses some physical attributes of the Wall Creek analysis area in response to questions about the relative sensitivity of the area to resource management activities, mainly ground disturbing, and about the sustainability of upland vegetation in response to timber harvesting activities and roading. As applicable, answers to these questions are followed by brief management advisories including: Level 1 heads Up (**L1HU**) -- subwatersheds whose attributes indicate extra consideration is advisable in developing suitable management strategies because of high sensitivity rating; Level 2 Heads-Up (**L2HU**) -- subwatersheds where ground-based harvest entry is more likely to increase detrimental soil conditons beyond standards and would requre post-harvest rehabilitation; Management Alert (**MA**) -- subwatersheds where existing conditions indicate the highest area (%) where past harvest has likely resulted in detrimental soil conditions that exceed standards and treatment is advised or excessive road densities should be addressed. Advisories also include general comments where management actions or projects are indicated by the conditions found.

Note that because this broad-scale analysis utilized databases containing varied degrees of ground truth, field efforts during project development are necessary to verify the conditions and locations involved.

Characterization of the Wall Analysis Area

The Wall Creek Ecosystem Analysis Area is 200.1 square miles (about 128,074 acres) of diverse natural resources within the John Day River Basin and within the North Fork John Day Sub-basin. About 74% of the area is National Forest administered by the Heppner Ranger District of the Umatilla National Forest. The analysis area is composed of 16 subwatersheds (SWS's) whose National Forest component ranges from 0 in one SWS to 100% in four SWS's (table 1, Fig. 1). The five potentially forested plant association groups (PAG's) present in the area include Juniper, Ponderosa Pine, Warm Grand Fir, Lodgepole, and Cool Grand Fir. Overall about 88% of the National Forest area supports these PAG's, and the range among subwatersheds is from 75% to 99%.

Table 1.-- Subwatershed sizes in total, amount of National Forest area, the potentially forested areas within NF, and the Soil Resources Inventory (SRI) area within the Wall Analysis Area.

Subwatershed		National Forest		Potentially Forested PAG's within NF		Soil Resource Inventory
Number	Acres	Acres	(% SWS)	Acres	(% NF)	Acres
23C	4889	0	0	-	-	-
24A	13644	5988	44	5058	84	6448
24G	6510	5695	87	4707	82	5691
24B	7366	7082	96	6893	97	7363
24C	8186	8186	100	7803	95	8177
24D	8973	3928	44	3137	80	5423
24E	9336	4439	48	4220	95	6585
24F	8258	6396	77	4772	75	7877
25A	13655	6987	51	6449	92	7049
25B	8920	8746	98	7335	84	8751
25C	4088	4036	99	3717	92	4039
26A	9048	8612	95	7422	86	8707
26B	5381	5381	100	4050	75	5376
26C	8770	8770	100	8747	99	8784
26D	7734	7734	100	6696	86	7747
26E	3314	3119	94	2983	96	3313
Total acres	128,074	Total acres	95,099	Total acres	84,024	Total 101,332

(PAG's include Juniper, Ponderosa Pine, Lodgepole, Warm Grand Fir, and Cool Grand Fir)

Site Attributes

Elevations range from a low of 2,060 feet at the confluence of Wall Creek with the North Fork John Day River at the southeast corner of the analysis area to a high of 5,707 feet at Madison Butte on the northern border near the northeast corner. Higher portions occur in the northeast, northwest and southwest corners of the area and drainage tends to be West to East and eventually mostly southerly when Wall Creek empties into the North Fork John Day River in the SE corner of the Analysis Area. Overall elevational distribution of area shows that 25% of the area is between 2,060 and 3,500 feet, 30% between 3,500 and 4,000 feet, 34% between 4,000 and 4,500 feet and 11 percent between 4,500 and 5,707 feet (reference the area above 4,000 feet, Fig. 2 and the area above 4,500 feet, Fig. 3). Only 1% is above 5,000 feet (for details, see the General attributes matrix table 9 appended at the end or this paper). None of the area supports dominantly spruce-fir vegetation associations, which is a clue to the relatively lower elevation and warmer conditions that exist in the Wall watershed compared to some areas of the Blue Mountains.

The precipitation range of 20-25 inches is most predominant and occurs across the mid-section of the Analysis Area. There is a pronounced dry period from June through mid September. (Reference the Hydrological Characteristics Report for a precipitation map and more details on weather.)

Aspects that are warmer and hotter (azmuths from 45-315 degrees) constitute 86% of the Area whereas colder aspects (315-45 degrees azmuth) constitute only 14%. Of the warmer and hotter aspects, azmuths from 45 to 135 degrees constitute 50% of the area and from 135 to 315 contstitute 36% of the area. In general, the predominance of warmer and hotter aspects increase the potential for temperature/moisture stresses in the ecosystem especially in watersheds like Wall, where there is a predominance of mid-elevations and rather limited precipitation.

Steep slopes (> =30%) are present in 18% of the Analysis Area. They are mainly associated with lower and mid-elevations (Fig. 4). The representation of steep slopes among the watersheds ranges from 1 to 31% on a SWS acres basis (also see table 10).

Geology

The analysis area is not geologically complex. About 94% of the area is composed predominantly of basic igneous rocks, such as basalts and andesites, of fairly young geologic age (Fig. 5 and table 2). The associated three geologic formations (Grande Ronde Basalt, Picture Gorge Basalt, Clastic Rocks and Andesite Flows, all three members of the Columbia River Basalt group) represent areas that are generally more stable and less subject to natural mass slope failures (landslides, debris flows, etc.). In contrast, the John Day Formation, present mostly in the northern portions of the area, contains a great deal of sedimentary rock that is less stable and more prone to mass failures. Representation of the latter formation in the subwatersheds is given in table 3 . The Soil Resources Inventory indicates natural instability associated with mass failures in only three subwatersheds. These naturally unstable areas were 47 acres or less each in SWS's 24A, 24E (only on private land), and 26C (details available in table 10). At the scale of mapping available there appears to be a strong but not unique coincident location of mass failures where the John Day Formation is located. Other elements being equal, expect more natural and accellerated erosion in both the uplands and instream where representation of the the John Day Formation are higher, i.e. SWS's 24E, 24F, 26C, and 26F. Instream sediment potential would also be higher.

The general deposition of significant amounts of volcanic ash during eruptions of Mt. Mazama (now known as Crater Lake, located in the south central Cascade Mtns. of Oregon) about 6,500 years ago has had significant influences on the hydrological and ecological attributes of the Area. Other ash depositions include very recent and older ash from Mt. St. Helens (located in south-central Washington) that contributed insignificant amounts. Subsequent wind and water action has redistributed these materials, such that the depth of volcanic ash superimposed on pre-existing soils and rock now varies from zero to 2-feet or more.

Table 2.-- Representation of geologic formations in the Wall Analysis Area

Geologic Formation Name	% of Wall WS
Grande Ronde Basalt	17
Picture Gorge Basalt	69
Clastic Rocks and Andesite Flows	8
(Subtotal areas of more stable formations)	(s.t. = 94%)
John Day Formation	6

Table 3.-- John Day Formation representation within subwatersheds of the Wall Analysis Area.

Subwatershed (SWS)	Acres	Percent of SWS area
24A	319	2
24D	177	2
24E	2344	25
24F	1106	13
24G	152	2
26C	3062	35
26F	813	24

Soil Attributes

The soils of the area have been widely and significantly influenced by the deposition of Mt. Mazama volcanic ash. Deeper ash deposits (> = 14 inches thickness) occur on 37% of the surveyed acres reported in the Umatilla NF Soil Resources Inventory (SRI; note there are more acres covered in the survey than are now in NF ownership, reference table 1). Deeper ash varies among the subwatersheds from 23 to 56% of the SRI acres surveyed. The nature of the SRI mapping units is such that groups (complexes) of soils are commonly mapped, so only an approximation of the location and extent of soils with specific properties can be mapped. An approximation of the present extent of the deeper volcanic ash occurrence is shown in Fig. 6.

Deeper soils (> 20inches) make up about 52 percent of the overall SRI acres, so deeper and more productive soils hold only a slight predominance compared to shallower soils. Deeper soils range from 33 to 82% of the SWS areas surveyed. (Note that deeper soils also include most if not all the deeper volcanic ash soils.) These are the more productive soils, since they store more moisture, generally offer greater availability of plant nutrients, and thus can potentially support more vegetation. Productivity is usually further enhanced when most of the total depth is volcanic ash. Deeper soils are those less sensitive to management activity, and they are the soils we can more likely rehabilitate when adverse impacts occur in management. The ash layer is particularly valuable because in natural or nearly natural conditions it absorbs precipitation rapidly, retains relatively large amounts of water, and readily yields a large percentage of that retained water to plants (Geist and Strickler 1978). The deeper volcanic ash soils support timber stands that are usually productive and healthy. The favorable water relations of the ash probably account for the strong association that water-demanding true firs have with these soils.

The shallower soils (< = 20 inches total depth) are important to watershed characterization since they represent areas with the shortest distance from surface to groundwater in the rock layers below. Shallower soils exist on 48% of the surveyed portions of Wall Area and the SWS's vary from 18 to 67% (approximate extent shown in Fig. 7). The very shallow soils (< = 10 inches) are the most sensitve to management disturbance and are the most difficult to rehabilitate from the standpoint of native vegetation replacement after surface disruptions have removed it. Very shallow soils represent 17% of the SRI area and range from 5 - 30% of the SWS's SRI area. Their extent has been approximated in Fig. 8. Such soils tend to be quite rocky (higher in coarse fragments) which lessens their already limited water-holding capacity on a volume basis. The shallower soils in general, and the very shallow soils in particular, were quite vulnerable to grazing damage during the peak years of sheep grazing. High numbers of sheep and cattle removed vegetation and increased the potential for accellerated erosion. Historical accounts of grazing and erosion, though not quantitative, make frequent and apparently urgent reference to numerous situations of significant soil erosion and the need to reduce and better control grazing. (Additional details about ties between erosion and historical grazing to be added when available.)

A map of the geologically-associated SRI-mapping units is appended to the end of this paper. It provides a more general view of soils in the Wall area than the published SRI maps.

Sensitivity Analysis

Question 1: How do the subwatersheds compare with respect to attributes that reflect inherent sensitivity to resource management?

To reflect the sensitivity of subwatersheds to management, especially ground disturbing activities four key attributes were chosen: deeper volcanic ash, very shallow soils, steep slopes, and potential for increasing mass failures through human activity. The values and ratings of these attributes are shown in table 4 and in the general attributes table 10.

Higher elevation areas could also be considered a sensitivity attribute but these areas are essentially lacking in the Wall ecosystem.

Table 4. – Resource attributes selected to compare sensitivity of the Wall subwatersheds.

SWS No.	Ash Soils (>= 14 inches)		Very Shallow Soils (<=10 inches)		Steep slopes: (>=30%)		Potential Incr. Mass Failure from hum. activ.		Relative Sensitivity
(basis)	% SRI	Score	% SRI	Score	% SWS	Score	% SRI	Score	---
23C	N/A	--	N/A	--	21	2	N/A	--	N/A
24A	34	2	22	2	31	2	18	2	Higher
24G	41	1	15	2	19	1	3	1	Moderate
24B	38	2	9	1	30	2	6	1	Moderate
24C	52	1	8	1	13	1	2	1	Lower
24D	54	1	10	1	1	1	1	1	Lower
24E	56	1	5	1	3	1	3	1	Lower
24F	29	2	22	2	28	2	10	1	Higher
25A	33	2	21	2	24	2	3	1	Higher
25B	35	2	27	3	11	1	2	1	Moderate +
25C	29	2	18	2	5	1	3	1	Moderate
26A	23	2	30	3	28	2	8	1	Higher
26B	25	2	23	2	9	1	1	1	Moderate
26C	43	1	7	1	14	1	16	2	Lower +
26D	34	2	12	2	15	1	2	1	Moderate
26F	28	2	15	2	4	1	2	1	Moderate

The sensitivity analysis considered attributes in combination and revealed four subwatersheds of higher concern, because they had lower area of deeper ash, greater area of steep slopes, and greater area of very shallow soils. Seven SWS's were moderate and four were lower in sensitivity. There were higher percentages of potential mass failure areas in SWS 24A-Lower Big Wall Cr., and 26C-Alder/Upper Skookum Cr. (Fig. 9). The mass failure values are notable, but they are not a sizable influence on overall sensitivity, because their respective areas are not particularly large. Further, there is little record of mass failures related to management in those areas, and no new roading is contemplated.

A simplified summary indicating the ratings of subwatershed sensitivities, accompanied by management advisories, is provided in table 5.

Table 5.– Summary of subwatershed sensitivities and associated management advisories.

Sensitivity	SWS's	Management Advisory Notes
Higher	24A, 24F, 25A, 26A	**LIHU** - applies to all four SWS's. Special grazing management attention, shallow soil rehabilitation and stream stability appear more important in these SWS's. Coordinate with botany and range
Medium	24G, 24B, 25B, 25C, 26B, 26D, 26F	Shallow soil rehab need appears high in SWS's 25B and 26B, coordinate with botany and range
Lower	24C, 24D, 24E, 26C	SWS's 24C, D, & E appear to have the best basic attributes for long-term timber management.

Sensitivity Summary:

Restating: **Question 1:** How do the subwatersheds compare with respect to attributes that reflect inherent sensitivity to resource management?

Answer to Question 1 – Notable differences in subwatershed sensitivity were indicated by the combinations of attributes: four subwatersheds were rated in the higher sensitivity group (SWS's 24A, 24F, 25A, 26A.), seven SWS's rated medium and four were rated low. Of the latter four SWS's 24C, 24D and 24E appeared best suited to long-term timber management.

Harvest/Timber Sale Attributes

This paper addresses ecosystem sustainability from the standpoint of sustained productivity of upland vegetation. Harvest and roadbuilding impacts that exceed adopted standards for detrimental soil conditions and road density are deemed to have reduced sustainability.

Forest harvest is often the most significant management-imposed change in the near-term history of an ecosystem. The magnitude of the change depends on the silvicultural prescription and the timetable over which it is carried out. It is commonly necessary to generalize at the ecosystem analysis scale, so site specific effects of harvest are masked. Differences in record-keeping and management approaches may be blurred with the construction of long-term scenarios. Such was the case with harvest information in the Wall analysis area. Thus users must be mindful of the necessity to field verify conditions in developing site specific operations.

Harvest information for the analysis area was available over the period 1937 to 1995, but only the period from 1987 to1995 included location-specific prescriptions. The earlier information had general prescriptions for relatively large areas over rather long time periods. Further, it is known that in earlier years, a single harvest was not necessarily equivalent to a single entry. In light of this, reference is made to timber sales rather than entries. Note also that each timber sale has been treated as all ground-based and all equal in effect.

Ground-based timber harvest can impose detrimental impacts on soils that results in lost productivity. Typically, the more sale activity the greater the total detrimental impact, most of which is soil compaction. The procedures used to quantitatively estimate the potential amount of detrimental soil compaction is described below under the Methods.

In general, the greater the road milage the higer the potential loss in upland vegetation productivity. Roads intercept and divert water from normal movement below the soil surface to surface water movement. This adds to the potential for surface soil erosion, reduces moisture availability that already limits plant growth, and potentially accellerates the routing of water, along with suspended sediment, to streams. These are undesireable impacts to be minimized.

Likely typical of the Blue Mountains in general, the harvest history in the Wall analysis area indicates a high proportion of the NF acres have been affected by timber sale activity. Nine of the SWS's had sale activity recorded for more than 3/4 of the NF area, two SWS's had 52-56% of the NF area affected, and four had 21-44% NF area affected. Since there is no NF area in SWS 23C there was no data available for harvest reporting. Timber sale influences overall and ranges among watersheds is provided in table 6. The harvest databases show that overall, about 65% if the Wall NF area involved one or more timber sales (Fig. 10), 19% involved two or more sales (Fig.11), and 46% involved only one timber sale (Fig. 12). Additional harvest information is provided in the general attributes matrix (table 10). The data in table 10 have been expressed in a variety of ways to suit reference for varied purposes.

Table 6.-- Summary statistics on Wall Area timber sales.

Harvest Info. Category	% of the watershed	% of the NF area	SWS Ranges in NF %
>= 1 Timber sale	48	65	21 - 99
>= 2 Timber sales	14	19	2 - 74
Only 1 Timber sale	34	46	17 - 90

Question 2: How do subwatersheds compare with respect to harvest and constructed road influences on sustainability of upland vegetation?

Three attributes were chosen to reflect the sustainable status of subwatershed upland vegetation: 1. the area (%) with only one timber sale, 2. the area total (%) potential detrimental soil conditions, and 3. the total road density. Values and ratings of the three are shown below (table 7 and the general attributes table 10). The level of concern for sustainability was again based on the combination of attribute values.

Currently existing potential detrimental soil conditons averaged 15% of the NF area overall, and subwatersheds ranged from 4 to 32% (refer to table 9 for details). It would be desireable to alleviate essentially all detrimental conditions, but obviouisy some areas should take priority and they are specified below.

Total road densities varied form 0.9 to 4.0. Only two SWS's had road densities of 2 mi/mi2 or less. Road closure should be considered when densities exceed 2.0. A **MA** has been indicated for those SWS's with values of 3.5 or above.

Reforestation information from the Heppner District indicates there are serious problems with both natural and artificial regeneration. This is likely the case in the Wall ecosystem given indications that it is located in a highly stress-prone setting. It is likely the negative impacts on soils associated with high levels of past harvest, described further below, are reducing reforestation success. Reforestation data unique to the Wall area is not available.

Table 7.— Resource attributes used to summarize management influences on sustainability of upland vegetation.

SWS No.	Hrvst =1 only Sale (%)		Total potential detr. soil Condiions (%)		Total Road density (mi/mi2)		Sustainability Concern
(basis)	(%NF)	Score	(%NF)	Score	(%NF)	Score	—
23C	N/A	—	N/A	—	N/A	—	N/A
24A	19	1	4	1	0.9	1	Lower
24G	86	3	18	2	3.3	2	Medium +
24B	90	3	14	1	3.8	2	Medium +
24C	83	3	15	1	3.7	2	Medium +
24D	28	2	27	2	3.1	2	Medium +
24E	51	3	17	2	3.5	2	Medium
24F	79	3	20	2	2.9	2	Medium +

SWS No.	Hrvst = 1 only Sale (%)		Total potential detr. soil Condtions (%)		Total Road density (mi/mi2)		Sustainability Concern
25A	33	2	14	1	2	1	Lower
25B	17	1	32	3	3.4	2	Higher -
25C	56	3	18	2	3.3	2	Medium
26A	18	1	5	1	1.9	1	Lower
26B	40	2	8	1	4	2+	Medium -
26C	26	2	5	1	2.1	2	Lower
26D	48	2	9	1	2.8	2	Lower +
26F	21	1	26	2	2.7	2	Medium

The simplified listing of SWS's by levels of concern are provided below in table 8.

Table 8.-- Subwatershed Summary of Sustainability Concern

Concern Level	Subwatershed Number	Management Advisory Notes
Higher	25B	MA; Highest potential treatable acres by a factor of 2 (table 10)
Medium	24B, 24C, 24D, 24E, 24F, 24G, 25C, 26B, 26F	L2HU applies to four SWS's that had over 3/4 of their area in the one-only timber sale category: 24B, 24C; 24F, 24G
Lower	24A, 25A, 26A, 26C, 26D	N/A

L2HU applies to SWS's highlighted in Fig.13.
MA for soil compaction applies to SWS's 24D and 26F as well as 25B, although applicable to much less area than in 25B (Fig. 14 and table 10).
MA applies to SWS's 24B, 24C, 24E, and 26B that have the highest road densities (> =3.5).

Restating: **Question 2**: How do subwatersheds compare with respect to harvest and constructed road influences on sustainability of upland vegetation?

Answer to Question 2: SWS 25 is the one standout among subwatersheds regarding sustainability problems and is the only one rated in the higher category. There is need for sustainability attention to several other SWS's, based mainly on detrimental soil conditions and excessive road densities. Only five of the SWS's were judged to be in the lower concern category, so there is considerable subwatershed area of medium and higher concern.

Final judgement among subwatersheds re: degree of concern, priorities for treatment, and implications on the ecosystem functions/processes resides in the blending of all sustainability attributes in the overall matrix synthesis, conducted interactively with all team members, for each issue and among issues to blend information for the entire Wall Analysis Area. The results of that information-integration process will be found in the Synthesis Report for the Wall Analysis Area.

Potential Projects

-- Road rehabilitation priorities are higher for SWS's 24B, 24C, 24E and 26B

-- Increase subsoiling to reduce soil compaction, aid hydrologic function, and improve establishment and growth of tree regeneration (SWS 25B highest priority, followed by SWS's 24D, and 26F). Figure 15 is a broad guide to locations where 40% is likely detrimentally compacted and need treatment, and soils generally meet criteria for acceptable results. On site verification of conditions is necessary and monitoring of results is desireable. The on-site review of compacted conditions should look for slope limitations and other possible logistical limitations.

-- Shallow soil revegetation/rehabilitation needed (coordinate w/ botany and range) SWS's 24A, 24F, 25A, 26A, 26B

-- Investigate opportunities to subsoil in feller-buncher logged lodgepole areas; there are likely opportunities to remove compaction and improve tree growth, plus there may be a double opportunity to improve growth if mechanical thinning is compatible with ground conditions.

Monitoring

-- To help define temperature potentials -- There is limited data available on groundwater (springs) temperature; Heppner District has a good strart on such monitoring and those efforts should be continued and expanded, even to get supplemental point-in-time observations at critical dates of the hydrologic timetable. (SWS's with higher groundwater temperatures will be harder to keep below the guidelines for fish-bearing waters.)

-- Increase monitoring to strengthen the knowledge of the level of benefits to tress and other monitored elements (the broader the better).

-- Monitoring the effects of prescribed landscape burning should include changes in composition of ground cover vegetation and the amount of soil erosion cover - stratify monitoring efforts by PAG's - (coordinate with soils, botany and range)

Methods

Past monitoring of ground-based logging indicates that on the average about 15% of 1-only timber sale acres and about 40% of 2 or more timber sale acres are detrimentally compacted. The sums of areas arising from the two mutiplications of percentages make up the **total potential detrimentally compacted** areas.

Areas that are more likely to exceed standards and occur in treatable configurations in the field are mainly in the area with >= 2 timber sales. Therefore the **potentially subsoilable area** queries and calculations involved only the area having 2 or more timber sales and including only the soils within that harvest area are that had a total depth of >=16 inches and with <= 35% coarse fragments. The resulting area was then multiplied by 40%.

Mapped estimates of location or extent are approximate because of the nature of mapping units mentioned above. Map unit complexes were included in the mapped area when soil characteristics met the depth and coarse fragment limits noted above for the primary soil member regardless of amount its representation in the complex (usually 40% or more); secondary complex members, however, had to meet depth and coarse fragment criteria and make up 30% or more of the complex. **The mapped location (Fig. 15) is less accurate than the tabled numbers (tables 8 and 10). Only about 40% of the mapped area indicated would be detrimentally compacted.

Table 9.-- Area percentages or miles associated with scores and importance weight assigned to subwatershed (SWS) attributes in susceptability, sustainability and final (team) integration matrix tables.

Attribute	Score = 1	Score = 2	Score = 3	Notes	Weight
Deeper volcanic ash	41+%	21 - 40%	0 - 20%	>= 14 inches, % SRI acres	H
Very shallow soil	0 - 10%	11 -24%	25+%	% SRI acres, <= 10 in.	H
Steep slopes	0-20%	21-40%	41+%	% total SWS, >=30%	M
Pot. for mass failure incrs. with mgmt.	0 -15%	16 - 30%	31+%	% SRI acres	M
Total road density	0-2.0 mi/mi2	2.1-4.0 mi/mi2	4.1+ mi/mi2	closed and open NF roads	M
Only 1 Tmbr. Sale	0 - 25%	26 - 50%	51+%	% NF	M
Tot. Det Compactn.	0 - 15%	16 - 30%	31+%	% NF	H

Literature Cited

Geist, J. Michael, and Gerald S. Strickler. 1978. Physical and chemical properties of some Blue Mountain Soils in Northeast Oregon. USDA Forest Service Research Paper PNW-236. Pacific Northwest Forest and Range Experiment Station, Forest Service, US Department of Agriculture. 19p.

Table 10.-- General Attributes Matrix for the Wall Watershed -- Area Distributions in acres by elevational zones in the Wall Analysis Area (M=1000)

SWS No.	El. 3.0-3.5M	El. 3.5-4.0M	El. 4.0-4.5M	El. 4.5-5.0M	El. >= 4M	El. >= 4.5M	El. >= 5M	HSN El 4M+
(basis)	(SWS)	(SWS)	(SWS)	(SWS)	(SWS)	(SWS)	(SWS)	(SWS)
23C	1667	337	0	0	0	0	0	0
24A	5092	3246	890	195	1085	195	0	3172
24G	2190	2690	1184	0	1184	0	0	1052
24B	1618	2656	2307	702	3009	702	0	6919
24C	722	35549	3915	0	3915	0	0	5196
24D	0	738	5515	2720	8235	2720	0	1001
24E	0	2609	6402	325	6727	325	0	3374
24F	1768	3022	3393	0	3393	0	0	1882
25A	4423	4544	2012	0	2012	0	0	691
25B	617	2596	5706	0	5706	0	0	681
25C	668	2813	606	0	606	0	0	0
26A	1901	5627	988	0	988	0	0	20
26B	320	1488	3082	491	3573	491	0	170
26C	0	597	3470	3861	8173	4703	842	7078
26D	553	1216	1453	3962	5965	4512	550	2543
26F	0	516	2399	361	2798	399	38	161

Table 10.-- General Attributes Matrix for the Wall Watershed (continued) -- Geology, Site Attributes, Soils and Road Density

SWS No.	Geol. J.Day Formation	Deeper Ash	Very Shallow Soils	>=30 % slope	Natural Instblty.	Instby + by human activities	Total Road Den.sity
(basis)	(%SWS)	(%SRI)	(%SRI)	(%SWS)	(%SRI)	(%SRI)	NF mi/mi2
23C	0	N/A	N/A	21	N/A	N/A	N/A
24A	2	34	22	31	47	18	0.9
24G	2	41	15	19	0	3	3.3
24B	0	38	9	30	0	6	3.8
24C	0	52	8	13	0	2	3.7
24D	2	54	10	1	0	1	3.1
24E	25	56	5	3	23 (pvt)	3	3.5
24F	13	29	22	28	0	10	2.9
25A	0	33	21	24	0	3	2.0
25B	0	35	27	11	0	2	3.4
25C	0	29	18	5	0	3	3.3
26A	0	23	30	28	0	8	1.9
26B	0	25	23	9	0	1	4.0
26C	35	43	7	14	21	16	2.1
26D	0	34	12	15	0	2	2.8
26F	24	28	15	4	0	2	2.7

Table 10.-- General Attributes Matrix for the Wall Watershed (Continued) --Wall Analysis Area Harvest information relative to NF and only Forested NF

SWS No.	NF acres	Potenl. For NF PAG's	Hrvst > = 1 Sales	Hrvst > = 1 Sales	Hrvst > = 1 Sales	Hrvst = 1 only Sale	Hrvst = 1 only Sale
(basis)	(NF acres)	(acres)	(NF acres)	(%NF)	(%Potentl. frstd. NF)	(NF acres)	(%NF)
23C	–	–	–	--	–	–	–
24A	5988	5058	1254	21	25	1131	19
24G	5695	4707	5687	99	100+	4917	86
24B	7082	6893	6541	92	95	6398	90
24C	8186	7803	7260	89	93	6827	83
24D	3928	3137	3378	86	100+	1096	28
24E	4439	4220	3351	76	79	2261	51
24F	6396	4772	6358	99	100+	5072	79
25A	6987	6449	3926	56	61	2319	33
25B	8746	7335	7989	91	100+	1517	17
25C	4036	3717	3173	79	85	2248	56
26A	8612	7422	1971	23	27	1533	18
26B	5381	4050	2356	44	58	2145	40
26C	8770	8747	2619	30	30	2314	26
26D	7734	6696	4012	52	60	3740	48
26F	3119	2983	2475	79	83	656	21

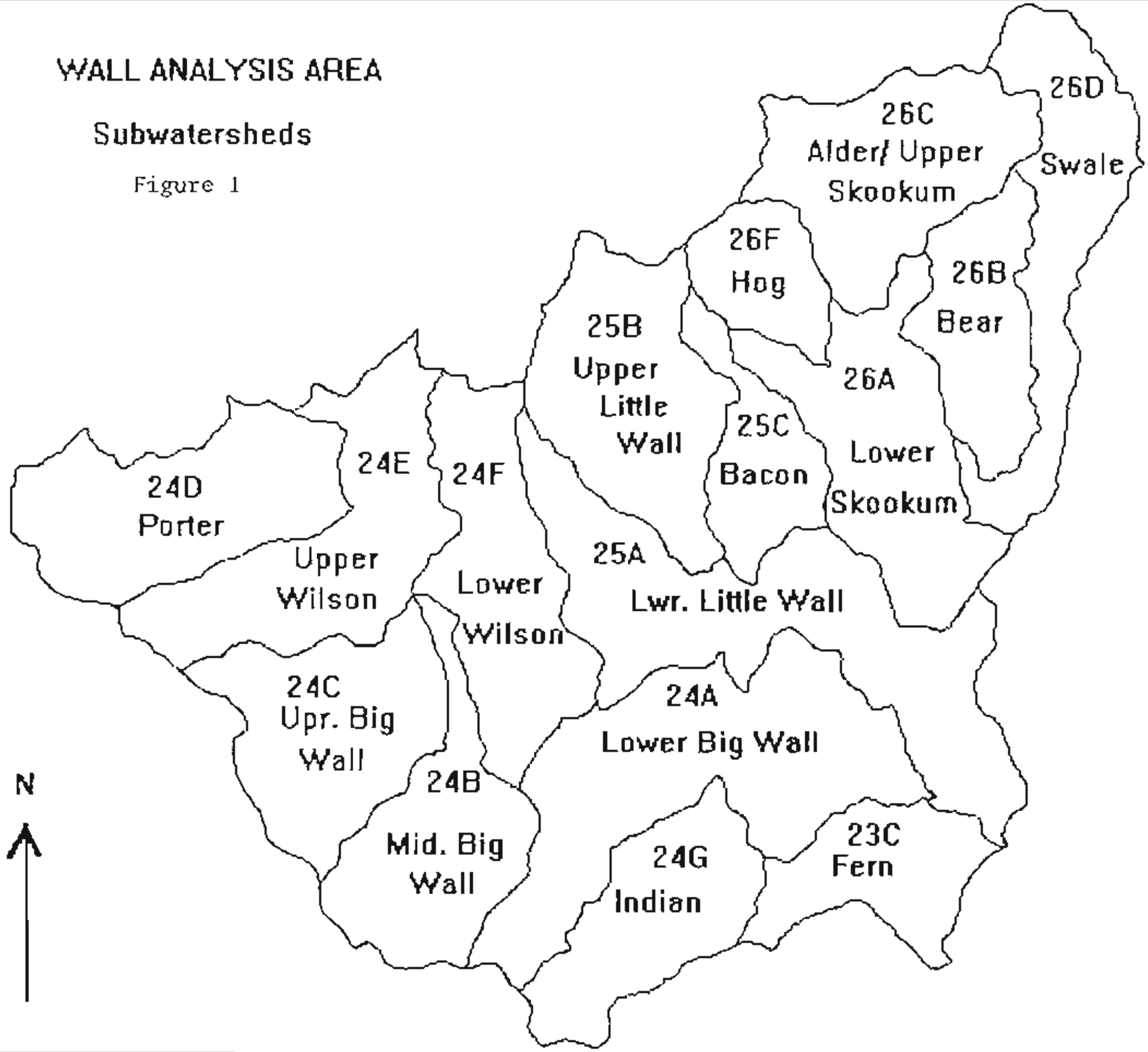
Table 10.-- General Attributes Matrix for the Wall Watershed (Continued) -- Harvest, detrimental soil conditions (principally compaction), stimated area treatable for compaction by proper subsoiling, and area already treated.

SWS No.	Harvst >=1 Sales	Hvst >=2 Sales	Hvst>= 2 Sales	Hvst >=3 Sales	Tot pot. det. soil Cndtns	Trtable. det. soil 2+ Entrs.	Already Trtd det cmp
(basis)	(%NF)	(%NF)	(NF acres)	(%NF)	(%NF)	(NF acres)	(NF acres)
23C	N/A	N/A	N/A	N/A	N/A	N/A	N/A
24A	21	2	123	0	4	46	4
24G	99	14	770	0	18	265	0
24B	92	2	143	0	14	56	93
24C	89	5	433	0	15	134	0
24D	86	58	2282	15	27	694	34
24E	76	25	1090	2	17	344	0
24F	99	20	1286	1	20	320	0
25A	56	23	1607	0	14	566	0
25B	91	74	6472	20	32	1368	0
25C	79	23	925	2	18	158	0
26A	23	5	438	0	5	92	0
26B	44	4	211	<1	8	40	0
26C	30	3	305	<1	5	116	21
26D	52	4	272	0	9	108	56
26F	79	58	1819	<1	26	413	0

WALL ANALYSIS AREA

Subwatersheds

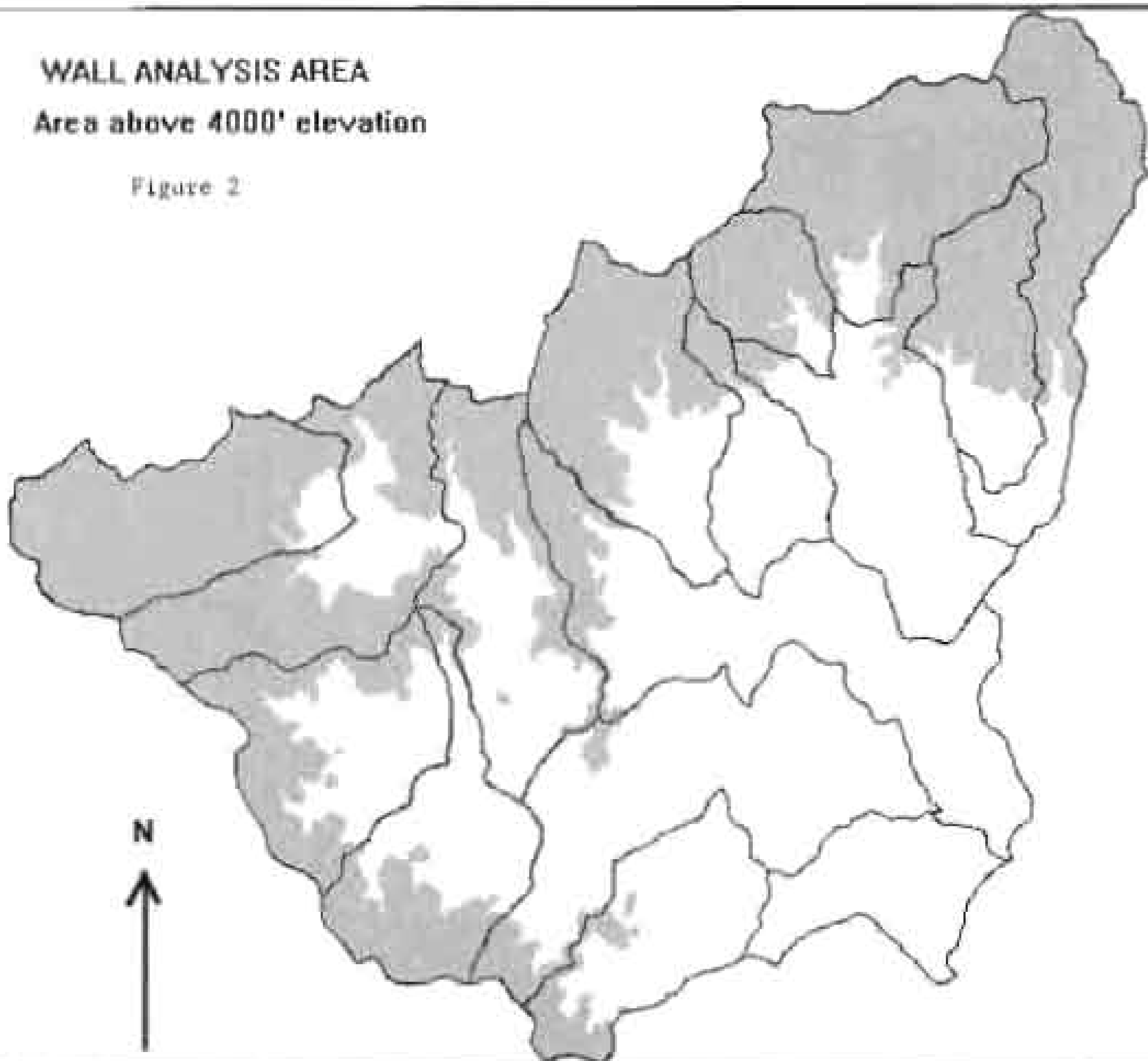
Figure 1

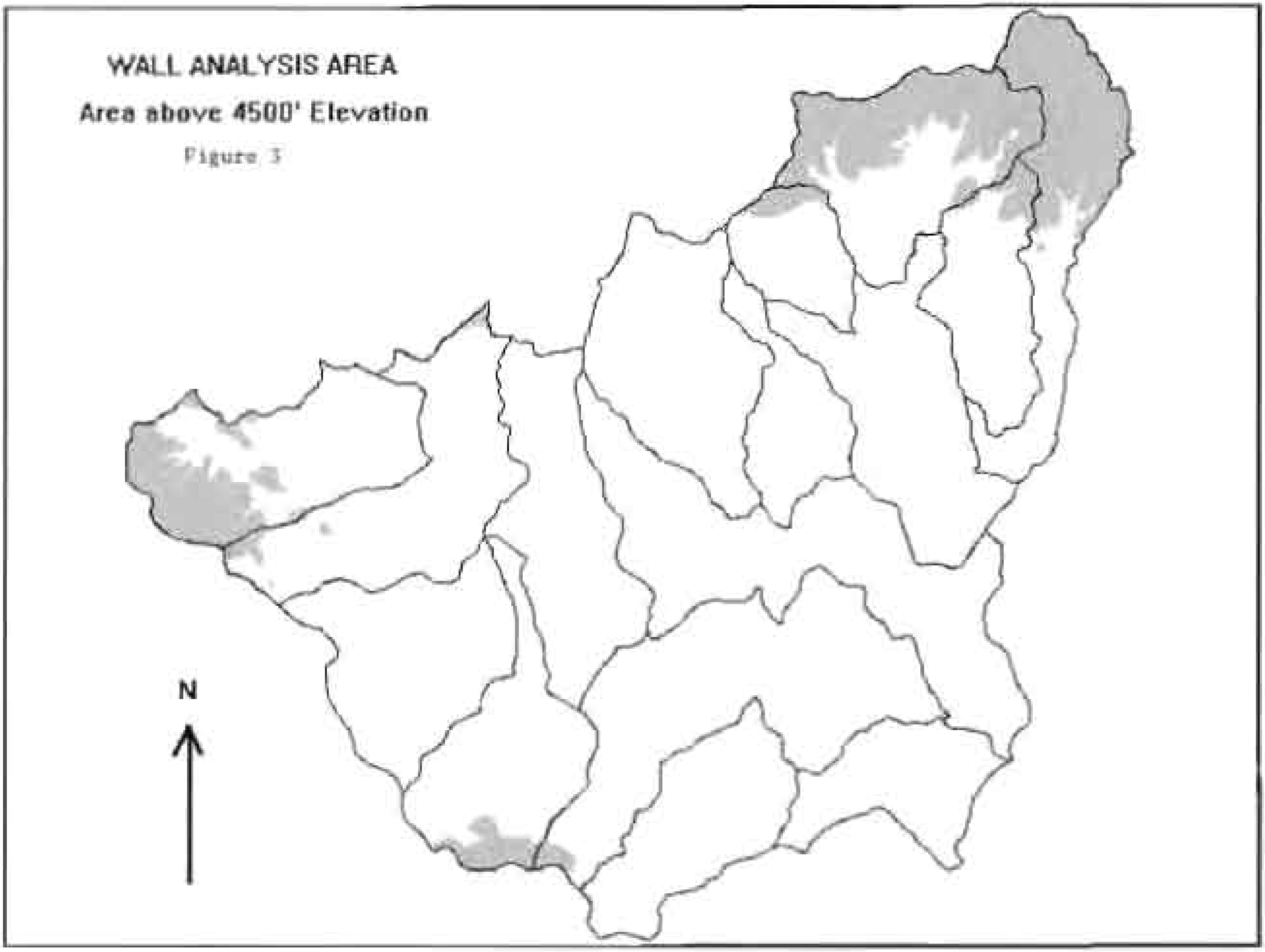


WALL ANALYSIS AREA

Area above 4000' elevation

Figure 2

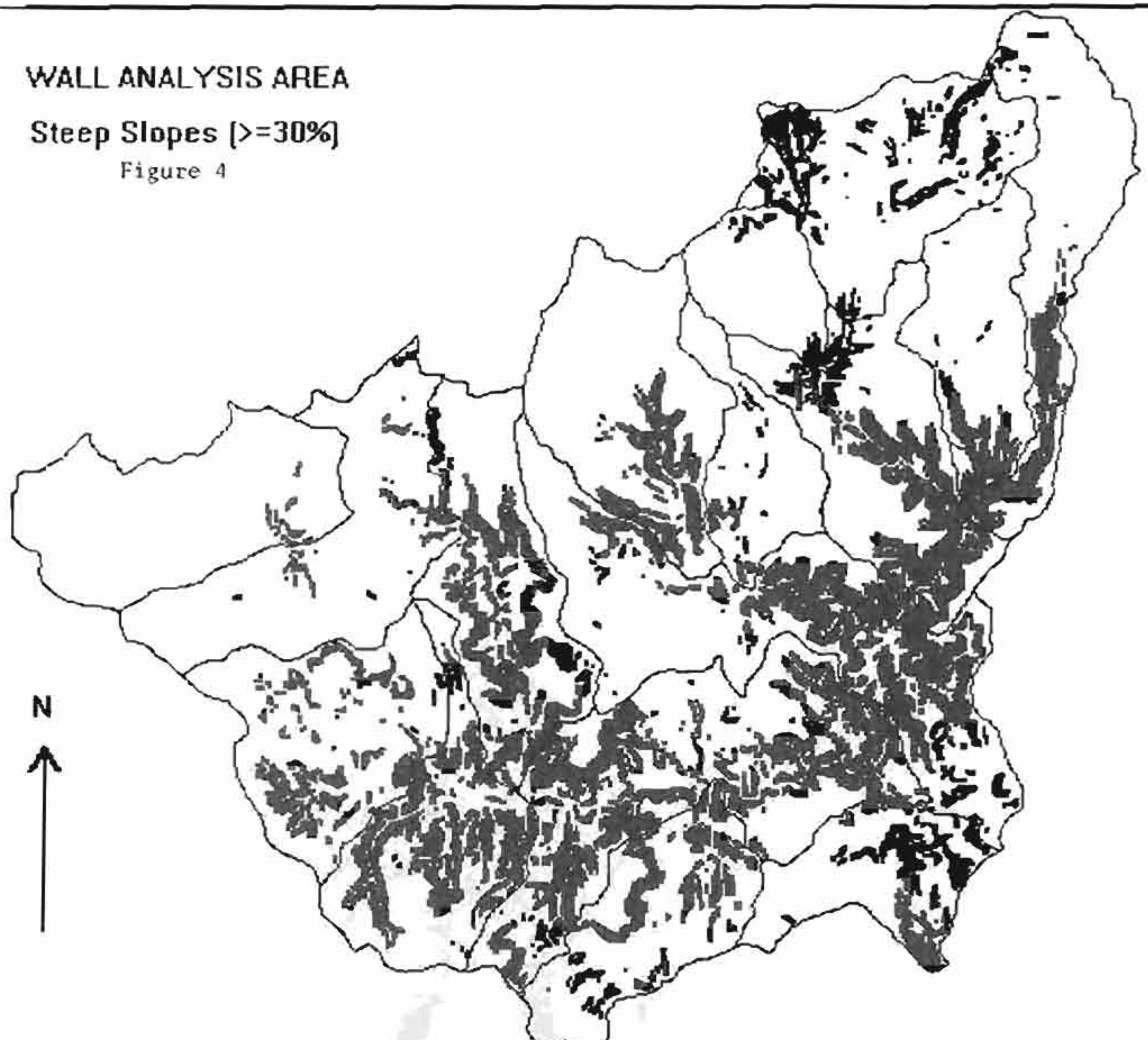


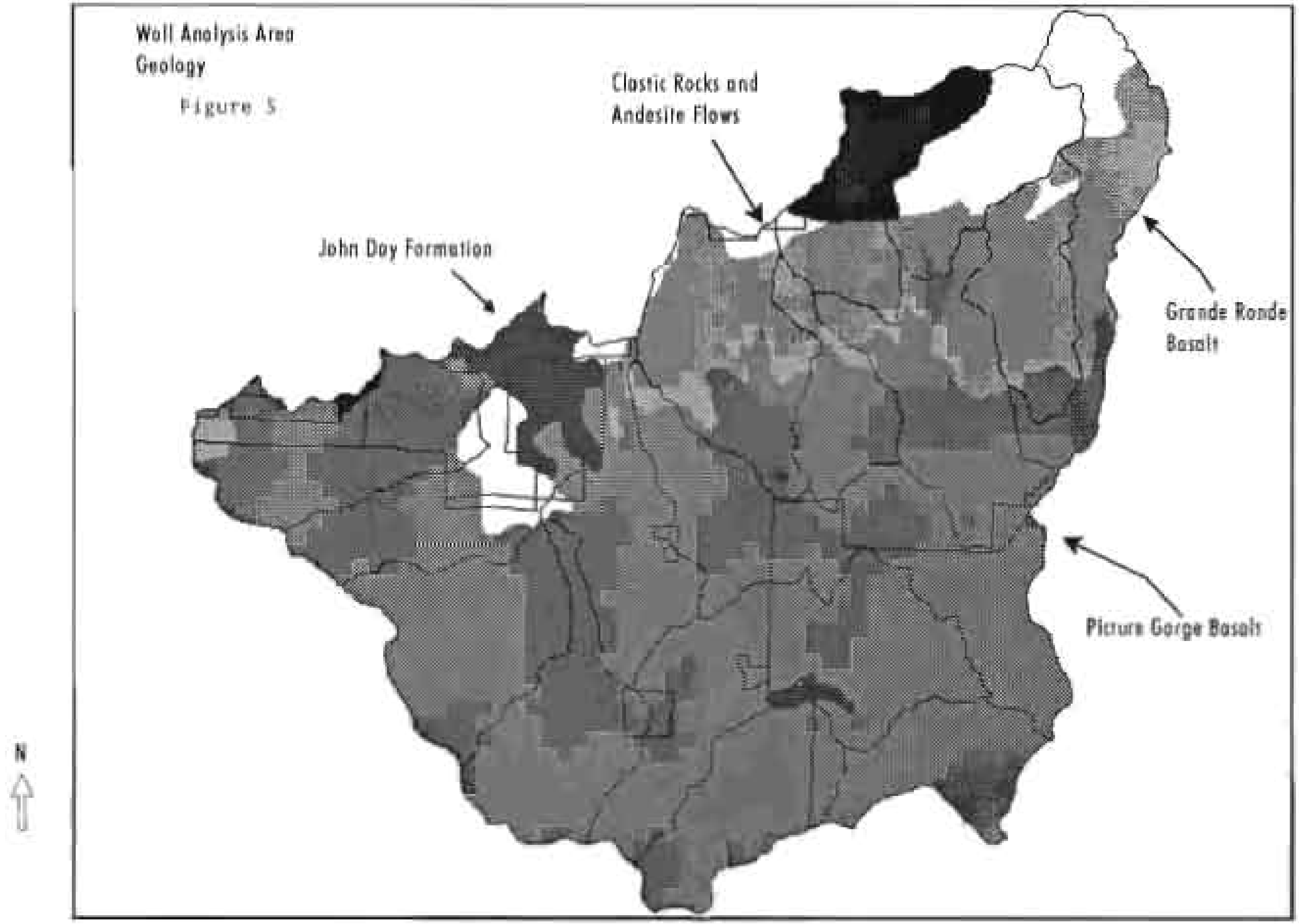

WALL ANALYSIS AREA
Area above 4500' Elevation
Figure 3
N

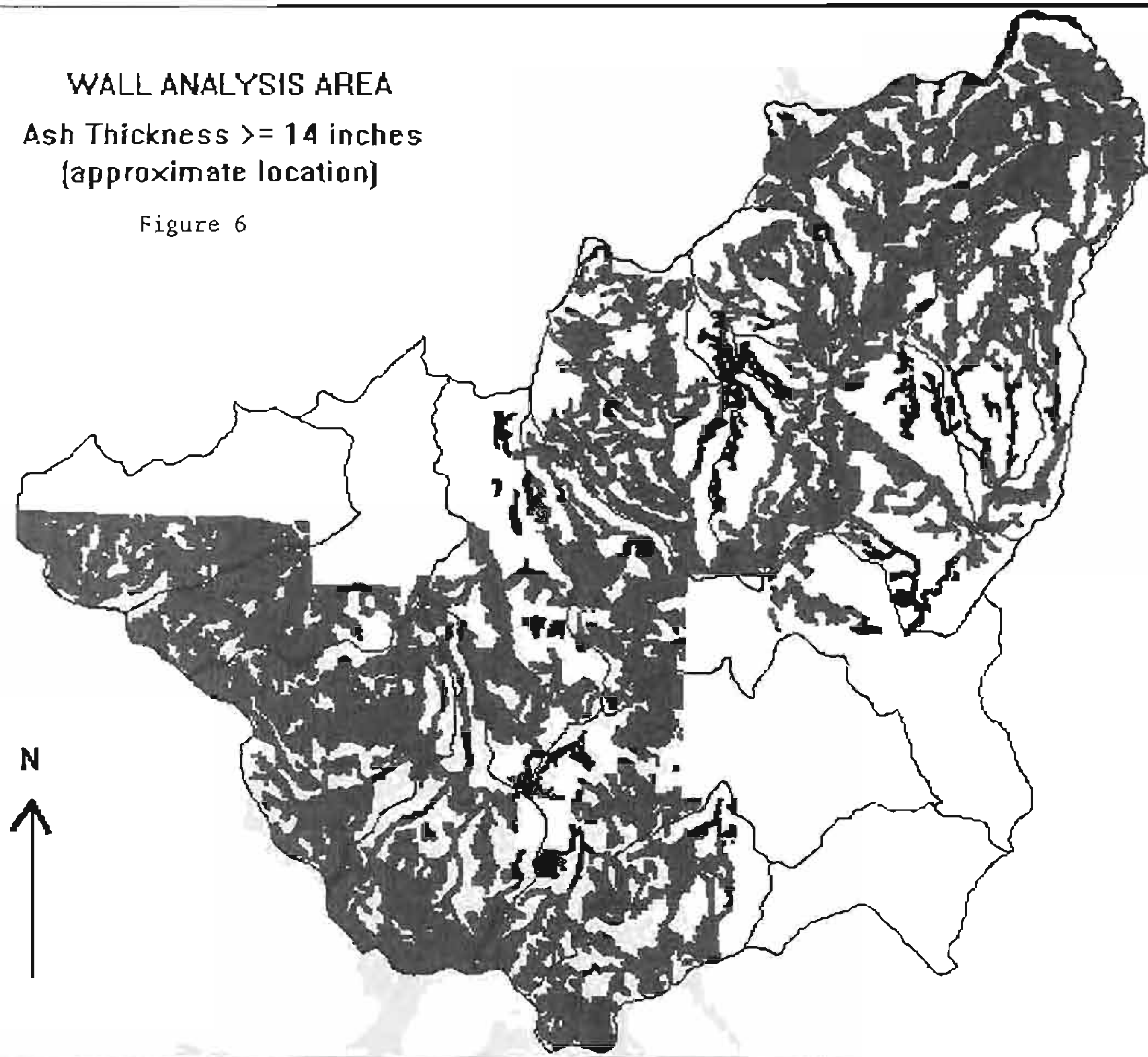
WALL ANALYSIS AREA

Steep Slopes (>=30%)

Figure 4




Well Analysis Area
Geology
Figure 5
Clastic Rocks and
Andesite Flows
John Day Formation
Grande Ronde
Basalt
Picture Gorge Basalt
N



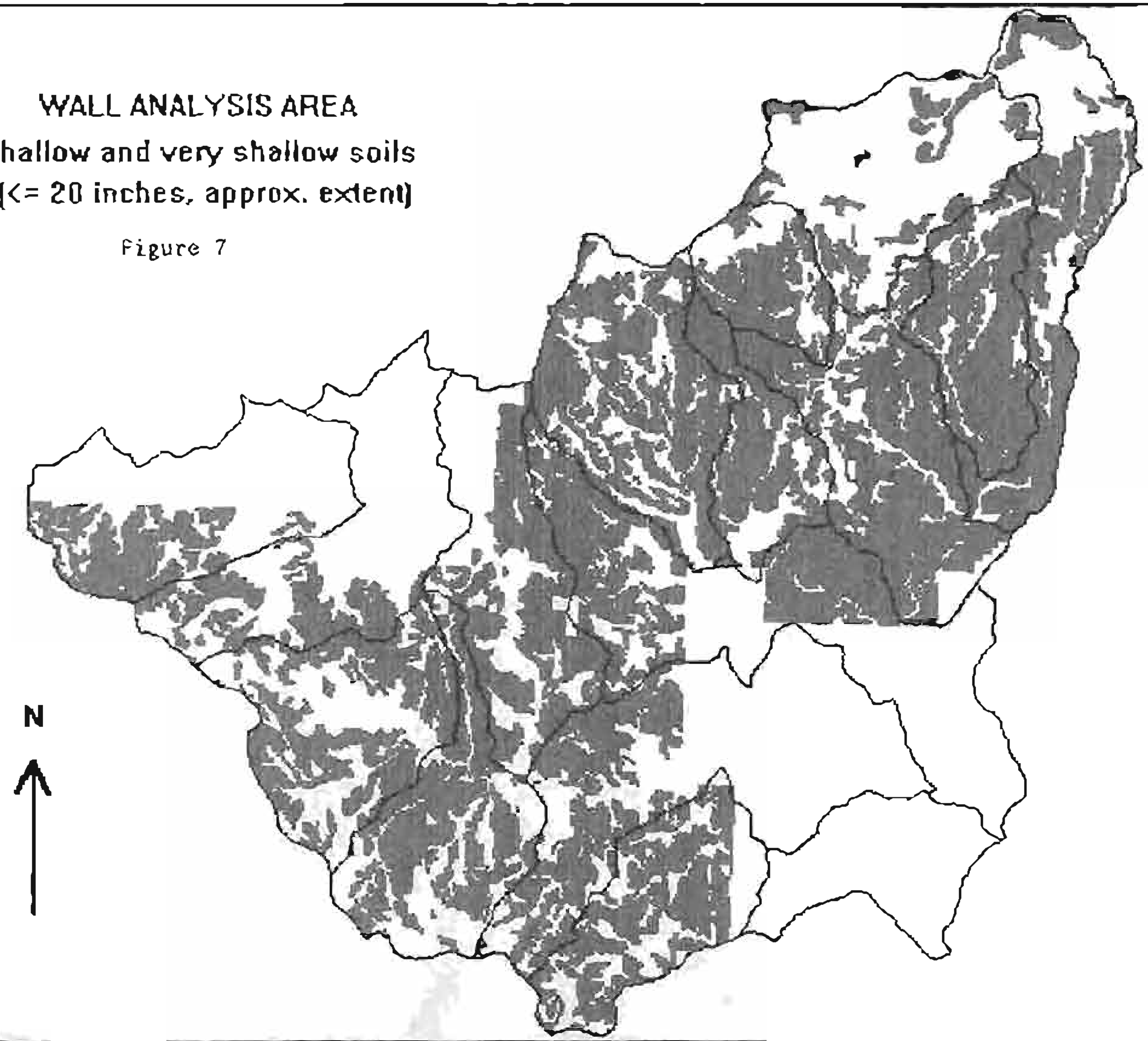
WALL ANALYSIS AREA

Ash Thickness >= 14 inches
(approximate location)

Figure 6

WALL ANALYSIS AREA
Shallow and very shallow soils
(<= 20 inches, approx. extent)

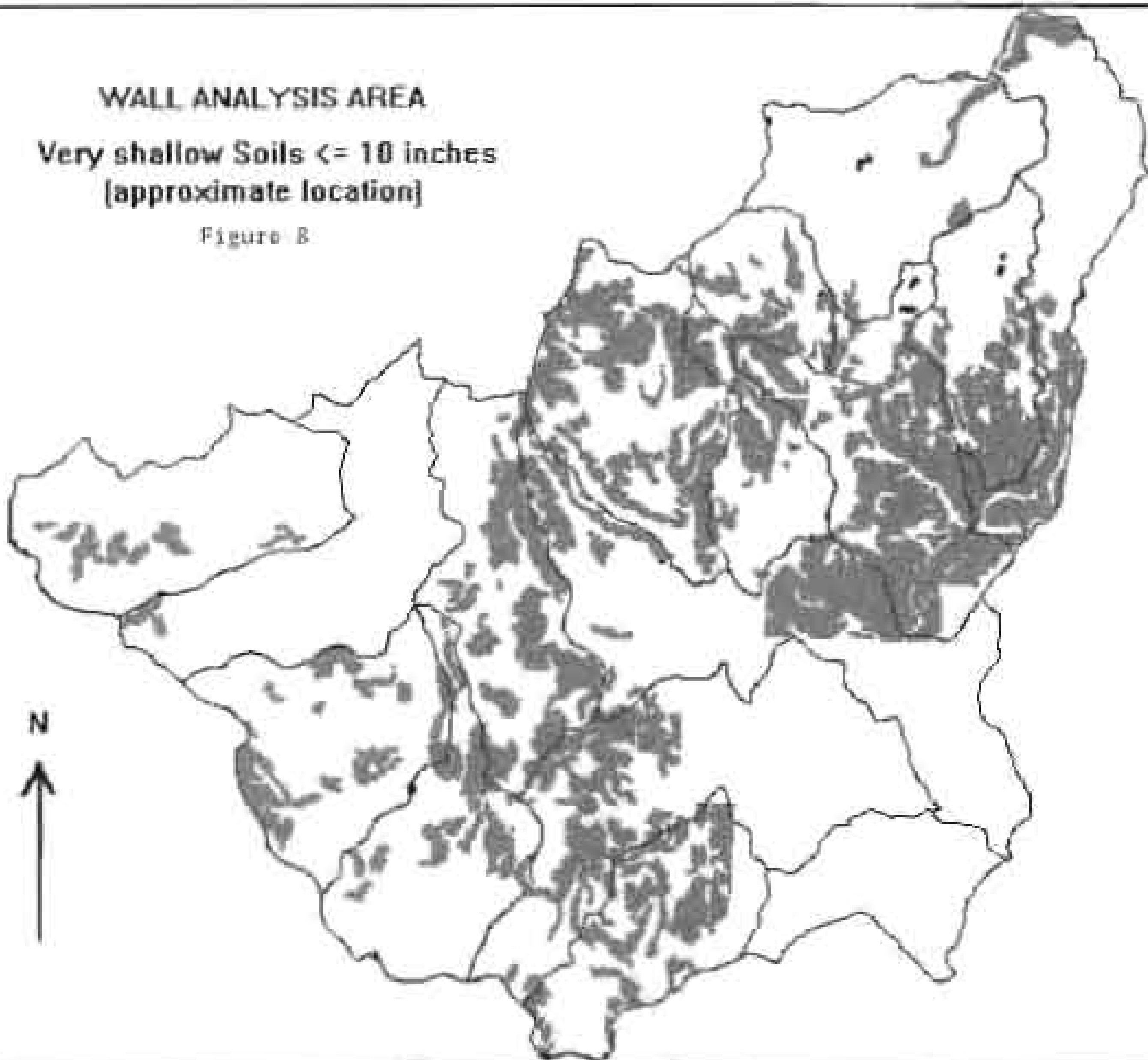
Figure 7



WALL ANALYSIS AREA

Very shallow Soils <= 10 inches
(approximate location)

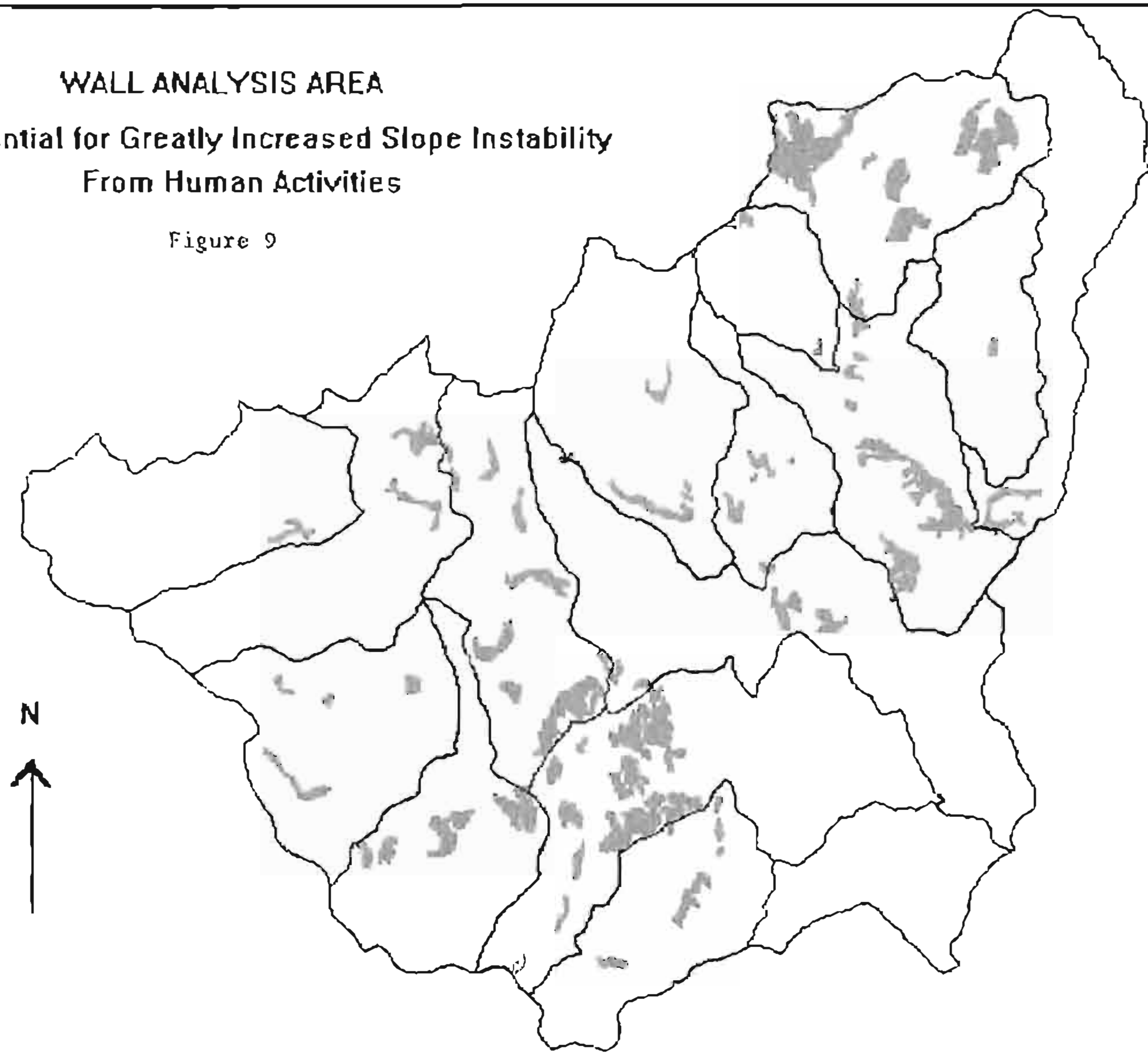
Figure 8

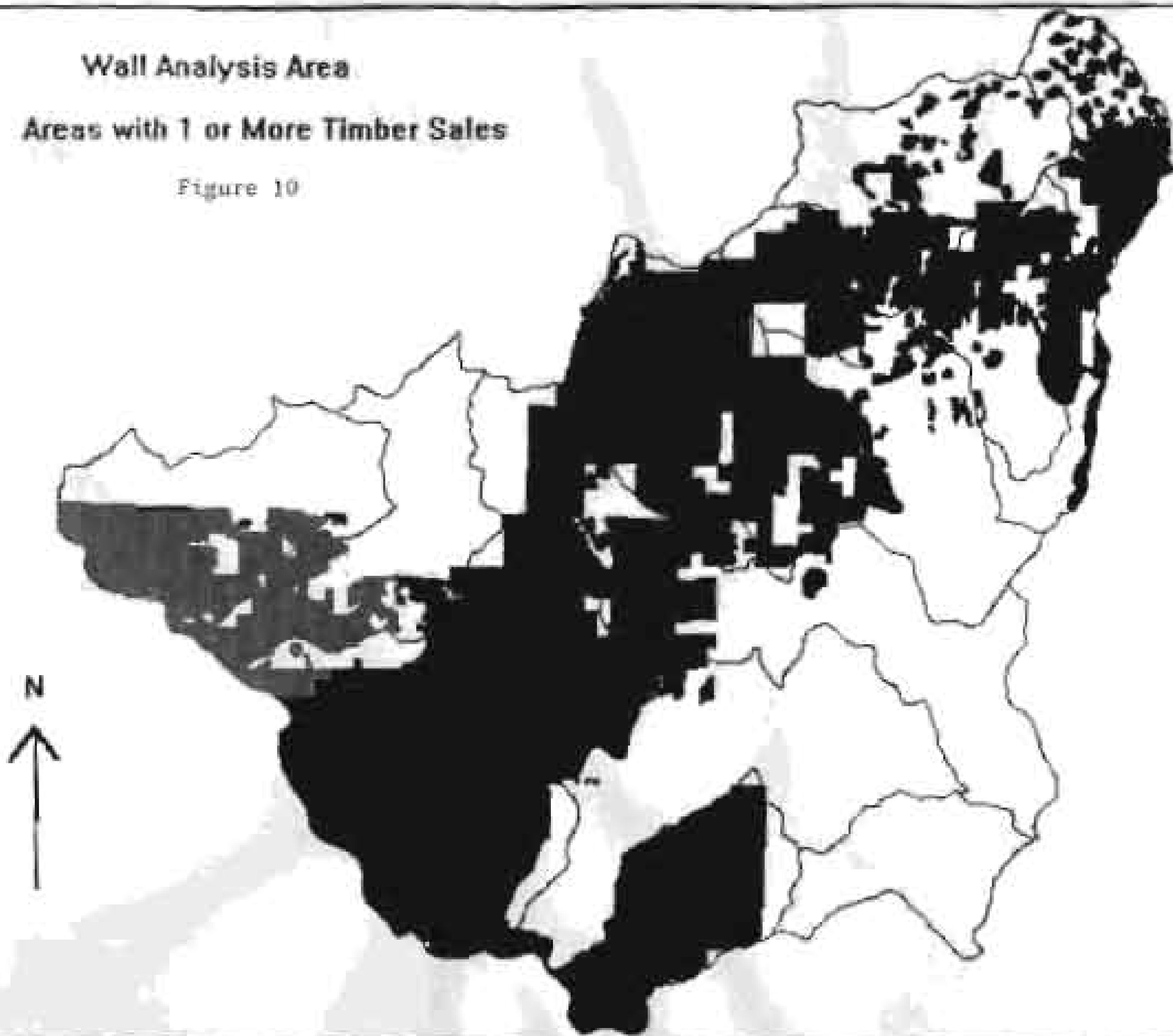


WALL ANALYSIS AREA

Potential for Greatly Increased Slope Instability From Human Activities

Figure 9





Wall Analysis Area

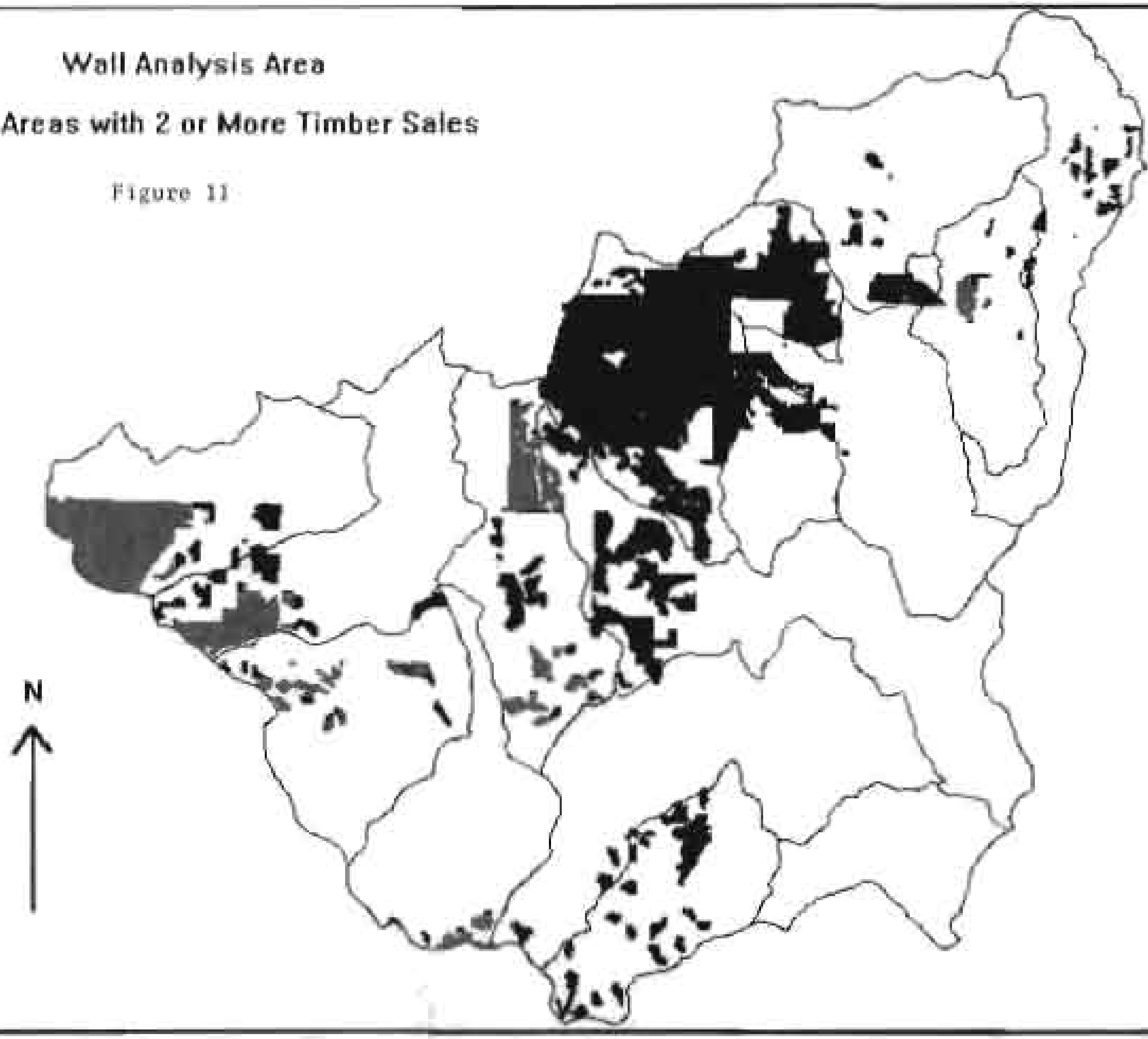
Areas with 1 or More Timber Sales

Figure 10

Wall Analysis Area

Areas with 2 or More Timber Sales

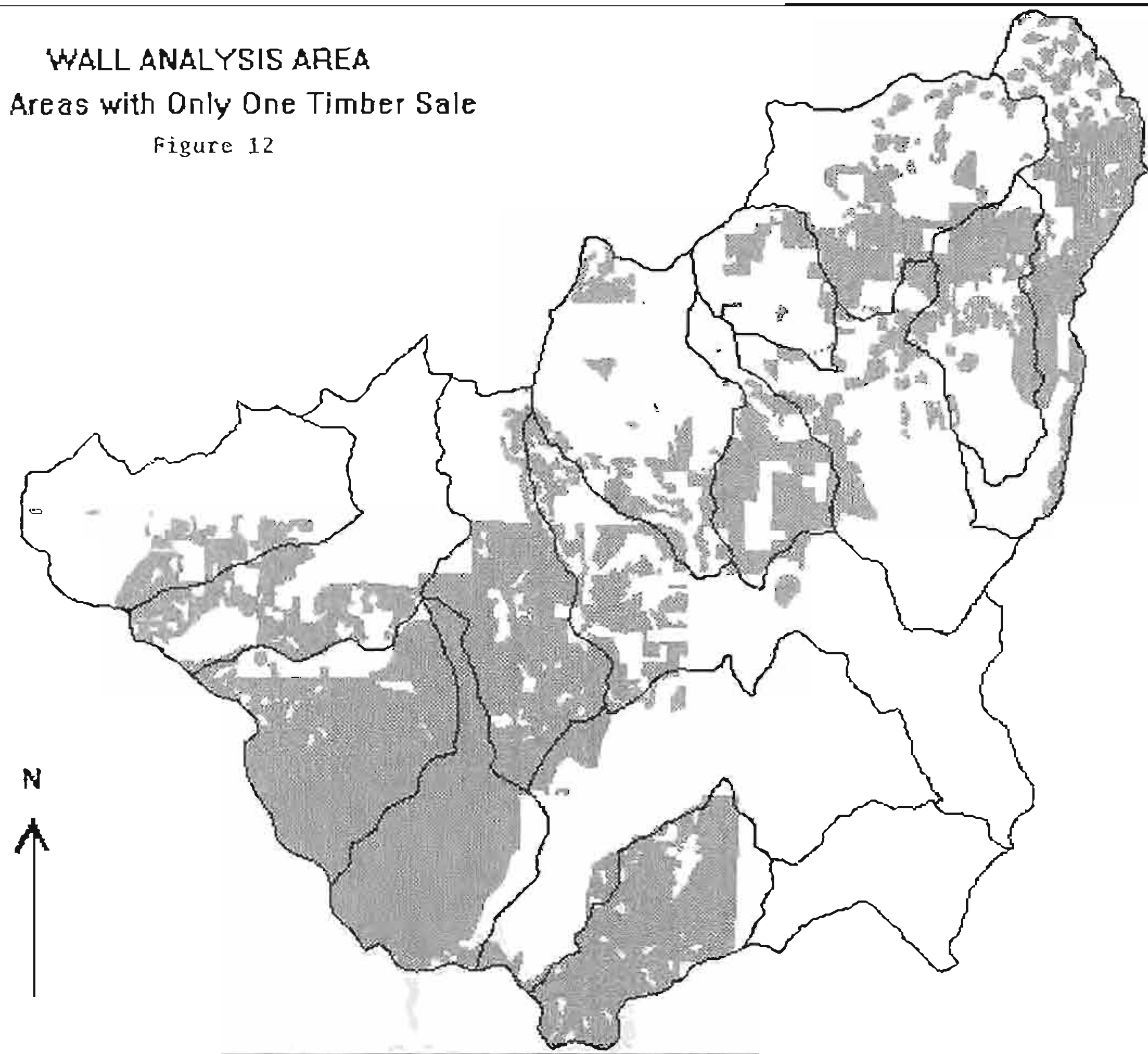
Figure 11



WALL ANALYSIS AREA

Areas with Only One Timber Sale

Figure 12



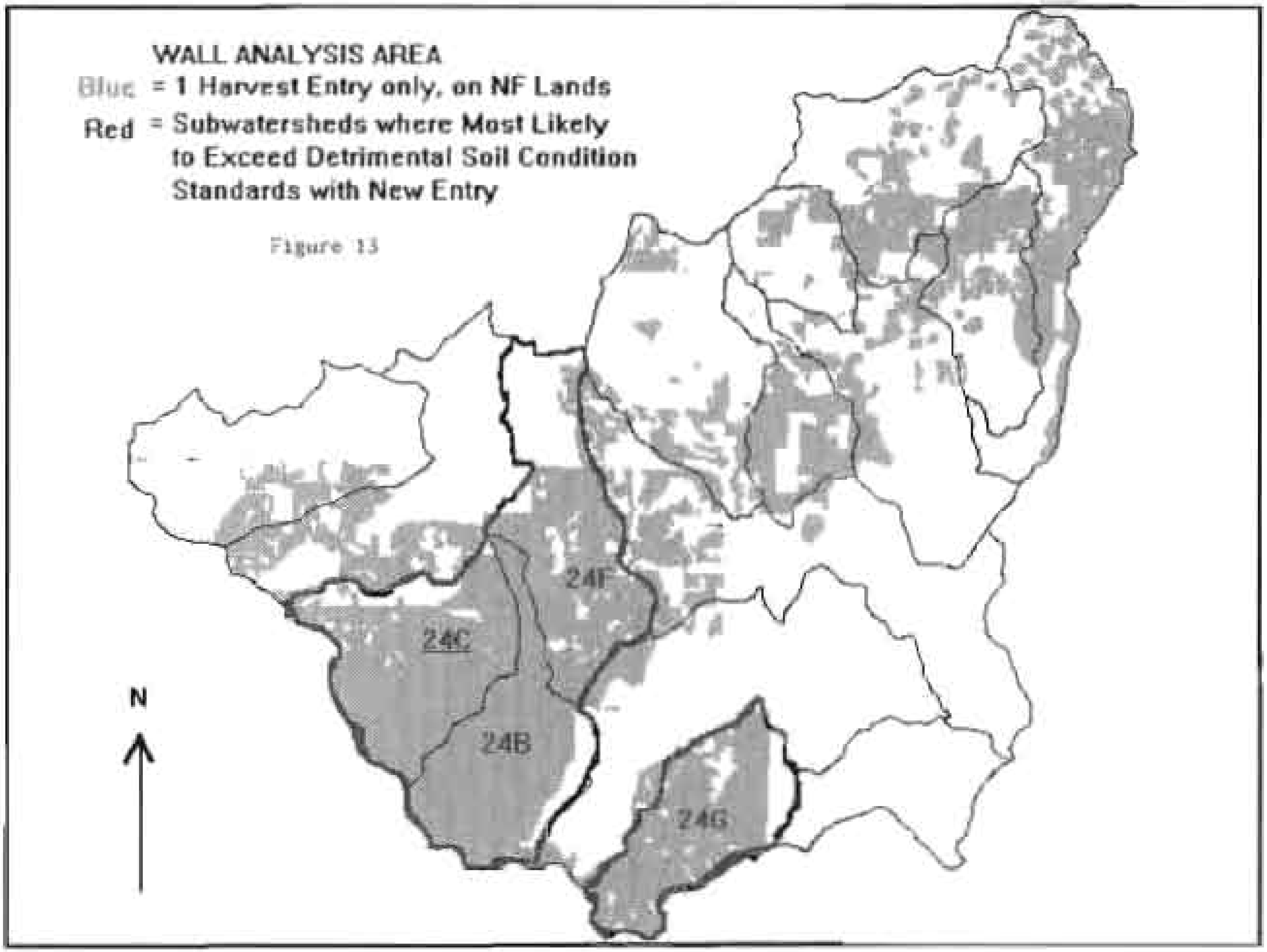

WALL ANALYSIS AREA
Blue = 1 Harvest Entry only, on NF Lands
Red = Subwatersheds where Most Likely to Exceed Detrimental Soil Condition Standards with New Entry
24F
24C
24B
24G
N

Figure 13

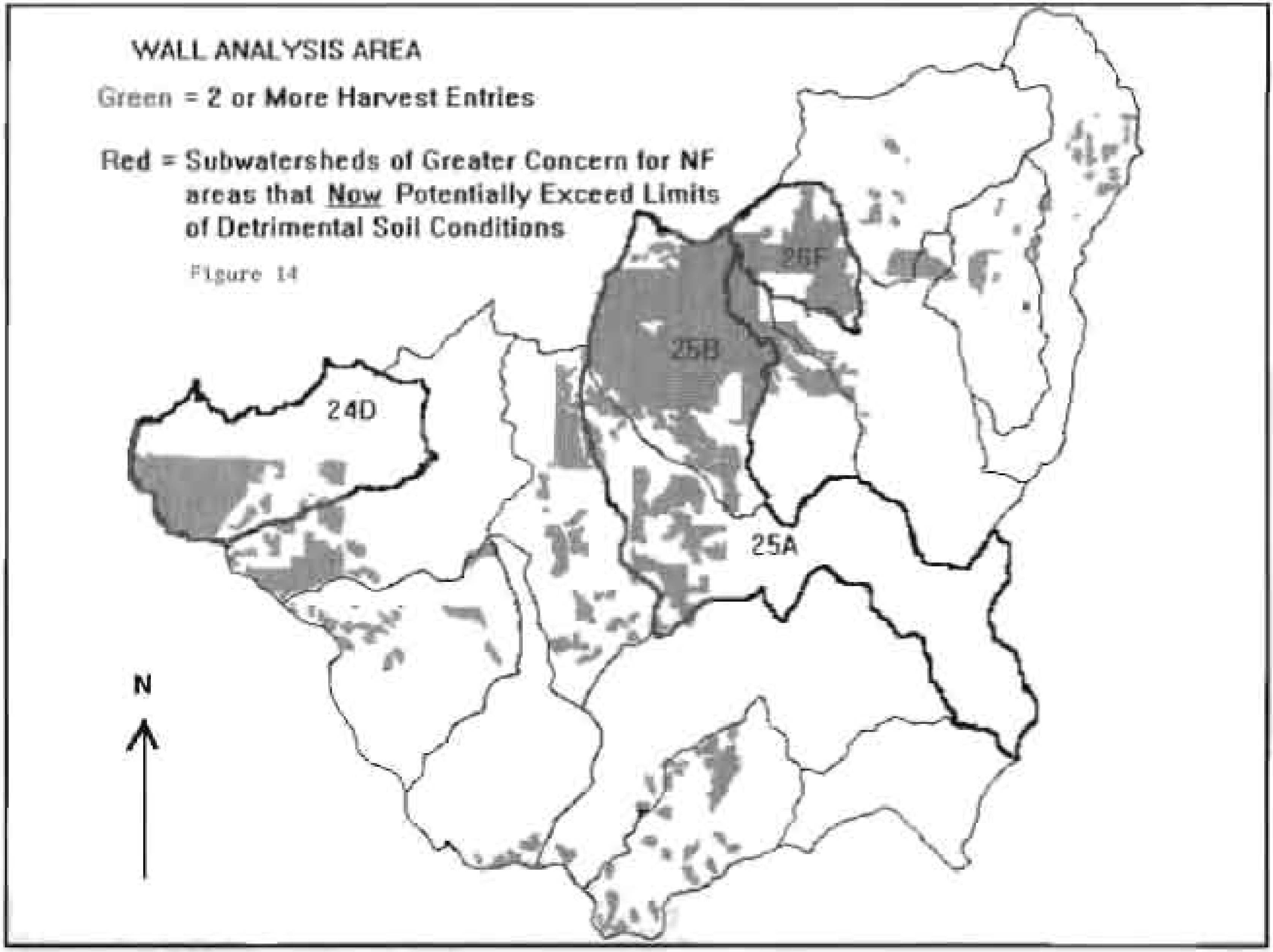
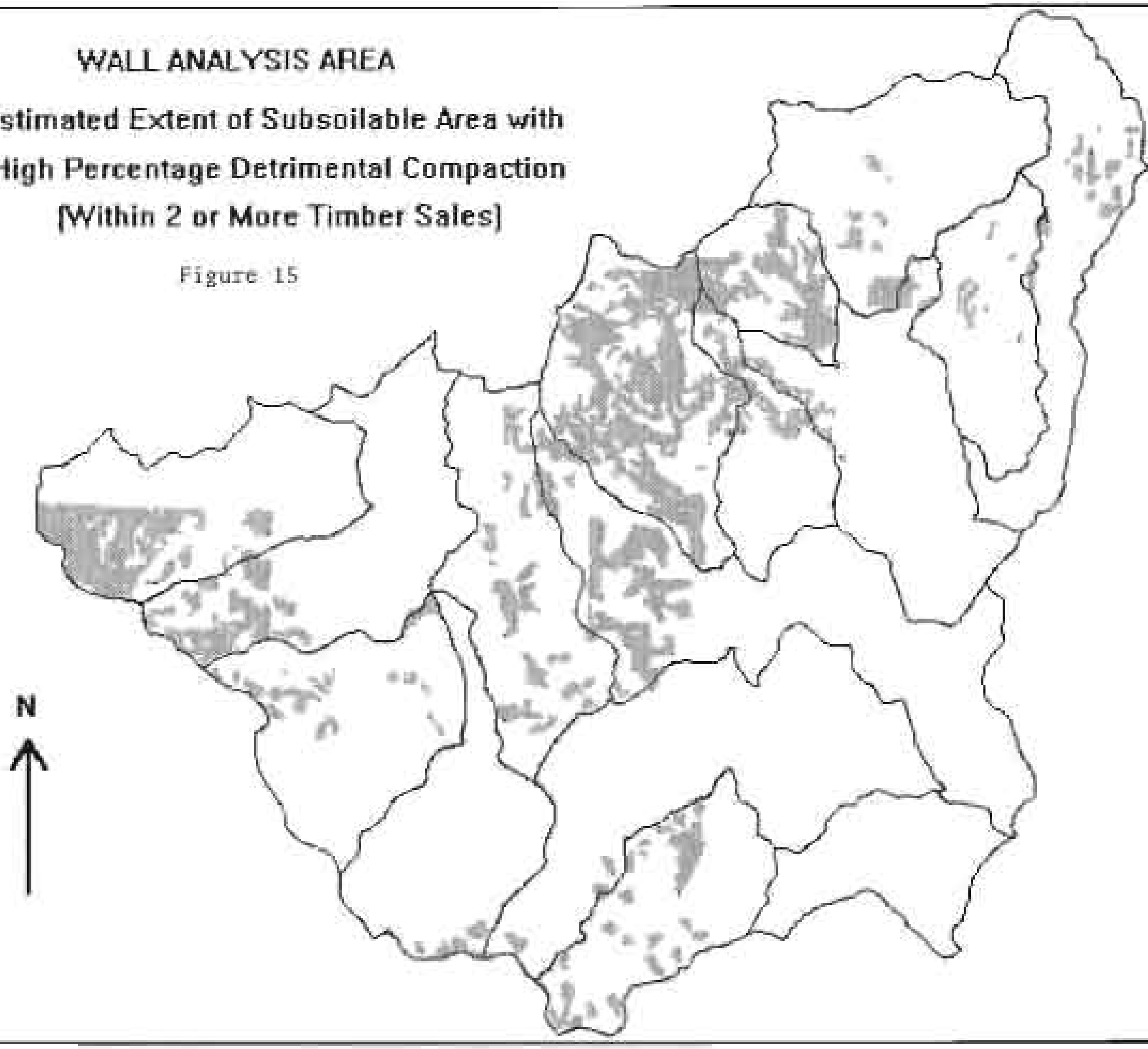

WALL ANALYSIS AREA
Green = 2 or More Harvest Entries
Red = Subwatersheds of Greater Concern for NF areas that Now Potentially Exceed Limits of Detrimental Soil Conditions
26F
25B
24D
25A
N

Figure 14



WALL ANALYSIS AREA

Estimated Extent of Subsoilable Area with High Percentage Detrimental Compaction (Within 2 or More Timber Sales)

Figure 15