

# Soil Monitoring on the Kootenai National Forest:

**From “unknowledge” to  
partial knowledge**

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# **KNF – Forest Plan**

- **Forestwide Management Direction**
- **Goals, Objectives, Standards**
- **Research Needs**
- **Desired Future Condition**
- **MONITORING and Evaluation**

# Kootenai National Forest Soil Monitoring Summary - Units

<b>YEAR</b>	<b><u>Line Transects</u></b>	<b><u>Walk-throughs</u></b>	<b><u>Totals</u></b>
1988	0	10	10
1989	0	20	20
1990	0	21	21
1991	0	25	25
1992	20	6	26
1993	14	20	34
1994	3	2	5
1995	9	6	15
1996	17	22	39
1997	22	22	44
1998	20	12	32
1999	15	15	30
2000	0	6	6
2001	3	6	9
2002	26	23	49
2003	15	16	31
2004	9	7	16
2005	2	20	22
<b>Totals</b>	<b>175</b>	<b>259</b>	<b>434</b>

# KNF - Methodology

- **Line Transect Method** – a defined path across an activity unit. The path is oriented perpendicular to the operational direction of the disturbance. The purpose of the transect placement is to evenly cover, and with unbiased intent, the activity area. The line transect(s) was preceded by a general reconnaissance of the activity area, which helped to determine the number of transects. The general reconnaissance also ensured a sampling of “undisturbed” sites within the area.
- **Walk-through Method** – a random, visual survey by general reconnaissance of an activity area. The visual observations are discussed in qualitative terms. Rather than establishing a monitoring point at each step, random points are evaluated for disturbance.

# KNF – Monitoring Summary

- **Activity Area** – A land area affected by a management activity to which soil quality standards are applied. Activity areas must be feasible to monitor and include harvest units within timber sale areas, prescribed burn areas, grazing areas or pastures within range allotments, riparian areas, recreation areas, and alpine areas. All temporary roads, skid trails, and landings are considered to be part of an activity area.
- **Disturbance modes** - include compaction, displacement, erosion, severe burning, mass movement, rutting, and puddling. Also, I often included qualitative discussion of organic matter. The Forest Service manual states that at least 85% of an activity area must have soil that is in satisfactory condition.

# KNF – Soil Monitoring Summary

## 18-Year

<u>Year</u>	<u>Sales – Transect</u>	<u>Units – Transect</u>	<u>Sales – Walk – thru</u>	<u>Units – Walk – thru</u>	<u>Total Acres</u>
1988	0	0	4	10	316
1989	0	0	10	20	672
1990	0	0	12	21	718
1991	0	0	14	25	833
1992	10	20	4	6	637
1993	6	14	10	20	935
1994	2	4	1	2	115
1995	4	9	3	6	343
1996	9	17	11	22	1609
1997	13	22	10	22	1676
1998	11	20	8	12	1365
1999	10	15	7	15	607
2000	0	0	5	6	337
2001	1	3	3	6	520
2002	11	26	10	23	1626
2003	6	15	9	16	1263
2004	3	9	6	7	492
2005	2	3	4	20	1257
<b>Totals</b>	<b>88</b>	<b>175</b>	<b>131</b>	<b>259</b>	<b>15321</b>

KOOTENAI NATIONAL FOREST  
SOIL DISTURBANCE MONITORING FORM

DATE \_\_\_\_\_ CUTTING METHOD \_\_\_\_\_  
 OBSERVER \_\_\_\_\_ SKIDDING METHOD \_\_\_\_\_  
 DISTRICT \_\_\_\_\_ If tractor: dispersed dedicated  
 SALE/S.A. \_\_\_\_\_ HAZARD TREATMENT \_\_\_\_\_  
 Unit# \_\_\_\_\_ Acres \_\_\_\_\_ SILVICULTURAL TRMT \_\_\_\_\_  
 H.T. \_\_\_\_\_ OPERATION PERIOD \_\_\_\_\_  
 Slope \_\_\_\_\_ Aspect \_\_\_\_\_  
 Location \_\_\_\_\_ Elevation \_\_\_\_\_

DISTURBANCE (Heavy) \_\_\_\_\_

Past Activity \_\_\_\_\_

DISTURBANCE (Light) \_\_\_\_\_

UNDISTURBED \_\_\_\_\_

DISPLACED \_\_\_\_\_ EROSION \_\_\_\_\_

RUTTING/PUDDLING \_\_\_\_\_ BURN PILE \_\_\_\_\_

EXCAVATED SKID TRAIL \_\_\_\_\_ SMZ/ROCK \_\_\_\_\_

COMMENTS (Include soil, geology, organic debris, large & small, road drainage, other pertinent info)

SHAPE OF UNIT AND PATTERN OF TRANSECT

COMPACTION (Heavy) – Any place where future vegetative growth will be significantly impacted, i.e. skid trails (both heavily and lightly used depending on amount of compaction related to soil moisture), landings, and other impacted areas.

COMPACTION (Light) – Any other area not included in heavy COMPACTION or UNDISTURBED.

UNDISTURBED – No signs of any machinery of skidding activity.

DISPLACED – removal of more than 1 inch of surface horizon on a contiguous greater than 100 square feet.

EROSION – rills, gullies, pedestals, deposition. RUTTING/PUDDLING – wet soil operations: ruts, standing water, soil deformation.

KOOTENAI NATIONAL FOREST  
SOIL DISTURBANCE MONITORING FORM

DATE 10-16-92 CUTTING METHOD hand felled  
 OBSERVER Kuennen SKIDDING METHOD dozer skidded  
 DISTRICT Fisher River If tractor: dispersed  X dedicated  
 SALE/S.A. Homesteader/Johnson HAZARD TREATMENT dozer piled  
 Unit# 29 Acres 7 SILVICULTURAL TRMT seed tree  
 H.T. DF/twinflower OPERATION PERIOD Feb. '92  
 Slope 5% Aspect ENE  
 Location NWNW S10 T26NR28W Elevation 3400'  
 DISTURBANCE (Heavy) 30 25%

Past Activity  
 DISTURBANCE (Light) 75 63%

UNDISTURBED 14 12%  
total 119 100%

DISPLACED 50 EROSION 0  
 RUTTING/PUDDLING 0 BURN PILE 0  
 EXCAVATED SKID TRAIL 0 SMZ/ROCK 0

COMMENTS (Include soil, geology, organic debris-large&small, road drainage, other pertinent info)  
Stand: 640-02-007, Unit was tractor logged and tractor piled. Machine over most of the ground. Glacial till - soil unit 301, Cambrian limestone. Very little debris, large or small. Trees were whole-tree, yarded, but lopped in the unit. Operations occurred at the beginning of spring breakup. Soils too wet, and ground no longer frozen under equipment.

SHAPE OF UNIT AND PATTERN OF TRANSECT

COMPACTION (Heavy) - Any place where future vegetative growth will be significantly impacted, i.e. skid trails (both heavily and lightly used depending on amount of compaction related to soil moisture), landings, and other impacted areas.

COMPACTION (Light) - Any other area not included in heavy COMPACTION or UNDISTURBED.

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EROSION - rills, gullies, pedestals, deposition. RUTTING/PUDDLING - wet soil operations: ruts, standing water, soil deformation.



KOOTENAI NATIONAL FOREST  
SOIL DISTURBANCE MONITORING FORM

DATE 8-13-97 CUTTING METHOD clipped  
 OBSERVER Kuennen/Moeller SKIDDING METHOD RTS & Hi-Trac  
 DISTRICT Three Rivers If tractor: dispersed X dedicated \_\_\_\_\_  
 SALE/S.A. Zimm Hill Fire Salvage/Hommel HAZARD TREATMENT none  
 Unit # 40 Acres 22 SILVICULTURAL TRMT LTM Seed tree  
 H.T. WH/queencup beadbily OPERATION PERIOD winter '96-'97  
 Slope 20 - 30% Aspect easterly  
 Location NWSE S26 T37NR31W Elevation 3400 - 3800  
 DISTURBANCE (Heavy) 34 6%

Past Activity \_\_\_\_\_  
 DISTURBANCE (Light) 153 26%

UNDISTURBED 405 68%  
 total 592 100%

DISPLACED 36 EROSION 0  
 RUTTING/PUDDLING 0 BURN PILE 0  
 EXCAVATED SKID TRAIL 0 SMZ/ROCK 0

COMMENTS (Include soil, geology, organic debris, large & small, road drainage, other pertinent info)  
Stand 424-02-177, Salvage of 1994 fire. Found area of overland flow-small amount of erosion. More ground disturbance than expected—possibly because snow was not set up when logging occurred. It appears that ground did not freeze in main trails. Several small areas of wildlife trees remain. Soil is a deep glacial till with good ash cap. Lots of near surface flow intercepted in several places with skid trails. Clipper got stuck which was the start of the overland flow.

SHAPE OF UNIT AND PATTERN OF TRANSECT

COMPACTION (Heavy) - Any place where future vegetative growth will be significantly impacted, i.e. skid trails (both heavily and lightly used depending on amount of compaction related to soil moisture), landings, and other impacted areas.

COMPACTION (Light) - Any other area not included in heavy COMPACTION or UNDISTURBED.

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## DETRIMENTAL SOIL DISTURBANCE SURVEY

Sale/Project: \_\_\_\_\_ Unit: \_\_\_\_\_ Acres: \_\_\_\_\_ Date: \_\_\_\_\_  
 Surveyor(s): \_\_\_\_\_ Point Spacing: \_\_\_\_\_ Map Attached: Y N  
 Planning Area: \_\_\_\_\_ Slope: \_\_\_\_\_ Aspect: \_\_\_\_\_ Landtype(s): \_\_\_\_\_  
 Harvest Rx: R I Cutting Method: H C Fuels Rx: U EP Yarding Method: T F C  
 Past Harvest: Y N OHV Disturbance: Y N Cattle Grazing: Y N Wet Areas: Y N

DESCRIPTION	TRANSECT POINTS				TOTAL	%
<b>HEAVY DISTURBANCE</b> Detrimental Compaction or Rutting	1	Detrimental Displacement Or Erosion	1	Class 3	Class 3	
	2		2			
	3		3			
	1	Detrimental Severely Burned	1			
	2		2			
	3		3			
<b>LIGHT/MOD DISTURBANCE</b> All non- detrimental disturbance	1			Class 1/2	Class 1/2	
	2					
	3					
<b>UNDISTURBED</b>	1			Class 0	Class 0	
	2					
	3					
<b>TOTALS</b>	<b>CUMULATIVE FOR ALL TRANSECT POINTS AND PERCENTAGES →</b>					

Minimum Sample Size for 95% CI ± 5%						NOTES/COMMENTS:
Dist	n	Dist	n	Dist	n	
1%	16	16%	207	31%	329	
2%	31	17%	217	32%	335	
3%	45	18%	227	33%	340	
4%	60	19%	237	34%	345	
5%	73	20%	246	35%	350	
6%	87	21%	255	36%	355	
7%	101	22%	264	37%	359	
8%	114	23%	273	38%	363	
9%	126	24%	281	39%	366	
10%	139	25%	289	40%	369	
11%	151	26%	296	41%	372	
12%	163	27%	303	42%	375	
13%	174	28%	310	43%	377	
14%	186	29%	317	44%	379	
15%	196	30%	323	45%	381	

# KNF – Soil Monitoring Summary

## Monitoring Specifics

<u>Activity</u>	<u>Totals</u>
Number Sales	219
Number Units	434
- Line Transects	175
- Walk-throughs	259
Acres	15,321
Number Transects	447
Monitoring Points	123,643

# SOILMON ACCESS Objects - Tables, Queries, Forms, Reports

The screenshot displays the Microsoft Access interface. The ribbon includes Home, Create, External Data, Database Tools, Add-Ins, and Acrobat. The left-hand pane shows 'All Access Objects' with categories: Tables (FSDBA\_SOIL\_MON, FSDBA\_SOIL\_TRAN), Queries, Forms (SOIL\_MON, SOIL\_TRAN Subform), and Reports (1\_AllTransects\_SpecifiedDistrict, 10\_GreaterThan15%\_Specified..., 11\_LessThan6%\_HeavyDisturba..., 12\_EqualTo6LessThan10%\_Hea..., 13\_EqualTo10LessThan15%\_He..., 14\_GreaterThan15%\_HeavyDist..., 15\_PctHeavy\_BySkid\_BySeason, 16\_PctHeavy\_BySeason\_ByMet..., 17\_Disturbance\_By\_SkidMethod, 2\_AllTransects, 3\_UnitsMonitored\_ByDistrict, 4\_MonSales\_ByHarvestType\_Ha..., 5\_UnitsMonitored\_ByYear, 6\_Units\_ByHarvestType, 7\_LessThan6%\_SpecifiedDistrict, 8\_EqualTo6LessThan10%\_Speci..., 9\_EqualTo10LessThan15%\_Spe..., District\_Data\_Check, Two Table Test Report).

The main window shows the 'SOIL\_MON' form with the following fields and values:

- P-Key: 100, Forest: 14, Prim. Stand: 35406069, Sec. Stand: [empty], Survey Date: 10-Oct-96, Survey Type: W
- Sale Name: TWIN MEADOWS FIRE, Sale Unit: 1, Unit Acres: 40, Sale Type: FIRE SALVAGE
- Prescription: CC/R, Burn Date: [empty], Ash Cap: [empty]
- Comments: WALK THROUGH: Review of these units was part of a Sale Administrator certification for Ed Ferruzzi. Units 1, 2 & 3 were winter logged. Winter logging in units 1, 2 & 3 was excellent! The only way to determine where the skid trails were was by the
- Entered Date: 06-Feb-04, Heavy: [empty], Total: [empty], Undist: [empty], Limit: [empty], MUSH: 143540606910/10/1996

A photograph of a person in a green shirt and hat holding a shovel is visible in the top right corner of the form.

The 'Transect Info' table is displayed below the form:

P-Key	F-Key	Date	Tran #	Tran Len	Total Pts	Heavy	Light	Undist	Dozer	Displaced	Eroded	Puddled	Burn Pile	Excav	Trail
334	100	10-Oct-96	0001												
(New)	100		0	0	0	0	0	0	0	0	0	0	0	0	0

At the bottom of the form, the status bar shows 'Record: 14 of 1 of 1', 'Unfiltered', and 'Walk'.

# SOILMON ACCESS Data Entry/Query Form

Microsoft Access

Home Create External Data Database Tools Add-Ins Acrobat

View Paste Copy Format Painter Font Rich Text Records Sort & Filter Window Find

Navigation Pane

SOIL\_MON

P-Key: 61 Forest: 14 Prim. Stand: 12304104 Sec. Stand: Survey Date: 16-Jul-96 Survey Type: T

Sale Name: INCH\_MTN\_PC Sale Unit: 1 Unit Acres: 38 Sale Type: LPSALVAGE

Prescription: SD Burn Date: Ash Cap: 4-10

Comments: Quartzite bedrock. Soil very rocky. Soil very wet. Two operations periods!? Some erosion occurring in fireline! Soils saturated. Wetspots scattered throughout unit. More in southern finger. Unit looks very good. Ash 4-10", mixed in places! HT: SAF/AISI or

Entered Date: 10-Feb-04 Heavy: 0.8 Total: Undist: 44.9 Light: 54.4 MISC: 1412304104716/1996

**Transect Info**

P-Key	F-Key	Date	Tran #	Tran Len	Total Pts	Heavy	Light	Undist	Dozer	Displaced	Eroded	Puddled	Burn Pile	Excav	Trail	RHCA
111	61	16-Jul-96	0001	357.9	347	2	170	175		0	0	0	0	0	0	5
112	61	16-Jul-96	0002	369.7	444	4	260	180		0	0	0	0	0	0	0
(New)	61		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals					727.6	791	6	430	355		0	0	0	0	0	5

Record: 1 of 2 Unfiltered Search

Record: 61 of 460 Unfiltered INCH

Form View Num Lock

## Expanded Comments:

Quartzite bedrock. Soil very rocky. Soil very wet. Two operations periods!? Some erosion occurring in fireline! Soils saturated. Wetspots scattered throughout unit. More in southern finger. Unit looks very good. Ash 4-10", mixed in places! HT: SAF/AISI or Mefe



# SOILMON ACCESS Data Entry/Query Form

Microsoft Access

Home Create External Data Database Tools Add-Ins Acrobat

View Paste Copy Format Painter Font Rich Text Records Sort & Filter Window Find

Navigation Pane

SOIL\_MON

P-Key: 50 Forest: 14 Prim. Stand: 12304058 Sec. Stand: Survey Date: 16-Jul-96 Survey Type: T

Sale Name: INCH\_MTN\_PC Sale Unit: 11 Unit Acres: 39 Sale Type: LPSALVAGE

Prescription: SD Burn Date: Ash Cap:

Comments: Over quart of site bedrock. Lots of angular rock in soil (over 65%). Fire left most of partially decomposed O.M. Some erosion in excavator fireline. Lower end of skid trails have some erosion. Bedrock exposures in unit. Lower part of unit much steeper

Entered Date: 06-Feb-04 Heavy: 1.3 Total: Undist: 98.8 Light: 29.9 Dist: 1412304059716/1996

**Transect Info**

P-Key	F-Key	Date	Tran #	Tran Len	Total Pts	Heavy	Light	Undist	Dozer	Displaced	Eroded	Puddled	Burn Pile	Excav	Trail	RHCA
98	50	16-Jul-96	0001	94.2	250	8	62	180		0	3	0	0	0	0	0
99	50	16-Jul-96	0002	478.2	495	3	160	332		0	0	10	0	0	0	0
100	50	16-Jul-96	0003	268.1	130	0	40	90		0	0	0	0	0	0	0
*	(New)		0	0	0	0	0	0	0	0	0	0	0	0	0	0
				<b>Totals</b>	840.5	875	11	262	602		3	10	0	0	0	0

Record: 1 of 3 Unfiltered Search

Record: 50 of 460 Unfiltered INCH

Form View Num Lock

## Expanded Comments:

Over quart of site bedrock. Lots of angular rock in soil (over 65%). Fire left most of partially decomposed O.M. Some erosion in excavator fireline. Lower end of skid trails have some erosion. Bedrock exposures in unit. Lower part of unit much steeper than upper part; except for SW corner. Wet spots in unit. Unit looks very good. Middle across middle of longer part of unit. Lower across middle of shorter part of unit. Planted ES,WL,DF HT: SAF/Aisi or Mefe

# SOILMON ACCESS Data Entry/Query Form

Microsoft Access

Home Create External Data Database Tools Add-Ins Acrobat

View Paste Copy Format Painter Views Clipboard Font Rich Text Refresh All New Save Spelling Delete More Filter Advanced Toggle Filter Sort & Filter Size to Fit Form Switch Windows Window Find Replace Go To Select Find

SOIL\_MON

Pkey: 50 Forest: 14 Prim. Stand: 12304058 Sec. Stand: Survey Date: 16-Jul-96 Survey Type: T  
 Sale Name: INCH\_MTN\_PC Sale Unit: 11 Unit Acres: 39 Sale Type: LPSALVAGE  
 Prescription: SD Burn Date: Ash Cap:  
 Comments: Over quart of site bedrock. Lots of angular rock in soil (over 65%). Fire left most of partially decomposed O.M. Some erosion in excavator fireline. Lower end of skid trails have some erosion. Bedrock exposures in unit. Lower part of unit much steeper  
 Entered Date: 06-Feb-04 Heavy: 1.3 Total: Unders: RR R Light: 20.0 MUSH: 14123040587/16/1996

Navigation Pane

**Transect Info**

HCA	Rock	Leave	Overland	Springs	Acres	Slope	Harv Year	Season	Fell Method	Skid Method	Skid Trails	Haz Abatement
0	0	0	0	0	0	0	1995	SU	CLIPPER	TRACTOR	DISPERSED	BROADCAST BURN
0	0	0	0	0	0	0	1995	SU	CLIPPER	TRACTOR	DISPERSED	BROADCAST BURN
0	0	0	0	0	0	0	1995	SU	CLIPPER	TRACTOR	DISPERSED	BROADCAST BURN
*	0	0	0	0	0	0	0					
0	0	0	0	0	0	0						

Record: 1 of 3 Unfiltered Search

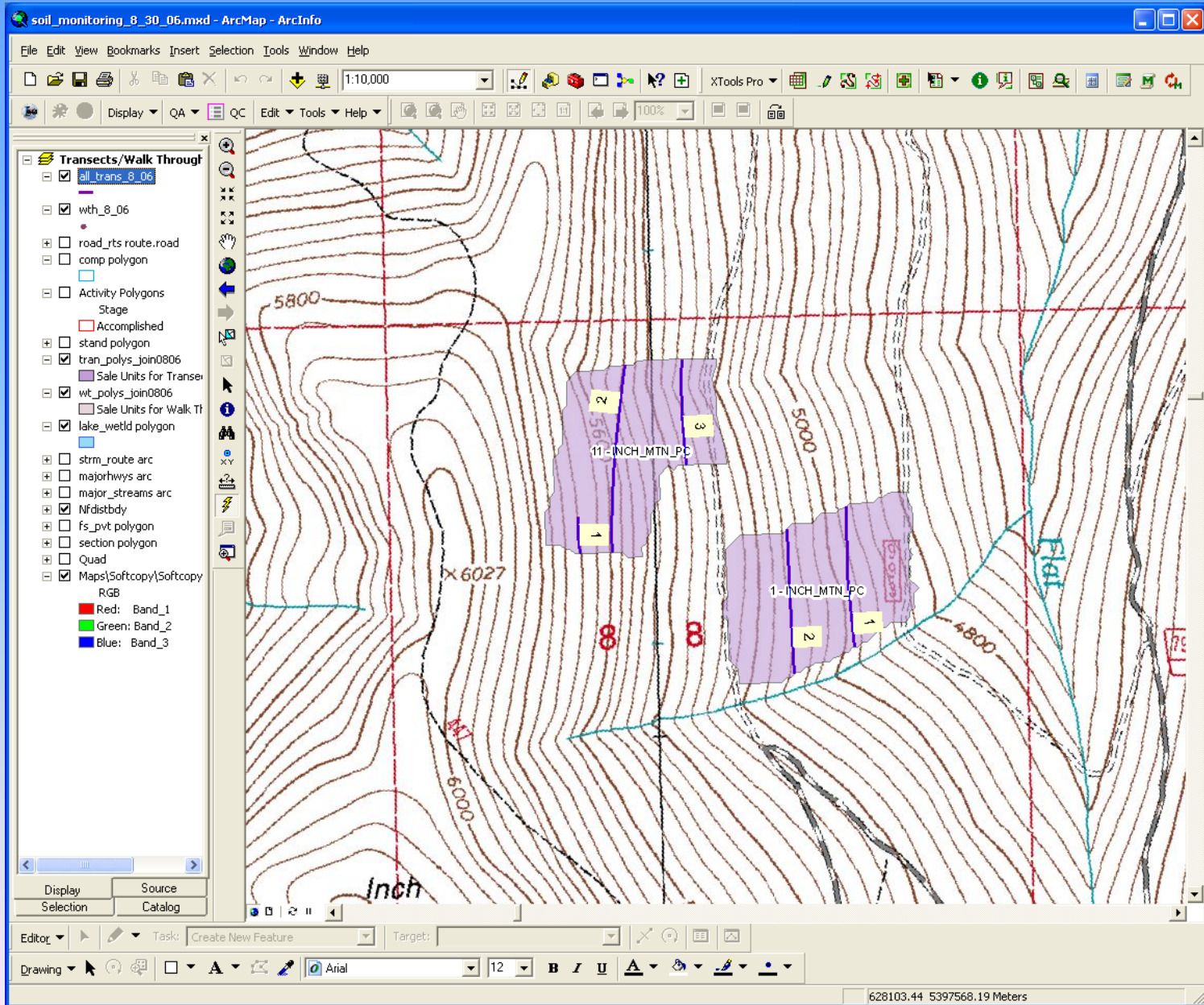
Record: 150 of 460 Unfiltered INCH

Form View Num Lock

Displays expanded Transect Info



# SOILMON Spatial Component - ArcMap





# SOILMON ACCESS Reports Example - Forest-Wide

Microsoft Access

Home Create External Data Database Tools Add-Ins Acrobat

View Paste Copy Format Painter Views Clipboard Font Rich Text Refresh All New Save Delete Records Totals Spelling More Sort & Filter Selection Advanced Toggle Filter Filter Find Replace Go To Select Find

All Access Objects

Tables

- FSDBA\_SOIL\_MON
- FSDBA\_SOIL\_TRAN

Queries

Forms

- SOIL\_MON
- SOIL\_TRAN Subform

Reports

- 1\_AllTransects\_SpecifiedDistrict
- 10-GreaterThan15%\_Specified...
- 11-LessThan6%\_HeavyDisturba...
- 12-EqualTo6LessThan10%\_Hea...
- 13-EqualTo10LessThan15%\_He...
- 14\_GreaterThan15%\_HeavyDist...
- 15\_PctHeavy\_BySkid\_BySeason
- 16\_PctHeavy\_BySeason\_ByMet...
- 17\_Disturbance\_By\_SkidMethod
- 2\_AllTransects
- 3\_UnitsMonitored\_ByDistrict
- 4\_MonSales\_ByHarvestType\_Ha...
- 5\_UnitsMonitored\_ByYear
- 6\_Units\_ByHarvestType
- 7\_LessThan6%\_SpecifiedDistrict
- 8\_EqualTo6LessThan10%\_Speci...
- 9\_EqualTo10LessThan15%\_Spe...
- District\_Data\_Check
- Two Table Test Report

14\_GreaterThan15%\_HeavyDisturbance

29-Mar-10 10:24 AM

14-Transects with >=15% Heavy Disturbance

% Heavy Dist	Stand ID	Sale Name	Unit	Acres	Sale Type	Prescription
27.6	51402011	BLUE RICE	17	29	SALVAGE	SEEDTREE
25.2	59002007	HOMESTEADER	29	7	REGULAR	LTM-SEED
24.8	58801113	EAST RARITAN	1	35	REGULAR	LTM
24.1	71501033	Beaver Peak Resell	9		REGULAR	SEEDTREE
21.8	43001108	DOGWOOD WINDY BURN	28	29	FIRE SALVAGE	LTM-SEED
20.5	42903210	UPPER BASIN P.C.	9	20	LPSALVAGE	SANITATION
20.2	10704085	UPPER_SCALP_FIRE_SALVAGE	3	33	FIRE SALVAGE	LTM
19.9	51401054	BLUE MTN BUGS	2	77	LPSALVAGE	CC
19.8	11101011	GOOD_CREEK_PC	14	26	LPSALVAGE	CC
17.2	56503047	BUTLER DIDIT	5	8	LPSALVAGE	SANITATION

led Burn Pile Excav Trail

0 0 0

Report View Num Lock

# SOILMON ACCESS Reports Example – District

The screenshot shows the Microsoft Access interface with a report titled "1\_AllTransects\_SpecifiedDistrict" open in Report View. The report displays a table with the following data:

Transect ID	Location	Date	Units	Count	Code	Value 1	Value 2	Value 3	Value 4	Value 5	Value 6	Value 7	Value 8
12204080	SUTTON_REHAB_P_C	30-Sep-97	12	43	0001								
	East Sutton Salvage	27-Sep-02	57	8	0001	237.2	292	9	3.08	183	62.67	100	34.25
	East Sutton Salvage	27-Sep-02	57	8	0002	272.7	289	8	2.77	203	70.24	78	26.99
							581	17	2.93	386	66.44	178	30.64
12304058	INCH_MTN_PC	16-Jul-96	11	39	0001	94.2	250	8	3.20	62	24.80	180	72.00
	INCH_MTN_PC	16-Jul-96	11	39	0002	478.2	495	3	0.61	160	32.32	332	67.07
	INCH_MTN_PC	16-Jul-96	11	39	0003	268.1	130	0	0.00	40	30.77	90	69.23
							875	11	1.26	262	29.94	602	68.80
12304104	INCH_MTN_PC	16-Jul-96	1	38	0001	357.9	347	2	0.58	170	48.99	175	50.43
	INCH_MTN_PC	16-Jul-96	1	38	0002	369.7	444	4	0.90	260	58.56	180	40.54
							791	6	0.76	430	54.36	355	44.88
12604155	BRIER_PATCH_PC	11-Aug-99	12	9	0001								
12604156	BRIER_PATCH_PC	11-Aug-99	11	41	0001								
12802164	UPAL CREEK	10-Jul-96	5	46	0001	615.1	631	47	7.45	207	47.07	287	45.48

The interface includes a ribbon with tabs for Home, Create, External Data, Database Tools, Add-Ins, and Acrobat. The left sidebar shows "All Access Objects" with categories for Tables, Queries, Forms, and Reports. The "Reports" category is expanded, showing the current report and several other reports. The status bar at the bottom indicates "Report View" and "Num Lock" is on.

# KNF – Soil Monitoring Summary Units by Detrimental Disturbance Category

<u>DISTURBANCE CATEGORIES (%)</u>	<u>TOTALS</u>
< SIX	95
SIX to TEN	51
ELEVEN to FIFTEEN	19.5
FIFTEEN PLUS	9.5
TOTALS	175

# KNF - Monitoring Results 1988 - 2005

<u>Category</u>	<u>DSD Range</u>	<u>18-year</u>	<u>Last 10</u>	<u>Last 5</u>
Skyline/Cable	0 - 3	2	1	1
Tractor(summer)	.5 - 27	9	6	8
Tractor(winter)	0 - 10	4	4	4
Forwarder (summer)	0 - 7	4	3	4
Forwarder (winter)	0 - 4	2	2	2
Helicopter	0	0	0	0
Excavator Piling	0 - 3	2	2	2
Grazing	0 - 3	2	2	2

# Detrimental Soil Disturbance from Management Activities on the Kootenai National Forest: 2000 – 2005.

- <sup>1</sup> DSD is listed but not necessarily additive to other activities. This is because the percentages listed for each management activity included some units with excavator piling or fireline construction. In addition, disturbance from these activities within harvest units usually overlaps at least a portion of the skidding disturbance. The transformation from dozer piling to excavator piling significantly reduced soil impact.
- <sup>2</sup> Fireline construction prior to 1995 included a dozer fireline construction while data collected after generally include handline or excavator bucket-width construction. As a result there has been a reduction of fireline disturbance in a given unit.

<u>Activity Category</u>	<u>Season of Operation</u>	<u>Detrimental Disturbance (%)</u>
Skyline	NA	1
Tractor	Summer	8
Tractor	Winter	4
Forwarder	Summer	4
Forwarder	Winter	2
Excavator Piling <sup>1</sup>	NA	2
Fireline Construction <sup>1,2</sup>	NA	1
Grazing	NA	2 21





# SOIL

**A SOIL IS A LEAKY TANK FILLED WITH SPONGES, SPRINGS, DASHPOTS, PIPES, ORIFICES, VALVES, AND OTHER FLUID CONTROL DEVICES. THE HEALTH AND WELFARE OF PLANTS IS A FLUID MECHANICS PROBLEM AND THE SOIL IS THE MEDIUM WHERE THE CURRENTS, COUNTER CURRENTS, AND RESPONSE CURRENTS OCCUR.**

Dr. James Vomocil, presented at Soil Compaction Workshop, Medford Oregon, 1979.

# SOIL COMPACTION

**COMPACTION BREAKS SPRINGS, JAMS DASHPOTS, SMASHES SPONGES, BENDS AND KINKS PIPES, CLOGS OROFICES, GUMS UP VALVES, AND IN GENERAL RAISES HELL WITH SOIL AS A FLUID CONDUCTOR AND AS A MEDIUM FOR PLANT GROWTH.**

Dr. James Vomocil, presented at Soil Compaction Workshop, Medford Oregon, 1979.