TECHNICAL DOCUMENTATION REPORT

Intermountain Forest Tree Nutrition Cooperative

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College of Forestry, Wildlife and Range Sciences
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Section I

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Table 1. **Six year net basal area growth for ponderosa pine installations in northeastern Oregon and central Washington.**

Dependent Variable: NBAI6 6 Year Net BA Growth (sq.ft/a)

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
Model	22	8254.85045072	375.22047503
Error	37	5545.65404980	149.88254189
Corrected Total	59	13800.50450052	

MODEL F = 2.50 PR > F = 0.0067

R-SQUARE	C.V.	ROOT MSE	NBAI6 MEAN
0.598156	58.2164	12.24265257	21.02954661

SOURCE	DF	TYPE I SS	F VALUE	PR > F
Region	1	659.74023876	4.40	0.0428
Installation(Region)	8	5850.22538405	4.88	0.0004
Block(Region*Install)	10	1051.20909097	0.70	0.7169
Treatment	2	95.24126668	0.32	0.7298
Initial BA	1	598.43447026	3.99	0.0531

SOURCE	DF	TYPE III SS	F VALUE	PR > F
Region	1	1.80179983	0.01	0.9133
Installation(Region)	8	5072.17037098	4.23	0.0011
Block(Region*Install)	10	1313.24971190	0.88	0.5629
Treatment	2	127.44114452	0.43	0.6568
Initial BA	1	598.43447026	3.99	0.0531

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
NE Oregon:Control	20.70451656	5.75	0.0001	3.59959800
NE Oregon:200#N	23.67386654	6.22	0.0001	3.80785520
NE Oregon:400#N	20.45885587	5.46	0.0001	3.74521665
C Washington:Control	21.18818408	6.16	0.0001	3.43923481
C Washington:200#N	24.15753406	7.32	0.0001	3.30181535
C Washington:400#N	20.94252338	6.28	0.0001	3.33669622
All:Control	20.94635032	7.63	0.0001	2.74367841
All:200#N	23.91570030	8.54	0.0001	2.79927191
All:400#N	20.70068963	7.45	0.0001	2.77761499
200#N - Control	2.96934998	0.76	0.4504	3.89220036
400#N - Control	-0.24566069	-0.06	0.9499	3.88206804
400#N - 200#N	-3.21501067	-0.83	0.4118	3.87315972

Table 2. **Six year gross basal area growth for ponderosa pine installations in northeastern Oregon and central Washington.**

Dependent Variable: GBAI6 6 Year Gross BA Growth (sq.ft/a)

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
Model	22	4222.08447433	191.91293065
Error	37	561.95773347	15.18804685
Corrected Total	59	4784.04220781	

MODEL F =	12.64		PR > F = 0.0001

R-SQUARE	C.V.	ROOT MSE	GBAI6 MEAN
0.882535	16.0296	3.89718448	24.31238156

SOURCE	DF	TYPE I SS	F VALUE	PR > F
Region	1	496.11670016	32.66	0.0001
Installation(Region)	8	3177.24826856	26.15	0.0001
Block(Region*Install)	10	176.20755999	1.16	0.3474
Treatment	2	165.82966787	5.46	0.0084
Initial BA	1	206.68227775	13.61	0.0007

SOURCE	DF	TYPE III SS	F VALUE	PR > F
Region	1	35.20032394	2.32	0.1364
Installation(Region)	8	2473.61561189	20.36	0.0001
Block(Region*Install)	10	235.53446842	1.55	0.1607
Treatment	2	201.35008769	6.63	0.0035
Initial BA	1	206.68227775	13.61	0.0007

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
NE Oregon:Control	21.15454306	18.46	0.0001	1.14585441
NE Oregon:200#N	24.67809305	20.36	0.0001	1.21214860
NE Oregon:400#N	25.35179668	21.26	0.0001	1.19220897
C Washington:Control	23.29234259	21.28	0.0001	1.09480625
C Washington:200#N	26.81589258	25.51	0.0001	1.05106172
C Washington:400#N	27.48959621	25.88	0.0001	1.06216530
All:Control	22.22344283	25.45	0.0001	0.87339087
All:200#N	25.74699282	28.89	0.0001	0.89108786
All:400#N	26.42069645	29.88	0.0001	0.88419384
200#N - Control	3.52354999	2.84	0.0072	1.23899806
400#N - Control	4.19725362	3.40	0.0016	1.23577266
400#N - 200#N	0.67370363	0.55	0.5881	1.23293689

Table 3. Change in mean diameter after six years for ponderosa pine installations in northeastern Oregon and central Washington.

Dependent Variable: DELTAD6 6 Year Change in Mean Diameter

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
Model	22	5.70430687	0.25928668
Error	37	1.29620263	0.03503250
Corrected Total	59	7.00050950	

MODEL F =	7.40	PR > F = 0.0001

R-SQUARE	C.V.	ROOT MSE	DELTAD6 MEAN
0.814842	15.3360	0.18716972	1.22045744

SOURCE	DF	TYPE I SS	F VALUE	PR > F
Region	1	0.12667084	3.62	0.0650
Installation(Region)	8	4.76465642	17.00	0.0001
Block(Region*Install)	10	0.29106648	0.83	0.6023
Treatment	2	0.34740749	4.96	0.0124
Initial BA	1	0.17450563	4.98	0.0318

SOURCE	DF	TYPE III SS	F VALUE	PR > F
Region	1	0.29856627	8.52	0.0059
Installation(Region)	8	4.68814995	16.73	0.0001
Block(Region*Install)	10	0.41154381	1.17	0.3382
Treatment	2	0.37543770	5.36	0.0090
Initial BA	1	0.17450563	4.98	0.0318

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR >]T]	STD ERROR OF ESTIMATE
NE Oregon:Control	1.24576591	22.64	0.0001	0.05503184
NE Oregon:200#N	1.31563478	22.60	0.0001	0.05821575
NE Oregon:400#N	1.43754882	25.11	0.0001	0.05725811
C Washington:Control	1.04888028	19.95	0.0001	0.05258016
C Washington:200#N	1.11874916	22.16	0.0001	0.05047924
C Washington:400#N	1.24066319	24.32	0.0001	0.05101251
All:Control	1.14732309	27.35	0.0001	0.04194626
All:200#N	1.21719197	28.44	0.0001	0.04279619
All:400#N	1.33910601	31.53	0.0001	0.04246510
200#N - Control	0.06986888	1.17	0.2478	0.05950525
400#N - Control	0.19178291	3.23	0.0026	0.05935034
400#N - 200#N	0.12191404	2.06	0.0466	0.05921415

Table 4. **Net basal area increment in the first two years for ponderosa pine installations in northeastern Oregon and central Washington.**

Dependent Variable: PNBAI2 Net BA PAI--Period 1

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
Model	22	100.72672165	4.57848735
Error	37	20.40396850	0.55145861
Corrected Total	59	121.13069015	

MODEL F = 8.30 PR > F = 0.0001

R-SQUARE	C.V.	ROOT MSE	PNBAI2 MEAN
0.831554	16.7612	0.74260259	4.43048852

SOURCE	DF	TYPE I SS	F VALUE	PR > F
Region	1	3.82315668	6.93	0.0123
Installation(Region)	8	79.18377483	17.95	0.0001
Block(Region*Install)	10	9.21332193	1.67	0.1251
Treatment	2	3.86231021	3.50	0.0405
Initial BA	1	4.64415799	8.42	0.0062

SOURCE	DF	TYPE III SS	F VALUE	PR > F
Region	1	0.01041432	0.02	0.8914
Installation(Region)	8	64.02784134	14.51	0.0001
Block(Region*Install)	10	10.40147311	1.89	0.0791
Treatment	2	4.72059417	4.28	0.0213
Initial BA	1	4.64415799	8.42	0.0062

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR >]T]	STD ERROR OF ESTIMATE
NE Oregon:Control	4.12285979	18.88	0.0001	0.21834082
NE Oregon:200#N	4.71442408	20.41	0.0001	0.23097308
NE Oregon:400#N	4.72729149	20.81	0.0001	0.22717361
C Washington:Control	4.08608848	19.59	0.0001	0.20861367
C Washington:200#N	4.67765277	23.36	0.0001	0.20027822
C Washington:400#N	4.69052018	23.18	0.0001	0.20239399
All:Control	4.10447414	24.66	0.0001	0.16642330
All:200#N	4.69603842	27.66	0.0001	0.16979544
All:400#N	4.70890583	27.95	0.0001	0.16848180
200#N - Control	0.59156429	2.51	0.0167	0.23608920
400#N - Control	0.60443170	2.57	0.0144	0.23547461
400#N - 200#N	0.01286741	0.05	0.9566	0.23493425

Table 5. **Net basal area increment in the second two years for ponderosa pine installations in northeastern Oregon and central Washington.**

Dependent Variable: PNBAI4 Net BA PAI--Period 2

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
Model	22	800.33288592	36.37876754
Error	37	791.91885317	21.40321225
Corrected Total	59	1592.25173909	

MODEL F = 1.70 PR > F = 0.0753

R-SQUARE	C.V.	ROOT MSE	PNBAI4 MEAN
0.502642	177.5611	4.62636058	2.60550365

SOURCE	DF	TYPE I SS	F VALUE	PR > F
Region	1	30.50764760	1.43	0.2401
Installation(Region)	8	475.51293440	2.78	0.0164
Block(Region*Install)	10	183.31075338	0.86	0.5799
Treatment	2	40.48247874	0.95	0.3976
Initial BA	1	70.51907181	3.29	0.0776

SOURCE	DF	TYPE III SS	F VALUE	PR > F
Region	1	3.60808384	0.17	0.6837
Installation(Region)	8	424.91568957	2.48	0.0290
Block(Region*Install)	10	228.37332682	1.07	0.4110
Treatment	2	37.33045644	0.87	0.4265
Initial BA	1	70.51907181	3.29	0.0776

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
NE Oregon:Control	3.76073000	2.76	0.0088	1.36024756
NE Oregon:200#N	3.81624087	2.65	0.0117	1.43894561
NE Oregon:400#N	2.11549431	1.49	0.1435	1.41527521
C Washington:Control	3.07629540	2.37	0.0233	1.29964812
C Washington:200#N	3.13180627	2.51	0.0166	1.24771885
C Washington:400#N	1.43105971	1.13	0.2637	1.26089994
All:Control	3.41851270	3.30	0.0022	1.03680519
All:200#N	3.47402357	3.28	0.0022	1.05781334
All:400#N	1.77327701	1.69	0.0995	1.04962943
200#N - Control	0.05551088	0.04	0.9701	1.47081870
400#N - Control	-1.64523569	-1.12	0.2693	1.46698981
400#N - 200#N	-1.70074656	-1.16	0.2527	1.46362346

Table 6. **Net basal area increment in the third two years for ponderosa pine installations in northeastern Oregon and central Washington.**

Dependent Variable: PNBAI6 Net BA PAI--Period 3

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
Model	22	145.83117599	6.62868982
Error	37	98.62379292	2.66550792
Corrected Total	59	244.45496891	

MODEL F = 2.49 PR > F = 0.0070

R-SQUARE	C.V.	ROOT MSE	PNBAI6 MEAN
0.596556	46.9313	1.63263833	3.47878113

SOURCE	DF	TYPE I SS	F VALUE	PR > F
Region	1	28.77294953	10.79	0.0022
Installation(Region)	8	83.87592098	3.93	0.0019
Block(Region*Install)	10	21.07236490	0.79	0.6378
Treatment	2	9.29135004	1.74	0.1891
Initial BA	1	2.81859056	1.06	0.3105

SOURCE	DF	TYPE III SS	F VALUE	PR > F
Region	1	7.14333558	2.68	0.1101
Installation(Region)	8	77.11226516	3.62	0.0034
Block(Region*Install)	10	18.75599909	0.70	0.7149
Treatment	2	10.23598990	1.92	0.1609
Initial BA	1	2.81859056	1.06	0.3105

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR >]T]	STD ERROR OF ESTIMATE
NE Oregon:Control	2.46866850	5.14	0.0001	0.48003009
NE Oregon:200#N	3.30626832	6.51	0.0001	0.50780256
NE Oregon:400#N	3.38664214	6.78	0.0001	0.49944930
C Washington:Control	3.43170816	7.48	0.0001	0.45864461
C Washington:200#N	4.26930798	9.70	0.0001	0.44031882
C Washington:400#N	4.34968180	9.78	0.0001	0.44497041
All:Control	2.95018833	8.06	0.0001	0.36588758
All:200#N	3.78778815	10.15	0.0001	0.37330134
All:400#N	3.86816197	10.44	0.0001	0.37041325
200#N - Control	0.83759983	1.61	0.1151	0.51905055
400#N - Control	0.91797364	1.77	0.0844	0.51769933
400#N - 200#N	0.08037381	0.16	0.8772	0.51651135

Table 7. **Gross basal area increment in the first two years for ponderosa pine installations in northeastern Oregon and central Washington.**

Dependent Variable: PGBAI2 Gross BA PAI--Period 1

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
Model	22	89.48062498	4.06730114
Error	37	13.90454543	0.37579853
Corrected Total	59	103.38517041	

MODEL F = 10.82 PR > F = 0.0001

R-SQUARE	C.V.	ROOT MSE	PGBAI2 MEAN
0.865507	13.6934	0.61302408	4.47679809

SOURCE	DF	TYPE I SS	F VALUE	PR > F
Region	1	4.86449637	12.94	0.0009
Installation(Region)	8	69.33926863	23.06	0.0001
Block(Region*Install)	10	5.80736993	1.55	0.1626
Treatment	2	4.64260661	6.18	0.0048
Initial BA	1	4.82688343	12.84	0.0010

SOURCE	DF	TYPE III SS	F VALUE	PR > F
Region	1	0.00230411	0.01	0.9380
Installation(Region)	8	57.44049116	19.11	0.0001
Block(Region*Install)	10	7.28150054	1.94	0.0708
Treatment	2	5.53201328	7.36	0.0020
Initial BA	1	4.82688343	12.84	0.0010

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR >]T]	STD ERROR OF ESTIMATE
NE Oregon:Control	4.11745479	22.84	0.0001	0.18024201
NE Oregon:200#N	4.68939542	24.59	0.0001	0.19067003
NE Oregon:400#N	4.81979925	25.70	0.0001	0.18753354
C Washington:Control	4.13475078	24.01	0.0001	0.17221217
C Washington:200#N	4.70669141	28.47	0.0001	0.16533119
C Washington:400#N	4.83709524	28.95	0.0001	0.16707777
All:Control	4.12610279	30.03	0.0001	0.13738370
All:200#N	4.69804342	33.52	0.0001	0.14016743
All:400#N	4.82844724	34.72	0.0001	0.13908300
200#N - Control	0.57194063	2.93	0.0057	0.19489343
400#N - Control	0.70234445	3.61	0.0009	0.19438608
400#N - 200#N	0.13040382	0.67	0.5055	0.19394001

Table 8. **Gross basal area increment in the second two years for ponderosa pine installations in northeastern Oregon and central Washington.**

Dependent Variable: PGBAI4 Gross BA PAI--Period 2

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
Model	22	189.44126848	8.61096675
Error	37	18.13169112	0.49004571
Corrected Total	59	207.57295959	

MODEL F = 17.57 PR > F = 0.0001

R-SQUARE	C.V.	ROOT MSE	PGBAI4 MEAN
0.912649	18.0676	0.70003265	3.87450935

SOURCE	DF	TYPE I SS	F VALUE	PR > F
Region	1	19.21228594	39.21	0.0001
Installation(Region)	8	153.30263488	39.10	0.0001
Block(Region*Install)	10	5.13666764	1.05	0.4247
Treatment	2	5.33269462	5.44	0.0085
Initial BA	1	6.45698540	13.18	0.0009

SOURCE	DF	TYPE III SS	F VALUE	PR > F
Region	1	1.87266425	3.82	0.0582
Installation(Region)	8	106.86679554	27.26	0.0001
Block(Region*Install)	10	7.99490445	1.63	0.1359
Treatment	2	6.47630557	6.61	0.0035
Initial BA	1	6.45698540	13.18	0.0009

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR >]T]	STD ERROR OF ESTIMATE
NE Oregon:Control	3.24988165	15.79	0.0001	0.20582436
NE Oregon:200#N	3.89883503	17.91	0.0001	0.21773247
NE Oregon:400#N	3.99217534	18.64	0.0001	0.21415081
C Washington:Control	3.74296871	19.03	0.0001	0.19665482
C Washington:200#N	4.39192209	23.26	0.0001	0.18879720
C Washington:400#N	4.48526240	23.51	0.0001	0.19079168
All:Control	3.49642518	22.29	0.0001	0.15688303
All:200#N	4.14537856	25.90	0.0001	0.16006186
All:400#N	4.23871887	26.69	0.0001	0.15882352
200#N - Control	0.64895338	2.92	0.0060	0.22255531
400#N - Control	0.74229368	3.34	0.0019	0.22197594
400#N - 200#N	0.09334031	0.42	0.6759	0.22146657

Table 9. **Gross basal area increment in the third two years for ponderosa pine installations in northeastern Oregon and central Washington.**

Dependent Variable: PGBAI6 Gross BA PAI--Period 3

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
Model	22	105.34114683	4.78823395
Error	37	22.83693286	0.61721440
Corrected Total	59	128.17807970	

MODEL F = 7.76 PR > F = 0.0001

R-SQUARE	C.V.	ROOT MSE	PGBAI6 MEAN
0.821834	20.6479	0.78562994	3.80488334

SOURCE	DF	TYPE I SS	F VALUE	PR > F
Region	1	20.68517854	33.51	0.0001
Installation(Region)	8	69.29757466	14.03	0.0001
Block(Region*Install)	10	5.44459690	0.88	0.5578
Treatment	2	3.91057383	3.17	0.0537
Initial BA	1	6.00322289	9.73	0.0035

SOURCE	DF	TYPE III SS	F VALUE	PR > F
Region	1	2.40261981	3.89	0.0560
Installation(Region)	8	61.43808971	12.44	0.0001
Block(Region*Install)	10	5.96561046	0.97	0.4877
Treatment	2	4.84202856	3.92	0.0285
Initial BA	1	6.00322289	9.73	0.0035

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR >]T]	STD ERROR OF ESTIMATE
NE Oregon:Control	3.20993508	13.90	0.0001	0.23099177
NE Oregon:200#N	3.75081607	15.35	0.0001	0.24435595
NE Oregon:400#N	3.86392376	16.08	0.0001	0.24033634
C Washington:Control	3.76845180	17.07	0.0001	0.22070101
C Washington:200#N	4.30933278	20.34	0.0001	0.21188259
C Washington:400#N	4.42244047	20.65	0.0001	0.21412095
All:Control	3.48919344	19.82	0.0001	0.17606608
All:200#N	4.03007443	22.43	0.0001	0.17963361
All:400#N	4.14318212	23.24	0.0001	0.17824385
200#N - Control	0.54088099	2.17	0.0369	0.24976851
400#N - Control	0.65398868	2.63	0.0125	0.24911831
400#N - 200#N	0.11310769	0.46	0.6517	0.24854665

Table 10. Four year net basal area growth for ponderosa pine installations in Montana.

4 Year Data for 1987 Ponderosa Pine Installations (301 - 306)

Dependent Variable: NBAI4 4 Year Net BA Growth (sq.ft/a)

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
Model	14	818.70848457	58.47917747
Error	21	576.39081280	27.44718156
Corrected Total	35	1395.09929737	

Model F = 2.13 PR > F = 0.0569

R-SQUARE	C.V.	ROOT MSE	NBAI4 MEAN
0.586846	42.7947	5.23900578	12.24218263

SOURCE	DF	TYPE I SS	F VALUE	PR > F
Installation	5	385.23459225	2.81	0.0429
Block(Installation)	6	260.19959401	1.58	0.2022
Treatment	2	172.67883875	3.15	0.0638
Initial BA	1	0.59545956	0.02	0.8843

SOURCE	DF	TYPE III SS	F VALUE	PR > F
Installation	5	357.46179076	2.60	0.0553
Block(Installation)	6	256.47875175	1.56	0.2088
Treatment	2	168.24254082	3.06	0.0679
Initial BA	1	0.59545956	0.02	0.8843

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR >]T]	STD ERROR OF ESTIMATE
Control Mean	12.29613940	8.04	0.0001	1.52933843
200#N Mean	9.50630090	6.17	0.0001	1.54074498
200#N+200#K Mean	14.94485603	9.79	0.0001	1.52660925
200#N Effect	-2.78983850	-1.27	0.2189	2.20147745
200#N+200#K Effect	2.64871663	1.24	0.2293	2.13890101
200#K Effect	5.43855513	2.48	0.0219	2.19701651

Table 11. Four year gross basal area growth for ponderosa pine installations in Montana.

4 Year Data for 1987 Ponderosa Pine Installations (301 - 306)

Dependent Variable: GBAI4 4 Year Gross BA Growth (sq.ft/a)

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
Model	14	487.42692966	34.81620926
Error	21	66.77532776	3.17977751
Corrected Total	35	554.20225742	

Model F = 10.95 PR > F = 0.0001

R-SQUARE	C.V.	ROOT MSE	GBAI4 MEAN
0.879511	12.7932	1.78319307	13.93864690

SOURCE	DF	TYPE I SS	F VALUE	PR > F
Installation	5	411.98990006	25.91	0.0001
Block(Installation)	6	30.50304185	1.60	0.1968
Treatment	2	36.35900010	5.72	0.0104
Initial BA	1	8.57498765	2.70	0.1154

SOURCE	DF	TYPE III SS	F VALUE	PR > F
Installation	5	419.99530505	26.42	0.0001
Block(Installation)	6	35.41750618	1.86	0.1364
Treatment	2	34.81217412	5.47	0.0122
Initial BA	1	8.57498765	2.70	0.1154

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR >]T]	STD ERROR OF ESTIMATE
Control Mean	12.72137275	24.44	0.0001	0.52053878
200#N Mean	14.04664599	26.79	0.0001	0.52442121
200#N+200#K Mean	15.12665848	29.11	0.0001	0.51960986
200#N Effect	1.32527324	1.77	0.0915	0.74931380
200#N+200#K Effect	2.40528573	3.30	0.0034	0.72801474
200#K Effect	1.08001249	1.44	0.1634	0.74779543

Table 12. Four year net volume growth for ponderosa pine installations in Montana.

4 Year Data for 1987 Ponderosa Pine Installations (301 - 306)

Dependent Variable: NVI4 4 Year Net Volume Growth (cu.ft/a)

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
Model	14	1396804.17550324	99771.72682166
Error	21	618307.72378759	29443.22494227
Corrected Total	35	2015111.89929083	

Model F = 3.39 PR > F = 0.0058

R-SQUARE	C.V.	ROOT MSE	NVI4 MEAN
0.693165	27.8932	171.59028219	615.16862615

SOURCE	DF	TYPE I SS	F VALUE	PR > F
Installation	5	846638.36637625	5.75	0.0017
Block(Installation)	6	357085.87420335	2.02	0.1079
Treatment	2	111177.85237354	1.89	0.1762
Initial BA	1	81902.08255010	2.78	0.1102

SOURCE	DF	TYPE III SS	F VALUE	PR > F
Installation	5	747432.46459545	5.08	0.0033
Block(Installation)	6	278771.20794951	1.58	0.2027
Treatment	2	140548.36133626	2.39	0.1164
Initial BA	1	81902.08255010	2.78	0.1102

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR >]T]	STD ERROR OF ESTIMATE
Control Mean	592.52434093	11.83	0.0001	50.08958254
200#N Mean	555.70127344	11.01	0.0001	50.46317523
200#N+200#K Mean	704.97523249	14.10	0.0001	50.00019536
200#N Effect	-36.82306749	-0.51	0.6149	72.10378325
200#N+200#K Effect	112.45089156	1.61	0.1234	70.05425137
200#K Effect	149.27395905	2.07	0.0505	71.95767636

Table 13. Four year gross volume growth for ponderosa pine installations in Montana.

4 Year Data for 1987 Ponderosa Pine Installations (301 - 306)

Dependent Variable: GVI4 4 Year Gross Volume Growth (cu.ft/a)

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
Model	14	1439618.71828518	102829.90844894
Error	21	134999.76886068	6428.56042194
Corrected Total	35	1574618.48714585	

Model F = 16.00 PR > F = 0.0001

R-SQUARE	C.V.	ROOT MSE	GVI4 MEAN
0.914265	12.1682	80.17830394	658.91583953

SOURCE	DF	TYPE I SS	F VALUE	PR > F
Installation	5	1101516.52121758	34.27	0.0001
Block(Installation)	6	88677.33296455	2.30	0.0730
Treatment	2	94468.87964641	7.35	0.0038
Initial BA	1	154955.98445663	24.10	0.0001

SOURCE	DF	TYPE III SS	F VALUE	PR > F
Installation	5	899780.52272054	27.99	0.0001
Block(Installation)	6	41928.35162374	1.09	0.4019
Treatment	2	71584.89348451	5.57	0.0115
Initial BA	1	154955.98445663	24.10	0.0001

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR >]T]	STD ERROR OF ESTIMATE
Control Mean	603.54702717	25.79	0.0001	23.40515862
200#N Mean	672.18375425	28.51	0.0001	23.57972578
200#N+200#K Mean	711.60107138	30.46	0.0001	23.36339103
200#N Effect	68.63672708	2.04	0.0544	33.69164602
200#N+200#K Effect	108.05404421	3.30	0.0034	32.73396947
200#K Effect	39.41731713	1.17	0.2542	33.62337524

Table 14. Change in mean diameter after four years for ponderosa pine installations in Montana.

4 Year Data for 1987 Ponderosa Pine Installations (301 - 306)

Dependent Variable: DELTAD4 4 Year Change in Mean Diameter

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
Model	14	0.95685723	0.06834695
Error	21	0.26049007	0.01240429
Corrected Total	35	1.21734730	

Model F = 5.51 PR > F = 0.0003

R-SQUARE	C.V.	ROOT MSE	DELTAD4 MEAN
0.786018	18.7370	0.11137454	0.59441120

SOURCE	DF	TYPE I SS	F VALUE	PR > F
Installation	5	0.83694039	13.49	0.0001
Block(Installation)	6	0.05350140	0.72	0.6389
Treatment	2	0.05390254	2.17	0.1388
Initial BA	1	0.01251290	1.01	0.3266

SOURCE	DF	TYPE III SS	F VALUE	PR > F
Installation	5	0.72972723	11.77	0.0001
Block(Installation)	6	0.04735017	0.64	0.7001
Treatment	2	0.05898046	2.38	0.1173
Initial BA	1	0.01251290	1.01	0.3266

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR >]T]	STD ERROR OF ESTIMATE
Control Mean	0.53592444	16.48	0.0001	0.03251177
200#N Mean	0.61811601	18.87	0.0001	0.03275426
200#N+200#K Mean	0.62618542	19.29	0.0001	0.03245375
200#N Effect	0.08219158	1.76	0.0936	0.04680059
200#N+200#K Effect	0.09026098	1.99	0.0604	0.04547029
200#K Effect	0.00806940	0.17	0.8645	0.04670575

Table 15. Four year height growth for ponderosa pine installations in Montana.

4 Year Data for 1987 Ponderosa Pine Installations (301 - 306)

Dependent Variable: HTI4 4 Year Average Height Growth (ft)

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
Model	14	31.88960017	2.27782858
Error	21	2.89569740	0.13789035
Corrected Total	35	34.78529757	

Model F =	16.52	PR > F = 0.0001

R-SQUARE	C.V.	ROOT MSE	HTI4 MEAN
0.916755	7.2740	0.37133590	5.10499027

SOURCE	DF	TYPE I SS	F VALUE	PR > F
Installation	5	27.06529939	39.26	0.0001
Block(Installation)	6	2.81087866	3.40	0.0168
Treatment	2	1.93919518	7.03	0.0046
Initial BA	1	0.07422694	0.54	0.4712

SOURCE	DF	TYPE III SS	F VALUE	PR > F
Installation	5	25.87105503	37.52	0.0001
Block(Installation)	6	2.88391711	3.49	0.0150
Treatment	2	2.01342201	7.30	0.0039
Initial BA	1	0.07422694	0.54	0.4712

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
Control Mean	4.77349446	44.04	0.0001	0.10839810
200#N Mean	5.34457736	48.94	0.0001	0.10920658
200#N+200#K Mean	5.18957343	47.96	0.0001	0.10820466
200#N Effect	0.57108290	3.66	0.0015	0.15603869
200#N+200#K Effect	0.41607897	2.74	0.0121	0.15160333
200#K Effect	-0.15500393	-1.00	0.3309	0.15572251

Table 16. **Net basal area increment in the first two years for ponderosa pine installations in Montana.**

4 Year Data for 1987 Ponderosa Pine Installations (301 - 306)

Dependent Variable: PNBAI2 Net BA PAI--Period 1

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
Model	14	68.30958721	4.87925623
Error	21	104.23151116	4.96340529
Corrected Total	35	172.54109837	

Model F =	0.98	PR > F = 0.5007

R-SQUARE	C.V.	ROOT MSE	PNBAI2 MEAN
0.395903	76.7742	2.22787012	2.90184570

SOURCE	DF	TYPE I SS	F VALUE	PR > F
Installation	5	12.64076228	0.51	0.7660
Block(Installation)	6	38.81339720	1.30	0.2987
Treatment	2	13.15835363	1.33	0.2870
Initial BA	1	3.69707410	0.74	0.3979

SOURCE	DF	TYPE III SS	F VALUE	PR > F
Installation	5	3.11152183	0.13	0.9851
Block(Installation)	6	40.46976232	1.36	0.2764
Treatment	2	9.19278612	0.93	0.4117
Initial BA	1	3.69707410	0.74	0.3979

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR >]T]	STD ERROR OF ESTIMATE
Control Mean	3.01083879	4.63	0.0001	0.65034618
200#N Mean	2.19221908	3.35	0.0031	0.65519678
200#N+200#K Mean	3.45077946	5.32	0.0001	0.64918561
200#N Effect	-0.81861971	-0.87	0.3918	0.93617111
200#N+200#K Effect	0.43994067	0.48	0.6336	0.90956068
200#K Effect	1.25856039	1.35	0.1923	0.93427411

Table 17. Net basal area increment in the second two years for ponderosa pine installations in Montana.

4 Year Data for 1987 Ponderosa Pine Installations (301 - 306)

Dependent Variable: PNBAI4 Net BA PAI--Period 2

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
Model	14	96.02074070	6.85862434
Error	21	35.22517747	1.67738940
Corrected Total	35	131.24591816	

Model F =	4.09	PR > F = 0.0019

R-SQUARE	C.V.	ROOT MSE	PNBAI4 MEAN
0.731609	40.2312	1.29514069	3.21924562

SOURCE	DF	TYPE I SS	F VALUE	PR > F
Installation	5	70.51769107	8.41	0.0002
Block(Installation)	6	10.36033810	1.03	0.4340
Treatment	2	9.81304140	2.93	0.0757
Initial BA	1	5.32967013	3.18	0.0891

SOURCE	DF	TYPE III SS	F VALUE	PR > F
Installation	5	74.89925614	8.93	0.0001
Block(Installation)	6	9.60234308	0.95	0.4790
Treatment	2	12.43152298	3.71	0.0418
Initial BA	1	5.32967013	3.18	0.0891

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR >]T]	STD ERROR OF ESTIMATE
Control Mean	3.13723091	8.30	0.0001	0.37806952
200#N Mean	2.56093137	6.72	0.0001	0.38088935
200#N+200#K Mean	4.02164855	10.66	0.0001	0.37739484
200#N Effect	-0.57629954	-1.06	0.3017	0.54422979
200#N+200#K Effect	0.88441764	1.67	0.1092	0.52876020
200#K Effect	1.46071718	2.69	0.0137	0.54312700

Table 18. Gross basal area increment in the first two years for ponderosa pine installations in Montana.

4 Year Data for 1987 Ponderosa Pine Installations (301 - 306)

Dependent Variable: PGBAI2 Gross BA PAI--Period 1

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
Model	14	15.27404613	1.09100330
Error	21	3.73471074	0.17784337
Corrected Total	35	19.00875688	

Model F =	6.13	PR > F =	0.0001

R-SQUARE	C.V.	ROOT MSE	PGBAI2 MEAN
0.803527	12.3558	0.42171480	3.41309775

SOURCE	DF	TYPE I SS	F VALUE	PR > F
Installation	5	13.18321983	14.83	0.0001
Block(Installation)	6	1.12434425	1.05	0.4203
Treatment	2	0.59735170	1.68	0.2106
Initial BA	1	0.36913036	2.08	0.1644

SOURCE	DF	TYPE III SS	F VALUE	PR > F
Installation	5	13.45632950	15.13	0.0001
Block(Installation)	6	1.32000414	1.24	0.3275
Treatment	2	0.62778121	1.76	0.1957
Initial BA	1	0.36913036	2.08	0.1644

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR >]T]	STD ERROR OF ESTIMATE
Control Mean	3.28641955	26.70	0.0001	0.12310440
200#N Mean	3.36987651	27.17	0.0001	0.12402257
200#N+200#K Mean	3.59933331	29.29	0.0001	0.12288471
200#N Effect	0.08345696	0.47	0.6425	0.17720836
200#N+200#K Effect	0.31291375	1.82	0.0834	0.17217126
200#K Effect	0.22945679	1.30	0.2085	0.17684927

Table 19. **Gross basal area increment in the second two years for ponderosa pine installations in Montana.**

4 Year Data for 1987 Ponderosa Pine Installations (301 - 306)

Dependent Variable: PGBAI4 Gross BA PAI--Period 2

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
Model	14	54.41923095	3.88708792
Error	21	5.25493870	0.25023518
Corrected Total	35	59.67416965	

Model F = 15.53 PR > F = 0.0001

R-SQUARE	C.V.	ROOT MSE	PGBAI4 MEAN
0.911939	14.0665	0.50023512	3.55622571

SOURCE	DF	TYPE I SS	F VALUE	PR > F
Installation	5	45.37059491	36.26	0.0001
Block(Installation)	6	3.15141285	2.10	0.0967
Treatment	2	5.16347162	10.32	0.0008
Initial BA	1	0.73375157	2.93	0.1016

SOURCE	DF	TYPE III SS	F VALUE	PR > F
Installation	5	46.09979273	36.85	0.0001
Block(Installation)	6	3.59342741	2.39	0.0640
Treatment	2	4.87962689	9.75	0.0010
Initial BA	1	0.73375157	2.93	0.1016

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
Control Mean	3.07426682	21.05	0.0001	0.14602557
200#N Mean	3.65344648	24.83	0.0001	0.14711470
200#N+200#K Mean	3.96399593	27.19	0.0001	0.14576498
200#N Effect	0.57917966	2.76	0.0119	0.21020331
200#N+200#K Effect	0.88972911	4.36	0.0003	0.20422833
200#K Effect	0.31054945	1.48	0.1536	0.20977736

Table 20. **Net volume increment in the first two years for ponderosa pine installations in Montana.**

4 Year Data for 1987 Ponderosa Pine Installations (301 - 306)

Dependent Variable: PNVI2 Net Volume PAI--Period 1

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
Model	14	65206.77470536	4657.62676467
Error	21	107061.56704597	5098.16985933
Corrected Total	35	172268.34175133	

Model F =	0.91	PR > F = 0.5593

R-SQUARE	C.V.	ROOT MSE	PNVI2 MEAN
0.378519	55.5071	71.40146959	128.63483311

SOURCE	DF	TYPE I SS	F VALUE	PR > F
Installation	5	13836.35642517	0.54	0.7418
Block(Installation)	6	43072.07199557	1.41	0.2579
Treatment	2	8284.11327891	0.81	0.4572
Initial BA	1	14.23300572	0.00	0.9584

SOURCE	DF	TYPE III SS	F VALUE	PR > F
Installation	5	13586.77689030	0.53	0.7489
Block(Installation)	6	41958.19894220	1.37	0.2715
Treatment	2	7683.28732647	0.75	0.4830
Initial BA	1	14.23300572	0.00	0.9584

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR >]T]	STD ERROR OF ESTIMATE
Control Mean	129.44539552	6.21	0.0001	20.84307898
200#N Mean	109.80008026	5.23	0.0001	20.99853690
200#N+200#K Mean	146.55758391	7.04	0.0001	20.80588354
200#N Effect	-19.64531526	-0.65	0.5197	30.00354112
200#N+200#K Effect	17.11218839	0.59	0.5634	29.15069802
200#K Effect	36.75750365	1.23	0.2332	29.94274369

Table 21. Net volume increment in the second two years for ponderosa pine installations in Montana.

4 Year Data for 1987 Ponderosa Pine Installations (301 - 306)

Dependent Variable: PNVI4 Net Volume PAI--Period 2

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
Model	14	182710.44674685	13050.74619620
Error	21	34487.76145548	1642.27435502
Corrected Total	35	217198.20820233	

Model F =	7.95	PR > F = 0.0001

R-SQUARE	C.V.	ROOT MSE	PNVI4 MEAN
0.841215	22.6460	40.52498433	178.94947997

SOURCE	DF	TYPE I SS	F VALUE	PR > F
Installation	5	136585.77925209	16.63	0.0001
Block(Installation)	6	14996.05319984	1.52	0.2196
Treatment	2	9559.17884220	2.91	0.0766
Initial BA	1	21569.43545272	13.13	0.0016

SOURCE	DF	TYPE III SS	F VALUE	PR > F
Installation	5	119526.60959897	14.56	0.0001
Block(Installation)	6	8827.20837570	0.90	0.5160
Treatment	2	11696.47203096	3.56	0.0466
Initial BA	1	21569.43545272	13.13	0.0016

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
Control Mean	166.81677494	14.10	0.0001	11.82980482
200#N Mean	168.05055646	14.10	0.0001	11.91803731
200#N+200#K Mean	205.93003233	17.44	0.0001	11.80869399
200#N Effect	1.23378152	0.07	0.9429	17.02896370
200#N+200#K Effect	39.11325739	2.36	0.0278	16.54491969
200#K Effect	37.87947588	2.23	0.0369	16.99445720

Table 22. **Gross volume increment in the first two years for ponderosa pine installations in Montana.**

4 Year Data for 1987 Ponderosa Pine Installations (301 - 306)

Dependent Variable: PGVI2 Gross Volume PAI--Period 1

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
Model	14	48221.19548804	3444.37110629
Error	21	6024.14305509	286.86395500
Corrected Total	35	54245.33854314	

Model F =	12.01	PR > F =	0.0001

R-SQUARE	C.V.	ROOT MSE	PGVI2 MEAN
0.888946	11.8370	16.93705863	143.08546407

SOURCE	DF	TYPE I SS	F VALUE	PR > F
Installation	5	34982.40229331	24.39	0.0001
Block(Installation)	6	4637.90804211	2.69	0.0423
Treatment	2	1915.94938998	3.34	0.0550
Initial BA	1	6684.93576264	23.30	0.0001

SOURCE	DF	TYPE III SS	F VALUE	PR > F
Installation	5	25475.81234249	17.76	0.0001
Block(Installation)	6	1621.27034293	0.94	0.4865
Treatment	2	1274.28728497	2.22	0.1333
Initial BA	1	6684.93576264	23.30	0.0001

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR >]T]	STD ERROR OF ESTIMATE
Control Mean	136.33588847	27.58	0.0001	4.94416225
200#N Mean	144.22325217	28.95	0.0001	4.98103824
200#N+200#K Mean	150.89565801	30.57	0.0001	4.93533917
200#N Effect	7.88736371	1.11	0.2803	7.11710470
200#N+200#K Effect	14.55976954	2.11	0.0474	6.91480279
200#K Effect	6.67240583	0.94	0.3582	7.10268302

Table 23. Gross volume increment in the second two years for ponderosa pine installations in Montana.

4 Year Data for 1987 Ponderosa Pine Installations (301 - 306)

Dependent Variable: PGVI4 Gross Volume PAI--Period 2

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
Model	14	149014.04120172	10643.86008584
Error	21	11997.59030431	571.31382401
Corrected Total	35	161011.63150602	

Model F =	18.63	PR > F = 0.0001

R-SQUARE	C.V.	ROOT MSE	PGVI4 MEAN
0.925486	12.8249	23.90217195	186.37245570

SOURCE	DF	TYPE I SS	F VALUE	PR > F
Installation	5	116555.52827756	40.80	0.0001
Block(Installation)	6	7098.24987074	2.07	0.1006
Treatment	2	12121.27800163	10.61	0.0007
Initial BA	1	13238.98505178	23.17	0.0001

SOURCE	DF	TYPE III SS	F VALUE	PR > F
Installation	5	100425.96159811	35.16	0.0001
Block(Installation)	6	4445.77998024	1.30	0.3014
Treatment	2	9670.23676536	8.46	0.0020
Initial BA	1	13238.98505178	23.17	0.0001

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR >]T]	STD ERROR OF ESTIMATE
Control Mean	165.43762512	23.71	0.0001	6.97737541
200#N Mean	191.86862495	27.30	0.0001	7.02941610
200#N+200#K Mean	204.90487769	29.42	0.0001	6.96492396
200#N Effect	26.43099983	2.63	0.0156	10.04390810
200#N+200#K Effect	39.46725256	4.04	0.0006	9.75841254
200#K Effect	13.03625273	1.30	0.2075	10.02355571

Section II

SUMMARY CHARACTERISTICS FOR ALL OF THE PONDEROSA PINE INSTALLATIONS

PLOT SUMMARY REPORT

INSTALLATION 291 SARDINE SPRINGS
REGION: NORTHEAST OREGON OWNERSHIP: FOREST SERVICE
LEGAL DESCRIPTION: 7S R42E SECTION 4 MERIDIAN: WILLAMETTE

	PLOT NUMBER					
	1	2	3	4	5	6
TREATMENT	200#N	NONE	400#N	400#N	NONE	200#N
SITE AND SOIL CHARACTERISTICS:						
SLOPE (%)	7	5	15	7	7	6
ASPECT	216	225	318	288	310	300
PONDEROSA PINE SITE INDEX	95.1	89.9	97.0	111.0	105.2	105.9
MENSURATIONAL CHARACTERISTICS:						
AT TIME OF TREATMENT (1985)	STAND TOTAL AGE = 83					
LIVE TREES PER ACRE	80	75	65	65	70	70
LIVE BASAL AREA (SQ.FT/A)	79.7	75.3	72.1	79.2	83.2	71.4
LIVE TOTAL VOLUME (CU.FT/A)	2453	2242	2214	2844	2716	2397
CROWN COMPETITION FACTOR	62	58	55	60	63	55
RELATIVE DENSITY INDEX	21.7	20.4	19.1	20.5	21.7	19.3
SITE HEIGHT (FT)	73.7	71.3	74.3	83.6	76.5	77.0
MEAN DIAMETER (IN)	13.5	13.6	14.3	14.9	14.8	13.7
AVERAGE CROWN RATIO (%)	51	53	52	48	52	42
AVERAGE CROWN LENGTH (FT)	34.6	35.8	35.8	38.7	37.7	31.1
SPECIES COMPOSITION (% OF BA)						
PONDEROSA PINE	100.0	100.0	100.0	100.0	100.0	100.0
2 YEARS AFTER TREATMENT (1987)						
LIVE TREES PER ACRE	80	75	65	65	70	70
LIVE BASAL AREA (SQ.FT/A)	87.6	83.0	79.2	88.3	91.1	77.9
LIVE TOTAL VOLUME (CU.FT/A)	2773	2548	2497	3276	3057	2672
CROWN COMPETITION FACTOR	67	63	60	65	68	59
RELATIVE DENSITY INDEX	23.3	22.0	20.5	22.2	23.2	20.6
SITE HEIGHT (FT)	75.4	73.1	75.8	86.1	78.3	78.6
MEAN DIAMETER (IN)	14.2	14.2	14.9	15.8	15.4	14.3
AVERAGE HEIGHT GROWTH (FT)	1.9	1.9	1.7	2.3	1.8	1.6
DEAD TREES PER ACRE	0	0	0	0	0	0
DEAD BASAL AREA (SQ.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
DEAD TOTAL VOLUME (CU.FT/A)	0	0	0	0	0	0
TOPKILL VOLUME (CU.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
4 YEARS AFTER TREATMENT (1989)						
LIVE TREES PER ACRE	80	75	65	65	70	70
LIVE BASAL AREA (SQ.FT/A)	92.5	88.6	83.5	93.5	96.5	82.3
LIVE TOTAL VOLUME (CU.FT/A)	2986	2800	2710	3552	3335	2888
CROWN COMPETITION FACTOR	70	67	62	69	72	62
RELATIVE DENSITY INDEX	24.2	23.1	21.3	23.2	24.2	21.5
SITE HEIGHT (FT)	76.5	74.9	70.0	85.9	80.5	81.8
MEAN DIAMETER (IN)	14.6	14.7	15.4	16.2	15.9	14.7
AVERAGE HEIGHT GROWTH (FT)	3.4	3.7	3.6	4.3	3.9	3.2
AVERAGE CROWN RATIO (%)	59	61	61	54	57	48
AVERAGE CROWN LENGTH (FT)	41.9	42.9	43.9	46.2	43.6	37.0
DEAD TREES PER ACRE	0	0	0	0	0	0
DEAD BASAL AREA (SQ.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
DEAD TOTAL VOLUME (CU.FT/A)	0	0	0	0	0	0
TOPKILL VOLUME (CU.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
6 YEARS AFTER TREATMENT (1991)						
LIVE TREES PER ACRE	80	75	65	65	70	70
LIVE BASAL AREA (SQ.FT/A)	97.1	93.1	86.7	98.7	101.4	86.2
CROWN COMPETITION FACTOR	73	70	64	72	75	64
RELATIVE DENSITY INDEX	25.1	24.0	21.9	24.2	25.1	22.2
MEAN DIAMETER (IN)	14.9	15.1	15.6	16.7	16.3	15.0
DEAD TREES PER ACRE	0	0	0	0	0	0
DEAD BASAL AREA (SQ.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0

PLOT SUMMARY REPORT

INSTALLATION 292 SPARTA BUTTE
REGION: NORTHEAST OREGON OWNERSHIP: FOREST SERVICE
LEGAL DESCRIPTION: 8S R44E SECTION 4 MERIDIAN: WILLAMETTE

	PLOT NUMBER					
	1	2	3	4	5	6
TREATMENT	200#N	NONE	400#N	400#N	NONE	200#N
SITE AND SOIL CHARACTERISTICS:						
SLOPE (%)	15	12	15	10	8	20
ASPECT	30	8	358	14	10	80
PONDEROSA PINE SITE INDEX	114.4	121.6	115.3	97.8	116.3	105.4
MENSURATIONAL CHARACTERISTICS:						
AT TIME OF TREATMENT (1985)	STAND TOTAL AGE =		88			
LIVE TREES PER ACRE	70	70	95	90	130	90
LIVE BASAL AREA (SQ.FT/A)	108.1	141.0	136.0	90.1	140.4	101.5
LIVE TOTAL VOLUME (CU.FT/A)	4502	6492	5183	2914	4965	3471
CROWN COMPETITION FACTOR	81	100	100	71	109	81
RELATIVE DENSITY INDEX	26.4	32.2	33.8	24.5	37.4	26.8
SITE HEIGHT (FT)	98.7	104.1	92.8	77.0	88.9	83.4
MEAN DIAMETER (IN)	16.8	19.2	16.2	13.5	14.1	14.4
AVERAGE CROWN RATIO (%)	47	46	53	48	51	50
AVERAGE CROWN LENGTH (FT)	43.7	47.9	43.6	35.5	37.6	38.2
SPECIES COMPOSITION (% OF BA)						
DOUGLAS-FIR	10.7	7.6	0.0	0.0	4.6	12.6
PONDEROSA PINE	89.3	92.4	100.0	100.0	95.4	87.4
2 YEARS AFTER TREATMENT (1987)						
LIVE TREES PER ACRE	70	70	95	90	130	90
LIVE BASAL AREA (SQ.FT/A)	113.4	149.4	142.8	97.4	147.3	106.3
LIVE TOTAL VOLUME (CU.FT/A)	4790	6995	5553	3246	5316	3707
CROWN COMPETITION FACTOR	85	105	104	75	114	84
RELATIVE DENSITY INDEX	27.3	33.6	35.1	26.0	38.8	27.7
SITE HEIGHT (FT)	99.7	105.7	94.4	79.0	90.5	84.9
MEAN DIAMETER (IN)	17.2	19.8	16.6	14.1	14.4	14.7
AVERAGE HEIGHT GROWTH (FT)	1.3	1.8	1.7	1.8	1.5	1.4
DEAD TREES PER ACRE	0	0	0	0	0	0
DEAD BASAL AREA (SQ.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
DEAD TOTAL VOLUME (CU.FT/A)	0	0	0	0	0	0
TOPKILL VOLUME (CU.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
4 YEARS AFTER TREATMENT (1989)						
LIVE TREES PER ACRE	60	70	95	90	125	80
LIVE BASAL AREA (SQ.FT/A)	98.4	154.5	147.2	102.2	151.4	96.8
LIVE TOTAL VOLUME (CU.FT/A)	4114	7335	5811	3482	5582	3424
CROWN COMPETITION FACTOR	74	108	107	78	117	77
RELATIVE DENSITY INDEX	23.6	34.4	35.9	26.9	39.2	25.1
SITE HEIGHT (FT)	97.6	107.1	95.9	81.0	92.1	85.2
MEAN DIAMETER (IN)	17.3	20.1	16.9	14.4	14.9	14.9
AVERAGE HEIGHT GROWTH (FT)	3.0	3.3	2.9	3.9	3.0	3.2
AVERAGE CROWN RATIO (%)	48	53	56	52	52	53
AVERAGE CROWN LENGTH (FT)	46.1	56.6	47.6	40.2	39.6	42.0
DEAD TREES PER ACRE	10	0	0	0	5	10
DEAD BASAL AREA (SQ.FT/A)	18.4	0.0	0.0	0.0	1.0	12.4
DEAD TOTAL VOLUME (CU.FT/A)	864	0	0	0	16	443
TOPKILL VOLUME (CU.FT/A)	6.3	0.0	0.0	5.3	0.0	5.1
6 YEARS AFTER TREATMENT (1991)						
LIVE TREES PER ACRE	60	70	95	90	125	80
LIVE BASAL AREA (SQ.FT/A)	101.9	159.9	153.1	108.1	156.9	100.7
CROWN COMPETITION FACTOR	76	112	111	82	120	79
RELATIVE DENSITY INDEX	24.3	35.3	36.9	28.1	40.3	25.8
MEAN DIAMETER (IN)	17.6	20.5	17.2	14.8	15.2	15.2
DEAD TREES PER ACRE	10	0	0	0	5	10
DEAD BASAL AREA (SQ.FT/A)	18.4	0.0	0.0	0.0	1.0	12.4

PLOT SUMMARY REPORT

INSTALLATION 293 SUMMIT SALVAGE
REGION: NORTHEAST OREGON OWNERSHIP: FOREST SERVICE
LEGAL DESCRIPTION: 5S R41E SECTION 27 MERIDIAN: WILLAMETTE

	PLOT NUMBER					
	1	2	3	4	5	6
TREATMENT	200#N	NONE	400#N	200#N	NONE	400#N
SITE AND SOIL CHARACTERISTICS:						
SLOPE (%)	10	15	10	5	5	10
ASPECT	200	240	230	240	110	194
PONDEROSA PINE SITE INDEX	105.0	108.9	103.2	115.0	116.9	103.8
MENSURATIONAL CHARACTERISTICS:						
AT TIME OF TREATMENT (1985)	STAND TOTAL AGE = 47					
LIVE TREES PER ACRE	190	160	210	150	160	190
LIVE BASAL AREA (SQ.FT/A)	95.9	101.2	88.4	87.9	82.1	75.5
LIVE TOTAL VOLUME (CU.FT/A)	1895	2273	1661	1565	1468	1271
CROWN COMPETITION FACTOR	84	81	79	74	70	66
RELATIVE DENSITY INDEX	30.9	30.8	29.8	27.3	26.4	25.9
SITE HEIGHT (FT)	51.7	59.6	52.6	48.4	49.5	46.9
MEAN DIAMETER (IN)	9.6	10.8	8.8	10.4	9.7	8.5
AVERAGE CROWN RATIO (%)	57	58	56	65	64	58
AVERAGE CROWN LENGTH (FT)	26.1	25.6	23.7	26.8	27.2	22.9
SPECIES COMPOSITION (% OF BA)						
DOUGLAS-FIR	4.7	0.0	18.8	0.0	0.0	0.0
PONDEROSA PINE	95.3	100.0	81.2	100.0	100.0	100.0
2 YEARS AFTER TREATMENT (1987)						
LIVE TREES PER ACRE	190	160	210	150	160	190
LIVE BASAL AREA (SQ.FT/A)	105.6	107.7	98.2	97.4	89.3	86.2
LIVE TOTAL VOLUME (CU.FT/A)	2197	2522	1906	1832	1695	1541
CROWN COMPETITION FACTOR	90	86	87	81	76	74
RELATIVE DENSITY INDEX	33.2	32.3	32.3	29.5	28.1	28.5
SITE HEIGHT (FT)	54.2	62.0	54.6	50.7	52.0	49.8
MEAN DIAMETER (IN)	10.1	11.1	9.3	10.9	10.1	9.1
AVERAGE HEIGHT GROWTH (FT)	2.1	1.5	1.6	2.1	2.4	2.3
DEAD TREES PER ACRE	0	0	0	0	0	0
DEAD BASAL AREA (SQ.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
DEAD TOTAL VOLUME (CU.FT/A)	0	0	0	0	0	0
TOPKILL VOLUME (CU.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
4 YEARS AFTER TREATMENT (1989)						
LIVE TREES PER ACRE	190	150	190	150	160	190
LIVE BASAL AREA (SQ.FT/A)	114.5	108.1	102.2	104.4	95.7	96.3
LIVE TOTAL VOLUME (CU.FT/A)	2485	2650	2072	2054	1914	1799
CROWN COMPETITION FACTOR	97	85	90	86	81	82
RELATIVE DENSITY INDEX	35.3	31.9	32.4	31.1	29.6	31.0
SITE HEIGHT (FT)	55.7	63.7	54.2	52.9	54.6	51.5
MEAN DIAMETER (IN)	10.5	11.5	9.9	11.3	10.5	9.6
AVERAGE HEIGHT GROWTH (FT)	4.0	3.2	3.5	3.9	4.5	4.2
AVERAGE CROWN RATIO (%)	59	55	60	62	62	63
AVERAGE CROWN LENGTH (FT)	29.3	25.9	27.0	28.1	29.2	27.3
DEAD TREES PER ACRE	0	10	20	0	0	0
DEAD BASAL AREA (SQ.FT/A)	0.0	4.6	3.9	0.0	0.0	0.0
DEAD TOTAL VOLUME (CU.FT/A)	0	82	56	0	0	0
TOPKILL VOLUME (CU.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
6 YEARS AFTER TREATMENT (1991)						
LIVE TREES PER ACRE	190	130	190	140	160	190
LIVE BASAL AREA (SQ.FT/A)	122.8	109.3	110.8	106.9	101.7	106.1
CROWN COMPETITION FACTOR	103	84	97	87	86	90
RELATIVE DENSITY INDEX	37.2	31.0	34.5	31.1	30.9	33.4
MEAN DIAMETER (IN)	10.9	12.4	10.3	11.8	10.8	10.1
DEAD TREES PER ACRE	0	30	20	10	0	0
DEAD BASAL AREA (SQ.FT/A)	0.0	9.1	3.9	4.8	0.0	0.0

PLOT SUMMARY REPORT

INSTALLATION 294 MOSES CREEK
REGION: NORTHEAST OREGON OWNERSHIP: BOISE CASCADE
LEGAL DESCRIPTION: 3N R40E SECTION 30 MERIDIAN: WILLAMETTE

	PLOT NUMBER					
	1	2	3	4	5	6
TREATMENT	NONE	200#N	400#N	400#N	NONE	200#N
SITE AND SOIL CHARACTERISTICS:						
SLOPE (%)	3	0	10	9	9	10
ASPECT	102	0	78	250	215	260
PONDEROSA PINE SITE INDEX	120.5	124.7	140.3	117.1	114.9	109.5
MENSURATIONAL CHARACTERISTICS:						
AT TIME OF TREATMENT (1985)	STAND TOTAL AGE = 81					
LIVE TREES PER ACRE	120	140	105	90	125	140
LIVE BASAL AREA (SQ.FT/A)	129.4	135.2	126.3	130.2	150.6	148.0
LIVE TOTAL VOLUME (CU.FT/A)	4747	4507	4813	4885	5508	5063
CROWN COMPETITION FACTOR	97	106	96	95	112	111
RELATIVE DENSITY INDEX	34.5	37.1	32.8	32.3	39.1	39.7
SITE HEIGHT (FT)	89.9	87.6	93.4	88.3	88.2	85.3
MEAN DIAMETER (IN)	14.1	13.3	14.9	16.3	14.9	13.9
AVERAGE CROWN RATIO (%)	53	58	52	46	44	49
AVERAGE CROWN LENGTH (FT)	34.0	40.6	40.8	37.7	34.8	34.4
SPECIES COMPOSITION (% OF BA)						
DOUGLAS-FIR	0.6	3.5	12.7	0.0	0.0	0.0
GRAND FIR	0.6	0.0	0.0	0.0	0.0	0.0
WESTERN LARCH	0.0	16.0	1.4	0.0	0.0	0.0
PONDEROSA PINE	98.8	80.6	85.9	100.0	100.0	100.0
2 YEARS AFTER TREATMENT (1987)						
LIVE TREES PER ACRE	120	140	105	90	120	140
LIVE BASAL AREA (SQ.FT/A)	136.3	145.6	135.0	134.5	157.2	158.6
LIVE TOTAL VOLUME (CU.FT/A)	5141	4997	5296	5147	5970	5579
CROWN COMPETITION FACTOR	101	113	102	98	116	118
RELATIVE DENSITY INDEX	35.9	39.2	34.5	33.1	39.9	41.8
SITE HEIGHT (FT)	92.5	90.1	96.2	89.3	91.3	87.5
MEAN DIAMETER (IN)	14.4	13.8	15.4	16.6	15.5	14.4
AVERAGE HEIGHT GROWTH (FT)	1.9	2.0	2.2	1.5	2.5	2.0
DEAD TREES PER ACRE	0	0	0	0	5	0
DEAD BASAL AREA (SQ.FT/A)	0.0	0.0	0.0	0.0	0.8	0.0
DEAD TOTAL VOLUME (CU.FT/A)	0	0	0	0	16	0
TOPKILL VOLUME (CU.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
4 YEARS AFTER TREATMENT (1989)						
LIVE TREES PER ACRE	115	135	95	65	120	140
LIVE BASAL AREA (SQ.FT/A)	141.1	151.7	137.7	100.5	163.8	166.6
LIVE TOTAL VOLUME (CU.FT/A)	5432	5366	5567	3939	6361	6001
CROWN COMPETITION FACTOR	104	117	103	73	120	123
RELATIVE DENSITY INDEX	36.4	40.0	34.1	24.5	41.2	43.3
SITE HEIGHT (FT)	94.1	92.4	97.9	89.0	92.9	89.5
MEAN DIAMETER (IN)	15.0	14.4	16.3	16.8	15.8	14.8
AVERAGE HEIGHT GROWTH (FT)	3.6	4.1	4.2	4.0	4.3	3.7
AVERAGE CROWN RATIO (%)	54	59	53	49	50	54
AVERAGE CROWN LENGTH (FT)	37.1	44.2	43.5	42.2	41.7	40.1
DEAD TREES PER ACRE	5	5	10	25	5	0
DEAD BASAL AREA (SQ.FT/A)	1.0	2.1	4.4	37.2	0.8	0.0
DEAD TOTAL VOLUME (CU.FT/A)	21	61	113	1407	16	0
TOPKILL VOLUME (CU.FT/A)	0.2	0.0	0.0	0.0	0.0	0.4
6 YEARS AFTER TREATMENT (1991)						
LIVE TREES PER ACRE	105	135	95	65	120	140
LIVE BASAL AREA (SQ.FT/A)	129.7	159.0	144.4	104.9	171.6	176.2
CROWN COMPETITION FACTOR	96	122	107	76	125	129
RELATIVE DENSITY INDEX	33.4	41.5	35.3	25.3	42.6	45.2
MEAN DIAMETER (IN)	15.0	14.7	16.7	17.2	16.2	15.2
DEAD TREES PER ACRE	15	5	10	25	5	0
DEAD BASAL AREA (SQ.FT/A)	17.7	2.1	4.4	37.2	0.8	0.0

PLOT SUMMARY REPORT

INSTALLATION 295 PARKERS FLAT
REGION: NORTHEAST OREGON OWNERSHIP: BOISE CASCADE
LEGAL DESCRIPTION: 2N R39E SECTION 34 MERIDIAN: WILLAMETTE

	PLOT NUMBER					
	1	2	3	4	5	6
TREATMENT	NONE	400#N	200#N	400#N	200#N	NONE
SITE AND SOIL CHARACTERISTICS:						
SLOPE (%)	12	7	7	10	13	14
ASPECT	216	230	193	180	208	190
PONDEROSA PINE SITE INDEX	124.6	126.0	136.6	133.6	138.5	140.3
MENSURATIONAL CHARACTERISTICS:						
AT TIME OF TREATMENT (1985)	STAND TOTAL AGE = 32					
LIVE TREES PER ACRE	260	250	280	220	220	240
LIVE BASAL AREA (SQ.FT/A)	103.7	108.5	118.1	127.5	138.5	124.6
LIVE TOTAL VOLUME (CU.FT/A)	1824	1959	2081	2475	2861	2370
CROWN COMPETITION FACTOR	91	95	103	108	117	106
RELATIVE DENSITY INDEX	35.5	36.3	39.8	39.7	42.3	39.9
SITE HEIGHT (FT)	47.9	48.1	52.8	50.5	54.5	49.0
MEAN DIAMETER (IN)	8.6	8.9	8.8	10.3	10.7	9.8
AVERAGE CROWN RATIO (%)	61	59	56	57	59	62
AVERAGE CROWN LENGTH (FT)	25.1	26.1	22.3	26.0	29.1	27.2
SPECIES COMPOSITION (% OF BA)						
PONDEROSA PINE	100.0	100.0	100.0	100.0	100.0	100.0
2 YEARS AFTER TREATMENT (1987)						
LIVE TREES PER ACRE	260	250	280	220	220	240
LIVE BASAL AREA (SQ.FT/A)	113.2	120.9	130.9	138.1	147.6	134.0
LIVE TOTAL VOLUME (CU.FT/A)	2115	2302	2440	2837	3211	2686
CROWN COMPETITION FACTOR	99	105	112	116	124	113
RELATIVE DENSITY INDEX	37.9	39.4	43.0	42.2	44.3	42.1
SITE HEIGHT (FT)	50.6	50.3	55.2	52.9	56.6	51.4
MEAN DIAMETER (IN)	8.9	9.4	9.3	10.7	11.1	10.1
AVERAGE HEIGHT GROWTH (FT)	2.5	2.3	2.1	2.3	2.5	2.3
DEAD TREES PER ACRE	0	0	0	0	0	0
DEAD BASAL AREA (SQ.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
DEAD TOTAL VOLUME (CU.FT/A)	0	0	0	0	0	0
TOPKILL VOLUME (CU.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
4 YEARS AFTER TREATMENT (1989)						
LIVE TREES PER ACRE	260	250	280	220	220	240
LIVE BASAL AREA (SQ.FT/A)	121.8	131.9	143.7	147.7	156.1	142.2
LIVE TOTAL VOLUME (CU.FT/A)	2396	2642	2819	3184	3549	3003
CROWN COMPETITION FACTOR	106	114	123	123	130	119
RELATIVE DENSITY INDEX	40.0	42.1	46.1	44.3	46.2	44.0
SITE HEIGHT (FT)	52.7	52.5	57.7	55.1	59.0	53.5
MEAN DIAMETER (IN)	9.3	9.8	9.7	11.1	11.4	10.4
AVERAGE HEIGHT GROWTH (FT)	4.6	4.6	4.1	4.3	4.6	4.5
AVERAGE CROWN RATIO (%)	58	56	54	56	57	59
AVERAGE CROWN LENGTH (FT)	26.6	27.3	23.9	27.9	30.8	28.5
DEAD TREES PER ACRE	0	0	0	0	0	0
DEAD BASAL AREA (SQ.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
DEAD TOTAL VOLUME (CU.FT/A)	0	0	0	0	0	0
TOPKILL VOLUME (CU.FT/A)	0.0	0.0	0.4	0.0	0.0	0.0
6 YEARS AFTER TREATMENT (1991)						
LIVE TREES PER ACRE	260	250	280	220	220	240
LIVE BASAL AREA (SQ.FT/A)	129.6	140.5	154.7	155.7	163.3	149.9
CROWN COMPETITION FACTOR	111	121	131	128	135	125
RELATIVE DENSITY INDEX	41.9	44.1	48.8	46.1	47.8	45.8
MEAN DIAMETER (IN)	9.6	10.2	10.1	11.4	11.7	10.7
DEAD TREES PER ACRE	0	0	0	0	0	0
DEAD BASAL AREA (SQ.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0

PLOT SUMMARY REPORT

INSTALLATION 296 MOSES CREEK
REGION: CENTRAL WASHINGTON OWNERSHIP: FOREST SERVICE
LEGAL DESCRIPTION: 21N R14E SECTION 24 MERIDIAN: WILLAMETTE

	PLOT NUMBER					
	1	2	3	4	5	6
TREATMENT	400#N	NONE	200#N	NONE	400#N	200#N
SITE AND SOIL CHARACTERISTICS:						
SLOPE (%)	3	3	5	13	11	10
ASPECT	100	100	100	130	124	127
PONDEROSA PINE SITE INDEX	114.2	118.4	119.7	117.5	124.5	120.7
MENSURATIONAL CHARACTERISTICS:						
AT TIME OF TREATMENT (1985)	STAND TOTAL AGE = 37					
LIVE TREES PER ACRE	150	170	180	200	160	190
LIVE BASAL AREA (SQ.FT/A)	82.5	78.3	93.5	88.8	106.4	106.2
LIVE TOTAL VOLUME (CU.FT/A)	1397	1304	1566	1481	2103	1837
CROWN COMPETITION FACTOR	70	67	81	78	88	91
RELATIVE DENSITY INDEX	26.0	25.8	29.9	29.6	32.0	33.4
SITE HEIGHT (FT)	46.0	46.1	45.5	46.4	51.0	46.8
MEAN DIAMETER (IN)	10.0	9.2	9.8	9.0	11.0	10.1
AVERAGE CROWN RATIO (%)	64	64	63	60	60	63
AVERAGE CROWN LENGTH (FT)	25.1	24.9	25.2	23.1	27.2	25.9
SPECIES COMPOSITION (% OF BA)						
PONDEROSA PINE	100.0	100.0	100.0	100.0	100.0	100.0
2 YEARS AFTER TREATMENT (1987)						
LIVE TREES PER ACRE	150	170	180	200	160	190
LIVE BASAL AREA (SQ.FT/A)	96.4	89.9	107.5	99.6	120.3	120.3
LIVE TOTAL VOLUME (CU.FT/A)	1772	1647	1972	1825	2600	2248
CROWN COMPETITION FACTOR	80	76	91	87	98	102
RELATIVE DENSITY INDEX	29.3	28.6	33.2	32.2	35.1	36.7
SITE HEIGHT (FT)	49.0	50.2	49.3	50.6	55.2	49.6
MEAN DIAMETER (IN)	10.9	9.8	10.5	9.6	11.7	10.8
AVERAGE HEIGHT GROWTH (FT)	3.1	3.6	3.5	3.7	3.7	3.2
DEAD TREES PER ACRE	0	0	0	0	0	0
DEAD BASAL AREA (SQ.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
DEAD TOTAL VOLUME (CU.FT/A)	0	0	0	0	0	0
TOPKILL VOLUME (CU.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
4 YEARS AFTER TREATMENT (1989)						
LIVE TREES PER ACRE	150	170	180	200	160	190
LIVE BASAL AREA (SQ.FT/A)	111.6	100.8	121.3	110.2	134.9	134.8
LIVE TOTAL VOLUME (CU.FT/A)	2217	2015	2421	2202	3172	2732
CROWN COMPETITION FACTOR	91	85	102	94	108	113
RELATIVE DENSITY INDEX	32.6	31.2	36.4	34.7	38.3	39.9
SITE HEIGHT (FT)	51.9	54.4	52.9	54.6	59.8	52.8
MEAN DIAMETER (IN)	11.7	10.4	11.1	10.0	12.4	11.4
AVERAGE HEIGHT GROWTH (FT)	6.4	7.2	6.9	7.1	7.3	6.7
AVERAGE CROWN RATIO (%)	62	59	57	54	55	63
AVERAGE CROWN LENGTH (FT)	28.5	27.4	26.7	24.6	28.9	30.2
DEAD TREES PER ACRE	0	0	0	0	0	0
DEAD BASAL AREA (SQ.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
DEAD TOTAL VOLUME (CU.FT/A)	0	0	0	0	0	0
TOPKILL VOLUME (CU.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
6 YEARS AFTER TREATMENT (1991)						
LIVE TREES PER ACRE	150	170	180	200	160	190
LIVE BASAL AREA (SQ.FT/A)	123.8	111.9	133.1	120.4	147.9	149.3
CROWN COMPETITION FACTOR	100	93	109	101	117	122
RELATIVE DENSITY INDEX	35.3	33.8	39.0	37.1	41.0	43.1
MEAN DIAMETER (IN)	12.3	11.0	11.6	10.5	13.0	12.0
DEAD TREES PER ACRE	0	0	0	0	0	0
DEAD BASAL AREA (SQ.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0

PLOT SUMMARY REPORT

INSTALLATION 297 UPPER MUD CREEK
REGION: CENTRAL WASHINGTON OWNERSHIP: FOREST SERVICE
LEGAL DESCRIPTION: 27N R20E SECTION 25 MERIDIAN: WILLAMETTE

	PLOT NUMBER					
	1	2	3	4	5	6
TREATMENT	NONE	400#N	200#N	200#N	NONE	400#N
SITE AND SOIL CHARACTERISTICS:						
SLOPE (%)	3	0	5	5	5	0
ASPECT	335	0	130	130	160	0
PONDEROSA PINE SITE INDEX	80.6	81.7	67.7	69.2	77.3	75.5
MENSURATIONAL CHARACTERISTICS:						
AT TIME OF TREATMENT (1985)	STAND TOTAL AGE = 73					
LIVE TREES PER ACRE	140	120	140	170	170	190
LIVE BASAL AREA (SQ.FT/A)	70.6	66.0	61.9	62.6	76.9	80.0
LIVE TOTAL VOLUME (CU.FT/A)	1360	1302	1080	983	1483	1410
CROWN COMPETITION FACTOR	61	57	54	55	67	70
RELATIVE DENSITY INDEX	22.8	20.8	20.6	21.8	25.5	27.0
SITE HEIGHT (FT)	52.1	51.9	47.3	40.7	51.0	48.0
MEAN DIAMETER (IN)	9.6	10.0	9.0	8.2	9.1	8.8
AVERAGE CROWN RATIO (%)	64	58	64	62	64	64
AVERAGE CROWN LENGTH (FT)	29.2	27.8	26.8	23.1	29.4	27.5
SPECIES COMPOSITION (% OF BA)						
PONDEROSA PINE	100.0	100.0	100.0	100.0	100.0	100.0
2 YEARS AFTER TREATMENT (1987)						
LIVE TREES PER ACRE	140	110	140	170	170	190
LIVE BASAL AREA (SQ.FT/A)	75.8	65.4	67.0	68.4	83.4	87.8
LIVE TOTAL VOLUME (CU.FT/A)	1546	1307	1233	1135	1687	1620
CROWN COMPETITION FACTOR	65	56	58	59	72	77
RELATIVE DENSITY INDEX	24.0	20.2	21.9	23.3	27.1	28.9
SITE HEIGHT (FT)	54.9	52.5	49.7	42.9	53.5	50.0
MEAN DIAMETER (IN)	10.0	10.4	9.4	8.6	9.5	9.2
AVERAGE HEIGHT GROWTH (FT)	2.6	0.5	2.4	2.3	2.2	2.0
DEAD TREES PER ACRE	0	10	0	0	0	0
DEAD BASAL AREA (SQ.FT/A)	0.0	4.7	0.0	0.0	0.0	0.0
DEAD TOTAL VOLUME (CU.FT/A)	0	92	0	0	0	0
TOPKILL VOLUME (CU.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
4 YEARS AFTER TREATMENT (1989)						
LIVE TREES PER ACRE	140	30	140	170	170	190
LIVE BASAL AREA (SQ.FT/A)	80.8	17.2	70.4	72.4	88.7	93.4
LIVE TOTAL VOLUME (CU.FT/A)	1701	358	1337	1243	1857	1778
CROWN COMPETITION FACTOR	69	15	61	63	76	81
RELATIVE DENSITY INDEX	25.2	5.4	22.7	24.4	28.4	30.3
SITE HEIGHT (FT)	56.3	49.9	51.3	44.5	55.1	49.3
MEAN DIAMETER (IN)	10.3	10.3	9.6	8.8	9.8	9.5
AVERAGE HEIGHT GROWTH (FT)	4.0	3.5	3.9	3.6	3.8	3.4
AVERAGE CROWN RATIO (%)	62	58	65	63	62	62
AVERAGE CROWN LENGTH (FT)	30.7	28.5	29.8	25.8	30.7	28.6
DEAD TREES PER ACRE	0	90	0	0	0	0
DEAD BASAL AREA (SQ.FT/A)	0.0	53.8	0.0	0.0	0.0	0.0
DEAD TOTAL VOLUME (CU.FT/A)	0	1071	0	0	0	0
TOPKILL VOLUME (CU.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
6 YEARS AFTER TREATMENT (1991)						
LIVE TREES PER ACRE	140	30	140	170	170	190
LIVE BASAL AREA (SQ.FT/A)	87.1	18.7	75.1	78.1	95.3	100.9
CROWN COMPETITION FACTOR	73	16	65	68	81	87
RELATIVE DENSITY INDEX	26.6	5.7	23.9	25.8	29.9	32.1
MEAN DIAMETER (IN)	10.7	10.7	9.9	9.2	10.1	9.9
DEAD TREES PER ACRE	0	90	0	0	0	0
DEAD BASAL AREA (SQ.FT/A)	0.0	53.8	0.0	0.0	0.0	0.0

PLOT SUMMARY REPORT

INSTALLATION 298 LILLY LAKE
REGION: CENTRAL WASHINGTON OWNERSHIP: WASHINGTON DNR
LEGAL DESCRIPTION: 21N R20E SECTION 22 MERIDIAN: WILLAMETTE

	PLOT NUMBER					
	1	2	3	4	5	6
TREATMENT	200#N	NONE	400#N	200#N	NONE	400#N
SITE AND SOIL CHARACTERISTICS:						
SLOPE (%)	0	0	0	30	20	23
ASPECT	0	0	0	145	145	192
PONDEROSA PINE SITE INDEX	89.7	76.5	81.1	89.7	77.3	87.1
MENSURATIONAL CHARACTERISTICS:						
AT TIME OF TREATMENT (1985)	STAND TOTAL AGE = 79					
LIVE TREES PER ACRE	190	190	180	150	200	150
LIVE BASAL AREA (SQ.FT/A)	101.6	94.3	104.9	71.8	82.7	84.6
LIVE TOTAL VOLUME (CU.FT/A)	2461	2051	2351	1507	1684	1966
CROWN COMPETITION FACTOR	86	81	90	62	72	71
RELATIVE DENSITY INDEX	32.3	30.5	32.6	23.4	28.0	26.5
SITE HEIGHT (FT)	62.0	55.5	55.0	58.2	53.8	61.2
MEAN DIAMETER (IN)	9.9	9.5	10.3	9.4	8.7	10.2
AVERAGE CROWN RATIO (%)	47	51	54	56	52	60
AVERAGE CROWN LENGTH (FT)	25.9	26.3	29.3	27.7	25.5	30.6
SPECIES COMPOSITION (% OF BA)						
PONDEROSA PINE	100.0	100.0	100.0	100.0	100.0	100.0
2 YEARS AFTER TREATMENT (1987)						
LIVE TREES PER ACRE	190	190	180	150	200	150
LIVE BASAL AREA (SQ.FT/A)	110.2	101.9	113.2	77.6	89.2	90.7
LIVE TOTAL VOLUME (CU.FT/A)	2790	2332	2643	1705	1885	2184
CROWN COMPETITION FACTOR	93	87	96	66	78	76
RELATIVE DENSITY INDEX	34.3	32.4	34.5	24.9	29.7	28.0
SITE HEIGHT (FT)	64.3	58.2	56.6	60.3	55.9	62.9
MEAN DIAMETER (IN)	10.3	9.9	10.7	9.7	9.0	10.5
AVERAGE HEIGHT GROWTH (FT)	2.1	2.4	1.9	2.2	1.8	1.7
DEAD TREES PER ACRE	0	0	0	0	0	0
DEAD BASAL AREA (SQ.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
DEAD TOTAL VOLUME (CU.FT/A)	0	0	0	0	0	0
TOPKILL VOLUME (CU.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
4 YEARS AFTER TREATMENT (1989)						
LIVE TREES PER ACRE	190	190	160	150	200	150
LIVE BASAL AREA (SQ.FT/A)	115.9	106.4	105.1	81.4	92.7	94.2
LIVE TOTAL VOLUME (CU.FT/A)	3050	2518	2535	1839	2018	2340
CROWN COMPETITION FACTOR	97	90	88	69	80	78
RELATIVE DENSITY INDEX	35.6	33.4	31.7	25.8	30.5	28.8
SITE HEIGHT (FT)	67.0	59.8	59.5	61.6	57.4	65.0
MEAN DIAMETER (IN)	10.6	10.1	11.0	10.0	9.2	10.7
AVERAGE HEIGHT GROWTH (FT)	4.0	4.0	3.8	3.7	3.3	3.5
AVERAGE CROWN RATIO (%)	52	53	57	60	57	58
AVERAGE CROWN LENGTH (FT)	31.0	29.4	32.8	32.0	29.9	31.3
DEAD TREES PER ACRE	0	0	20	0	0	0
DEAD BASAL AREA (SQ.FT/A)	0.0	0.0	13.1	0.0	0.0	0.0
DEAD TOTAL VOLUME (CU.FT/A)	0	0	310	0	0	0
TOPKILL VOLUME (CU.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
6 YEARS AFTER TREATMENT (1991)						
LIVE TREES PER ACRE	190	190	150	150	200	140
LIVE BASAL AREA (SQ.FT/A)	123.4	113.3	106.5	86.9	98.0	96.2
CROWN COMPETITION FACTOR	102	96	89	73	85	79
RELATIVE DENSITY INDEX	37.4	35.0	31.5	27.1	31.8	28.7
MEAN DIAMETER (IN)	10.9	10.5	11.4	10.3	9.5	11.2
DEAD TREES PER ACRE	0	0	30	0	0	10
DEAD BASAL AREA (SQ.FT/A)	0.0	0.0	18.7	0.0	0.0	3.6

PLOT SUMMARY REPORT

INSTALLATION 299 LICK CREEK
REGION: CENTRAL WASHINGTON OWNERSHIP: BOISE CASCADE
LEGAL DESCRIPTION: 21N R16E SECTION 30 MERIDIAN: WILLAMETTE

	PLOT NUMBER					
	1	2	3	4	5	6
TREATMENT	400#N	200#N	NONE	NONE	200#N	400#N
SITE AND SOIL CHARACTERISTICS:						
SLOPE (%)	13	7	0	0	0	0
ASPECT	155	165	0	0	0	0
PONDEROSA PINE SITE INDEX	103.2	96.9	100.7	100.2	107.9	116.8
MENSURATIONAL CHARACTERISTICS:						
AT TIME OF TREATMENT (1985)	STAND TOTAL AGE = 69					
LIVE TREES PER ACRE	280	210	230	220	240	240
LIVE BASAL AREA (SQ.FT/A)	162.7	156.8	164.3	159.9	165.8	194.5
LIVE TOTAL VOLUME (CU.FT/A)	4324	4214	4825	4653	5034	5872
CROWN COMPETITION FACTOR	139	129	136	131	138	155
RELATIVE DENSITY INDEX	50.7	45.8	48.6	47.1	49.4	55.7
SITE HEIGHT (FT)	72.3	70.6	80.0	75.5	76.4	79.2
MEAN DIAMETER (IN)	10.3	11.7	11.4	11.5	11.3	12.2
AVERAGE CROWN RATIO (%)	46	47	41	41	41	43
AVERAGE CROWN LENGTH (FT)	27.3	29.1	26.7	27.0	29.1	29.4
SPECIES COMPOSITION (% OF BA)						
DOUGLAS-FIR	5.1	0.0	5.9	0.0	0.0	0.0
PONDEROSA PINE	94.9	100.0	94.1	100.0	100.0	100.0
2 YEARS AFTER TREATMENT (1987)						
LIVE TREES PER ACRE	280	210	230	220	240	240
LIVE BASAL AREA (SQ.FT/A)	174.8	167.1	172.5	167.8	176.5	205.3
LIVE TOTAL VOLUME (CU.FT/A)	4803	4669	5231	5054	5576	6450
CROWN COMPETITION FACTOR	148	136	142	136	145	164
RELATIVE DENSITY INDEX	53.4	48.1	50.4	48.8	51.8	58.0
SITE HEIGHT (FT)	74.7	72.9	82.3	77.9	79.2	82.2
MEAN DIAMETER (IN)	10.7	12.1	11.7	11.8	11.6	12.5
AVERAGE HEIGHT GROWTH (FT)	2.0	2.3	2.0	2.1	2.4	2.5
DEAD TREES PER ACRE	0	0	0	0	0	0
DEAD BASAL AREA (SQ.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
DEAD TOTAL VOLUME (CU.FT/A)	0	0	0	0	0	0
TOPKILL VOLUME (CU.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
4 YEARS AFTER TREATMENT (1989)						
LIVE TREES PER ACRE	280	210	230	220	230	240
LIVE BASAL AREA (SQ.FT/A)	186.2	177.5	180.1	174.6	181.1	216.1
LIVE TOTAL VOLUME (CU.FT/A)	5301	5168	5628	5445	5970	7029
CROWN COMPETITION FACTOR	156	143	147	141	148	171
RELATIVE DENSITY INDEX	56.0	50.3	52.0	50.3	52.2	60.3
SITE HEIGHT (FT)	77.0	75.3	84.4	80.3	81.8	84.6
MEAN DIAMETER (IN)	11.0	12.4	12.0	12.1	12.0	12.8
AVERAGE HEIGHT GROWTH (FT)	4.2	4.7	3.9	4.3	5.0	4.7
AVERAGE CROWN RATIO (%)	49	49	44	45	45	48
AVERAGE CROWN LENGTH (FT)	31.4	32.6	30.6	32.2	34.1	35.1
DEAD TREES PER ACRE	0	0	0	0	10	0
DEAD BASAL AREA (SQ.FT/A)	0.0	0.0	0.0	0.0	5.2	0.0
DEAD TOTAL VOLUME (CU.FT/A)	0	0	0	0	144	0
TOPKILL VOLUME (CU.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
6 YEARS AFTER TREATMENT (1991)						
LIVE TREES PER ACRE	280	210	230	220	230	240
LIVE BASAL AREA (SQ.FT/A)	201.0	189.5	187.4	181.3	193.1	229.9
CROWN COMPETITION FACTOR	167	151	151	145	155	180
RELATIVE DENSITY INDEX	59.3	52.8	53.6	51.7	54.8	63.2
MEAN DIAMETER (IN)	11.5	12.9	12.2	12.3	12.4	13.3
DEAD TREES PER ACRE	0	0	0	0	10	0
DEAD BASAL AREA (SQ.FT/A)	0.0	0.0	0.0	0.0	5.2	0.0

PLOT SUMMARY REPORT

INSTALLATION 300 SAGE FLAT
REGION: CENTRAL WASHINGTON OWNERSHIP: WASHINGTON DNR
LEGAL DESCRIPTION: 6N R12E SECTION 17 MERIDIAN: WILLAMETTE

	PLOT NUMBER					
	1	2	3	4	5	6
TREATMENT	NONE	200#N	400#N	400#N	200#N	NONE
SITE AND SOIL CHARACTERISTICS:						
SLOPE (%)	6	5	5	5	0	5
ASPECT	10	220	100	134	0	180
PONDEROSA PINE SITE INDEX	101.7	111.4	113.3	102.1	118.9	96.8
MENSURATIONAL CHARACTERISTICS:						
AT TIME OF TREATMENT (1985)	STAND TOTAL AGE = 95					
LIVE TREES PER ACRE	210	260	200	250	220	240
LIVE BASAL AREA (SQ.FT/A)	220.0	219.2	189.2	239.0	206.4	210.7
LIVE TOTAL VOLUME (CU.FT/A)	7532	7952	6639	8161	7448	6967
CROWN COMPETITION FACTOR	169	175	147	187	161	167
RELATIVE DENSITY INDEX	59.1	62.2	52.1	65.7	57.0	59.2
SITE HEIGHT (FT)	83.9	98.6	88.0	89.0	98.0	87.2
MEAN DIAMETER (IN)	13.9	12.4	13.2	13.2	13.1	12.7
AVERAGE CROWN RATIO (%)	45	30	36	39	38	40
AVERAGE CROWN LENGTH (FT)	33.6	24.6	28.1	29.7	29.0	29.5
SPECIES COMPOSITION (% OF BA)						
PONDEROSA PINE	100.0	100.0	100.0	100.0	100.0	100.0
2 YEARS AFTER TREATMENT (1987)						
LIVE TREES PER ACRE	210	260	200	250	220	240
LIVE BASAL AREA (SQ.FT/A)	230.6	230.1	200.5	253.6	218.1	221.6
LIVE TOTAL VOLUME (CU.FT/A)	8154	8646	7284	8958	8112	7561
CROWN COMPETITION FACTOR	176	182	154	196	168	175
RELATIVE DENSITY INDEX	61.2	64.5	54.5	68.7	59.4	61.4
SITE HEIGHT (FT)	86.4	101.5	90.9	91.6	100.5	89.2
MEAN DIAMETER (IN)	14.2	12.7	13.6	13.6	13.5	13.0
AVERAGE HEIGHT GROWTH (FT)	2.4	2.4	2.4	2.3	2.2	2.1
DEAD TREES PER ACRE	0	0	0	0	0	0
DEAD BASAL AREA (SQ.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
DEAD TOTAL VOLUME (CU.FT/A)	0	0	0	0	0	0
TOPKILL VOLUME (CU.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
4 YEARS AFTER TREATMENT (1989)						
LIVE TREES PER ACRE	210	260	200	250	220	240
LIVE BASAL AREA (SQ.FT/A)	242.0	243.1	214.0	271.3	231.4	232.6
LIVE TOTAL VOLUME (CU.FT/A)	8809	9429	8016	9888	8865	8164
CROWN COMPETITION FACTOR	184	191	163	208	177	182
RELATIVE DENSITY INDEX	63.5	67.2	57.2	72.2	62.1	63.7
SITE HEIGHT (FT)	88.7	104.3	93.7	94.0	103.0	91.4
MEAN DIAMETER (IN)	14.5	13.1	14.0	14.1	13.9	13.3
AVERAGE HEIGHT GROWTH (FT)	4.5	4.7	4.7	4.4	4.4	4.1
AVERAGE CROWN RATIO (%)	50	41	45	43	43	45
AVERAGE CROWN LENGTH (FT)	39.8	35.0	36.6	34.2	35.4	35.0
DEAD TREES PER ACRE	0	0	0	0	0	0
DEAD BASAL AREA (SQ.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
DEAD TOTAL VOLUME (CU.FT/A)	0	0	0	0	0	0
TOPKILL VOLUME (CU.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
6 YEARS AFTER TREATMENT (1991)						
LIVE TREES PER ACRE	210	250	200	240	220	240
LIVE BASAL AREA (SQ.FT/A)	251.0	247.6	222.6	282.5	240.1	241.0
CROWN COMPETITION FACTOR	190	193	169	214	182	188
RELATIVE DENSITY INDEX	65.2	67.5	58.9	73.7	63.8	65.4
MEAN DIAMETER (IN)	14.8	13.5	14.3	14.7	14.1	13.6
DEAD TREES PER ACRE	0	10	0	10	0	0
DEAD BASAL AREA (SQ.FT/A)	0.0	3.4	0.0	0.6	0.0	0.0

PLOT SUMMARY REPORT

INSTALLATION 301 LUBRECHT EXP. FOREST
REGION: MONTANA OWNERSHIP: UofM--LUBRECHT
LEGAL DESCRIPTION: 13N R15W SECTION 16 MERIDIAN: PRINCIPAL

	PLOT NUMBER					
	1	2	3	4	5	6
TREATMENT	200#N	NONE	N+K	N+K	200#N	NONE
SITE AND SOIL CHARACTERISTICS:						
SLOPE (%)	7	8	12	7	10	15
ASPECT	155	135	110	174	180	198
PONDEROSA PINE SITE INDEX	69.1	73.0	69.8	70.5	69.5	70.1
MENSURATIONAL CHARACTERISTICS:						
AT TIME OF TREATMENT (1987)	STAND TOTAL AGE = 89					
LIVE TREES PER ACRE	270	260	230	250	180	200
LIVE BASAL AREA (SQ.FT/A)	90.2	83.2	67.5	95.7	73.4	80.6
LIVE TOTAL VOLUME (CU.FT/A)	1767	1625	1249	1957	1573	1533
CROWN COMPETITION FACTOR	80	74	64	97	63	72
RELATIVE DENSITY INDEX	32.3	30.0	24.9	33.1	25.0	27.5
SITE HEIGHT (FT)	54.4	55.3	50.4	58.4	61.3	52.5
MEAN DIAMETER (IN)	7.8	7.7	7.3	8.4	8.6	8.6
AVERAGE CROWN RATIO (%)	45	44	44	46	49	51
AVERAGE CROWN LENGTH (FT)	20.8	19.6	19.0	22.5	23.6	23.2
SPECIES COMPOSITION (% OF BA)						
DOUGLAS-FIR	0.0	0.0	8.7	40.8	0.0	4.6
PONDEROSA PINE	100.0	100.0	91.3	59.2	100.0	95.4
2 YEARS AFTER TREATMENT (1989)						
LIVE TREES PER ACRE	270	260	230	250	180	200
LIVE BASAL AREA (SQ.FT/A)	98.7	90.2	74.9	102.6	80.7	86.9
LIVE TOTAL VOLUME (CU.FT/A)	2018	1840	1449	2173	1799	1719
CROWN COMPETITION FACTOR	87	79	70	103	70	77
RELATIVE DENSITY INDEX	34.5	31.9	26.9	34.8	26.8	29.1
SITE HEIGHT (FT)	56.4	57.6	52.5	60.5	63.5	54.8
MEAN DIAMETER (IN)	8.2	8.0	7.7	8.7	9.1	8.9
AVERAGE HEIGHT GROWTH (FT)	2.0	1.8	1.8	1.9	2.0	1.8
AVERAGE CROWN RATIO (%)	48	46	48	49	51	54
AVERAGE CROWN LENGTH (FT)	23.0	21.2	21.5	25.1	25.4	25.5
DEAD TREES PER ACRE	0	0	0	0	0	0
DEAD BASAL AREA (SQ.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
DEAD TOTAL VOLUME (CU.FT/A)	0	0	0	0	0	0
TOPKILL VOLUME (CU.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
4 YEARS AFTER TREATMENT (1991)						
LIVE TREES PER ACRE	270	260	230	250	180	200
LIVE BASAL AREA (SQ.FT/A)	107.3	96.5	83.5	109.5	87.8	92.0
LIVE TOTAL VOLUME (CU.FT/A)	2336	2086	1727	2448	2068	1926
CROWN COMPETITION FACTOR	94	84	77	109	75	81
RELATIVE DENSITY INDEX	36.7	33.6	29.2	36.6	28.5	30.4
SITE HEIGHT (FT)	59.7	60.8	56.2	63.7	67.0	57.9
MEAN DIAMETER (IN)	8.5	8.2	8.2	9.0	9.5	9.2
AVERAGE HEIGHT GROWTH (FT)	5.1	4.3	4.8	4.7	5.1	4.4
AVERAGE CROWN RATIO (%)	44	40	43	44	44	47
AVERAGE CROWN LENGTH (FT)	22.6	19.7	20.5	23.7	22.6	23.1
DEAD TREES PER ACRE	0	0	0	0	0	0
DEAD BASAL AREA (SQ.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
DEAD TOTAL VOLUME (CU.FT/A)	0	0	0	0	0	0
TOPKILL VOLUME (CU.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0

PLOT SUMMARY REPORT

INSTALLATION 302 BLUE MTN.
REGION: MONTANA OWNERSHIP: FOREST SERVICE
LEGAL DESCRIPTION: 13N R20W SECTION 34 MERIDIAN: PRINCIPAL

	PLOT NUMBER					
	1	2	3	4	5	6
TREATMENT	200#N	NONE	N+K	N+K	NONE	200#N
SITE AND SOIL CHARACTERISTICS:						
SLOPE (%)	20	15	13	10	10	12
ASPECT	30	15	90	78	76	75
PONDEROSA PINE SITE INDEX	91.6	84.3	74.3	71.6	67.2	72.0
MENSURATIONAL CHARACTERISTICS:						
AT TIME OF TREATMENT (1987)	STAND TOTAL AGE = 100					
LIVE TREES PER ACRE	190	240	280	350	330	350
LIVE BASAL AREA (SQ.FT/A)	157.9	158.3	126.7	129.2	115.3	122.0
LIVE TOTAL VOLUME (CU.FT/A)	4844	4450	3028	2743	2318	2508
CROWN COMPETITION FACTOR	129	135	117	124	106	127
RELATIVE DENSITY INDEX	44.9	47.7	42.0	45.0	40.8	43.2
SITE HEIGHT (FT)	78.0	74.2	65.8	60.1	55.5	58.1
MEAN DIAMETER (IN)	12.3	11.0	9.1	8.2	8.0	8.0
AVERAGE CROWN RATIO (%)	47	41	38	35	40	45
AVERAGE CROWN LENGTH (FT)	31.9	26.7	21.2	17.9	18.7	21.3
SPECIES COMPOSITION (% OF BA)						
DOUGLAS-FIR	9.1	13.3	17.6	28.4	10.8	43.0
PONDEROSA PINE	90.9	86.7	82.4	71.6	89.2	57.0
2 YEARS AFTER TREATMENT (1989)						
LIVE TREES PER ACRE	190	230	280	340	330	350
LIVE BASAL AREA (SQ.FT/A)	162.4	161.1	131.8	133.2	119.8	127.4
LIVE TOTAL VOLUME (CU.FT/A)	5131	4661	3241	2899	2473	2682
CROWN COMPETITION FACTOR	132	137	121	127	110	132
RELATIVE DENSITY INDEX	45.9	47.8	43.2	45.8	41.9	44.6
SITE HEIGHT (FT)	80.0	75.7	67.7	61.4	56.5	59.6
MEAN DIAMETER (IN)	12.5	11.3	9.3	8.5	8.2	8.2
AVERAGE HEIGHT GROWTH (FT)	2.0	1.6	1.6	1.3	1.3	1.3
AVERAGE CROWN RATIO (%)	53	44	44	38	43	46
AVERAGE CROWN LENGTH (FT)	37.4	29.3	24.9	19.6	20.7	22.3
DEAD TREES PER ACRE	0	10	0	10	0	0
DEAD BASAL AREA (SQ.FT/A)	0.0	1.6	0.0	1.2	0.0	0.0
DEAD TOTAL VOLUME (CU.FT/A)	0	31	0	19	0	0
TOPKILL VOLUME (CU.FT/A)	0.0	0.0	1.4	2.4	0.0	1.2
4 YEARS AFTER TREATMENT (1991)						
LIVE TREES PER ACRE	190	230	280	340	330	320
LIVE BASAL AREA (SQ.FT/A)	165.2	162.7	134.2	135.7	122.2	119.9
LIVE TOTAL VOLUME (CU.FT/A)	5414	4859	3435	3053	2616	2629
CROWN COMPETITION FACTOR	133	138	123	129	112	126
RELATIVE DENSITY INDEX	46.5	48.2	43.8	46.4	42.6	41.7
SITE HEIGHT (FT)	82.5	78.2	70.4	63.4	58.7	61.7
MEAN DIAMETER (IN)	12.6	11.4	9.4	8.6	8.2	8.3
AVERAGE HEIGHT GROWTH (FT)	4.5	3.6	4.0	3.1	3.2	3.0
AVERAGE CROWN RATIO (%)	47	38	38	33	39	39
AVERAGE CROWN LENGTH (FT)	34.3	26.2	22.4	18.1	19.4	19.7
DEAD TREES PER ACRE	0	10	0	10	0	30
DEAD BASAL AREA (SQ.FT/A)	0.0	1.6	0.0	1.2	0.0	11.0
DEAD TOTAL VOLUME (CU.FT/A)	0	31	0	19	0	218
TOPKILL VOLUME (CU.FT/A)	0.0	0.0	1.5	2.4	0.0	0.0

PLOT SUMMARY REPORT

INSTALLATION 303 FOUR MILE CR.
REGION: MONTANA OWNERSHIP: FOREST SERVICE
LEGAL DESCRIPTION: 18N R27W SECTION 12 MERIDIAN: PRINCIPAL

	PLOT NUMBER					
	1	2	3	4	5	6
TREATMENT	200#N	NONE	N+K	N+K	NONE	200#N
SITE AND SOIL CHARACTERISTICS:						
SLOPE (%)	47	45	45	40	40	20
ASPECT	215	220	200	196	208	195
PONDEROSA PINE SITE INDEX	99.2	89.8	101.6	119.4	117.4	98.6
MENSURATIONAL CHARACTERISTICS:						
AT TIME OF TREATMENT (1987)	STAND TOTAL AGE = 81					
LIVE TREES PER ACRE	170	170	200	140	170	170
LIVE BASAL AREA (SQ.FT/A)	138.2	124.9	145.3	138.0	127.4	112.9
LIVE TOTAL VOLUME (CU.FT/A)	4546	3770	4374	4756	3857	3447
CROWN COMPETITION FACTOR	109	102	123	108	105	101
RELATIVE DENSITY INDEX	39.6	36.7	42.8	37.6	37.2	34.0
SITE HEIGHT (FT)	84.8	74.4	76.2	84.4	77.0	77.0
MEAN DIAMETER (IN)	12.2	11.6	11.5	13.4	11.7	11.0
AVERAGE CROWN RATIO (%)	52	51	47	57	56	45
AVERAGE CROWN LENGTH (FT)	36.0	34.3	33.5	43.4	37.5	32.6
SPECIES COMPOSITION (% OF BA)						
DOUGLAS-FIR	0.0	0.0	5.7	0.0	4.1	16.9
PONDEROSA PINE	100.0	100.0	94.3	100.0	95.9	83.1
2 YEARS AFTER TREATMENT (1989)						
LIVE TREES PER ACRE	170	170	200	140	170	170
LIVE BASAL AREA (SQ.FT/A)	142.1	130.8	152.2	145.1	132.6	118.6
LIVE TOTAL VOLUME (CU.FT/A)	4788	4070	4732	5150	4128	3748
CROWN COMPETITION FACTOR	112	106	128	112	109	106
RELATIVE DENSITY INDEX	40.4	37.9	44.3	39.1	38.3	35.3
SITE HEIGHT (FT)	86.6	76.4	78.5	86.6	78.8	79.2
MEAN DIAMETER (IN)	12.4	11.9	11.8	13.8	12.0	11.3
AVERAGE HEIGHT GROWTH (FT)	1.6	1.8	1.9	2.2	1.8	2.2
AVERAGE CROWN RATIO (%)	50	49	48	54	56	43
AVERAGE CROWN LENGTH (FT)	35.2	34.3	34.8	42.8	38.5	32.5
DEAD TREES PER ACRE	0	0	0	0	0	0
DEAD BASAL AREA (SQ.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
DEAD TOTAL VOLUME (CU.FT/A)	0	0	0	0	0	0
TOPKILL VOLUME (CU.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
4 YEARS AFTER TREATMENT (1991)						
LIVE TREES PER ACRE	170	170	200	140	170	170
LIVE BASAL AREA (SQ.FT/A)	147.2	136.9	160.7	154.4	138.1	126.0
LIVE TOTAL VOLUME (CU.FT/A)	5145	4436	5227	5716	4469	4192
CROWN COMPETITION FACTOR	116	110	134	118	113	111
RELATIVE DENSITY INDEX	41.5	39.3	46.1	40.9	39.5	36.9
SITE HEIGHT (FT)	89.5	79.2	81.8	90.1	81.4	82.7
MEAN DIAMETER (IN)	12.6	12.2	12.1	14.2	12.2	11.7
AVERAGE HEIGHT GROWTH (FT)	4.0	4.4	4.8	5.8	4.4	5.7
AVERAGE CROWN RATIO (%)	43	45	44	49	47	41
AVERAGE CROWN LENGTH (FT)	31.9	32.5	33.4	40.6	34.1	31.8
DEAD TREES PER ACRE	0	0	0	0	0	0
DEAD BASAL AREA (SQ.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
DEAD TOTAL VOLUME (CU.FT/A)	0	0	0	0	0	0
TOPKILL VOLUME (CU.FT/A)	0.0	0.0	0.0	5.7	0.0	0.0

PLOT SUMMARY REPORT

INSTALLATION 304 HINCHWOOD CR.
REGION: MONTANA OWNERSHIP: CHAMPION
LEGAL DESCRIPTION: 21N R25W SECTION 19 MERIDIAN: PRINCIPAL

	PLOT NUMBER					
	1	2	3	4	5	6
TREATMENT	NONE	N+K	200#N	N+K	NONE	200#N
SITE AND SOIL CHARACTERISTICS:						
SLOPE (%)	12	15	10	10	12	12
ASPECT	245	220	242	250	246	226
PONDEROSA PINE SITE INDEX	95.3	110.2	94.7	98.8	99.4	106.9
MENSURATIONAL CHARACTERISTICS:						
AT TIME OF TREATMENT (1987)	STAND TOTAL AGE = 60					
LIVE TREES PER ACRE	250	370	220	300	280	280
LIVE BASAL AREA (SQ.FT/A)	125.1	147.5	136.3	104.6	102.8	122.1
LIVE TOTAL VOLUME (CU.FT/A)	3200	3601	3723	2372	2269	2882
CROWN COMPETITION FACTOR	107	128	117	92	91	106
RELATIVE DENSITY INDEX	40.4	50.5	41.7	37.0	35.9	40.8
SITE HEIGHT (FT)	70.5	66.4	72.8	64.2	62.9	63.4
MEAN DIAMETER (IN)	9.6	8.6	10.7	8.0	8.2	8.9
AVERAGE CROWN RATIO (%)	54	46	50	49	46	50
AVERAGE CROWN LENGTH (FT)	31.1	25.7	32.3	25.7	23.8	26.7
SPECIES COMPOSITION (% OF BA)						
DOUGLAS-FIR	0.4	0.0	9.8	0.0	0.0	4.3
PONDEROSA PINE	99.6	100.0	90.2	100.0	100.0	95.7
2 YEARS AFTER TREATMENT (1989)						
LIVE TREES PER ACRE	250	370	220	300	270	280
LIVE BASAL AREA (SQ.FT/A)	131.9	154.3	143.2	112.2	105.7	130.5
LIVE TOTAL VOLUME (CU.FT/A)	3494	3920	4078	2638	2424	3207
CROWN COMPETITION FACTOR	113	134	122	98	93	114
RELATIVE DENSITY INDEX	42.1	52.2	43.3	39.0	36.3	42.9
SITE HEIGHT (FT)	72.8	68.6	73.7	66.1	65.0	63.7
MEAN DIAMETER (IN)	9.8	8.7	10.9	8.3	8.5	9.2
AVERAGE HEIGHT GROWTH (FT)	2.0	2.0	2.3	1.8	1.8	2.2
AVERAGE CROWN RATIO (%)	55	46	50	49	45	46
AVERAGE CROWN LENGTH (FT)	32.9	26.9	33.4	26.6	24.2	26.0
DEAD TREES PER ACRE	0	0	0	0	10	0
DEAD BASAL AREA (SQ.FT/A)	0.0	0.0	0.0	0.0	2.4	0.0
DEAD TOTAL VOLUME (CU.FT/A)	0	0	0	0	45	0
TOPKILL VOLUME (CU.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
4 YEARS AFTER TREATMENT (1991)						
LIVE TREES PER ACRE	250	370	220	300	270	280
LIVE BASAL AREA (SQ.FT/A)	138.7	162.4	151.7	121.4	111.0	140.1
LIVE TOTAL VOLUME (CU.FT/A)	3871	4379	4603	3054	2702	3674
CROWN COMPETITION FACTOR	119	140	128	105	97	121
RELATIVE DENSITY INDEX	43.7	54.2	45.2	41.4	37.7	45.3
SITE HEIGHT (FT)	75.9	72.0	77.9	70.0	68.5	67.3
MEAN DIAMETER (IN)	10.1	9.0	11.2	8.6	8.7	9.6
AVERAGE HEIGHT GROWTH (FT)	5.0	5.3	6.3	5.5	5.0	5.9
AVERAGE CROWN RATIO (%)	47	42	44	46	40	43
AVERAGE CROWN LENGTH (FT)	30.0	25.9	30.9	26.7	22.8	26.0
DEAD TREES PER ACRE	0	0	0	0	10	0
DEAD BASAL AREA (SQ.FT/A)	0.0	0.0	0.0	0.0	2.4	0.0
DEAD TOTAL VOLUME (CU.FT/A)	0	0	0	0	45	0
TOPKILL VOLUME (CU.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0

PLOT SUMMARY REPORT

INSTALLATION 305 LIBBY PLANTATION
REGION: MONTANA OWNERSHIP: CHAMPION
LEGAL DESCRIPTION: 29N R31W SECTION 12 MERIDIAN: PRINCIPAL

	PLOT NUMBER					
	1	2	3	4	5	6
TREATMENT	NONE	N+K	200#N	200#N	N+K	NONE
SITE AND SOIL CHARACTERISTICS:						
SLOPE (%)	0	0	0	0	0	0
ASPECT						
PONDEROSA PINE SITE INDEX	120.8	127.1	114.3	115.0	123.1	127.1
MENSURATIONAL CHARACTERISTICS:						
AT TIME OF TREATMENT (1987)	STAND TOTAL AGE = 42					
LIVE TREES PER ACRE	230	210	230	240	200	230
LIVE BASAL AREA (SQ.FT/A)	111.9	102.1	84.5	96.0	101.3	110.8
LIVE TOTAL VOLUME (CU.FT/A)	2557	2371	1654	2061	2249	2566
CROWN COMPETITION FACTOR	97	89	74	84	87	96
RELATIVE DENSITY INDEX	36.4	33.2	29.5	32.8	32.6	36.1
SITE HEIGHT (FT)	59.3	62.4	52.9	54.8	57.4	60.9
MEAN DIAMETER (IN)	9.4	9.4	8.2	8.6	9.6	9.4
AVERAGE CROWN RATIO (%)	55	54	57	53	57	56
AVERAGE CROWN LENGTH (FT)	30.1	29.9	26.9	27.6	30.9	31.2
SPECIES COMPOSITION (% OF BA)						
PONDEROSA PINE	100.0	100.0	100.0	100.0	100.0	100.0
2 YEARS AFTER TREATMENT (1989)						
LIVE TREES PER ACRE	230	210	220	230	200	230
LIVE BASAL AREA (SQ.FT/A)	120.4	109.7	89.1	99.7	109.4	119.0
LIVE TOTAL VOLUME (CU.FT/A)	2884	2676	1848	2250	2568	2901
CROWN COMPETITION FACTOR	103	95	78	86	95	103
RELATIVE DENSITY INDEX	38.5	35.1	30.4	33.4	34.6	38.1
SITE HEIGHT (FT)	61.9	64.9	55.5	57.6	60.2	63.7
MEAN DIAMETER (IN)	9.8	9.8	8.6	8.9	10.0	9.7
AVERAGE HEIGHT GROWTH (FT)	2.4	2.4	2.5	2.6	2.7	2.7
AVERAGE CROWN RATIO (%)	48	47	48	46	50	47
AVERAGE CROWN LENGTH (FT)	28.0	27.4	24.0	25.2	28.3	27.8
DEAD TREES PER ACRE	0	0	10	10	0	0
DEAD BASAL AREA (SQ.FT/A)	0.0	0.0	2.2	3.3	0.0	0.0
DEAD TOTAL VOLUME (CU.FT/A)	0	0	34	69	0	0
TOPKILL VOLUME (CU.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
4 YEARS AFTER TREATMENT (1991)						
LIVE TREES PER ACRE	230	210	210	210	200	230
LIVE BASAL AREA (SQ.FT/A)	129.6	119.5	93.5	97.1	118.6	126.1
LIVE TOTAL VOLUME (CU.FT/A)	3314	3147	2097	2325	3009	3301
CROWN COMPETITION FACTOR	111	102	81	84	101	108
RELATIVE DENSITY INDEX	40.7	37.4	31.1	32.0	36.7	39.8
SITE HEIGHT (FT)	65.4	69.2	59.5	61.1	64.4	67.6
MEAN DIAMETER (IN)	10.2	10.2	9.0	9.2	10.4	10.0
AVERAGE HEIGHT GROWTH (FT)	6.0	6.3	6.3	6.5	6.7	6.6
AVERAGE CROWN RATIO (%)	47	48	41	39	46	44
AVERAGE CROWN LENGTH (FT)	28.5	29.2	21.8	22.9	27.5	27.2
DEAD TREES PER ACRE	0	0	20	30	0	0
DEAD BASAL AREA (SQ.FT/A)	0.0	0.0	5.4	13.3	0.0	0.0
DEAD TOTAL VOLUME (CU.FT/A)	0	0	98	317	0	0
TOPKILL VOLUME (CU.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0

PLOT SUMMARY REPORT

INSTALLATION 306 SEDLAK CR.
REGION: MONTANA OWNERSHIP: CHAMPION
LEGAL DESCRIPTION: 26N R29W SECTION 9 MERIDIAN: PRINCIPAL

	PLOT NUMBER					
	1	2	3	4	5	6
TREATMENT	200#N	NONE	N+K	200#N	N+K	NONE
SITE AND SOIL CHARACTERISTICS:						
SLOPE (%)	35	30	30	30	35	20
ASPECT	140	170	250	160	125	140
PONDEROSA PINE SITE INDEX	118.5	89.1	106.1	112.7	110.8	95.7
MENSURATIONAL CHARACTERISTICS:						
AT TIME OF TREATMENT (1987)	STAND TOTAL AGE = 75					
LIVE TREES PER ACRE	240	210	170	220	230	230
LIVE BASAL AREA (SQ.FT/A)	199.4	128.5	108.0	166.4	132.0	125.4
LIVE TOTAL VOLUME (CU.FT/A)	6218	3161	2922	5183	3826	3284
CROWN COMPETITION FACTOR	162	113	91	136	112	110
RELATIVE DENSITY INDEX	56.8	39.5	32.9	48.5	41.2	39.7
SITE HEIGHT (FT)	82.3	64.4	72.6	78.5	75.1	68.3
MEAN DIAMETER (IN)	12.3	10.6	10.8	11.8	10.3	10.0
AVERAGE CROWN RATIO (%)	49	56	61	53	46	50
AVERAGE CROWN LENGTH (FT)	33.0	31.8	38.6	39.1	31.4	32.5
SPECIES COMPOSITION (% OF BA)						
DOUGLAS-FIR	3.7	6.3	0.0	0.0	0.0	4.0
WESTERN LARCH	13.1	27.8	13.0	12.8	12.5	35.8
PONDEROSA PINE	83.2	65.4	87.0	87.2	87.5	60.1
ENGELMANN SPRUCE	0.0	0.5	0.0	0.0	0.0	0.0
2 YEARS AFTER TREATMENT (1989)						
LIVE TREES PER ACRE	240	210	170	180	230	230
LIVE BASAL AREA (SQ.FT/A)	208.6	138.0	116.9	148.5	140.4	132.2
LIVE TOTAL VOLUME (CU.FT/A)	6718	3526	3301	4770	4222	3582
CROWN COMPETITION FACTOR	168	120	98	120	118	116
RELATIVE DENSITY INDEX	58.7	41.6	34.9	42.3	43.2	41.3
SITE HEIGHT (FT)	84.6	66.5	75.4	81.1	77.9	70.3
MEAN DIAMETER (IN)	12.6	11.0	11.2	12.3	10.6	10.3
AVERAGE HEIGHT GROWTH (FT)	2.2	2.1	2.4	2.3	2.0	2.1
AVERAGE CROWN RATIO (%)	48	54	54	39	44	46
AVERAGE CROWN LENGTH (FT)	32.9	32.3	36.2	29.9	31.0	31.4
DEAD TREES PER ACRE	0	0	0	40	0	0
DEAD BASAL AREA (SQ.FT/A)	0.0	0.0	0.0	26.2	0.0	0.0
DEAD TOTAL VOLUME (CU.FT/A)	0	0	0	837	0	0
TOPKILL VOLUME (CU.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0
4 YEARS AFTER TREATMENT (1991)						
LIVE TREES PER ACRE	240	210	170	180	230	230
LIVE BASAL AREA (SQ.FT/A)	219.6	148.6	127.5	158.5	149.7	139.0
LIVE TOTAL VOLUME (CU.FT/A)	7419	4013	3837	5366	4741	3958
CROWN COMPETITION FACTOR	176	127	105	127	124	120
RELATIVE DENSITY INDEX	61.0	44.0	37.2	44.5	45.3	42.8
SITE HEIGHT (FT)	87.9	69.7	79.5	85.0	81.5	73.9
MEAN DIAMETER (IN)	13.0	11.4	11.7	12.7	10.9	10.5
AVERAGE HEIGHT GROWTH (FT)	5.4	5.5	6.2	6.0	5.2	5.1
AVERAGE CROWN RATIO (%)	45	52	53	37	41	42
AVERAGE CROWN LENGTH (FT)	32.5	32.2	36.7	29.7	29.6	29.5
DEAD TREES PER ACRE	0	0	0	40	0	0
DEAD BASAL AREA (SQ.FT/A)	0.0	0.0	0.0	26.2	0.0	0.0
DEAD TOTAL VOLUME (CU.FT/A)	0	0	0	837	0	0
TOPKILL VOLUME (CU.FT/A)	0.0	0.0	0.0	0.0	0.0	0.0

Section III

GROWTH RESPONSE SUMMARIES FOR ALL OF THE PONDEROSA PINE INSTALLATIONS

Installation 291 SARDINE SPRINGS
Region: NE OREGON Ownership: FOREST SERVICE
Legal Description: T7S R42E Section 4 Meridian: WILLAMETTE

Initial Stand Characteristics:

Total Age	89	years
Trees per Acre	71	trees/acre
Total Volume	2478	cu.ft/acre
CCF	58.8	
Relative Density Index	20.4	
Mean Diameter	14.1	inches
Average Crown Length	35.6	feet
Average Crown Ratio	49.8	percent
Site Height (40 tpa)	76.1	feet
Species Composition (% of Total BA)		
Ponderosa Pine	100.0	percent

Growth:

Note: all increments have been adjusted to a common initial basal area of 76.8 sq.feet/acre

			Response	
	Treatment	Increment	Difference	% of Control
6-Year Net Basal Area (sq.feet/acre)	Control	17.2		
	200 # N	16.5	-0.7	-4.1
	400 # N	17.4	0.2	1.2
6-Year Gross Basal Area (sq.feet/acre)	Control	17.5		
	200 # N	16.3	-1.2	-6.9
	400 # N	17.3	-0.2	-1.1
6-Year Change in Mean Diameter (inches)	Control	1.51		
	200 # N	1.38	-0.13	-8.6
	400 # N	1.56	0.05	3.3

Periodic Annual Increment

		First Two Years			Second Two Years		
			Response			Response	
	TRT	INC	DIFF	%	INC	DIFF	%
Net Basal Area PAI (sq.ft/a)	CON	3.8			2.5		
	200	3.6	-0.2	-5.3	2.5	0.0	0.0
	400	4.1	0.3	7.9	2.5	0.0	0.0
Gross Basal Area PAI (sq.ft/a)	CON	3.8			2.7		
	200	3.6	-0.2	-5.3	2.4	-0.3	-11.1
	400	4.1	0.3	7.9	2.4	-0.3	-11.1

		Third Two Years		
			Response	
	TRT	INC	DIFF	%
Net Basal Area PAI (sq.ft/a)	CON	2.3		
	200	2.1	-0.2	-8.7
	400	2.1	-0.2	-8.7
Gross Basal Area PAI (sq.ft/a)	CON	2.3		
	200	2.2	-0.1	-4.3
	400	2.1	-0.2	-8.7

Installation 292 SPARTA BUTTE
Region: NE OREGON Ownership: FOREST SERVICE
Legal Description: T8S R44E Section 4 Meridian: WILLAMETTE

Initial Stand Characteristics:

Total Age	101	years
Trees per Acre	91	trees/acre
Total Volume	14588	cu.ft/acre
CCF	90.5	
Relative Density Index	30.2	
Mean Diameter	15.7	inches
Average Crown Length	41.1	feet
Average Crown Ratio	49.0	percent
Site Height (40 tpa)	90.8	feet
Species Composition (% of Total BA)		
Douglas-fir	5.9	percent
Ponderosa Pine	94.1	percent

Growth:

Note: all increments have been adjusted to a common initial basal area of 119.5 sq.feet/acre

	Treatment	Increment	Response	
			Difference	% of Control
6-Year Net Basal Area (sq.feet/acre)	Control	10.6		
	200 # N	1.4	-9.2	-86.8
	400 # N	19.7	9.1	85.8
6-Year Gross Basal Area (sq.feet/acre)	Control	14.0		
	200 # N	14.8	0.8	5.7
	400 # N	18.8	4.8	34.3
6-Year Change in Mean Diameter (inches)	Control	1.05		
	200 # N	0.90	-0.15	-14.3
	400 # N	1.18	0.13	12.4

Periodic Annual Increment

		First Two Years			Second Two Years		
			Response			Response	
	TRT	INC	DIFF	%	INC	DIFF	%
Net Basal Area PAI (sq.ft/a)	CON	3.2			-0.1		
	200	3.0	-0.2	-6.2	-4.5	-4.4	4400.0
	400	3.7	0.5	15.6	3.0	3.1	-3100.0
Gross Basal Area PAI (sq.ft/a)	CON	3.2			1.8		
	200	3.0	-0.2	-6.2	2.1	0.3	16.7
	400	3.7	0.5	15.6	2.5	0.7	38.9

		Third Two Years		
			Response	
	TRT	INC	DIFF	%
Net Basal Area PAI (sq.ft/a)	CON	2.2		
	200	2.2	0.0	0.0
	400	3.1	0.9	40.9
Gross Basal Area PAI (sq.ft/a)	CON	2.0		
	200	2.3	0.3	15.0
	400	3.2	1.2	60.0

Installation 293 SUMMIT SALVAGE
Region: NE OREGON Ownership: FOREST SERVICE
Legal Description: T5S R41E Section 27 Meridian: WILLAMETTE

Initial Stand Characteristics:

Total Age	48	years
Trees per Acre	177	trees/acre
Total Volume	1689	cu.ft/acre
CCF	75.6	
Relative Density Index	28.5	
Mean Diameter	9.6	inches
Average Crown Length	25.4	feet
Average Crown Ratio	59.9	percent
Site Height (40 tpa)	51.5	feet
Species Composition (% of Total BA)		
Douglas-fir	3.9	percent
Ponderosa Pine	96.1	percent

Growth:

Note: all increments have been adjusted to a common initial basal area of 88.5 sq.feet/acre

	Treatment	Increment	Response	
			Difference	% of Control
6-Year Net Basal Area (sq.feet/acre)	Control	12.8		
	200 # N	21.8	9.0	70.3
	400 # N	28.7	15.9	124.2
6-Year Gross Basal Area (sq.feet/acre)	Control	17.8		
	200 # N	24.7	6.9	38.8
	400 # N	29.7	11.9	66.9
6-Year Change in Mean Diameter (inches)	Control	1.35		
	200 # N	1.35	0.00	0.0
	400 # N	1.61	0.26	19.3

Periodic Annual Increment

		First Two Years			Second Two Years		
			Response			Response	
	TRT	INC	DIFF	%	INC	DIFF	%
Net Basal Area PAI (sq.ft/a)	CON	3.3			1.4		
	200	4.7	1.4	42.4	3.6	2.2	157.1
	400	5.3	2.0	60.6	4.3	2.9	207.1
Gross Basal Area PAI (sq.ft/a)	CON	3.3			2.8		
	200	4.7	1.4	42.4	3.9	1.1	39.3
	400	5.3	2.0	60.6	4.7	1.9	67.9

		Third Two Years		
			Response	
	TRT	INC	DIFF	%
Net Basal Area PAI (sq.ft/a)	CON	1.7		
	200	2.6	0.9	52.9
	400	4.8	3.1	182.4
Gross Basal Area PAI (sq.ft/a)	CON	2.8		
	200	3.8	1.0	35.7
	400	4.8	2.0	71.4

Installation 294 MOSES CREEK
Region: NE OREGON Ownership: BOISE CASCADE
Legal Description: T3N R40E Section 30 Meridian: WILLAMETTE

Initial Stand Characteristics:

Total Age	81	years
Trees per Acre	120	trees/acre
Total Volume	14921	cu.ft/acre
CCF	103.0	
Relative Density Index	35.9	
Mean Diameter	14.5	inches
Average Crown Length	37.0	feet
Average Crown Ratio	50.2	percent
Site Height (40 tpa)	88.8	feet
Species Composition (% of Total BA)		
Douglas-fir	2.8	percent
Grand Fir	0.1	percent
Western Larch	2.9	percent
Ponderosa Pine	94.2	percent

Growth:

Note: all increments have been adjusted to a common initial basal area of 136.6 sq.feet/acre

	Treatment	Increment	Response: Difference	Response: % of Control
6-Year Net Basal Area (sq.feet/acre)	Control	9.5		
	200 # N	24.4	14.9	156.8
	400 # N	-0.8	-10.3	-108.4
6-Year Gross Basal Area (sq.feet/acre)	Control	19.2		
	200 # N	26.1	6.9	35.9
	400 # N	18.8	-0.4	-2.1
6-Year Change in Mean Diameter (inches)	Control	1.14		
	200 # N	1.30	0.16	14.0
	400 # N	1.43	0.29	25.4

Periodic Annual Increment

		First Two Years			Second Two Years		
			Response			Response	
	TRT	INC	DIFF	%	INC	DIFF	%
Net Basal Area PAI (sq.ft/a)	CON	3.3			2.5		
	200	5.1	1.8	54.5	3.0	0.5	20.0
	400	3.5	0.2	6.1	-6.9	-9.4	-376.0
Gross Basal Area PAI (sq.ft/a)	CON	3.5			3.0		
	200	5.1	1.6	45.7	3.9	0.9	30.0
	400	3.5	0.0	0.0	2.9	-0.1	-3.3

		Third Two Years		
			Response	
	TRT	INC	DIFF	%
Net Basal Area PAI (sq.ft/a)	CON	-1.0		
	200	4.1	5.1	-510.0
	400	3.0	4.0	-400.0
Gross Basal Area PAI (sq.ft/a)	CON	3.1		
	200	4.1	1.0	32.3
	400	3.0	-0.1	-3.2

Installation 295 PARKERS FLAT
Region: NE OREGON Ownership: BOISE CASCADE
Legal Description: T2N R39E Section 34 Meridian: WILLAMETTE

Initial Stand Characteristics:

Total Age	33	years
Trees per Acre	245	trees/acre
Total Volume	12261	cu.ft/acre
CCF	103.4	
Relative Density Index	38.9	
Mean Diameter	9.5	inches
Average Crown Length	26.0	feet
Average Crown Ratio	59.2	percent
Site Height (40 tpa)	50.5	feet
Species Composition (% of Total BA)		
Ponderosa Pine	100.0	percent

Growth:

Note: all increments have been adjusted to a common initial basal area of 120.1 sq.feet/acre

	Treatment	Increment	Response: Difference	Response: % of Control
6-Year Net Basal Area (sq.feet/acre)	Control	27.6		
	200 # N	28.0	0.4	1.4
	400 # N	30.8	3.2	11.6
6-Year Gross Basal Area (sq.feet/acre)	Control	26.8		
	200 # N	29.1	2.3	8.6
	400 # N	30.6	3.8	14.2
6-Year Change in Mean Diameter (inches)	Control	1.01		
	200 # N	1.05	0.04	4.0
	400 # N	1.17	0.16	15.8

Periodic Annual Increment

		First Two Years			Second Two Years		
			Response			Response	
	TRT	INC	DIFF	%	INC	DIFF	%
Net Basal Area PAI (sq.ft/a)	CON	4.9			4.9		
	200	5.2	0.3	6.1	4.4	-0.5	-10.2
	400	5.8	0.9	18.4	5.4	0.5	10.2
Gross Basal Area PAI (sq.ft/a)	CON	4.9			4.4		
	200	5.2	0.3	6.1	5.1	0.7	15.9
	400	5.8	0.9	18.4	5.2	0.8	18.2

		Third Two Years		
			Response	
	TRT	INC	DIFF	%
Net Basal Area PAI (sq.ft/a)	CON	4.0		
	200	4.4	0.4	10.0
	400	4.2	0.2	5.0
Gross Basal Area PAI (sq.ft/a)	CON	4.1		
	200	4.3	0.2	4.9
	400	4.2	0.1	2.4

Installation 296 MOSES CREEK
Region: CEN WASHINGTON Ownership: FOREST SERVICE
Legal Description: T21N R14E Section 24 Meridian: WILLAMETTE

Initial Stand Characteristics:

Total Age	37	years
Trees per Acre	175	trees/acre
Total Volume	1615	cu.ft/acre
CCF	79.2	
Relative Density Index	29.5	
Mean Diameter	9.9	inches
Average Crown Length	25.2	feet
Average Crown Ratio	62.2	percent
Site Height (40 tpa)	47.0	feet
Species Composition (% of Total BA)		
Ponderosa Pine	100.0	percent

Growth:

Note: all increments have been adjusted to a common initial basal area of 92.6 sq.feet/acre

	Treatment	Increment	Response	
			Difference	% of Control
6-Year Net Basal Area (sq.feet/acre)	Control	35.6		
	200 # N	38.9	3.3	9.3
	400 # N	40.7	5.1	14.3
6-Year Gross Basal Area (sq.feet/acre)	Control	34.4		
	200 # N	39.9	5.5	16.0
	400 # N	41.0	6.6	19.2
6-Year Change in Mean Diameter (inches)	Control	1.69		
	200 # N	1.84	0.15	8.9
	400 # N	2.11	0.42	24.9

Periodic Annual Increment

		First Two Years			Second Two Years		
			Response			Response	
	TRT	INC	DIFF	%	INC	DIFF	%
Net Basal Area PAI (sq.ft/a)	CON	5.9			6.4		
	200	6.8	0.9	15.3	6.3	-0.1	-1.6
	400	6.9	1.0	16.9	7.2	0.8	12.5
Gross Basal Area PAI (sq.ft/a)	CON	5.9			5.7		
	200	6.8	0.9	15.3	6.8	1.1	19.3
	400	6.9	1.0	16.9	7.4	1.7	29.8

		Third Two Years		
			Response	
	TRT	INC	DIFF	%
Net Basal Area PAI (sq.ft/a)	CON	5.5		
	200	6.4	0.9	16.4
	400	6.3	0.8	14.5
Gross Basal Area PAI (sq.ft/a)	CON	5.6		
	200	6.3	0.7	12.5
	400	6.3	0.7	12.5

Installation 297 UPPER MUD CREEK
Region: CEN WASHINGTON Ownership: FOREST SERVICE
Legal Description: T27N R20E Section 25 Meridian: WILLAMETTE

Initial Stand Characteristics:

Total Age	70	years
Trees per Acre	155	trees/acre
Total Volume	1270	cu.ft/acre
CCF	60.6	
Relative Density Index	23.1	
Mean Diameter	9.1	inches
Average Crown Length	27.3	feet
Average Crown Ratio	62.7	percent
Site Height (40 tpa)	48.5	feet
Species Composition (% of Total BA)		
Ponderosa Pine	100.0	percent

Growth:

Note: all increments have been adjusted to a common initial basal area of 69.7 sq.feet/acre

			Response	
	Treatment	Increment	Difference	% of Control
6-Year Net Basal Area (sq.feet/acre)	Control	16.1		
	200 # N	16.8	0.7	4.3
	400 # N	-14.4	-30.5	-189.4
6-Year Gross Basal Area (sq.feet/acre)	Control	16.6		
	200 # N	15.8	-0.8	-4.8
	400 # N	13.0	-3.6	-21.7
6-Year Change in Mean Diameter (inches)	Control	1.02		
	200 # N	0.98	-0.04	-3.9
	400 # N	0.84	-0.18	-17.6

Periodic Annual Increment

		First Two Years			Second Two Years		
			Response			Response	
	TRT	INC	DIFF	%	INC	DIFF	%
Net Basal Area PAI (sq.ft/a)	CON	2.8			2.1		
	200	2.9	0.1	3.6	2.7	0.6	28.6
	400	1.7	-1.1	-39.3	-11.0	-13.1	-623.8
Gross Basal Area PAI (sq.ft/a)	CON	2.8			2.4		
	200	2.9	0.1	3.6	2.1	-0.3	-12.5
	400	2.9	0.1	3.6	1.5	-0.9	-37.5

		Third Two Years		
			Response	
	TRT	INC	DIFF	%
Net Basal Area PAI (sq.ft/a)	CON	3.1		
	200	2.8	-0.3	-9.7
	400	2.2	-0.9	-29.0
Gross Basal Area PAI (sq.ft/a)	CON	3.1		
	200	2.8	-0.3	-9.7
	400	2.1	-1.0	-32.3

Installation 298 LILLY LAKE
Region: CEN WASHINGTON Ownership: WASHINGTON DNR
Legal Description: T21N R20E Section 22 Meridian: WILLAMETTE

Initial Stand Characteristics:

Total Age	76	years
Trees per Acre	177	trees/acre
Total Volume	2003	cu.ft/acre
CCF	77.1	
Relative Density Index	28.9	
Mean Diameter	9.7	inches
Average Crown Length	27.5	feet
Average Crown Ratio	53.4	percent
Site Height (40 tpa)	57.6	feet
Species Composition (% of Total BA)		
Ponderosa Pine	100.0	percent

Growth:

Note: all increments have been adjusted to a common initial basal area of 90.0 sq.feet/acre

	Treatment	Increment	Response Difference	Response % of Control
6-Year Net Basal Area (sq.feet/acre)	Control	17.7		
	200 # N	19.6	1.9	10.7
	400 # N	5.0	-12.7	-71.8
6-Year Gross Basal Area (sq.feet/acre)	Control	17.4		
	200 # N	19.1	1.7	9.8
	400 # N	16.8	-0.6	-3.4
6-Year Change in Mean Diameter (inches)	Control	0.85		
	200 # N	0.99	0.14	16.5
	400 # N	1.04	0.19	22.4

Periodic Annual Increment

		First Two Years			Second Two Years		
			Response			Response	
	TRT	INC	DIFF	%	INC	DIFF	%
Net Basal Area PAI (sq.ft/a)	CON	3.6			2.2		
	200	3.7	0.1	2.8	2.8	0.6	27.3
	400	3.5	-0.1	-2.8	-1.7	-3.9	-177.3
Gross Basal Area PAI (sq.ft/a)	CON	3.6			2.0		
	200	3.7	0.1	2.8	2.5	0.5	25.0
	400	3.5	-0.1	-2.8	1.9	-0.1	-5.0

		Third Two Years		
			Response	
	TRT	INC	DIFF	%
Net Basal Area PAI (sq.ft/a)	CON	3.1		
	200	3.3	0.2	6.5
	400	0.7	-2.4	-77.4
Gross Basal Area PAI (sq.ft/a)	CON	3.1		
	200	3.3	0.2	6.5
	400	3.0	-0.1	-3.2

Installation 299 LICK CREEK
Region: CEN WASHINGTON Ownership: BOISE CASCADE
Legal Description: T21N R16E Section 30 Meridian: WILLAMETTE

Initial Stand Characteristics:

Total Age	78	years
Trees per Acre	237	trees/acre
Total Volume	14820	cu.ft/acre
CCF	138.0	
Relative Density Index	49.5	
Mean Diameter	11.4	inches
Average Crown Length	28.1	feet
Average Crown Ratio	43.1	percent
Site Height (40 tpa)	75.7	feet
Species Composition (% of Total BA)		
Douglas-fir	1.8	percent
Ponderosa Pine	98.2	percent

Growth:

Note: all increments have been adjusted to a common initial basal area of 167.3 sq.feet/acre

	Treatment	Increment	Response Difference	Response % of Control
6-Year Net Basal Area (sq.feet/acre)	Control	24.0		
	200 # N	32.0	8.0	33.3
	400 # N	33.0	9.0	37.5
6-Year Gross Basal Area (sq.feet/acre)	Control	23.3		
	200 # N	33.8	10.5	45.1
	400 # N	34.6	11.3	48.5
6-Year Change in Mean Diameter (inches)	Control	0.79		
	200 # N	1.19	0.40	50.6
	400 # N	1.04	0.25	31.6

Periodic Annual Increment

		First Two Years			Second Two Years		
			Response			Response	
	TRT	INC	DIFF	%	INC	DIFF	%
Net Basal Area PAI (sq.ft/a)	CON	4.2			4.2		
	200	5.4	1.2	28.6	4.4	0.2	4.8
	400	5.4	1.2	28.6	4.3	0.1	2.4
Gross Basal Area PAI (sq.ft/a)	CON	4.2			3.8		
	200	5.4	1.2	28.6	5.2	1.4	36.8
	400	5.4	1.2	28.6	5.2	1.4	36.8

		Third Two Years		
			Response	
	TRT	INC	DIFF	%
Net Basal Area PAI (sq.ft/a)	CON	3.6		
	200	6.1	2.5	69.4
	400	6.9	3.3	91.7
Gross Basal Area PAI (sq.ft/a)	CON	3.7		
	200	6.2	2.5	67.6
	400	6.8	3.1	83.8

Installation 300 SAGE FLAT
Region: CEN WASHINGTON Ownership: WASHINGTON DNR
Legal Description: T6N R12E Section 17 Meridian: WILLAMETTE

Initial Stand Characteristics:

Total Age	84	years
Trees per Acre	230	trees/acre
Total Volume	27450	cu.ft/acre
CCF	167.6	
Relative Density Index	59.2	
Mean Diameter	13.1	inches
Average Crown Length	29.1	feet
Average Crown Ratio	38.0	percent
Site Height (40 tpa)	90.8	feet
Species Composition (% of Total BA)		
Ponderosa Pine	100.0	percent

Growth:

Note: all increments have been adjusted to a common initial basal area of 214.1 sq.feet/acre

	Treatment	Increment	Response: Difference	Response: % of Control
6-Year Net Basal Area (sq.feet/acre)	Control	30.2		
	200 # N	31.5	1.3	4.3
	400 # N	38.5	8.3	27.5
6-Year Gross Basal Area (sq.feet/acre)	Control	30.3		
	200 # N	33.0	2.7	8.9
	400 # N	38.8	8.5	28.1
6-Year Change in Mean Diameter (inches)	Control	0.90		
	200 # N	1.04	0.14	15.6
	400 # N	1.28	0.38	42.2

Periodic Annual Increment

		First Two Years			Second Two Years		
			Response			Response	
	TRT	INC	DIFF	%	INC	DIFF	%
Net Basal Area PAI (sq.ft/a)	CON	5.3			5.4		
	200	5.7	0.4	7.5	6.7	1.3	24.1
	400	6.5	1.2	22.6	7.8	2.4	44.4
Gross Basal Area PAI (sq.ft/a)	CON	5.3			5.5		
	200	5.7	0.4	7.5	6.6	1.1	20.0
	400	6.5	1.2	22.6	7.8	2.3	41.8

		Third Two Years		
			Response	
	TRT	INC	DIFF	%
Net Basal Area PAI (sq.ft/a)	CON	4.3		
	200	3.3	-1.0	-23.3
	400	4.9	0.6	14.0
Gross Basal Area PAI (sq.ft/a)	CON	4.3		
	200	4.2	-0.1	-2.3
	400	5.1	0.8	18.6

Installation 301 LUBRECHT EXP. FOREST
Region: MONTANA Ownership: UofM--LUBRECHT
Legal Description: T13N R15W Section 16 Meridian: PRINCIPAL

Initial Stand Characteristics:

Total Age	90	years
Trees per Acre	232	trees/acre
Total Volume	1617	cu.ft/acre
CCF	75.0	
Relative Density Index	28.8	
Mean Diameter	8.1	inches
Average Crown Length	21.4	feet
Average Crown Ratio	46.5	percent
Site Height (40 tpa)	55.4	feet
Species Composition (% of Total BA)		
Douglas-fir	9.0	percent
Ponderosa Pine	91.0	percent

Growth:

Note: all increments have been adjusted to a common initial basal area of 81.8 sq.feet/acre

	Treatment	Increment	Response Difference	Response % of Control
4-Year Net Basal Area (sq.feet/acre)	Control	12.3		
	200 # N	15.7	3.4	27.6
	N + K	14.9	2.6	21.1
4-Year Net Total Volume (cu.feet/acre)	Control	427		
	200 # N	532	105	24.6
	N + K	485	58	13.6
4-Year Gross Basal Area (sq.feet/acre)	Control	12.3		
	200 # N	15.7	3.4	27.6
	N + K	14.9	2.6	21.1
4-Year Gross Total Volume (cu.feet/acre)	Control	427		
	200 # N	532	105	24.6
	N + K	485	58	13.6
4-Year Change in Mean Diameter (inches)	Control	0.59		
	200 # N	0.76	0.17	28.8
	N + K	0.70	0.11	18.6
4-Year Change in Height Growth (feet)	Control	4.40		
	200 # N	5.10	0.70	15.9
	N + K	4.80	0.40	9.1

Periodic Annual Increment

		First Two Years			Second Two Years		
			Response			Response	
	TRT	INC	DIFF	%	INC	DIFF	%
Net Basal Area PAI (sq.ft/a)	CON	3.3			2.9		
	200	3.9	0.6	18.2	3.9	1.0	34.5
	N+K	3.6	0.3	9.1	3.9	1.0	34.5
Gross Basal Area PAI (sq.ft/a)	CON	3.3			2.9		
	200	3.9	0.6	18.2	3.9	1.0	34.5
	N+K	3.6	0.3	9.1	3.9	1.0	34.5
Net Volume PAI (cu.ft/a)	CON	100			113		
	200	119	19	19.0	147	34	30.1
	N+K	104	4	4.0	139	26	23.0
Gross Volume PAI (cu.ft/a)	CON	100			113		
	200	119	19	19.0	147	34	30.1
	N+K	104	4	4.0	138	25	22.1

Installation 302 BLUE MTN.
Region: MONTANA Ownership: FOREST SERVICE
Legal Description: T13N R20W Section 34 Meridian: PRINCIPAL

Initial Stand Characteristics:

Total Age	94	years
Trees per Acre	290	trees/acre
Total Volume	13315	cu.ft/acre
CCF	123.1	
Relative Density Index	43.9	
Mean Diameter	9.4	inches
Average Crown Length	22.9	feet
Average Crown Ratio	41.0	percent
Site Height (40 tpa)	65.3	feet
Species Composition (% of Total BA)		
Douglas-fir	20.4	percent
Ponderosa Pine	79.6	percent

Growth:

Note: all increments have been adjusted to a common initial basal area of 134.9 sq.feet/acre

	Treatment	Increment	Response Difference	Response % of Control
4-Year Net Basal Area (sq.feet/acre)	Control	5.6		
	200 # N	2.5	-3.1	-55.4
	N + K	7.0	1.4	25.0
4-Year Net Total Volume (cu.feet/acre)	Control	347		
	200 # N	329	-18	-5.2
	N + K	381	34	9.8
4-Year Gross Basal Area (sq.feet/acre)	Control	6.4		
	200 # N	7.9	1.5	23.4
	N + K	7.8	1.4	21.9
4-Year Gross Total Volume (cu.feet/acre)	Control	360		
	200 # N	432	72	20.0
	N + K	401	41	11.4
4-Year Change in Mean Diameter (inches)	Control	0.32		
	200 # N	0.29	-0.03	-9.4
	N + K	0.29	-0.03	-9.4
4-Year Change in Height Growth (feet)	Control	3.40		
	200 # N	3.80	0.40	11.8
	N + K	3.50	0.10	2.9

Periodic Annual Increment

		First Two Years			Second Two Years		
			Response			Response	
	TRT	INC	DIFF	%	INC	DIFF	%
Net Basal Area PAI (sq.ft/a)	CON	1.9			0.9		
	200	2.6	0.7	36.8	-1.3	-2.2	-244.4
	N+K	2.1	0.2	10.5	1.4	0.5	55.6
Gross Basal Area PAI (sq.ft/a)	CON	2.2			1.0		
	200	2.4	0.2	9.1	1.5	0.5	50.0
	N+K	2.6	0.4	18.2	1.3	0.3	30.0
Net Volume PAI (cu.ft/a)	CON	92			82		
	200	115	23	25.0	49	-33	-40.2
	N+K	92	0	0.0	99	17	20.7
Gross Volume PAI (cu.ft/a)	CON	98			83		
	200	111	13	13.3	105	22	26.5
	N+K	104	6	6.1	96	13	15.7

Installation 303 FOUR MILE CR.
Region: MONTANA Ownership: FOREST SERVICE
Legal Description: T18N R27W Section 12 Meridian: PRINCIPAL

Initial Stand Characteristics:

Total Age	95	years
Trees per Acre	170	trees/acre
Total Volume	14125	cu.ft/acre
CCF	108.2	
Relative Density Index	38.0	
Mean Diameter	11.9	inches
Average Crown Length	36.2	feet
Average Crown Ratio	51.2	percent
Site Height (40 tpa)	79.0	feet
Species Composition (% of Total BA)		
Douglas-fir	4.4	percent
Ponderosa Pine	95.6	percent

Growth:

Note: all increments have been adjusted to a common initial basal area of 131.1 sq.feet/acre

	Treatment	Increment	Response Difference	Response % of Control
4-Year Net Basal Area (sq.feet/acre)	Control	11.4		
	200 # N	11.1	-0.3	-2.6
	N + K	15.8	4.4	38.6
4-Year Net Total Volume (cu.feet/acre)	Control	655		
	200 # N	690	35	5.3
	N + K	872	217	33.1
4-Year Gross Basal Area (sq.feet/acre)	Control	11.5		
	200 # N	11.3	-0.2	-1.7
	N + K	15.5	4.0	34.8
4-Year Gross Total Volume (cu.feet/acre)	Control	661		
	200 # N	696	35	5.3
	N + K	862	201	30.4
4-Year Change in Mean Diameter (inches)	Control	0.51		
	200 # N	0.50	-0.01	-2.0
	N + K	0.70	0.19	37.3
4-Year Change in Height Growth (feet)	Control	4.40		
	200 # N	4.90	0.50	11.4
	N + K	5.40	1.00	22.7

Periodic Annual Increment

		First Two Years			Second Two Years		
			Response			Response	
	TRT	INC	DIFF	%	INC	DIFF	%
Net Basal Area PAI (sq.ft/a)	CON	2.7			3.0		
	200	2.3	-0.4	-14.8	3.3	0.3	10.0
	N+K	3.7	1.0	37.0	4.2	1.2	40.0
Gross Basal Area PAI (sq.ft/a)	CON	2.8			3.0		
	200	2.4	-0.4	-14.3	3.2	0.2	6.7
	N+K	3.4	0.6	21.4	4.3	1.3	43.3
Net Volume PAI (cu.ft/a)	CON	142			185		
	200	135	-7	-4.9	209	24	13.0
	N+K	188	46	32.4	247	62	33.5
Gross Volume PAI (cu.ft/a)	CON	147			183		
	200	141	-6	-4.1	207	24	13.1
	N+K	178	31	21.1	253	70	38.3

Installation 304 HINCHWOOD CR.
Region: MONTANA Ownership: CHAMPION
Legal Description: T21N R25W Section 19 Meridian: PRINCIPAL

Initial Stand Characteristics:

Total Age	77	years
Trees per Acre	283	trees/acre
Total Volume	13008	cu.ft/acre
CCF	106.9	
Relative Density Index	41.1	
Mean Diameter	9.0	inches
Average Crown Length	27.6	feet
Average Crown Ratio	48.9	percent
Site Height (40 tpa)	66.7	feet
Species Composition (% of Total BA)		
Douglas-fir	2.4	percent
Ponderosa Pine	97.6	percent

Growth:

Note: all increments have been adjusted to a common initial basal area of 123.1 sq.feet/acre

	Treatment	Increment	Response	
			Difference	% of Control
4-Year Net Basal Area (sq.feet/acre)	Control	11.0		
	200 # N	16.7	5.7	51.8
	N + K	15.8	4.8	43.6
4-Year Net Total Volume (cu.feet/acre)	Control	582		
	200 # N	816	234	40.2
	N + K	720	138	23.7
4-Year Gross Basal Area (sq.feet/acre)	Control	12.4		
	200 # N	16.5	4.1	33.1
	N + K	15.7	3.3	26.6
4-Year Gross Total Volume (cu.feet/acre)	Control	616		
	200 # N	809	193	31.3
	N + K	717	101	16.4
4-Year Change in Mean Diameter (inches)	Control	0.48		
	200 # N	0.62	0.14	29.2
	N + K	0.52	0.04	8.3
4-Year Change in Height Growth (feet)	Control	5.00		
	200 # N	6.10	1.10	22.0
	N + K	5.40	0.40	8.0

Periodic Annual Increment

		First Two Years			Second Two Years		
			Response			Response	
	TRT	INC	DIFF	%	INC	DIFF	%
Net Basal Area PAI (sq.ft/a)	CON	2.2			3.3		
	200	4.0	1.8	81.8	4.4	1.1	33.3
	N+K	3.7	1.5	68.2	4.2	0.9	27.3
Gross Basal Area PAI (sq.ft/a)	CON	3.1			3.1		
	200	3.8	0.7	22.6	4.5	1.4	45.2
	N+K	3.6	0.5	16.1	4.3	1.2	38.7
Net Volume PAI (cu.ft/a)	CON	112			179		
	200	170	58	51.8	238	59	33.0
	N+K	146	34	30.4	214	35	19.6
Gross Volume PAI (cu.ft/a)	CON	132			176		
	200	164	32	24.2	240	64	36.4
	N+K	143	11	8.3	215	39	22.2

Installation 305 LIBBY PLANTATION
Region: MONTANA Ownership: CHAMPION
Legal Description: T29N R13W Section 12 Meridian: PRINCIPAL

Initial Stand Characteristics:

Total Age	43	years
Trees per Acre	223	trees/acre
Total Volume	12243	cu.ft/acre
CCF	87.8	
Relative Density Index	33.5	
Mean Diameter	9.1	inches
Average Crown Length	29.4	feet
Average Crown Ratio	55.4	percent
Site Height (40 tpa)	58.0	feet
Species Composition (% of Total BA)		
Ponderosa Pine	100.0	percent

Growth:

Note: all increments have been adjusted to a common initial basal area of 101.1 sq.feet/acre

	Treatment	Increment	Response Difference	Response % of Control
4-Year Net Basal Area (sq.feet/acre)	Control	16.5		
	200 # N	5.1	-11.4	-69.1
	N + K	17.3	0.8	4.8
4-Year Net Total Volume (cu.feet/acre)	Control	712		
	200 # N	389	-323	-45.4
	N + K	766	54	7.6
4-Year Gross Basal Area (sq.feet/acre)	Control	16.2		
	200 # N	14.7	-1.5	-9.3
	N + K	17.3	1.1	6.8
4-Year Gross Total Volume (cu.feet/acre)	Control	700		
	200 # N	609	-91	-13.0
	N + K	765	65	9.3
4-Year Change in Mean Diameter (inches)	Control	0.69		
	200 # N	0.72	0.03	4.3
	N + K	0.78	0.09	13.0
4-Year Change in Height Growth (feet)	Control	6.30		
	200 # N	6.40	0.10	1.6
	N + K	6.50	0.20	3.2

Periodic Annual Increment

		First Two Years			Second Two Years		
			Response			Response	
	TRT	INC	DIFF	%	INC	DIFF	%
Net Basal Area PAI (sq.ft/a)	CON	4.4			3.8		
	200	1.8	-2.6	-59.1	0.7	-3.1	-81.6
	N+K	3.9	-0.5	-11.4	4.7	0.9	23.7
Gross Basal Area PAI (sq.ft/a)	CON	4.1			4.0		
	200	3.5	-0.6	-14.6	3.9	-0.1	-2.5
	N+K	3.9	-0.2	-4.9	4.7	0.7	17.5
Net Volume PAI (cu.ft/a)	CON	166			190		
	200	95	-71	-42.8	99	-91	-47.9
	N+K	156	-10	-6.0	227	37	19.5
Gross Volume PAI (cu.ft/a)	CON	156			194		
	200	131	-25	-16.0	173	-21	-10.8
	N+K	155	-1	-0.6	227	33	17.0

Installation 306 SEDLAK CR.
Region: MONTANA Ownership: CHAMPION
Legal Description: T26N R29W Section 9 Meridian: PRINCIPAL

Initial Stand Characteristics:

Total Age	64	years
Trees per Acre	217	trees/acre
Total Volume	14099	cu.ft/acre
CCF	120.6	
Relative Density Index	43.1	
Mean Diameter	11.0	inches
Average Crown Length	34.4	feet
Average Crown Ratio	52.6	percent
Site Height (40 tpa)	73.6	feet
Species Composition (% of Total BA)		
Douglas-fir	2.3	percent
Western Larch	19.2	percent
Ponderosa Pine	78.4	percent
Engelmann Spruce	0.1	percent

Growth:

Note: all increments have been adjusted to a common initial basal area of 143.3 sq.feet/acre

	Treatment	Increment	Response	
			Difference	% of Control
4-Year Net Basal Area (sq.feet/acre)	Control	16.9		
	200 # N	5.8	-11.1	-65.7
	N + K	18.8	1.9	11.2
4-Year Net Total Volume (cu.feet/acre)	Control	816		
	200 # N	563	-253	-31.0
	N + K	991	175	21.4
4-Year Gross Basal Area (sq.feet/acre)	Control	17.3		
	200 # N	18.0	0.7	4.0
	N + K	19.4	2.1	12.1
4-Year Gross Total Volume (cu.feet/acre)	Control	836		
	200 # N	934	98	11.7
	N + K	1019	183	21.9
4-Year Change in Mean Diameter (inches)	Control	0.64		
	200 # N	0.82	0.18	28.1
	N + K	0.77	0.13	20.3
4-Year Change in Height Growth (feet)	Control	5.20		
	200 # N	5.80	0.60	11.5
	N + K	5.60	0.40	7.7

Periodic Annual Increment

		First Two Years			Second Two Years		
			Response			Response	
	TRT	INC	DIFF	%	INC	DIFF	%
Net Basal Area PAI (sq.ft/a)	CON	3.7			4.8		
	200	-1.3	-5.0	-135.1	4.2	-0.6	-12.5
	N+K	3.8	0.1	2.7	5.6	0.8	16.7
Gross Basal Area PAI (sq.ft/a)	CON	4.2			4.5		
	200	4.1	-0.1	-2.4	4.9	0.4	8.9
	N+K	4.5	0.3	7.1	5.2	0.7	15.6
Net Volume PAI (cu.ft/a)	CON	165			243		
	200	23	-142	-86.1	258	15	6.2
	N+K	193	28	17.0	302	59	24.3
Gross Volume PAI (cu.ft/a)	CON	181			237		
	200	194	13	7.2	272	35	14.8
	N+K	216	35	19.3	294	57	24.1

Section IV

FOLIAR NUTRIENT CONCENTRATION SUMMARIES FOR ALL PONDEROSA PINE INSTALLATIONS

Foliar Nutrient Concentrations Summary Report

Installation 291 SARDINE SPRINGS
Region: Northeast Oregon Ownership: FOREST SERVICE
Legal Description: T7S R42E Section 4 Meridian: WILLAMETTE

	Plot Number					
	1	2	3	4	5	6
Treatment	200#N	CONT	400#N	400#N	CONT	200#N
Foliar Nutrient Concentrations: (in micrograms per gram)						
Nitrogen	17227	20832	15155	20181	12999	15239
Phosphorus	1992	2008	1462	1928	2358	1638
Potassium	4964	5809	5676	5539	6380	5924
Calcium	1650	778	998	746	731	916
Magnesium	1021	833	971	867	1122	1082
Manganese	186.9	82.9	127.1	93.2	102.9	75.6
Zinc	51.2	47.5	54.4	61.5	44.0	46.5
Iron	47.1	48.2	40.0	40.1	46.6	28.8
Boron	26.3	19.7	15.6	22.5	23.4	25.7
Copper	6.60	5.15	4.45	4.80	4.10	4.55
Needle Weight (g/100 needles)	33.52	40.55	31.26	29.38	27.62	40.68

	Treatment Type			
	Control	200 LBS	400 LBS	Overall
Nitrogen	16915	16233	17668	16939
Phosphorus	2183	1815	1695	1898
Potassium	6094	5444	5608	5715
Calcium	754	1283	872	970
Magnesium	977	1051	919	982
Manganese	92.9	131.3	110.2	111.5
Zinc	45.8	48.9	58.0	50.9
Iron	47.4	38.0	40.1	41.8
Boron	21.5	26.0	19.1	22.2
Copper	4.62	5.57	4.62	4.94
Needle Weight (g/100 needles)	34.08	37.10	30.32	33.84

Foliar Nutrient Concentrations Summary Report

Installation 292 SPARTA BUTTE
Region: Northeast Oregon Ownership: FOREST SERVICE
Legal Description: T8S R44E Section 4 Meridian: WILLAMETTE

	Plot Number					
	1	2	3	4	5	6
Treatment	200#N	CONT	400#N	400#N	CONT	200#N
Foliar Nutrient Concentrations: (in micrograms per gram)						
Nitrogen	13125	13944	18263	23954	12299	16814
Phosphorus	1432	2411	1863	2089	1723	2007
Potassium	4220	5696	4890	4712	5171	4981
Calcium	1238	1582	790	1110	1155	1294
Magnesium	970	1380	1119	1260	1240	1300
Manganese	209.9	203.8	111.8	174.8	170.1	192.1
Zinc	25.3	51.8	61.4	60.5	46.3	50.0
Iron	36.0	36.1	25.4	38.8	36.3	29.5
Boron	24.2	25.8	19.7	23.8	20.2	24.7
Copper	3.45	4.90	4.35	1.05	5.60	4.05
Needle Weight (g/100 needles)	.	46.84	.	44.71	29.00	35.59

	Treatment Type			
	Control	200 LBS	400 LBS	Overall
Nitrogen	13121	14969	21108	16400
Phosphorus	2067	1720	1976	1921
Potassium	5434	4600	4801	4945
Calcium	1369	1266	950	1195
Magnesium	1310	1135	1189	1211
Manganese	187.0	201.0	143.3	177.1
Zinc	49.0	37.7	61.0	49.2
Iron	36.2	32.8	32.1	33.7
Boron	23.0	24.4	21.7	23.1
Copper	5.25	3.75	2.70	3.90
Needle Weight (g/100 needles)	37.92	35.59	44.71	39.04

Foliar Nutrient Concentrations Summary Report

Installation 293 SUMMIT SALVAGE
Region: Northeast Oregon Ownership: FOREST SERVICE
Legal Description: T5S R41E Section 27 Meridian: WILLAMETTE

	Plot Number					
	1	2	3	4	5	6
Treatment	200#N	CONT	400#N	200#N	CONT	400#N
Foliar Nutrient Concentrations: (in micrograms per gram)						
Nitrogen	15911	12236	22022	19425	11823	22304
Phosphorus	1649	2101	1815	2152	1684	1989
Potassium	5235	6330	6712	7640	5912	5882
Calcium	379	846	704	615	918	746
Magnesium	617	777	793	767	733	739
Manganese	59.8	90.7	95.8	75.3	130.6	95.2
Zinc	30.2	44.7	41.4	50.9	47.6	46.8
Iron	30.9	44.1	26.6	38.9	49.9	46.6
Boron	15.3	23.0	17.8	22.8	24.2	17.5
Copper	4.10	4.65	2.95	4.05	3.40	0.45
Needle Weight (g/100 needles)	25.30	34.92	23.56	28.76	.	.

	Treatment Type			
	Control	200 LBS	400 LBS	Overall
Nitrogen	12029	17668	22163	17287
Phosphorus	1893	1901	1902	1899
Potassium	6121	6437	6297	6285
Calcium	882	497	725	701
Magnesium	755	692	766	738
Manganese	110.7	67.6	95.5	91.3
Zinc	46.1	40.6	44.1	43.6
Iron	47.0	34.9	36.6	39.5
Boron	23.6	19.0	17.7	20.1
Copper	4.02	4.07	1.70	3.27
Needle Weight (g/100 needles)	34.92	27.03	23.56	28.13

Foliar Nutrient Concentrations Summary Report

Installation 294 MOSES CREEK
Region: Northeast Oregon Ownership: BOISE CASCADE
Legal Description: T3N R40E Section 30 Meridian: WILLAMETTE

	Plot Number					
	1	2	3	4	5	6
Treatment	CONT	200#N	400#N	400#N	CONT	200#N
Foliar Nutrient Concentrations: (in micrograms per gram)						
Nitrogen	12229	12649	16765	17206	12495	15736
Phosphorus	1412	1691	1859	2405	1785	2198
Potassium	4592	5397	5787	5997	5622	6806
Calcium	784	763	611	771	809	613
Magnesium	766	690	748	1082	884	947
Manganese	103.3	118.1	107.3	98.2	71.5	65.0
Zinc	36.4	41.5	42.0	60.1	36.2	46.4
Iron	48.3	47.0	46.0	60.4	35.6	52.7
Boron	18.7	17.9	17.0	26.8	22.0	18.9
Copper	2.80	2.75	2.95	3.65	3.35	3.45
Needle Weight (g/100 needles)	.	.	35.88	29.90	25.40	36.07

	Treatment Type			
	Control	200 LBS	400 LBS	Overall
Nitrogen	12362	14192	16985	14513
Phosphorus	1599	1945	2132	1892
Potassium	5107	6102	5892	5700
Calcium	797	688	691	725
Magnesium	825	818	915	853
Manganese	87.4	91.6	102.8	93.9
Zinc	36.3	44.0	51.1	43.8
Iron	41.9	49.9	53.2	48.3
Boron	20.3	18.4	21.9	20.2
Copper	3.07	3.10	3.30	3.16
Needle Weight (g/100 needles)	25.40	36.07	32.89	31.81

Foliar Nutrient Concentrations Summary Report

Installation 295 PARKERS FLAT
Region: Northeast Oregon Ownership: BOISE CASCADE
Legal Description: T2N R39E Section 34 Meridian: WILLAMETTE

	Plot Number					
	1	2	3	4	5	6
Treatment	CONT	400#N	200#N	400#N	200#N	CONT
Foliar Nutrient Concentrations: (in micrograms per gram)						
Nitrogen	11669	20104	15421	19131	13531	11949
Phosphorus	2352	2000	1783	2212	1872	2093
Potassium	8227	5416	7762	4770	6350	7638
Calcium	612	1196	897	654	674	1059
Magnesium	799	980	832	783	960	1142
Manganese	65.0	93.6	60.4	57.6	73.4	68.9
Zinc	38.5	33.4	44.6	32.4	42.1	48.4
Iron	39.4	28.9	32.6	34.8	43.8	44.9
Boron	20.4	16.4	21.4	16.6	19.6	22.1
Copper	4.40	3.45	3.00	4.00	2.90	4.00
Needle Weight (g/100 needles)	19.22	32.50	.	26.59	30.53	29.59

	Treatment Type			
	Control	200 LBS	400 LBS	Overall
Nitrogen	11809	14476	19617	15301
Phosphorus	2222	1828	2106	2052
Potassium	7932	7056	5093	6694
Calcium	835	786	925	848
Magnesium	971	896	881	916
Manganese	67.0	66.9	75.6	69.8
Zinc	43.5	43.3	32.9	39.9
Iron	42.2	38.2	31.8	37.4
Boron	21.3	20.5	16.5	19.4
Copper	4.20	2.95	3.72	3.62
Needle Weight (g/100 needles)	24.40	30.53	29.55	27.69

Foliar Nutrient Concentrations Summary Report

Installation 296 CORRAL CREEK
Region: Central Washington Ownership: FOREST SERVICE
Legal Description: T21N R14E Section 24 Meridian: WILLAMETTE

	Plot Number					
	1	2	3	4	5	6
Treatment	400#N	CONT	200#N	CONT	400#N	200#N
Foliar Nutrient Concentrations: (in micrograms per gram)						
Nitrogen	27328	16695	20762	12677	22680	16562
Phosphorus	2811	2398	2169	1980	2531	1950
Potassium	11182	7210	8669	9007	9457	6804
Calcium	663	1072	1077	819	974	849
Magnesium	707	820	654	877	814	850
Manganese	92.2	161.1	179.9	77.8	194.5	122.8
Zinc	51.0	48.9	54.6	47.6	60.9	39.5
Iron	38.3	74.1	61.6	46.6	53.0	45.8
Boron	21.1	17.5	16.3	18.6	21.4	15.9
Copper	3.10	4.55	3.50	4.65	4.55	4.05
Needle Weight (g/100 needles)	20.04	23.37	35.85	.	19.13	.

	Treatment Type			
	Control	200 LBS	400 LBS	Overall
Nitrogen	14686	18662	25004	19451
Phosphorus	2189	2060	2671	2307
Potassium	8109	7737	10319	8721
Calcium	946	963	818	909
Magnesium	849	752	760	787
Manganese	119.5	151.4	143.4	138.1
Zinc	48.3	47.1	56.0	50.4
Iron	60.4	53.7	45.7	53.3
Boron	18.1	16.1	21.2	18.5
Copper	4.60	3.77	3.82	4.07
Needle Weight (g/100 needles)	23.37	35.85	19.59	24.60

Foliar Nutrient Concentrations Summary Report

Installation 297 UPPER MUD CREEK
Region: Central Washington Ownership: FOREST SERVICE
Legal Description: T27N R20E Section 25 Meridian: WILLAMETTE

	Plot Number					
	1	2	3	4	5	6
Treatment	CONT	400#N	200#N	200#N	CONT	400#N
Foliar Nutrient Concentrations: (in micrograms per gram)						
Nitrogen	11305	15330	15380	16618	12019	14581
Phosphorus	1819	1987	1768	2105	2409	1815
Potassium	6819	6573	6551	7311	8028	7872
Calcium	693	726	621	816	530	733
Magnesium	845	1054	750	810	671	761
Manganese	107.5	102.9	113.8	120.9	69.9	109.7
Zinc	39.7	49.4	52.7	48.3	42.2	49.1
Iron	42.4	40.2	50.8	46.8	56.3	40.6
Boron	21.8	18.9	15.9	18.7	20.6	15.1
Copper	4.85	5.15	6.35	5.80	2.35	1.45
Needle Weight (g/100 needles)	.	.	.	.	.	.

	Treatment Type			
	Control	200 LBS	400 LBS	Overall
Nitrogen	11662	15999	14955	14205
Phosphorus	2114	1936	1901	1984
Potassium	7423	6931	7223	7192
Calcium	611	719	729	686
Magnesium	758	780	908	815
Manganese	88.7	117.4	106.3	104.1
Zinc	41.0	50.5	49.3	46.9
Iron	49.4	48.8	40.4	46.2
Boron	21.2	17.3	17.0	18.5
Copper	3.60	6.07	3.30	4.32
Needle Weight (g/100 needles)	.	.	.	.

Foliar Nutrient Concentrations Summary Report

Installation 298 LILLY LAKE
Region: Central Washington Ownership: WASHINGTON DNR
Legal Description: T21N R20E Section 22 Meridian: WILLAMETTE

	Plot Number					
	1	2	3	4	5	6
Treatment	200#N	CONT	400#N	200#N	CONT	400#N
Foliar Nutrient Concentrations: (in micrograms per gram)						
Nitrogen	14910	12642	15155	12698	11984	19117
Phosphorus	1976	2044	1538	2123	2012	2309
Potassium	6552	6253	6588	7867	6079	7646
Calcium	877	986	1324	921	1732	948
Magnesium	888	1005	1196	826	1110	978
Manganese	162.0	215.3	306.2	85.9	251.5	171.6
Zinc	52.7	52.6	67.1	45.1	71.8	47.2
Iron	44.6	37.0	41.4	33.7	48.8	61.5
Boron	18.1	19.3	16.0	19.3	18.3	18.4
Copper	1.45	1.35	2.00	1.80	0.50	3.50
Needle Weight (g/100 needles)	16.92	.	.	.	.	.

	Treatment Type			
	Control	200 LBS	400 LBS	Overall
Nitrogen	12313	13804	17136	14418
Phosphorus	2028	2050	1924	2001
Potassium	6166	7210	7117	6831
Calcium	1359	899	1136	1131
Magnesium	1057	857	1087	1000
Manganese	233.4	123.9	238.9	198.8
Zinc	62.2	48.9	57.2	56.1
Iron	42.9	39.1	51.5	44.5
Boron	18.8	18.7	17.2	18.3
Copper	0.92	1.62	2.75	1.77
Needle Weight (g/100 needles)	.	16.92	.	16.92

Foliar Nutrient Concentrations Summary Report

Installation 299 LICK CREEK
Region: Central Washington Ownership: BOISE CASCADE
Legal Description: T21N R16E Section 30 Meridian: WILLAMETTE

	Plot Number					
	1	2	3	4	5	6
Treatment	400#N	200#N	CONT	CONT	200#N	400#N
Foliar Nutrient Concentrations: (in micrograms per gram)						
Nitrogen	21742	14910	12278	.	.	15701
Phosphorus	1952	1970	2058	.	.	1739
Potassium	5813	7721	8683	.	.	5527
Calcium	922	1257	1671	.	.	984
Magnesium	1114	1170	1420	.	.	876
Manganese	246.2	271.2	284.3	.	.	254.3
Zinc	54.4	53.0	59.3	.	.	34.0
Iron	42.5	44.7	38.6	.	.	44.7
Boron	12.7	14.7	30.5	.	.	15.2
Copper	5.80	3.00	3.20	.	.	3.65
Needle Weight (g/100 needles)	.	17.38	15.94	.	.	.

	Treatment Type			
	Control	200 LBS	400 LBS	Overall
Nitrogen	12278	14910	18721	16158
Phosphorus	2058	1970	1845	1930
Potassium	8683	7721	5670	6936
Calcium	1671	1257	953	1208
Magnesium	1420	1170	995	1145
Manganese	284.3	271.2	250.3	264.0
Zinc	59.3	53.0	44.2	50.2
Iron	38.6	44.7	43.6	42.6
Boron	30.5	14.7	14.0	18.3
Copper	3.20	3.00	4.72	3.91
Needle Weight (g/100 needles)	15.94	17.38	.	16.66

Foliar Nutrient Concentrations Summary Report

Installation 300 SAGE FLAT
Region: Central Washington Ownership: WASHINGTON DNR
Legal Description: T6N R12E Section 17 Meridian: WILLAMETTE

	Plot Number					
	1	2	3	4	5	6
Treatment	CONT	200#N	400#N	400#N	200#N	CONT
Foliar Nutrient Concentrations: (in micrograms per gram)						
Nitrogen	10619	13286	12761	12253	12533	10444
Phosphorus	1435	1993	1420	1797	1688	1602
Potassium	5605	5416	3488	6349	6416	4807
Calcium	1490	1126	1171	1278	938	1166
Magnesium	933	1087	1045	937	864	1156
Manganese	289.4	132.5	334.1	116.5	139.7	238.5
Zinc	36.9	44.2	40.8	35.0	42.1	42.8
Iron	52.6	107.4	64.7	79.4	68.1	64.4
Boron	9.7	6.9	13.6	10.5	8.5	13.1
Copper	4.20	2.25	2.10	5.60	4.02	1.80
Needle Weight (g/100 needles)	.	.	.	.	.	.

	Treatment Type			
	Control	200 LBS	400 LBS	Overall
Nitrogen	10531	12910	12507	11983
Phosphorus	1518	1841	1609	1656
Potassium	5206	5916	4918	5347
Calcium	1328	1032	1224	1195
Magnesium	1045	975	991	1003
Manganese	264.0	136.1	225.3	208.5
Zinc	39.9	43.2	37.9	40.3
Iron	58.5	87.8	72.0	72.8
Boron	11.4	7.7	12.1	10.4
Copper	3.00	3.14	3.85	3.33
Needle Weight (g/100 needles)	.	.	.	.

Foliar Nutrient Concentrations Summary Report

Installation 301 LUBRECHT EXP. FOREST
Region: Montana Ownership: UofM--LUBRECHT
Legal Description: T13N R15W Section 16 Meridian: PRINCIPAL

	Plot Number					
	1	2	3	4	5	6
Treatment	200#N	CONT	N+K	N+K	200#N	CONT
Foliar Nutrient Concentrations: (in micrograms per gram)						
Nitrogen	12945	9640	16705	14430	11972	10080
Phosphorus	2425	2255	2255	1965	1667	1945
Potassium	8779	6542	7595	5365	6049	6601
Calcium	905	628	836	982	582	662
Magnesium	1126	1098	797	1025	753	840
Manganese	150.4	117.2	98.3	113.9	108.1	126.3
Zinc	39.2	35.3	39.6	46.4	28.6	32.9
Iron	48.3	43.9	51.9	38.5	50.9	38.7
Boron	25.1	17.3	15.1	15.4	15.3	17.9
Copper	3.59	3.06	3.68	3.31	2.78	1.78
Needle Weight (g/100 needles)	23.40	17.30	22.51	13.47	17.94	17.17

	Treatment Type			
	Control	200#N	200#N+K	Overall
Nitrogen	9860	12459	15567	12629
Phosphorus	2100	2046	2110	2085
Potassium	6572	7414	6480	6822
Calcium	645	744	909	766
Magnesium	969	940	911	940
Manganese	121.8	129.3	106.1	119.1
Zinc	34.1	33.9	43.0	37.0
Iron	41.3	49.6	45.2	45.4
Boron	17.6	20.2	15.3	17.7
Copper	2.42	3.19	3.50	3.03
Needle Weight (g/100 needles)	17.23	20.67	17.99	18.63

Foliar Nutrient Concentrations Summary Report

Installation 302 BLUE MTN.
Region: Montana Ownership: FOREST SERVICE
Legal Description: T13N R20W Section 34 Meridian: PRINCIPAL

	Plot Number					
	1	2	3	4	5	6
Treatment	200#N	CONT	N+K	N+K	CONT	200#N
Foliar Nutrient Concentrations: (in micrograms per gram)						
Nitrogen	13605	10805	12043	14460	10877	14890
Phosphorus	2127	2102	2188	2250	1995	2530
Potassium	8131	7139	7619	9044	13640	5744
Calcium	716	674	639	670	422	434
Magnesium	1008	900	933	1208	844	971
Manganese	130.0	114.3	101.1	123.7	90.6	126.0
Zinc	39.4	44.0	34.2	34.2	44.0	37.7
Iron	50.3	49.2	53.3	47.2	58.8	46.4
Boron	18.2	21.2	22.5	19.1	24.0	24.5
Copper	3.92	5.31	4.77	4.60	3.55	4.94
Needle Weight (g/100 needles)	14.81	12.47	15.63	13.46	12.87	10.55

	Treatment Type			
	Control	200#N	200#N+K	Overall
Nitrogen	10841	14247	13252	12780
Phosphorus	2048	2329	2219	2199
Potassium	10389	6937	8331	8553
Calcium	548	575	655	593
Magnesium	872	989	1071	977
Manganese	102.5	128.0	112.4	114.3
Zinc	44.0	38.5	34.2	38.9
Iron	54.0	48.3	50.2	50.9
Boron	22.6	21.4	20.8	21.6
Copper	4.43	4.43	4.68	4.51
Needle Weight (g/100 needles)	12.67	12.68	14.54	13.30

Foliar Nutrient Concentrations Summary Report

Installation 303 FOUR MILE CR.
Region: Montana Ownership: FOREST SERVICE
Legal Description: T18N R27W Section 12 Meridian: PRINCIPAL

	Plot Number					
	1	2	3	4	5	6
Treatment	200#N	CONT	N+K	N+K	CONT	200#N
Foliar Nutrient Concentrations: (in micrograms per gram)						
Nitrogen	18592	16425	15270	12910	10365	12707
Phosphorus	2300	2640	2255	2212	2110	2125
Potassium	8547	8463	10434	7745	7156	7155
Calcium	889	759	627	1103	683	768
Magnesium	1079	1129	1074	1105	1093	1005
Manganese	143.2	113.0	86.1	128.5	93.6	116.4
Zinc	41.9	45.0	49.2	42.4	38.9	51.6
Iron	36.9	48.6	52.7	47.3	48.2	45.4
Boron	23.6	30.2	23.5	16.1	32.4	15.4
Copper	4.79	6.37	5.35	6.71	5.74	4.55
Needle Weight (g/100 needles)	21.95	16.79	20.25	20.95	14.19	22.59

	Treatment Type			
	Control	200#N	200#N+K	Overall
Nitrogen	13395	15650	14090	14378
Phosphorus	2375	2212	2234	2274
Potassium	7810	7851	9089	8250
Calcium	721	829	865	805
Magnesium	1111	1042	1089	1081
Manganese	103.3	129.8	107.3	113.5
Zinc	42.0	46.8	45.8	44.9
Iron	48.4	41.1	50.0	46.5
Boron	31.3	19.5	19.8	23.5
Copper	6.05	4.67	6.03	5.59
Needle Weight (g/100 needles)	15.49	22.27	20.60	19.45

Foliar Nutrient Concentrations Summary Report

Installation 304 HINCHWOOD CR.
Region: Montana Ownership: CHAMPION
Legal Description: T21N R25W Section 19 Meridian: PRINCIPAL

	Plot Number					
	1	2	3	4	5	6
Treatment	CONT	N+K	200#N	N+K	CONT	200#N
Foliar Nutrient Concentrations: (in micrograms per gram)						
Nitrogen	10447	13257	14220	16490	11697	14175
Phosphorus	2492	2217	2460	2690	2040	2025
Potassium	7446	6772	7124	12380	6589	6960
Calcium	665	1069	663	685	875	1091
Magnesium	1070	1224	1059	959	992	1100
Manganese	101.7	130.4	92.2	113.6	154.4	138.6
Zinc	40.2	45.7	51.0	43.0	55.3	45.1
Iron	44.0	43.5	52.2	50.4	41.0	35.6
Boron	24.0	22.3	18.4	30.8	27.8	14.0
Copper	3.85	3.94	5.16	4.18	4.21	3.68
Needle Weight (g/100 needles)	17.45	22.18	20.09	20.40	21.86	26.47

	Treatment Type			
	Control	200#N	200#N+K	Overall
Nitrogen	11072	14197	14874	13381
Phosphorus	2266	2242	2454	2321
Potassium	7018	7042	9576	7879
Calcium	770	877	877	841
Magnesium	1031	1080	1091	1067
Manganese	128.1	115.4	122.0	121.8
Zinc	47.8	48.1	44.4	46.7
Iron	42.5	43.9	46.9	44.5
Boron	25.9	16.2	26.5	22.9
Copper	4.03	4.42	4.06	4.17
Needle Weight (g/100 needles)	19.65	23.28	21.29	21.41

Foliar Nutrient Concentrations Summary Report

Installation 305 LIBBY PLANTATION
Region: Montana Ownership: CHAMPION
Legal Description: T29N R13W Section 12 Meridian: PRINCIPAL

	Plot Number					
	1	2	3	4	5	6
Treatment	CONT	N+K	200#N	200#N	N+K	CONT
Foliar Nutrient Concentrations: (in micrograms per gram)						
Nitrogen	14575	16820	16385	14390	15195	12740
Phosphorus	2810	2230	2165	2255	2310	2095
Potassium	9218	6875	6824	6547	7399	5488
Calcium	926	767	975	925	726	566
Magnesium	1153	1102	1093	1126	999	1028
Manganese	92.8	73.6	108.9	102.1	70.6	43.4
Zinc	37.5	41.3	41.0	35.3	40.6	41.1
Iron	52.2	43.7	43.8	44.2	41.9	51.5
Boron	26.8	20.5	18.5	23.2	16.4	31.0
Copper	3.38	2.82	2.49	3.15	2.67	2.68
Needle Weight (g/100 needles)	22.57	16.05	23.67	25.14	27.23	24.12

	Treatment Type			
	Control	200#N	200#N+K	Overall
Nitrogen	13657	15387	16007	15017
Phosphorus	2452	2210	2270	2311
Potassium	7353	6685	7137	7058
Calcium	746	950	747	814
Magnesium	1090	1109	1051	1084
Manganese	68.1	105.5	72.1	81.9
Zinc	39.3	38.1	41.0	39.5
Iron	51.9	44.0	42.8	46.2
Boron	28.9	20.9	18.5	22.8
Copper	3.03	2.82	2.74	2.87
Needle Weight (g/100 needles)	23.35	24.40	21.64	23.13

Foliar Nutrient Concentrations Summary Report

Installation 306 SEDLAK CR.
Region: Montana Ownership: CHAMPION
Legal Description: T26N R29W Section 9 Meridian: PRINCIPAL

	Plot Number					
	1	2	3	4	5	6
Treatment	200#N	CONT	N+K	200#N	N+K	CONT
Foliar Nutrient Concentrations: (in micrograms per gram)						
Nitrogen	17585	18040	16950	13340	13395	12775
Phosphorus	2300	2695	2460	2050	2070	2115
Potassium	6605	5801	7643	8239	7053	6430
Calcium	965	837	846	830	845	580
Magnesium	1253	1231	1053	1481	975	970
Manganese	112.4	58.4	126.4	112.4	97.0	96.1
Zinc	57.2	61.4	45.9	46.8	32.7	39.8
Iron	72.3	54.6	67.3	57.0	44.6	59.3
Boron	24.0	33.1	16.4	19.3	18.6	11.6
Copper	5.16	3.39	3.65	3.66	4.23	2.83
Needle Weight (g/100 needles)	30.98	24.34	18.96	25.18	24.12	18.55

	Treatment Type			
	Control	200#N	200#N+K	Overall
Nitrogen	15407	15462	15172	15347
Phosphorus	2405	2175	2265	2282
Potassium	6116	7422	7348	6962
Calcium	708	897	846	817
Magnesium	1101	1367	1014	1161
Manganese	77.2	112.4	111.7	100.4
Zinc	50.6	52.0	39.3	47.3
Iron	57.0	64.7	56.0	59.2
Boron	22.4	21.6	17.5	20.5
Copper	3.11	4.41	3.94	3.82
Needle Weight (g/100 needles)	21.44	28.08	21.54	23.69

Section V

EMPIRICAL PREDICTION MODELS FOR DOUGLAS-FIR RESPONSE TO NITROGEN FERTILIZATION

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Figure 15. Ridge trace for mineralizable nitrogen & available phosphorus by parent material and nitrogen treatment 90

Appendex 1. SAS program for absolute response prediction model using Ridge regression

```
*********************************************************
* THE SAS IS USED TO DEVELOP THE ABSOLUTE RESPONSE     *
* PREDICTION MODEL FOR DF AND IFTNC DATABASE BY        *
* RIDGE REGRESSION                                     *
*********************************************************;
OPTIONS NOCENTER NODATE NOLABEL;
*---INPUT DATA SETS-----------------------------------;
DATA RDHT;
  SET SASDATA.RDTOPHG;
PROC SORT DATA=RDHT;
  BY INSTALL TREAT;
DATA SITE;
  SET SASDATA.SITE;
PROC SORT DATA=SITE;
  BY INSTALL TREAT;
DATA INST;
  SET SASDATA.INSTALL;
PROC SORT DATA=INST;
  BY INSTALL TREAT;
*---RE-CLASSIFY HABITAT AND PM------------------------;
DATA ALL;
  MERGE SITE INST RDHT;
  BY INSTALL TREAT;
  IF SERIES=2 THEN HABT=1;              *DF;
  ELSE IF SERIES=1 THEN HABT=2;         *GF;
  ELSE HABT=3;                          *RC, WH;
  IF PM=1 THEN PM=1;                    *GRANITE;
  ELSE IF PM=2 THEN PM=2;               *BASALT;
  ELSE THEN PM=3;                       *OTHER;
  IF RESPONSE>900 THEN DELETE;
*---CODE VARIABLES FOR REGRESSION--------------------;
DATA CODE;
  SET ALL;
  HABT1=0; HABT2=0; HABT3=0;
   IF HABT=1 THEN HABT1=1;
   ELSE IF HABT=2 THEN HABT2=1;
   ELSE IF HABT=3 THEN HABT3=1;
   ELEV1=ELEV*HABT1; ELEV2=ELEV*HABT2; ELEV3=ELEV*HABT3;
   RD1=RD0*HABT1; RD2=RD0*HABT2; RD3=RD0*HABT3;
  PM1=0; PM2=0; PM3=0;
   IF PM=1 THEN PM1=1;
   ELSE IF PM=2 THEN PM2=1;
   ELSE IF PM=3 THEN PM3=1;
  TRT1=0; TRT2=0;
   IF TREAT=1 THEN TRT1=1;
   ELSE IF TREAT=2 THEN TRT2=1;
   NP1T1=MIN_N*PM1*TRT1; NP1T2=MIN_N*PM1*TRT2;
   NP2T1=MIN_N*PM2*TRT1; NP2T2=MIN_N*PM2*TRT2;
   NP3T1=MIN_N*PM3*TRT1; NP3T2=MIN_N*PM3*TRT2;
   KP1T1=EX_K*PM1*TRT1; KP1T2=EX_K*PM1*TRT2;
```

```
   KP2T1=EX_K*PM2*TRT1; KP2T2=EX_K*PM2*TRT2;
   KP3T1=EX_K*PM3*TRT1; KP3T2=EX_K*PM3*TRT2;
   PP1T1=AVAIL_P*PM1*TRT1; PP1T2=AVAIL_P*PM1*TRT2;
   PP2T1=AVAIL_P*PM2*TRT1; PP2T2=AVAIL_P*PM2*TRT2;
   PP3T1=AVAIL_P*PM3*TRT1; PP3T2=AVAIL_P*PM3*TRT2;
   NKP1T1=MIN_N*EX_K*PM1*TRT1;
   NKP1T2=MIN_N*EX_K*PM1*TRT2;
   NKP2T1=MIN_N*EX_K*PM2*TRT1;
   NKP2T2=MIN_N*EX_K*PM2*TRT2;
   NKP3T1=MIN_N*EX_K*PM3*TRT1;
   NKP3T2=MIN_N*EX_K*PM3*TRT2;
   NPP1T1=MIN_N*AVAIL_P*PM1*TRT1;
   NPP1T2=MIN_N*AVAIL_P*PM1*TRT2;
   NPP2T1=MIN_N*AVAIL_P*PM2*TRT1;
   NPP2T2=MIN_N*AVAIL_P*PM2*TRT2;
   NPP3T1=MIN_N*AVAIL_P*PM3*TRT1;
   NPP3T2=MIN_N*AVAIL_P*PM3*TRT2;
*---LEAST SQUARE REDRESSION--------------------------;
PROC REG DATA=CODE;
  MODEL RESPONSE=HABT1 HABT2 HABT3 ELEV1 ELEV2 ELEV3
                 RD1 RD2 RD3 PM1 PM2 PM3 TRT1 TRT2
                 NP1T1 NP1T2 NP2T1 NP2T2 NP3T1 NP3T2
                 KP1T1 KP1T2 KP2T1 KP2T2 KP3T1 KP3T2
                 PP1T1 PP1T2 PP2T1 PP2T2 PP3T1 PP3T2
                 NKP1T1 NKP1T2 NKP2T1 NKP2T2 NKP3T1 NKP3T2
                 NPP1T1 NPP1T2 NPP2T1 NPP2T2 NPP3T1 NPP3T2
                 / SS1 SS2 VIF COLLIN;
*---RIDGE REGRESSION---------------------------------;
PROC RIDGEREG DATA=CODE OUT=OUT1;
  MODEL RESPONSE=HABT1 HABT2 HABT3 ELEV1 ELEV2 ELEV3
                 RD1 RD2 RD3 PM1 PM2 PM3 TRT1 TRT2
                 NP1T1 NP1T2 NP2T1 NP2T2 NP3T1 NP3T2
                 KP1T1 KP1T2 KP2T1 KP2T2 KP3T1 KP3T2
                 PP1T1 PP1T2 PP2T1 PP2T2 PP3T1 PP3T2
                 NKP1T1 NKP1T2 NKP2T1 NKP2T2 NKP3T1 NKP3T2
                 NPP1T1 NPP1T2 NPP2T1 NPP2T2 NPP3T1 NPP3T2
                 / NOPRINT;
*---PRINT AND PLOT RIDGE TRACE-----------------------;
PROC PRINT DATA=OUT1;
PROC PLOT DATA=OUT1;
  PLOT (HABT1 HABT2 HABT3 ELEV1 ELEV2 ELEV3
        RD1 RD2 RD3 PM1 PM2 PM3 TRT1 TRT2
        NP1T1 NP1T2 NP2T1 NP2T2 NP3T1 NP3T2
        KP1T1 KP1T2 KP2T1 KP2T2 KP3T1 KP3T2
        PP1T1 PP1T2 PP2T1 PP2T2 PP3T1 PP3T2
        NKP1T1 NKP1T2 NKP2T1 NKP2T2 NKP3T1 NKP3T2
        NPP1T1 NPP1T2 NPP2T1 NPP2T2 NPP3T1 NPP3T2)
        * _K_/ VREF=0;
```

Appendix 2. SAS program for relative response prediction model using Ridge regression

```
*********************************************************
* THE SAS IS USED TO DEVELOP THE RELATIVE RESPONSE      *
* PREDICTION MODEL FOR DF AND IFTNC DATABASE BY         *
* RIDGE REGRESSION                                      *
*********************************************************;
OPTIONS NOCENTER NODATE NOLABEL;
*---INPUT DATA SETS-----------------------------------;
DATA RDHT;
  SET SASDATA.RDTOPHG;
PROC SORT DATA=RDHT;
  BY INSTALL TREAT;
DATA SITE;
  SET SASDATA.SITE;
PROC SORT DATA=SITE;
  BY INSTALL TREAT;
DATA INST;
  SET SASDATA.INSTALL;
PROC SORT DATA=INST;
  BY INSTALL TREAT;
*---RE-CLASSIFY HABITAT AND PM------------------------;
DATA ALL;
  MERGE SITE INST RDHT;
  BY INSTALL TREAT;
  IF SERIES=2 THEN HABT=1;              *DF;
  ELSE IF SERIES=1 THEN HABT=2;         *GF;
  ELSE HABT=3;                          *RC, WH;
  IF PM=1 THEN PM=1;                    *GRANITE;
  ELSE IF PM=2 THEN PM=2;               *BASALT;
  ELSE PM=3;                            *OTHER;
  IF RESPONSE>900 THEN DELETE;
*---CODE VARIABLES FOR REGRESSION--------------------;
DATA CODE;
  SET ALL;
  HABT1=0; HABT2=0; HABT3=0;
   IF HABT=1 THEN HABT1=1;
   ELSE IF HABT=2 THEN HABT2=1;
   ELSE IF HABT=3 THEN HABT3=1;
   ELEV1=ELEV*HABT1; ELEV2=ELEV*HABT2; ELEV3=ELEV*HABT3;
   RD1=RD0*HABT1; RD2=RD0*HABT2; RD3=RD0*HABT3;
 PM1=0; PM2=0; PM3=0;
   IF PM=1 THEN PM1=1;
   ELSE IF PM=2 THEN PM2=1;
   ELSE IF PM=3 THEN PM3=1;
 TRT1=0; TRT2=0;
   IF TREAT=1 THEN TRT1=1;
   ELSE IF TREAT=2 THEN TRT2=1;
   NP1T1=MIN_N*PM1*TRT1; NP1T2=MIN_N*PM1*TRT2;
   NP2T1=MIN_N*PM2*TRT1; NP2T2=MIN_N*PM2*TRT2;
   NP3T1=MIN_N*PM3*TRT1; NP3T2=MIN_N*PM3*TRT2;
   KP1T1=EX_K*PM1*TRT1; KP1T2=EX_K*PM1*TRT2;
   KP2T1=EX_K*PM2*TRT1; KP2T2=EX_K*PM2*TRT2;
```

```
   KP3T1=EX_K*PM3*TRT1; KP3T2=EX_K*PM3*TRT2;
   PP1T1=AVAIL_P*PM1*TRT1; PP1T2=AVAIL_P*PM1*TRT2;
   PP2T1=AVAIL_P*PM2*TRT1; PP2T2=AVAIL_P*PM2*TRT2;
   PP3T1=AVAIL_P*PM3*TRT1; PP3T2=AVAIL_P*PM3*TRT2;
   NKP1T1=MIN_N*EX_K*PM1*TRT1;
   NKP1T2=MIN_N*EX_K*PM1*TRT2;
   NKP2T1=MIN_N*EX_K*PM2*TRT1;
   NKP2T2=MIN_N*EX_K*PM2*TRT2;
   NKP3T1=MIN_N*EX_K*PM3*TRT1;
   NKP3T2=MIN_N*EX_K*PM3*TRT2;
   NPP1T1=MIN_N*AVAIL_P*PM1*TRT1;
   NPP1T2=MIN_N*AVAIL_P*PM1*TRT2;
   NPP2T1=MIN_N*AVAIL_P*PM2*TRT1;
   NPP2T2=MIN_N*AVAIL_P*PM2*TRT2;
   NPP3T1=MIN_N*AVAIL_P*PM3*TRT1;
   NPP3T2=MIN_N*AVAIL_P*PM3*TRT2;
*---LEAST SQUARE REDRESSION--------------------------;
PROC REG DATA=CODE;
  MODEL REL_RESP=HABT1 HABT2 HABT3
                 RD1 RD2 RD3 PM1 PM2 PM3 TRT1 TRT2
                 NP1T1 NP1T2 NP2T1 NP2T2 NP3T1 NP3T2
                 KP1T1 KP1T2 KP2T1 KP2T2 KP3T1 KP3T2
                 PP1T1 PP1T2 PP2T1 PP2T2 PP3T1 PP3T2
                 NKP1T1 NKP1T2 NKP2T1 NKP2T2 NKP3T1 NKP3T2
                 NPP1T1 NPP1T2 NPP2T1 NPP2T2 NPP3T1 NPP3T2
                 / SS1 SS2 VIF COLLIN;
*---RIDGE REGRESSION---------------------------------;
PROC RIDGEREG DATA=CODE OUT=OUT1;
  MODEL REL_RESP=HABT1 HABT2 HABT3
                 RD1 RD2 RD3 PM1 PM2 PM3 TRT1 TRT2
                 NP1T1 NP1T2 NP2T1 NP2T2 NP3T1 NP3T2
                 KP1T1 KP1T2 KP2T1 KP2T2 KP3T1 KP3T2
                 PP1T1 PP1T2 PP2T1 PP2T2 PP3T1 PP3T2
                 NKP1T1 NKP1T2 NKP2T1 NKP2T2 NKP3T1 NKP3T2
                 NPP1T1 NPP1T2 NPP2T1 NPP2T2 NPP3T1 NPP3T2
                 / NOPRINT;
*---PRINT AND PLOT RIDGE TRACE-----------------------;
PROC PRINT DATA=OUT1;
PROC PLOT DATA=OUT1;
  PLOT (HABT1 HABT2 HABT3
        RD1 RD2 RD3 PM1 PM2 PM3 TRT1 TRT2
        NP1T1 NP1T2 NP2T1 NP2T2 NP3T1 NP3T2
        KP1T1 KP1T2 KP2T1 KP2T2 KP3T1 KP3T2
        PP1T1 PP1T2 PP2T1 PP2T2 PP3T1 PP3T2
        NKP1T1 NKP1T2 NKP2T1 NKP2T2 NKP3T1 NKP3T2
        NPP1T1 NPP1T2 NPP2T1 NPP2T2 NPP3T1 NPP3T2)
        * _K_/ VREF=0;
```

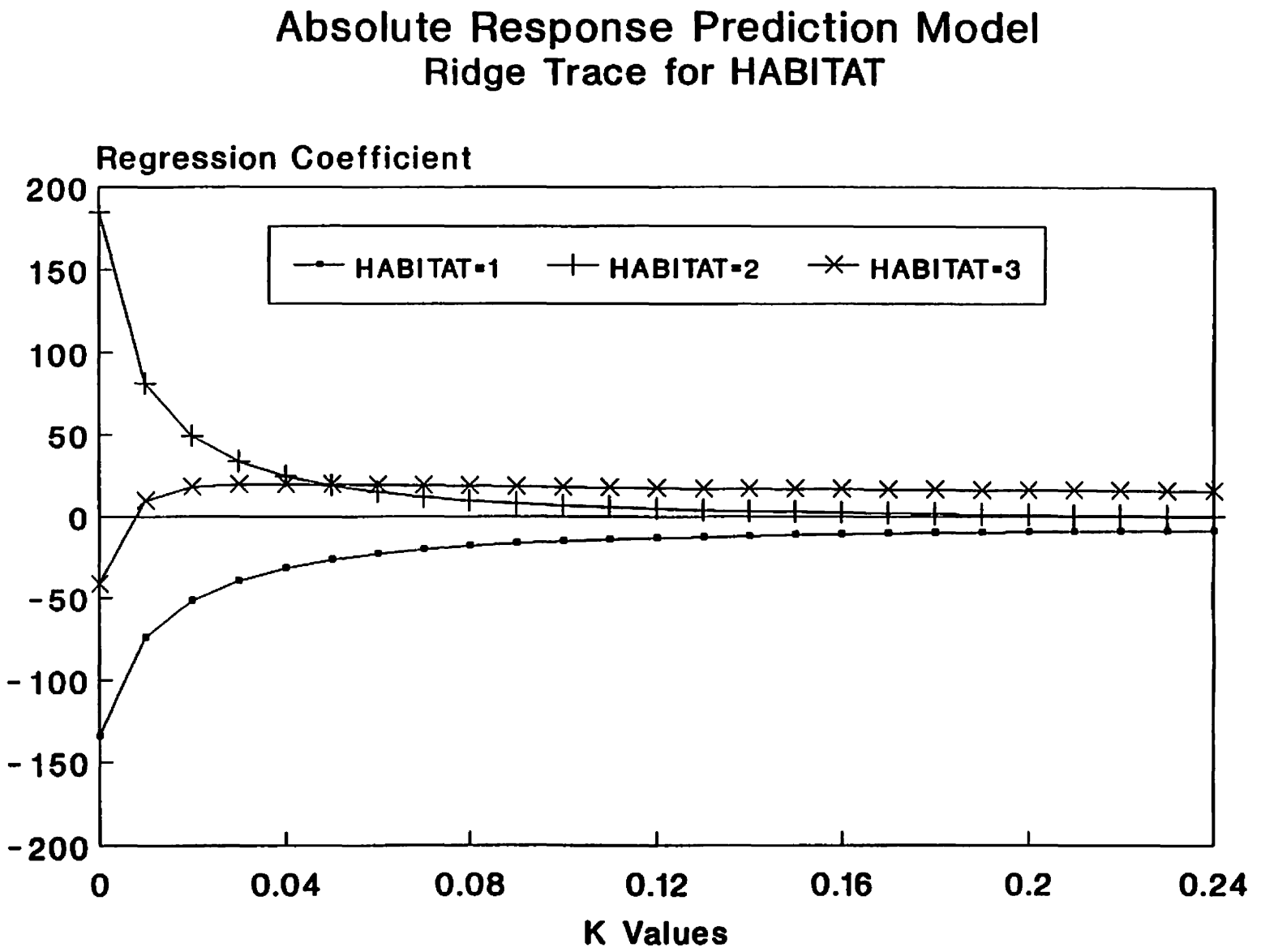

Figure 1. Ridge Trace for habitat type series.

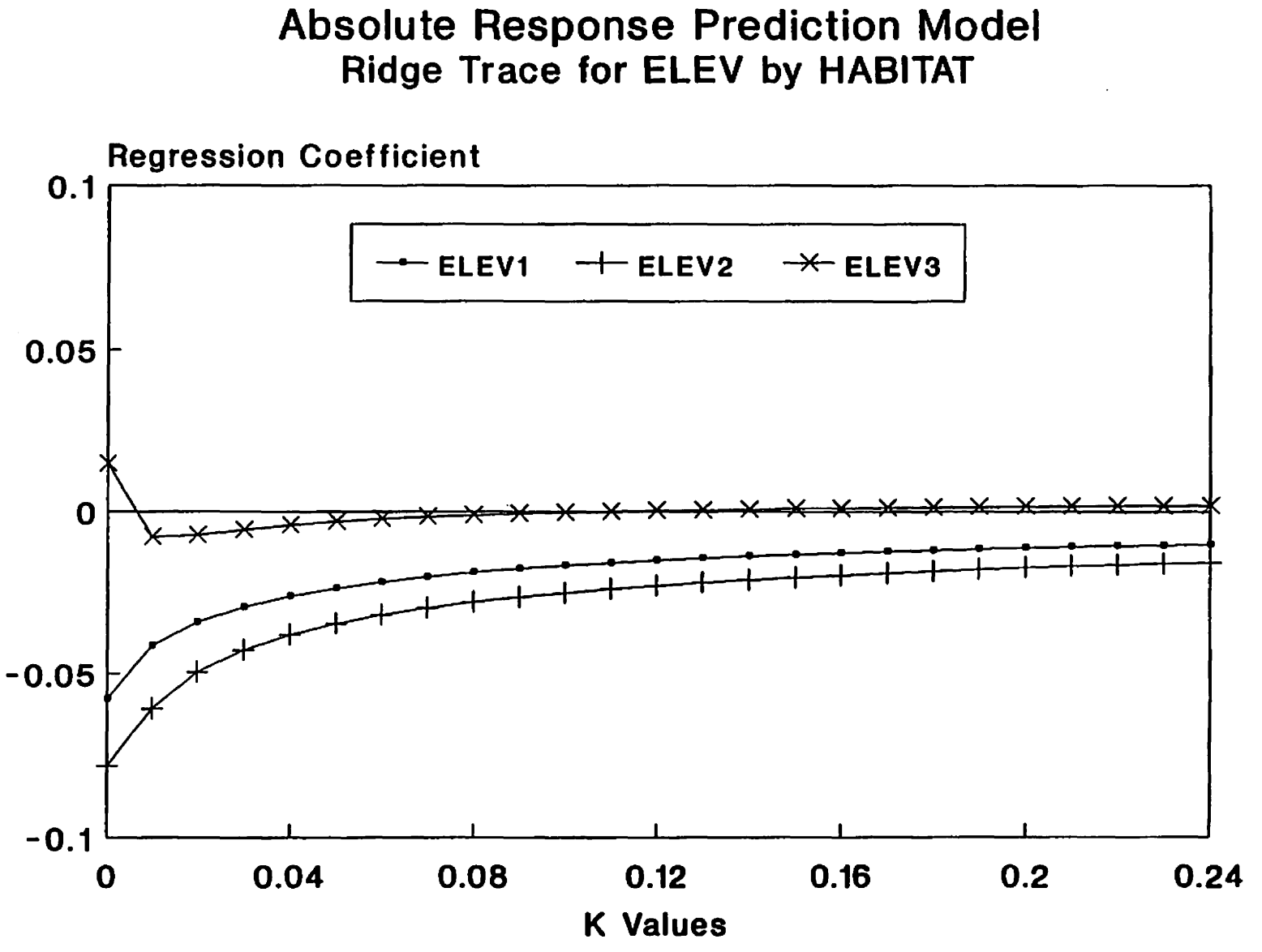

Figure 2. Ridge Trace for elevation by habitat type series.

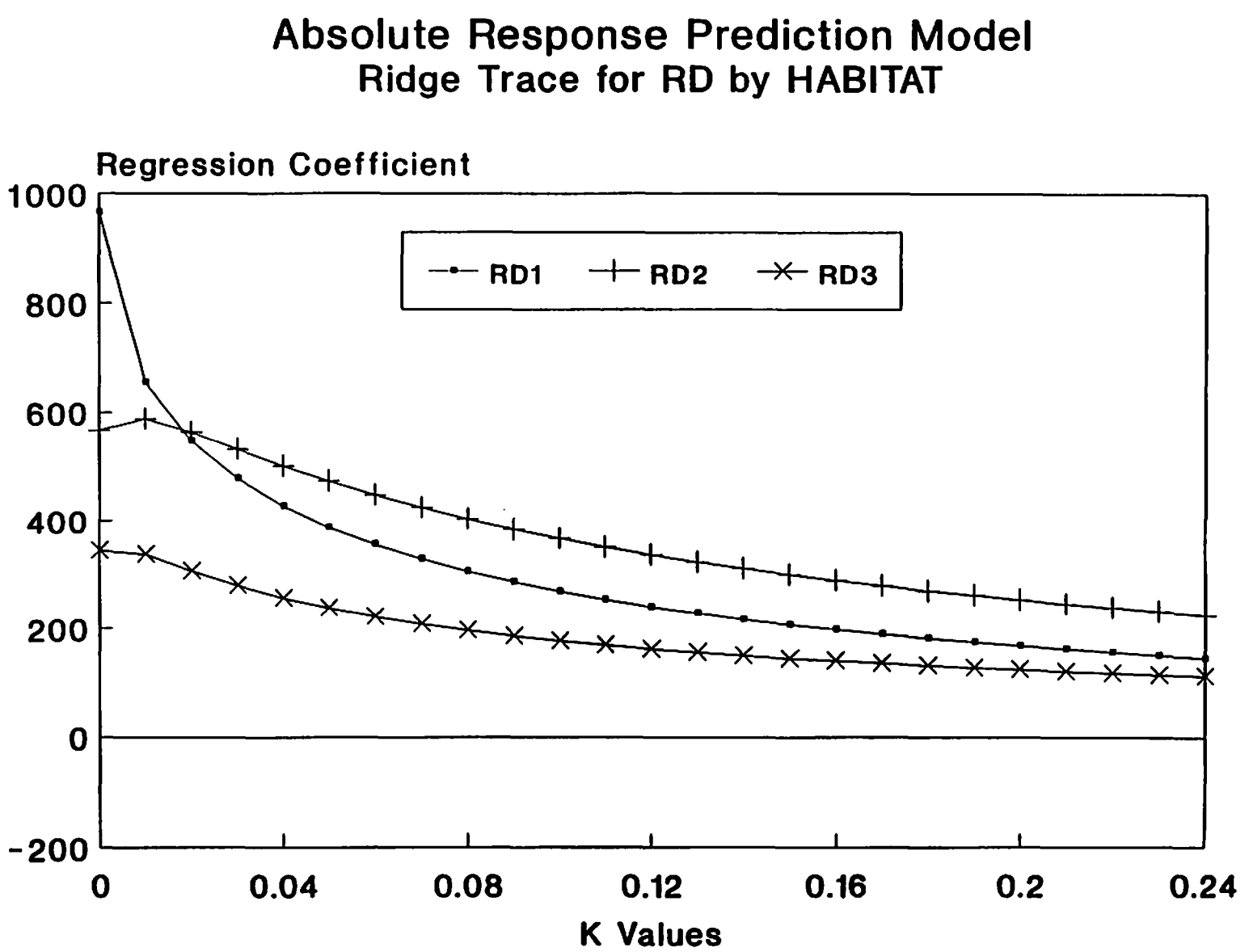

Figure 3. Ridge Trace for relative density habitat type series.

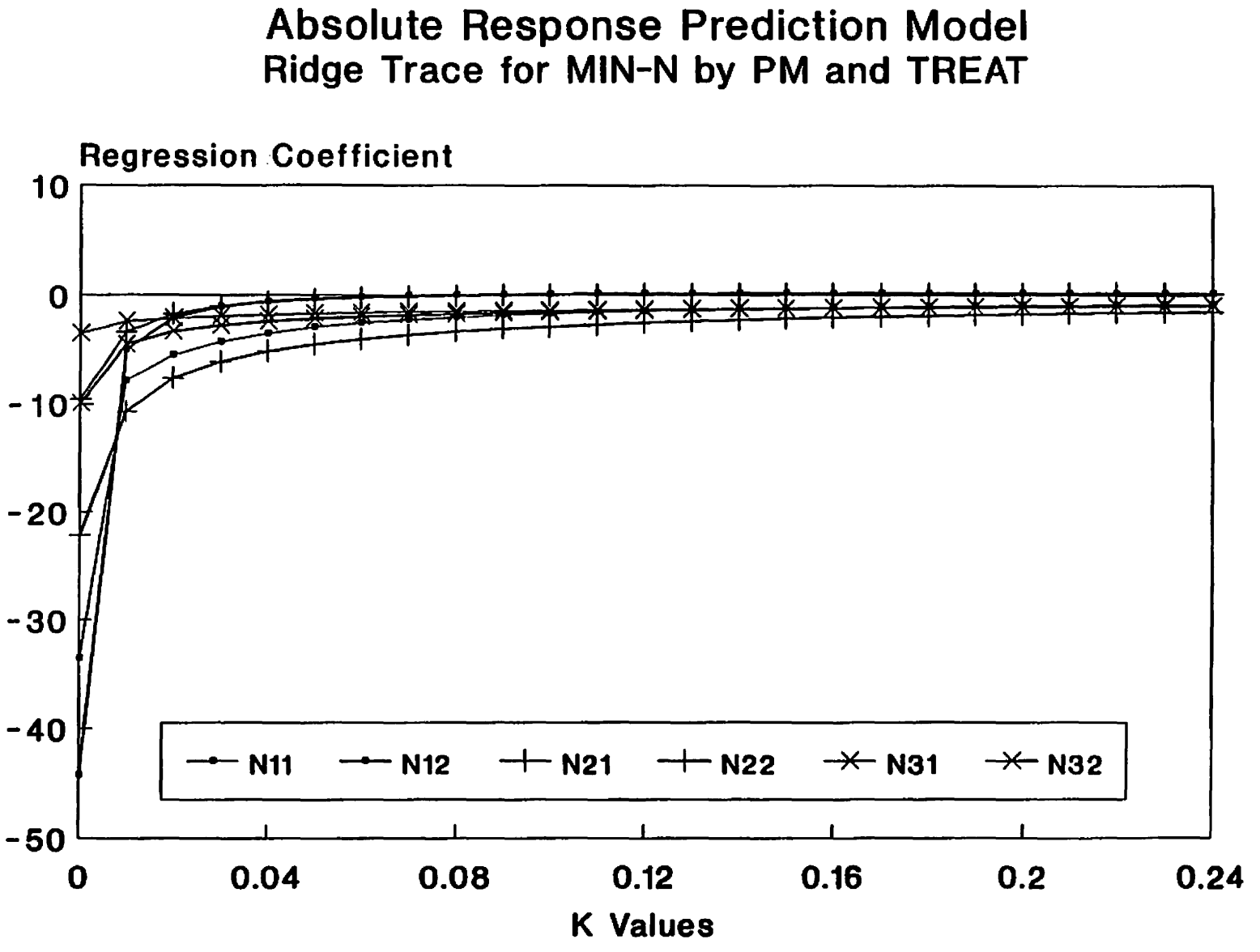

Figure 4. **Ridge Trace for mineralizable nitrogen by parent material and nitrogen treatment.**

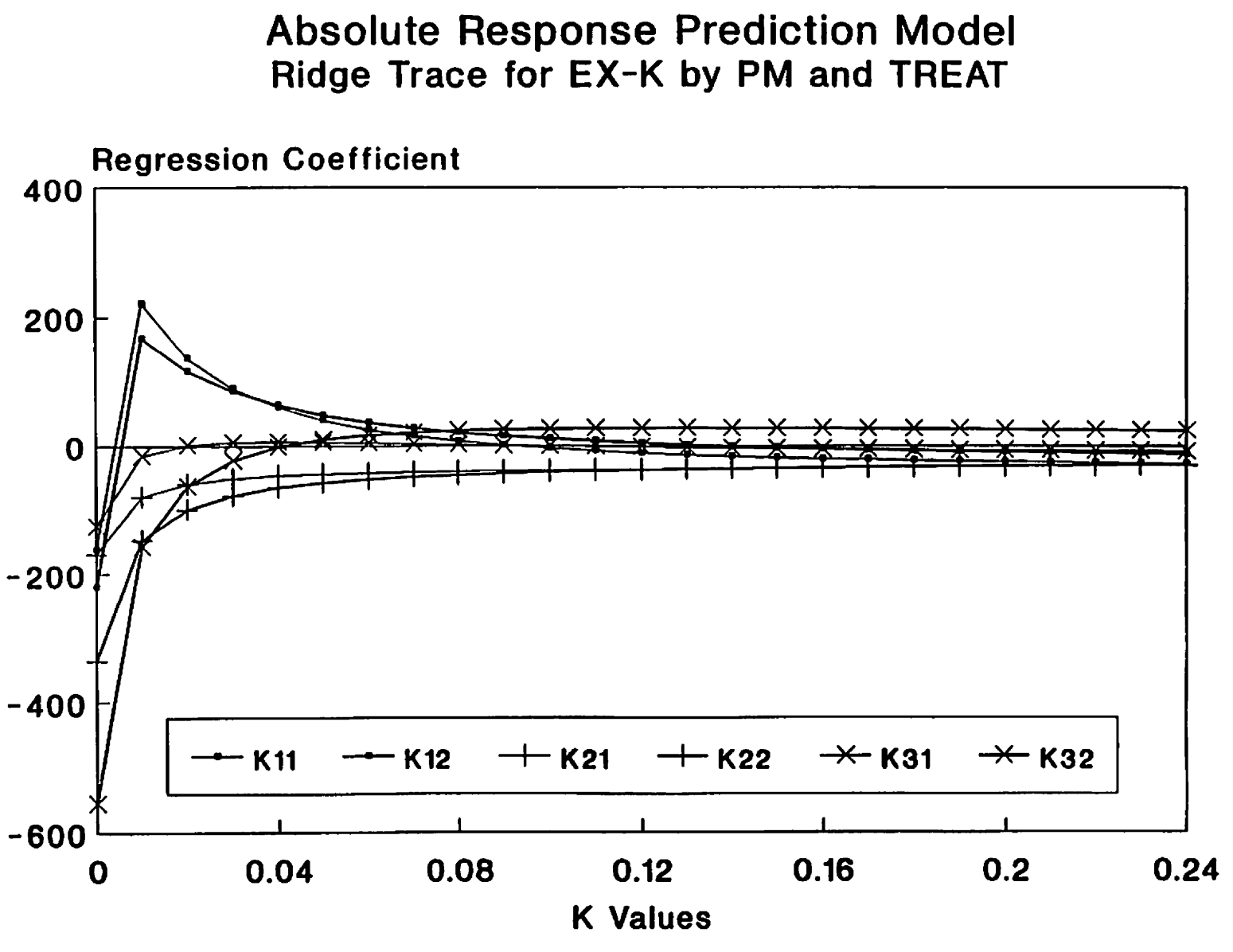

Figure 5. **Ridge trace for exchangeable potassium by parent material and nitrogen treatment.**

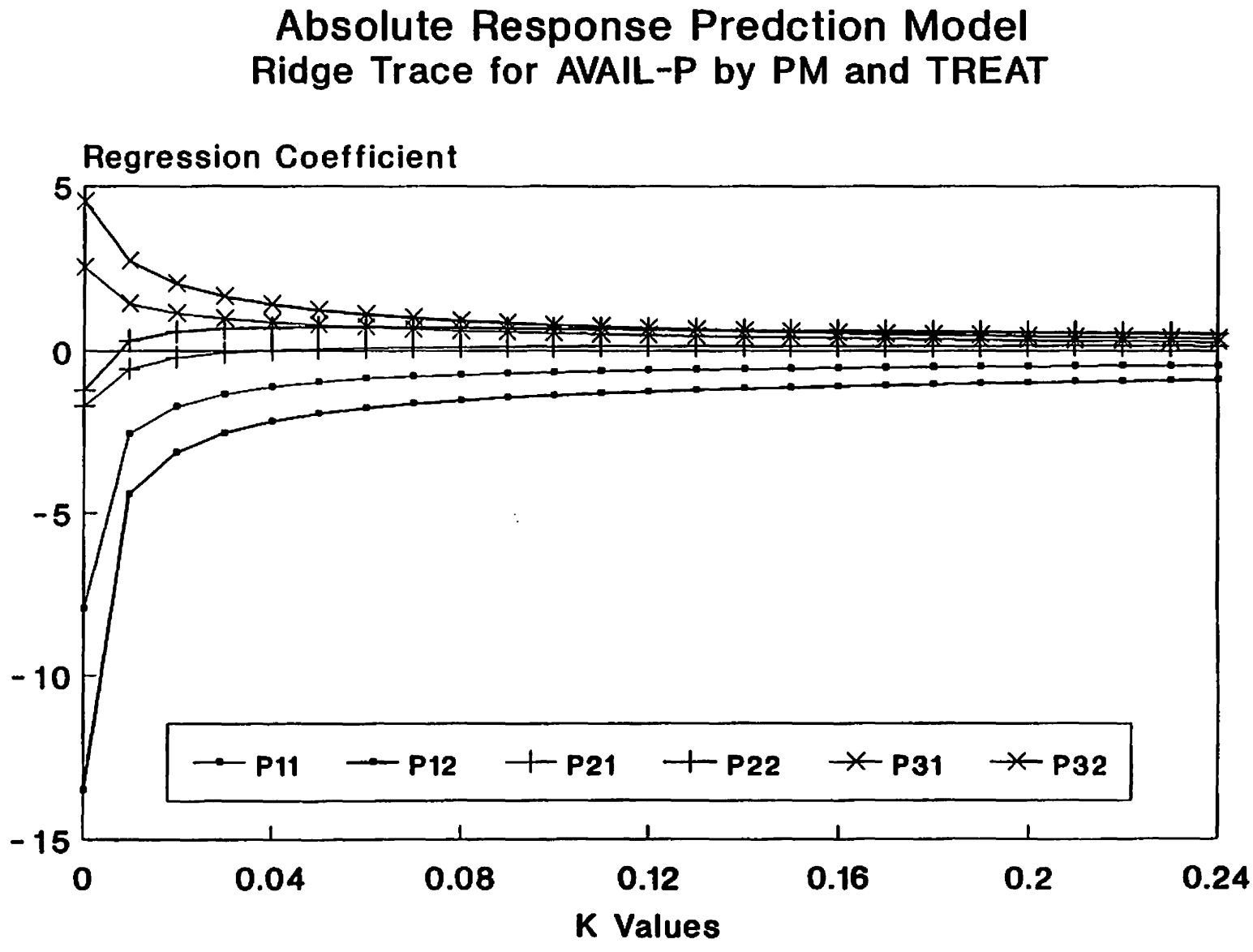

Figure 6. **Ridge trace for available phosphorus by parent material and nitrogen treatment.**

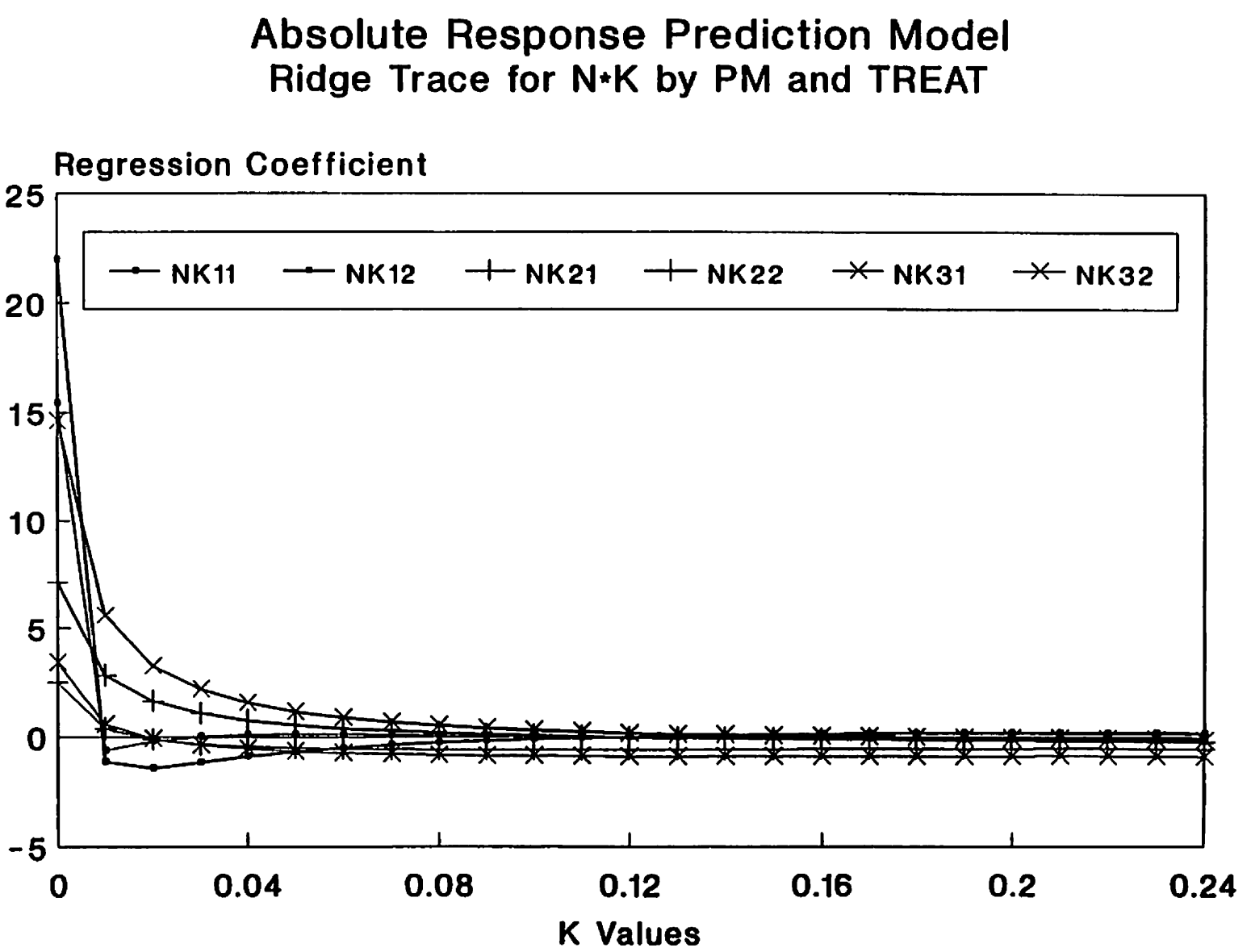

Figure 7. **Ridge trace for mineralizable nitrogen * exchangeable potassium by parent material and nitrogen treatment.**

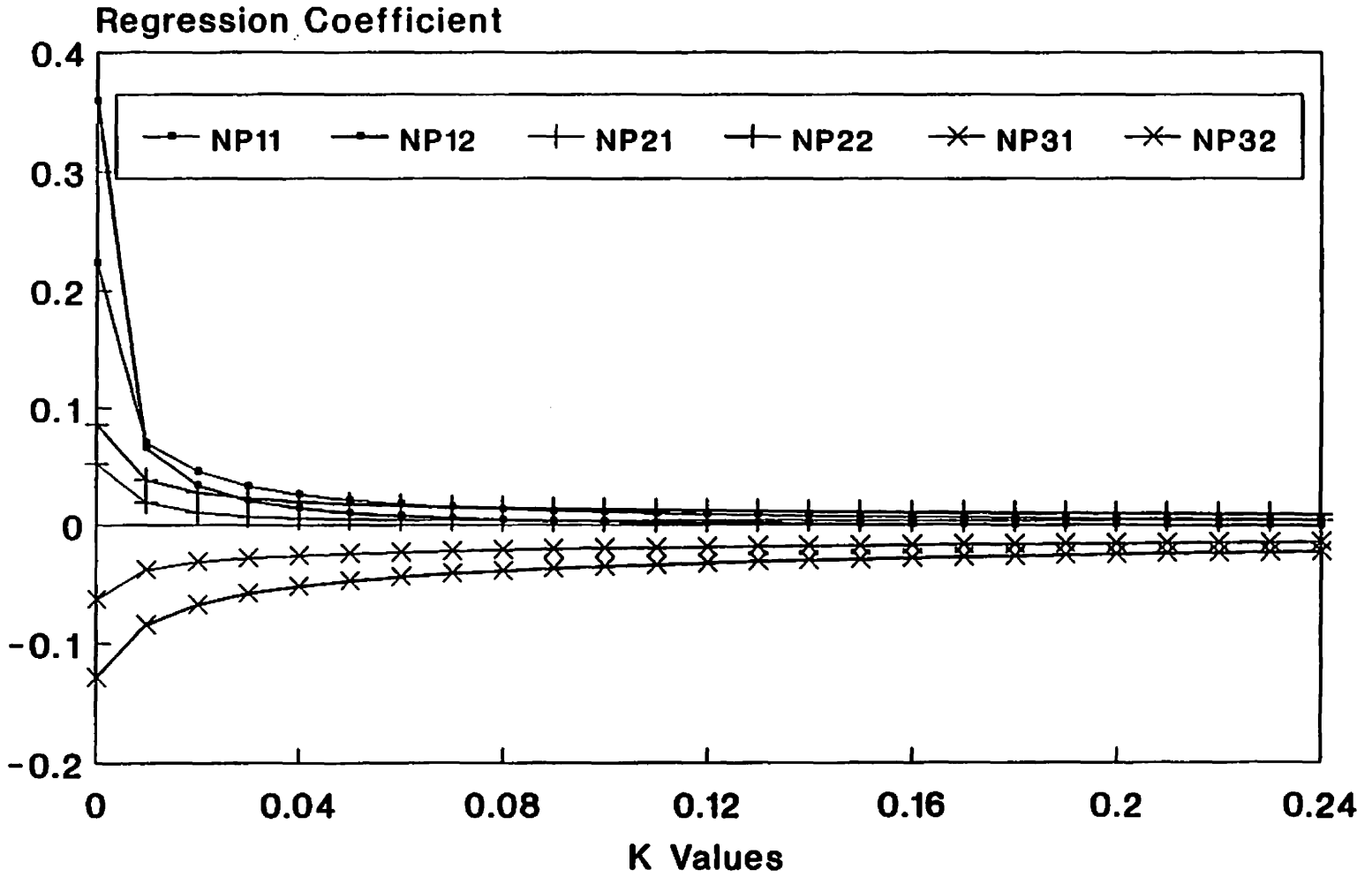

Figure 8. **Ridge trace for mineralizable nitrogen & available phosphorus by parent material and nitrogen treatment.**

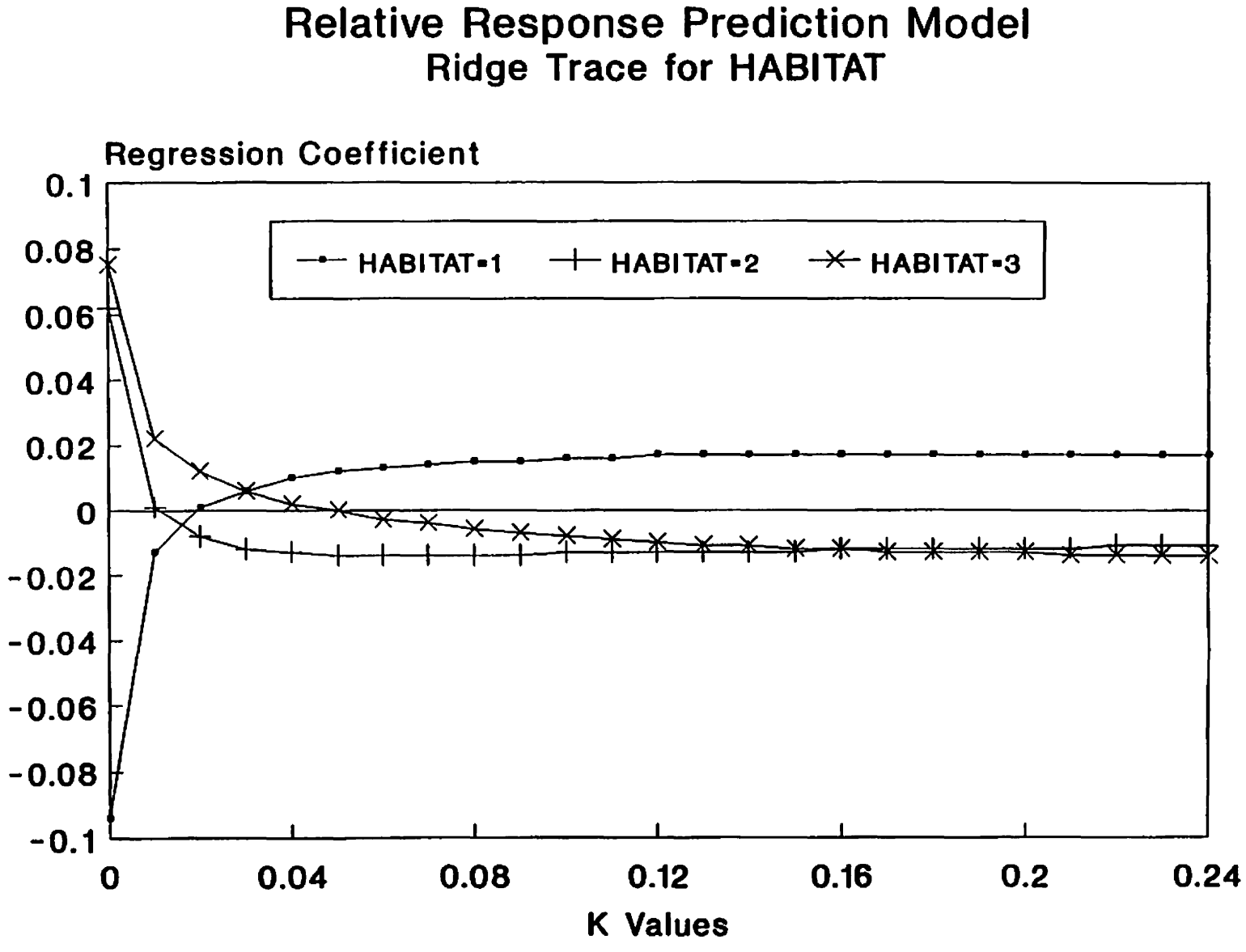

Figure 9. **Ridge Trace for habitat type series.**

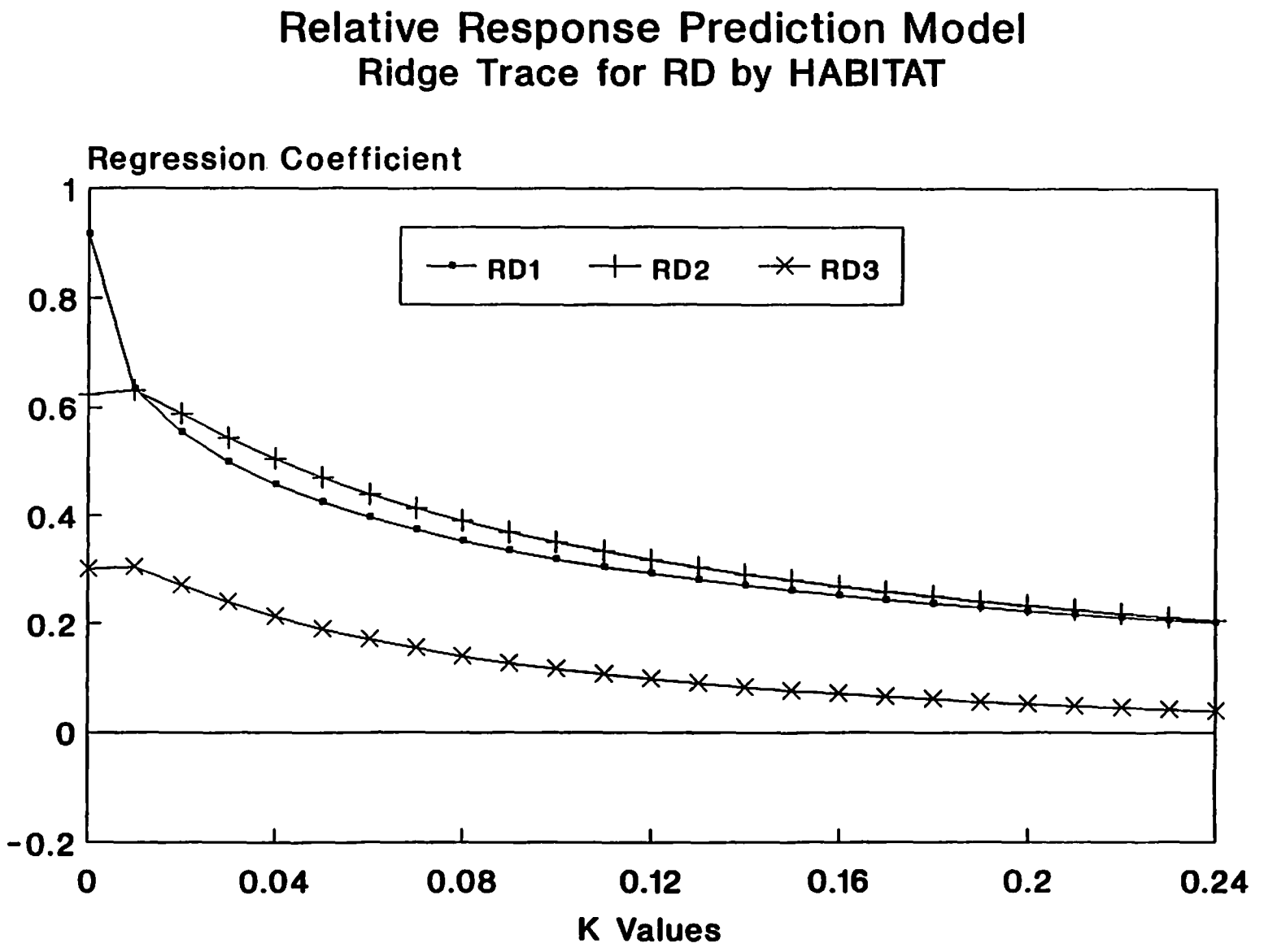

Figure 10. Ridge Trace for relative density habitat type series.

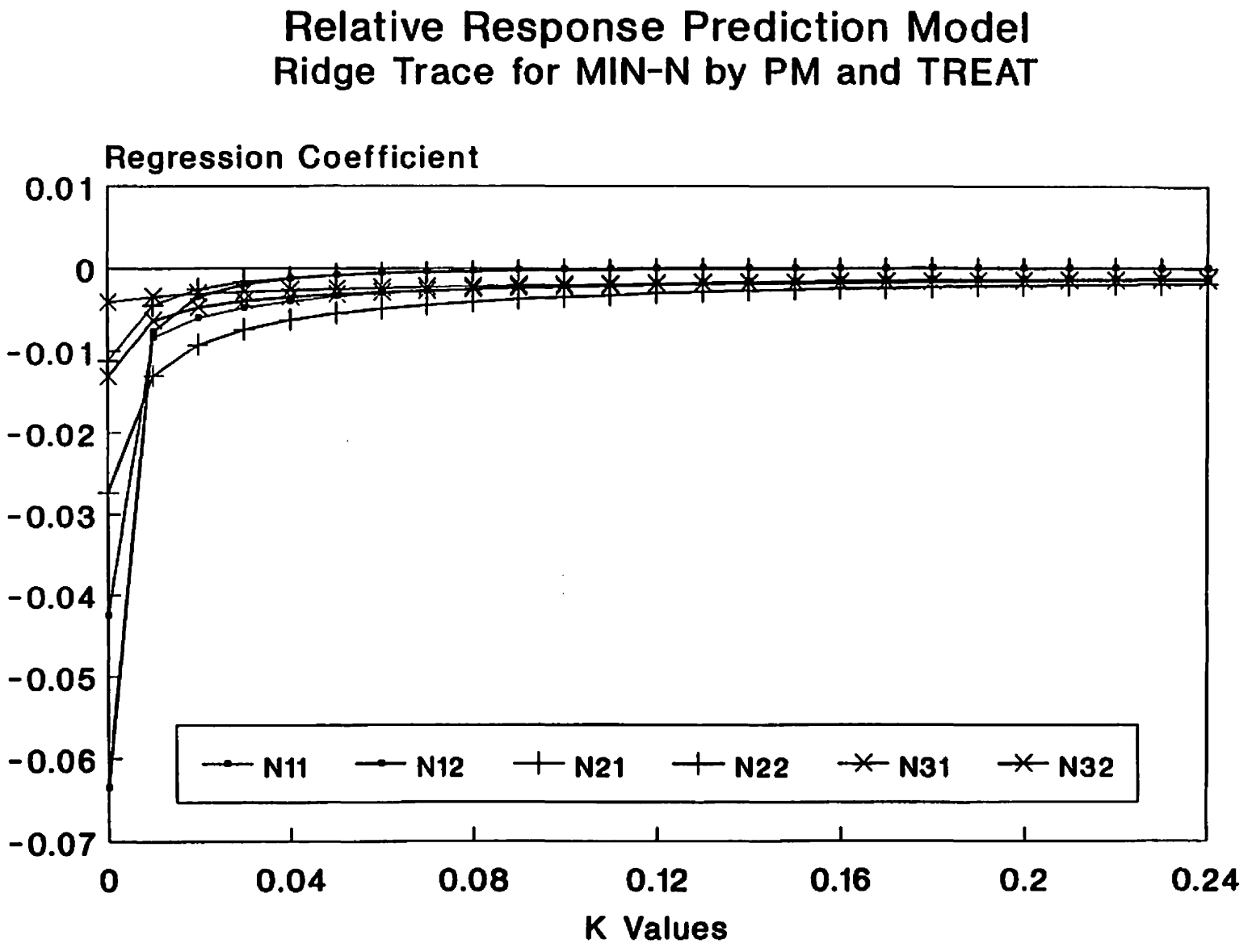

Figure 11. **Ridge Trace for mineralizable nitrogen by parent material and nitrogen treatment.**

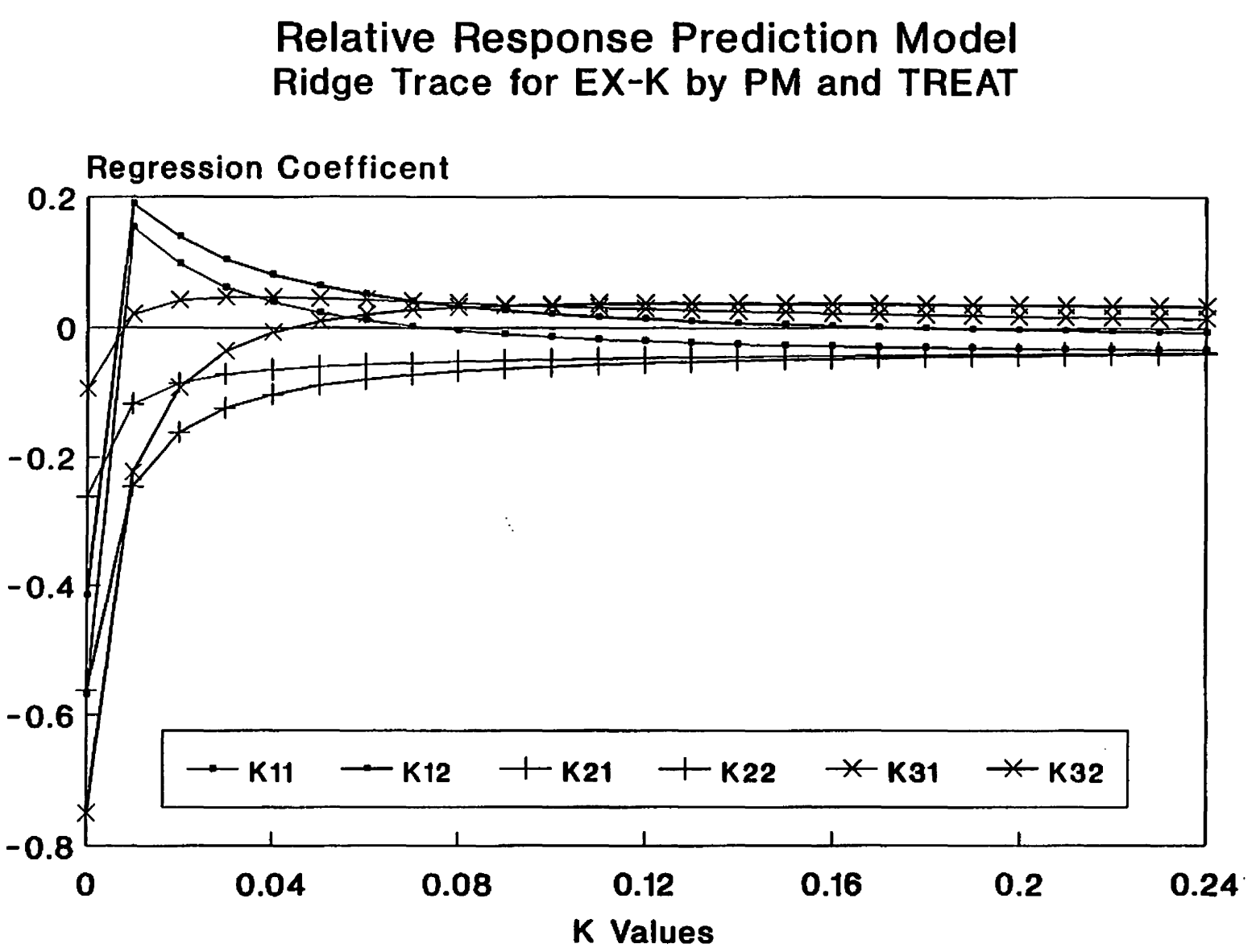

Figure 12. **Ridge trace for exchangeable potassium by parent material and nitrogen treatment.**

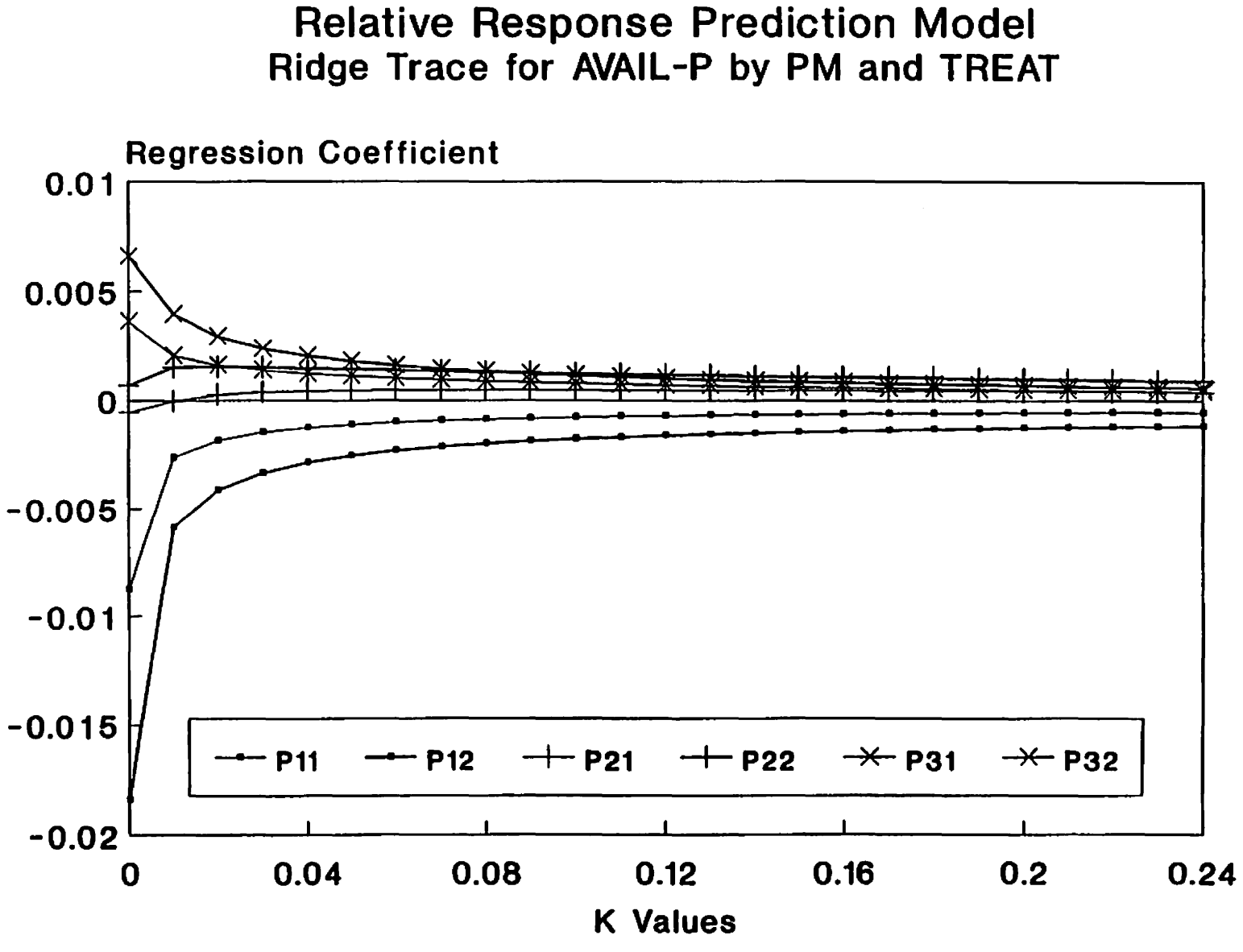

Figure 13. **Ridge trace for available phosphorus by parent material and nitrogen treatment.**

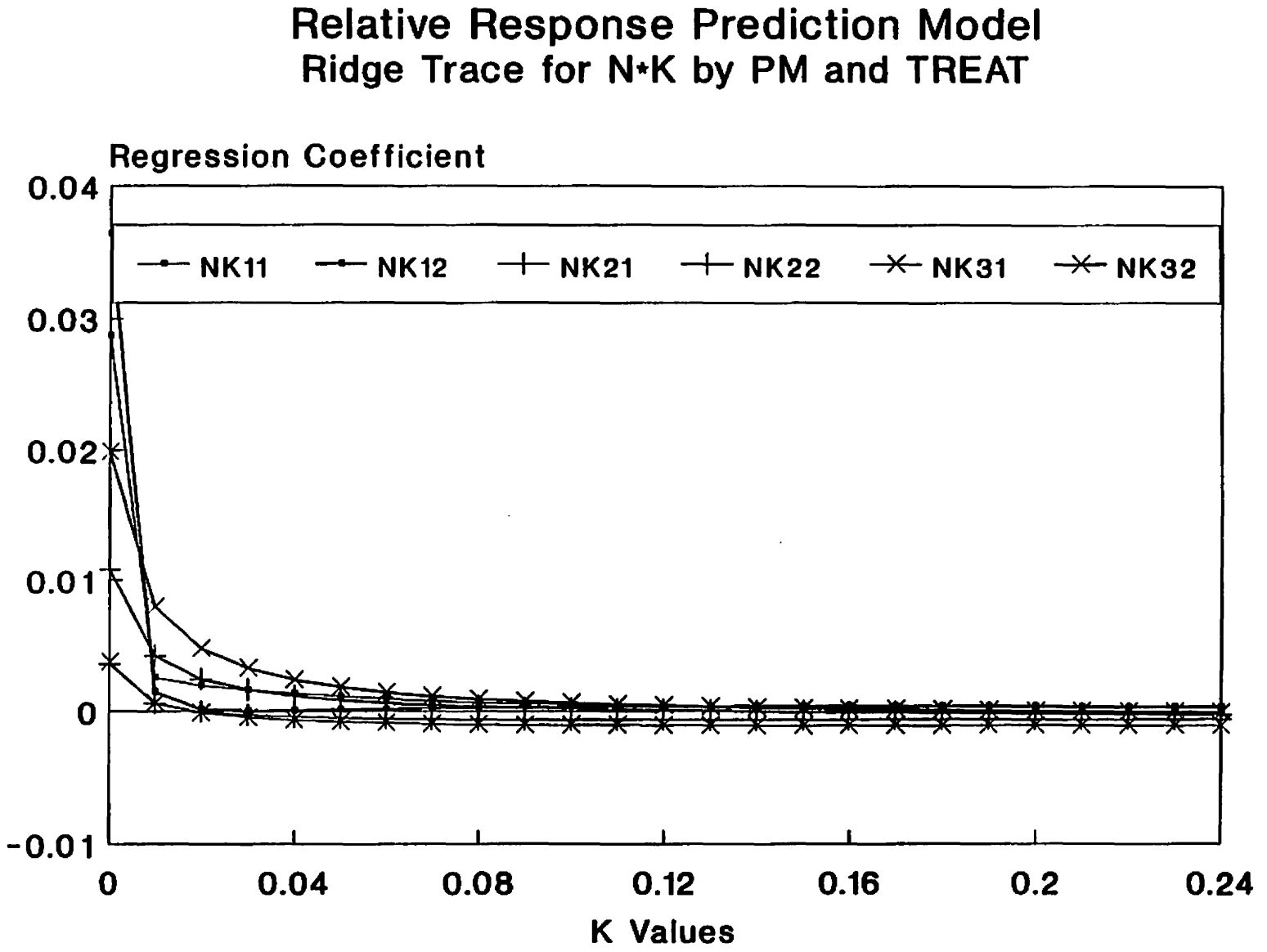

Figure 14. **Ridge trace for mineralizable nitrogen * exchangeable potassium by parent material and nitrogen treatment.**

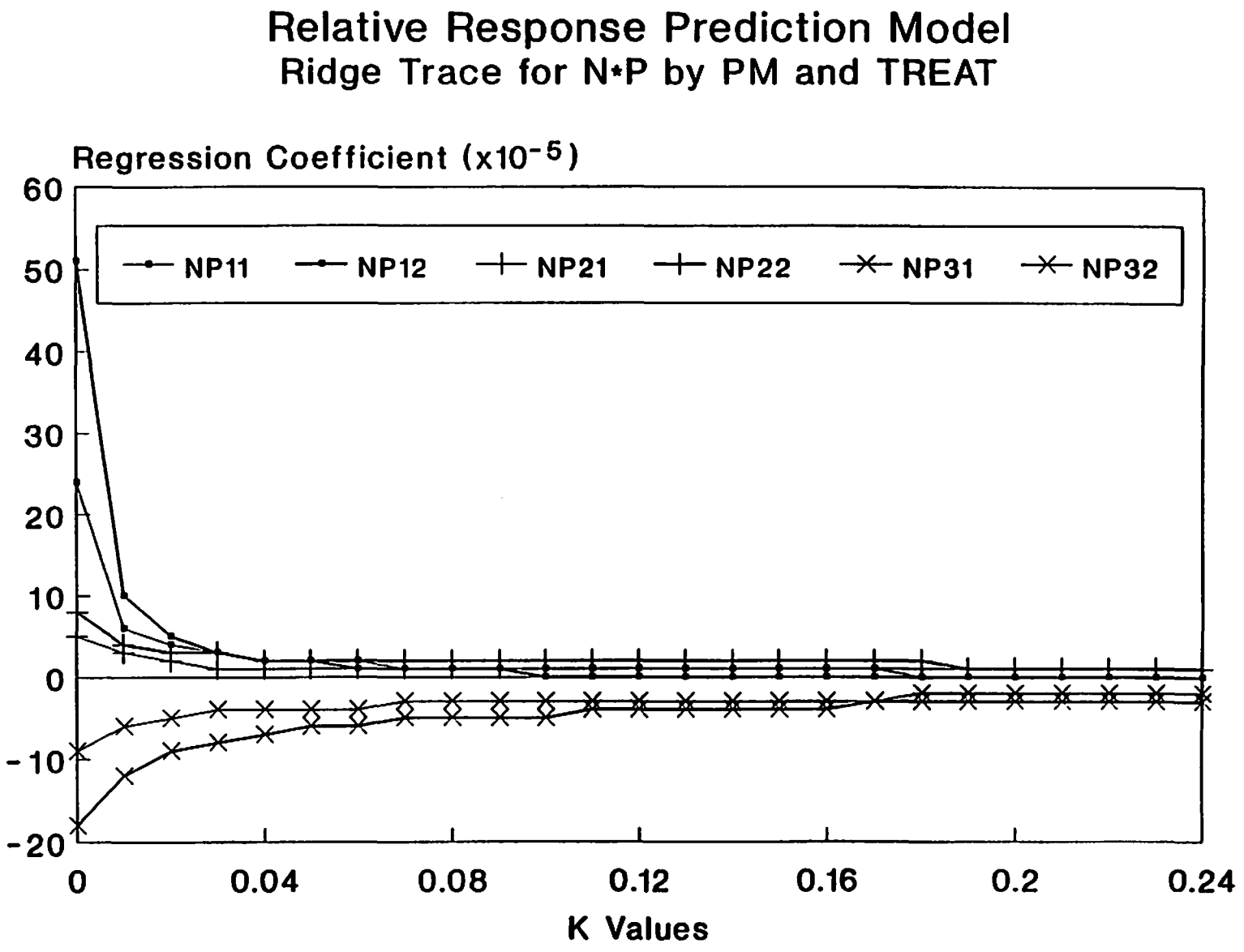

Figure 15. **Ridge trace for mineralizable nitrogen & available phosphorus by parent material and nitrogen treatment.**

Section VI

PREDICTING SIX-YEAR DOUGLAS-FIR RESPONSE TO NITROGEN FERTILIZATION USING OUTPUTS FROM PROCESS MODELS

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Figure 16. The relationship between daily base station and on-site weather for Douglas-fir installation 264. The upper panel is temperature while the lower is precipitation 120

Figure 17. Various input and output variables from a soil moisture budget program for Douglas-fir installation 264, during an "average" year. Daily fluctuations are shown in the top panel and cumulative behavior is illustrated in the lower panel 121

Figure 18. FOREST-BGC model outputs during an "average" year for Douglas-fir installation 264. Snowpack, soil moisture,

evaporation, and transpiration are shown in the upper panel, while photosynthesis and respiration are shown in the lower panel 122

Figure 19. The relationship between daily base station and on-site weather for Douglas-fir installation 286. The upper panel is temperature while the lower is precipitation 123

Figure 20. Various input and output variables from a soil moisture budget program for Douglas-fir installation 286, during an "average" year. Daily fluctuations are shown in the top panel and cumulative behavior is illustrated in the lower panel 124

Figure 21. FOREST-BGC model outputs during an "average" year for Douglas-fir installation 264. Snowpack, soil moisture, evaporation, and transpiration are shown in the upper panel, while photosynthesis and respiration are shown in the lower panel 125

Ridge Traces for the Volume Growth Prediction Model

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Ridge Traces for the Absolute Response to Nitrogen Prediction Model

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Ridge Traces for the Relative Response to Nitrogen Prediction Model

Figure 32. Ridge trace for relative density 136

Figure 33. Ridge trace for genetic index 137

Figure 34. Ridge trace for net primary production 138

Figure 35. Ridge trace for soil moisture deficit 139

Figure 36. Ridge trace for soil mineralizable nitrogen 140

---------- Welcome to WABAL4 ----------

The WAter BALance (WABAL) program was designed to calculate soil moisture deficit and evaluate soil moisture condition; concepts are documented in articles by Zahner and Stage (1966) and Zahner (1966). Tables are produced showing daily values for water demand (evapotranspiration - precipitation), soil moisture deficit, soil moisture storage, and daily water surplus. The program was first written by Stage in MAD language and later translated into Fortran by Marsden. Weibing Zhang translated the program into BASIC, using MSQuickBASIC. The present version (WABAL4), providing routines for calculating day length, selecting soil depletion curves based on soil texture, and handling incomplete climate data, was programmed by Peter Mika.

When running this program, you will need to provide some information. Prompts will be given for:

1) The site name and location.

2) The latitude of the site. This is needed to calculate the day length for evapotranspiration estimation. The program assumes that the surface is flat, that the location is in the northern hemisphere, and that the summer solstice falls on June 22. Calculations follow the logic of Frank and Lee (1966).

3) The year from which the weather data comes.

4) Some information on the climate at the site. This can either take the form of daily information on precipitation and temperature or monthly averages.

a) If you elect to use daily data, you will need to create an input data file containing the appropriate climate data before you run this program. The program will query you for the name of the data file; please include all necessary path information. The file should include the date (month and day), daily precipitation (inches), and daily minimum and maximum temperature (degrees F.), in that order. Input data is read using a free format, so make sure data values are separated by a comma (,) or at least one space and that zero values are represented by a 0 rather than a blank. Here is an example of an input data file that would work:

(month)	(day)	(prec)	(min temp)	(max temp)
2	27	0	10	37
2	28	0	25	37
3	1	0	23	45
3	2	0.06	17	37

Data does not have to be in chronological order, nor does the entire year have to be covered. However, the period for which you want soil moisture evaluation should have good climatic coverage. For months with partial climate data, missing values will be replaced with monthly averages. The program will notify you when this will occur.

If your weather data does not cover all months in the year, you will need to provide average monthly temperatures (degrees F.) for those missing. This is used to calculate heat indices (AHI) for the omitted months using equations from Thornthwaite (1948).

b) If you elect to use monthly average information, the program will query you for average temperature (degrees F.) and total precipitation (inches) for each month. Daily temperature and precipitation will then be set to the monthly averages. This may produce abnormal patterns of water loss, particularly due to the constant daily precipitation rates.

5) The beginning and ending dates of the period for which you want to evaluate the soil moisture status.

6) The number of soil types (combinations of soil textures and field capacities) to be evaluated. You, then, will be asked to enter the texture and field capacity for each soil type, and the soil moisture storage for the day previous to the beginning of the evaluation period. The texture determines the soil depletion curve used in translating moisture demand into inches of water lost. Three textural classes are provided:

a) fine texture
--in recharge storage, water loss is equal to moisture demand, but only 1 inch of water may be accumulated; the excess is added to main storage.
--in main storage, water loss rate is determined by the relative dryness of the soil. When main storage >= 67% of capacity, loss is equal to demand. When main storage < 67% but > 33% of capacity, loss is equal to demand times the ratio of actual moisture in the soil to soil moisture holding capacity. When main storage <= 33% of capacity, loss is equal to 1/2 of demand times the ratio of actual moisture in the soil to soil moisture holding capacity.

b) medium texture
--in recharge storage, water loss is equal to moisture demand, but only 2 inches of water may be accumulated; the excess is added to main storage.
--in main storage, water loss rate is determined by the relative dryness of the soil. When main storage >= 50% of capacity, loss is equal to demand. When main storage < 50% of capacity, loss is equal to demand times the ratio of actual moisture in the soil to soil moisture holding capacity.

c) coarse texture
--in recharge storage, water loss is equal to moisture demand.
--in main storage, water loss rate is determined by the relative dryness of the soil. When main storage >= 25% of capacity, loss is equal to demand. When main storage < 25% of capacity, loss is equal to 1/2 of demand times the ratio of actual moisture in the soil to soil moisture holding capacity.

7) You will also be asked whether you want to adjust estimates to observed soil moisture conditions within the evaluation period. If so, you will need to enter the dates and the observed soil moisture storage on those dates. Make sure to enter the dates in chronological order.

Output from the program consists of both tables and sequential listings of calculated information. You will be asked in what form you want the output information stored. Options include:

(1) a file containing tables of daily climatic inputs and calculated soil moisture conditions. The file contains standard ASCII carriage control characters so that the tables will print nicely on 8 1/2 by 11 paper using a 10 cpi font. Separate tables are available for minimum temperature, maximum temperature, average temperature, precipitation, relative day length, moisture demand, moisture deficit, cumulative moisture deficit, main soil moisture storage, recharge storage, and moisture surplus.

(2) an 80 byte file containing a sequential (by date) listing of climate and soil moisture data. Variables in the listing are Julian date, minimum temperature, maximum temperature, average temperature, precipitation, relative day length, moisture demand, moisture deficit, cumulative moisture deficit, main soil storage, recharge storage, and surplus. Header information indicating the soil type and variable labels is inserted at the beginning of each soil type's data.

Main References:

Frank, Ernest C. and Richard Lee. 1966. Potential solar beam irradiation on slopes. US Forest Service Research Paper RM-18. Rocky Mtn. For. & Range Exp. Station, Fort Collins, CO.

Thornthwaite, C.W. 1948. An approach toward a rational classification of climate. Geog. Rev. 38: 55-94

Thornthwaite, C.W., and J.R. Mather. 1955. The water balance. Drexel Inst. Lab. of Climatology, Pub. in Climatology 8(1):104 p.

Zahner, R. and A. Stage. 1966. A procedure for calculating daily moisture stress and its utility in regressions of tree growth on weather. Ecology. 47: 64-74.

Zahner, R. 1966. Refinement in empirical functions for realistic soil-moisture regimes under forest cover. pp. 261-274. In W.E. Sopper, ed. Proc., Int'l Symp. on Forest Hydrology, Penn. State Univ., Pergamon Press.

Here is an example showing what information you need to provide while running this program. The UPPER-CASE words are examples of the instructions that the program gives you. The lower-case words are examples of data you need to type in.

```
**************************************************************************

  ENTER THE SITE NAME, LOCATION AND STATE NAME (SEPARATED BY COMMAS)
  (e.g., MOSCOW MTN., T40N R4W sec 17, IDAHO)
==>   priest river, t58n r4w sec 27, idaho
  ENTER THE LATITUDE OF THE WEATHER STATION IN DEGREES (e.g., 46.5)
==>    48.5
  ENTER THE YEAR FROM WHICH THE DATA COMES (e.g., 1989)
==>    1947

  DO YOU HAVE A FILE CONTAINING DAILY TEMPERATURE AND
  PRECIPITATION DATA FOR THE SITE? (ENTER Y OR N)
==>     y
  TYPE THE NAME OF THE FILE CONTAINING THE WEATHER INPUT DATA
  (e.g., B:SAMPLE.DAT)
==>    a:test.dat

  PLEASE WAIT !  READING INPUT DATA FROM THE FILE: A:TEST.DAT

  RECORDS ON FILE A:TEST.DAT EXIST FOR THE PERIOD
  JAN 1  TO  DEC 31  OF  1947

  DOES THIS CORRESPOND TO YOUR UNDERSTANDING OF THE EXISTING DATA?
  IF NOT, YOU SHOULD TERMINATE THIS PROGRAM AND CHECK YOUR DATA FILE.

  IF YOU CONTINUE, FOR DAYS WITHIN THE PERIOD LACKING OBSERVATIONS,
  PRECIPITATION AND MEAN TEMPERATURE WILL BE SET TO THE MONTHLY AVERAGES.

  ENTER Y TO CONTINUE PROCESSING OR N TO TERMINATE THIS PROGRAM.
==>    y

  BECAUSE YOUR WEATHER DATA FILE DOES NOT COVER JAN
  YOU NEED TO ENTER IT'S MONTHLY MEAN TEMPERATURE (DEGREES F).
==>    22.0

  OUTPUT IS AVAILABLE IN 2 FORMS.  WHICH WOULD YOU LIKE?
    1) A TABULAR LISTING WITH HEADER INFORMATION
    2) A SIMPLE ASCII DATA FILE
    3) BOTH OF THE ABOVE
  ENTER YOUR CHOICE (1, 2, OR 3)?
==>    3

  TYPE THE FILE NAME FOR THE OUTPUT DATA (e.g., B:SAMPLE.LST)
==>    a:test.lst
```

```
  THE INFORMATION TO BE PRINTED INCLUDES:
   1) DAILY AVERAGE TEMPERATURES (OPTIONAL)
   2) DAILY MINIMUM TEMPERATURES (OPTIONAL)
   3) DAILY MAXIMUM TEMPERATURES (OPTIONAL)
   4) DAILY PRECIPITATION (OPTIONAL)
   5) DAILY RELATIVE DAYLENGTHS (OPTIONAL)
   6) MONTHLY MEAN TEMPERATURES, TOTAL PRECIPITATION, AND TOTAL HEAT INDEX
   7) DAILY DEMAND (POTENTIAL EVAPOTRANSPIRATION - PRECIPITATION)
   8) DAILY SOIL MOISTURE DEFICIT
   9) CUMULATIVE SOIL MOISTURE DEFICIT
  10) DAILY MAIN SOIL STORAGE
  11) DAILY RECHARGE STORAGE
  12) DAILY WATER SURPLUS

  AFTER EACH OPTIONAL ITEM, ENTER Y IF YOU WANT THE DATA PRINTED
  IN THE  OUTPUT FILE, OR N IF YOU DO NOT WANT THE INFORMATION.

  OUTPUT OPTIONS:
   1) DAILY AVERAGE TEMPERATURES? ==>    y
   2) DAILY MINIMUM TEMPERATURES? ==>    y
   3) DAILY MAXIMUM TEMPERATURES? ==>    y
   4) DAILY PRECIPITATION? ==>    y
   5) DAILY RELATIVE DAYLENGTHS? ==>    y

  TYPE THE FILE NAME FO THE ASCII DATA OUTPUT (E.G. B:SAMPLE.OUT)
==>    a:test.out

  PLEASE WAIT !
    SENDING OUTPUT TO THE FILE: A:TEST.LST

  PLEASE WAIT !
  CALCULATING POTENTIAL EVAPOTRANSPIRATION

  ENTER THE BEGINNING DATE (MONTH AND DAY) FOR THE PERIOD OF INTEREST
  FOR WHICH YOU WANT TO ESTIMATE SOIL MOISTURE CONDITIONS (e.g., 2, 10)
==>    4, 1
  ENTER THE LAST DATE (MONTH AND DAY) OF THE PERIOD OF INTEREST
  (e.g. 12, 31)
==>    10, 25
  HOW MANY SOILS (COMBINATIONS OF SOIL TYPES AND FIELD CAPACITIES)?
==>    2
  ENTER THE SOIL TYPE (TEXTURE) FOR SOIL NO. 1 (e.g., 1)
    WHERE 1=FINE TEXTURED (CLAYS)
          2=MEDIUM TEXTURED (SILTS)
      AND 3=COARSE TEXTURED (SANDS)
 ==>    2
  ENTER THE SOIL FIELD CAPACITY OF SOIL NO. 1 (e.g., 3.5)
==>    3
  WHAT WAS THE SOIL MOISTURE STORAGE OF SOIL TYPE 1 ON MAR 31? (e.g., 3.5)
==>    3
  DO YOU WANT TO ADJUST ESTIMATES TO AN OBSERVED SOIL MOISTURE
  FOR ANOTHER DATE WITHIN THE PERIOD?  (TYPE Y FOR YES: OTHERWISE, TYPE N)
==>    n
```

```
  PLEASE WAIT !  SENDING OUTPUT TO THE FILE: A:TEST.LST

  ENTER THE SOIL TYPE (TEXTURE) FOR SOIL NO. 2 (e.g., 1)
    WHERE 1=FINE TEXTURED (CLAYS)
          2=MEDIUM TEXTURED (SILTS)
      AND 3=COARSE TEXTURED (SANDS)
 ==>    2
  ENTER THE SOIL FIELD CAPACITY OF SOIL NO. 2 (e.g., 3.5)
==>    3.5
  WHAT WAS THE SOIL MOISTURE STORAGE OF SOIL NO. 2 ON MAR 31? (e.g., 3.5)
==>    3.5

  DO YOU WANT TO ADJUST ESTIMATES TO AN OBSERVED SOIL MOISTURE
  FOR ANOTHER DATE WITHIN THE PERIOD?  (TYPE Y FOR YES; OTHERWISE, TYPE N)
==>    y

  ENTER THE OBSERVATION DATE & OBSERVED SOIL MOISTURE:  (e.g., 6, 16, 1.8 )
==>    7, 1,  1.5

  DO YOU WANT TO ADJUST ESTIMATES TO AN OBSERVED SOIL MOISTURE
  FOR ANOTHER DATE WITHIN THE PERIOD?  (TYPE Y FOR YES; OTHERWISE, TYPE N)
==>    n

  PLEASE WAIT !  SENDING OUTPUT TO THE FILE: A:TEST.LST

  PROGRAM CALCULATIONS ARE COMPLETE
    TABULAR LISTING SAVED AS A:TEST.LST
    ASCII DATA SAVED AS A:TEST.OUT

  ************************************************************************

     To report any problems with the program or for further information,
     contact:

          Peter G. Mika              208/885-7205
          Intermountain Forest Tree Nutrition Cooperative
          Department of Forest Resources
          University of Idaho
          Moscow, Idaho  83843
```

Program Listing: WABAL4

Main Program:

```
' The WAter BALance program was designed to calculate soil moisture
' deficit and evaluate soil moisture condition, based on concepts
' documented by Zahner and Stage (Ecology 1966 47:64-74).  See the
' document file (wabal4.doc) for more information.

'  ************************************************************************
'  *  VARIABLE DESCRIPTION:                                               *
'  ************************************************************************
'  *  RelDayLeng = relative day length (hours of daylight / 12)           *
'  *  Prec = daily precipitation (inches)                                 *
'  *  AveT = daily mean temperature (degrees F)                           *
'  *  MinT = minimum daily temperature (degrees F)                        *
'  *  MaxT = maximum daily temperature (degrees F)                        *
'  *  MonthTemp = monthly mean temperature                                *
'  *  MonthDays = number of days with weather observations per month      *
'  *  Demand = difference between potential evapotranspiration and        *
'  *           precipitation                                              *
'  *  Capacity = soil field capacity (inches of water)                    *
'  *  SoilMoist = observed soil moisture (inches of water)                *
'  *  SoilStore = main soil storage (inches)                              *
'  *  Recharge = recharge storage (inches)                                *
'  *  MoistDef = daily soil moisture deficit (inches/day)                 *
'  *  CumMoistDef = cummulative moisture deficit (inches)                 *
'  *  Surplus = daily surplus (inches)                                    *
'  ************************************************************************


    DECLARE SUB DayLength (DLat, fday%, lday%, Length!())
    DECLARE SUB WriteVector (FirstDay%, LastDay%, Vector!())
    DECLARE SUB NewPage (Page%, STNAME$, LOCATION$, STATE$, Year%, fmonth%, fday%,
                         lmonth%, lday%)
    DECLARE SUB Calendar (jday%, m%, d%)
    DECLARE FUNCTION JulianDate% (Month%, Day%)
    DECLARE FUNCTION Declination! (jday%)
    DECLARE FUNCTION DegToRad! (degrees!)
    DECLARE FUNCTION RadToDeg! (Radians!)
    DECLARE FUNCTION WhichMonth% (jday%)
    DECLARE FUNCTION WhichDay% (jday%)
    DECLARE FUNCTION UpperDepletion! (SStore!, RStore!, Cap!, Deficit!)
    DECLARE FUNCTION MainDepletion! (SStore!, Cap!, Deficit!)


    DIM leapyear AS INTEGER, i AS INTEGER, k AS INTEGER, SoilType AS INTEGER
    DIM SoilStore(0 TO 366), Recharge(0 TO 366)
    DIM MinT(366), MaxT(366), AveT(366), Prec(366)
    DIM Demand(366), MoistDef(366), CumMoistDef(366), Surplus(366)
    DIM Month%(366), Day%(366), RelDayLeng(366)
    DIM MonthID$(12), NumDays%(12)
    DIM MonthDays%(12), MonthTemp(12), MonthPrec(12)

    CONST FALSE = 0, TRUE = NOT FALSE
```

```
    FOR k = 1 TO 12
      READ NumDays%(k), MonthID$(k)
    NEXT
    DATA 31, "JAN", 28, "FEB", 31, "MAR", 30, "APR", 31, "MAY", 30, "JUN"
    DATA 31, "JUL", 31, "AUG", 30, "SEP", 31, "OCT", 30, "NOV", 31, "DEC"

    COLOR 7, 1, 7
    CLS
     PRINT "Enter the site name, location, and state name (separated by commas)"
     PRINT "  (e.g., MOSCOW MTN., T40N R4W sec 17, IDAHO)"
     INPUT STNAME$, LOCATION$, STATE$

     PRINT "Enter the latitude of the site in degrees";
     PRINT " (e.g., 46.5)"
     INPUT DLat

     PRINT "Enter the year from which the data comes (e.g., 1989)"
     INPUT Year%

    IF Year% MOD 4 <> 0 THEN leapyear = FALSE ELSE leapyear = TRUE

    IF (leapyear) THEN NumDays%(2) = 29

'Initialize daily climate records to indicate missing values

    FOR i = 1 TO 366
      MinT(i) = -99.99: MaxT(i) = -99.99: AveT(i) = -99.99: Prec(i) = -99.99
    NEXT i

    DO
    PRINT "Do you have a file containing daily temperature and"
    PRINT "precipitation data for the site? (Enter Y or N)"
    INPUT weather$
    IF UCASE$(weather$) = "Y" OR UCASE$(weather$) = "N" THEN EXIT DO
    LOOP

IF UCASE$(weather$) = "Y" THEN    'weather file exists--open and process

     PRINT "Type the name of the file containing the weather input data"
     PRINT "(e.g., b:sample.dat)"
     INPUT file2$

'Open the file containing the weather records, read the data, and determine
'average daily temperature.  Also determine the length of the period covered
'by the records and if any daily records are missing within the period.

    PRINT CHR$(13)
    PRINT "Please WAIT !"
    PRINT "Reading input data from the file: "; UCASE$(file2$)
    VIEW PRINT 1 TO 24

    OPEN file2$ FOR INPUT AS #2
```

```
FirstDay% = 366: LastDay% = 1
FirstMonth% = 12: LastMonth% = 1

DO UNTIL EOF(2)
    INPUT #2, IMonth%, IDay%, Precip, MinTemp, MaxTemp
    JDate% = JulianDate(IMonth%, IDay%)
    Month%(JDate%) = IMonth%: Day%(JDate%) = IDay%
    Prec(JDate%) = Precip
    MinT(JDate%) = MinTemp: MaxT(JDate%) = MaxTemp
    AveT(JDate%) = .5 * (MinTemp + MaxTemp)
    MonthDays%(IMonth%) = MonthDays%(IMonth%) + 1
    MonthTemp(IMonth%) = MonthTemp(IMonth%) + AveT(JDate%)
    MonthPrec(IMonth%) = MonthPrec(IMonth%) + Prec(JDate%)
    IF JDate% < FirstDay% THEN FirstDay% = JDate%
    IF JDate% > LastDay% THEN LastDay% = JDate%
    IF IMonth% < FirstMonth% THEN FirstMonth% = IMonth%
    IF IMonth% > LastMonth% THEN LastMonth% = IMonth%
LOOP

CLOSE #2


CLS
PRINT "Records on file "; UCASE$(file2$); " exist for the period"
PRINT MonthID$(Month%(FirstDay%)); Day%(FirstDay%); " to ";
PRINT MonthID$(Month%(LastDay%)); Day%(LastDay%);
PRINT " of "; Year%
PRINT
missing = FALSE
MonthMiss = FALSE
FOR i = Month%(FirstDay%) TO Month%(LastDay%)
  SELECT CASE NumDays%(i) - MonthDays%(i)
    CASE NumDays%(i)
      PRINT "There are no observations for "; MonthID$(i)
      missing = TRUE
      MonthMiss = TRUE
    CASE 1 TO INT(NumDays%(i) / 2)
      PRINT MonthID$(i); " is missing data for ";
      PRINT NumDays%(i) - MonthDays%(i); " days."
      missing = TRUE
    CASE (INT(NumDays%(i) / 2) + 1) TO (NumDays%(i) - 1)
      PRINT MonthID$(i); " is missing data for ";
      PRINT NumDays%(i) - MonthDays%(i); " days. "
      PRINT "  Because the number of days missing is so large, extrapolations"
      PRINT "  based on monthly averages may be in considerable error."
      missing = TRUE
  END SELECT
NEXT i
```

```
    PRINT
    PRINT "Does this correspond to your understanding of the existing data?"
    PRINT "If not, you should terminate this program and check your data file."
    IF (missing) THEN
      PRINT "=>If you continue, for days within the period lacking observations,"
      PRINT "  precipitation and mean temperature will be set to the monthly averages."
      IF (MonthMiss) THEN
        PRINT "=>Please note that, for months with no observations, monthly"
        PRINT "  precipitation will be 0.  This may produce unreal soil moisture"
        PRINT "  predictions for these months and for days immediately following."
      END IF
    END IF
    DO WHILE UCASE$(Ans$) <> "Y"
        PRINT "Enter Y to continue processing or N to terminate this program."
        INPUT Ans$
        IF UCASE$(Ans$) = "N" THEN END
    LOOP

'Check whether temperature records cover all months of the year.  For those
'with data, calculate average temperature and precipitation.  For those
'without data, the user needs to enter the average monthly temperature in
'order to calculate the estimated heat indices (Thornthwaite, 1948).  Then
'sum the monthly indices to obtain the cumulative heat index.

    FOR i = 1 TO 12
      IF MonthDays%(i) = 0 THEN
          PRINT
          PRINT "Because your weather data file does not cover "; MonthID$(i)
          PRINT "you need to enter it's monthly mean temperature (degrees F)."
          INPUT MonthTemp(i)
        ELSE
          MonthTemp(i) = MonthTemp(i) / MonthDays%(i)
          MonthPrec(i) = MonthPrec(i) / MonthDays%(i)
      END IF
      IF MonthTemp(i) > 32 THEN
          ahit = ahit + (.11111111# * (MonthTemp(i) - 32!)) ^ 1.514
      END IF
    NEXT i


'Set daily precipitation and average temperature to the monthly means for
'all days with missing observations within the period of observation.

    IF (missing) THEN
        FOR i = FirstDay% TO LastDay%
            IF Prec(i) < 0 THEN
                Prec(i) = MonthPrec(WhichMonth%(i))
                AveT(i) = MonthTemp(WhichMonth%(i))
            END IF
        NEXT i
    END IF
```

```
ELSEIF UCASE$(weather$) = "N" THEN    'no weather file
                                      '--use average climate data

      PRINT "Enter the average daily temperature (degrees F.)"
      PRINT " and total precipitation (inches) for"
      FOR i = 1 TO 12

        PRINT MonthID$(i)
        INPUT MonthTemp(i), MonthPrec(i)
        MonthPrec(i) = MonthPrec(i) / NumDays%(i)
        IF MonthTemp(i) > 32 THEN
          ahit = ahit + (.11111111# * (MonthTemp(i) - 32!)) ^ 1.514
        END IF

     NEXT i

      FirstDay% = 1: FirstMonth% = 1: LastMonth% = 12
      IF (leapyear) THEN LastDay% = 366 ELSE LastDay% = 365

      FOR i = FirstDay% TO LastDay%
        Month%(i) = WhichMonth(i)
        Day%(i) = WhichDay%(i)
        Prec(i) = MonthPrec(Month%(i))
        AveT(i) = MonthTemp(Month%(i))
      NEXT i

END IF

    PRINT "Output is available in 2 forms.  Which would you like?"
    PRINT "   1) a tabular listing with header information"
    PRINT "   2) a simple ASCII data file"
    PRINT "   3) both of the above"
    DO
      INPUT "Enter your choice (1, 2, or 3)"; OChoice%
    LOOP UNTIL OChoice% > 0 AND OChoice% < 4
    SELECT CASE OChoice%
        CASE 1
          out1 = TRUE: out2 = FALSE
        CASE 2
          out1 = FALSE: out2 = TRUE
        CASE 3
          out1 = TRUE: out2 = TRUE
    END SELECT

  IF out1 THEN
    PRINT "Type the file name for the tabular listing (e.g., b:sample.lst)"
    INPUT file3$
    OPEN file3$ FOR OUTPUT AS #3
    PRINT #3, CHR$(13): PRINT #3, CHR$(13)

    Page% = 1
```

```
'List output options and determine desired listings
    CLS
    PRINT "The information to be printed includes:"
    PRINT " 1) Daily average temperatures (otional)"

    IF UCASE$(weather$) = "Y" THEN
    PRINT " 2) Daily minimum temperatures (optional)"
    PRINT " 3) Daily maximum temperatures (optional)"
    END IF

    PRINT " 4) Daily precipitation (optional)"
    PRINT " 5) Daily relative daylengths (optional)"
    PRINT " 6) Monthly mean temperatures, total precipitation, and total heat index "
    PRINT " 7) Daily demand (potential evapotranspiration - precipitation) "
    PRINT " 8) Daily soil moisture deficit "
    PRINT " 9) Cumulative soil moisture deficit "
    PRINT "10) Daily main soil storage "
    PRINT "11) Daily recharge storage "
    PRINT "12) Daily water surplus "
    PRINT
    PRINT "After each optional item, enter Y if you want the data printed"
    PRINT "in the output file, or N if you do not want the information."
    PRINT
    PRINT "Output options:"
    INPUT " 1) Daily average temperatures"; out1$

    IF UCASE$(weather$) = "Y" THEN
      INPUT " 2) Daily minimum temperatures"; out2$
      INPUT " 3) Daily maximum temperatures"; out3$
    ELSEIF UCASE$(weather$) = "N" THEN
      out2$ = "N": out3$ = "N"
    END IF

    INPUT " 4) Daily precipitation"; out4$
    INPUT " 5) Daily relative daylengths"; out5$
  END IF

  IF out2 THEN
    PRINT "Type the file name for the ASCII data output (e.g., b:sample.out)"
    INPUT file4$
    OPEN file4$ FOR OUTPUT AS #4
    PRINT #4, "Soil moisture budget information for site "; STNAME$; " in"; Year%
  END IF

    CLS
    PRINT CHR$(13): PRINT CHR$(13)
    PRINT CHR$(13): PRINT CHR$(13)
    IF out1 THEN
      PRINT "Please WAIT !"
      PRINT "  Sending output to the file: "; UCASE$(file3$)
    END IF
    VIEW PRINT 1 TO 4
```

```
'Calculate the relative daylength for each day within the observation period.

    CALL DayLength(DLat, FirstDay%, LastDay%, RelDayLeng())

  IF out1 THEN
'Output daily average temperatures
    IF UCASE$(out1$) <> "N" THEN
      CALL NewPage(Page%, STNAME$, LOCATION$, STATE$, Year%, Month%(FirstDay%),
                   Day%(FirstDay%), Month%(LastDay%), Day%(LastDay%))
      PRINT #3, TAB(24); "------ Average Temperature (degrees F) ------"
      CALL WriteVector(FirstDay%, LastDay%, AveT())
    END IF

'Output daily minimum temperatures
    IF UCASE$(out2$) <> "N" THEN
      CALL NewPage(Page%, STNAME$, LOCATION$, STATE$, Year%, Month%(FirstDay%),
                   Day%(FirstDay%), Month%(LastDay%), Day%(LastDay%))
      PRINT #3, TAB(24); "------ Minimum Temperature (degrees F) ------"
      PRINT #3, CHR$(13)
      PRINT #3, TAB(18); "Note: a value of -99.99 indicates a missing observation"
      CALL WriteVector(FirstDay%, LastDay%, MinT())
    END IF

'Output daily maximum temperatures
    IF UCASE$(out3$) <> "N" THEN
      CALL NewPage(Page%, STNAME$, LOCATION$, STATE$, Year%, Month%(FirstDay%),
                   Day%(FirstDay%), Month%(LastDay%), Day%(LastDay%))
      PRINT #3, TAB(24); "------ Maximum Temperature (degrees F) ------"
      PRINT #3, CHR$(13)
      PRINT #3, TAB(18); "Note: a value of -99.99 indicates a missing observation"
      CALL WriteVector(FirstDay%, LastDay%, MaxT())
    END IF

'Output daily precipitation
    IF UCASE$(out4$) <> "N" THEN
      CALL NewPage(Page%, STNAME$, LOCATION$, STATE$, Year%, Month%(FirstDay%),
                   Day%(FirstDay%), Month%(LastDay%), Day%(LastDay%))
      PRINT #3, TAB(24); "--------- Precipitation (inches/day) --------"
      CALL WriteVector(FirstDay%, LastDay%, Prec())
    END IF

'Output daylength information
    IF UCASE$(out5$) <> "N" THEN
      CALL NewPage(Page%, STNAME$, LOCATION$, STATE$, Year%, Month%(FirstDay%),
                   Day%(FirstDay%), Month%(LastDay%), Day%(LastDay%))
      PRINT #3, TAB(24); "------ Relative Day Length for"; Year%; "------"
      PRINT #3, TAB(26); "(based on a latitude of";
      PRINT #3, DLat; "degrees)"
        CALL WriteVector(FirstDay%, LastDay%, RelDayLeng())
    END IF
```

```
'Output monthly mean temperatures, total precipitation, and total heat index
    CALL NewPage(Page%, STNAME$, LOCATION$, STATE$, Year%, Month%(FirstDay%),
                 Day%(FirstDay%), Month%(LastDay%), Day%(LastDay%))
      PRINT #3, CHR$(13): PRINT #3, CHR$(13)
      PRINT #3, CHR$(13): PRINT #3, CHR$(13)
      PRINT #3, TAB(15); "------ Mean Monthly Temperature for";
      PRINT #3, Year%; "------"
      PRINT #3, CHR$(13): PRINT #3, CHR$(13)
      FOR k = FirstMonth% TO LastMonth%
        PRINT #3, TAB(4 + 6 * N); MonthID$(k);
        N = N + 1
      NEXT k
      PRINT #3, CHR$(13): PRINT #3, CHR$(13)
      FOR k = FirstMonth% TO LastMonth%
        PRINT #3, USING "####.#"; MonthTemp(k);
      NEXT k
      PRINT #3, CHR$(13): PRINT #3, CHR$(13)

      PRINT #3, CHR$(13): PRINT #3, CHR$(13)
      PRINT #3, CHR$(13): PRINT #3, CHR$(13)
      PRINT #3, TAB(15); "---- Total Monthly Precipitation for";
      PRINT #3, Year%; "----"
      PRINT #3, CHR$(13): PRINT #3, CHR$(13)
      N = 0
      FOR k = FirstMonth% TO LastMonth%
        PRINT #3, TAB(4 + 6 * N); MonthID$(k);
        N = N + 1
      NEXT k
      PRINT #3, CHR$(13): PRINT #3, CHR$(13)
      FOR k = FirstMonth% TO LastMonth%
        PRINT #3, USING "####.#"; MonthPrec(k) * NumDays%(k);
      NEXT k
      PRINT #3, CHR$(13): PRINT #3, CHR$(13)

      PRINT #3, CHR$(13): PRINT #3, CHR$(13): PRINT #3, CHR$(13)
      PRINT #3, TAB(3); " HEAT INDEX :";
      PRINT #3, USING "####.##"; ahit
      PRINT #3, CHR$(13): PRINT #3, CHR$(13)
  END IF

    VIEW PRINT 1 TO 24
    CLS
    PRINT CHR$(13): PRINT CHR$(13)
    PRINT CHR$(13): PRINT CHR$(13)
    PRINT "Please WAIT !"
    PRINT "Calculating potential evapotranspiration"
    VIEW PRINT 1 TO 4
```

```
'Calculate the daily difference between potential evapotranspiration
'and precipitation
    AH = (6.75E-07) * ahit ^ 3 - (.0000771) * ahit ^ 2 + .01792 * ahit + .49239
    FOR k = FirstDay% TO LastDay%
      IF AveT(k) > 32 THEN
        Demand(k) = (.021 * (5.555556 * (AveT(k) - 32) / ahit) ^ AH)
                    * RelDayLeng(k) - Prec(k)
      ELSE
        Demand(k) = -Prec(k)
      END IF
    NEXT k

    IF out1 THEN
'Output the difference between potential evapotranspiriation and precipitation

      CALL NewPage(Page%, STNAME$, LOCATION$, STATE$, Year%, Month%(FirstDay%),
                   Day%(FirstDay%), Month%(LastDay%), Day%(LastDay%))
      PRINT #3, TAB(7); "-- Potential Evapotranspiration less Precipitation ";
      PRINT #3, "(in./day) --"
      CALL WriteVector(FirstDay%, LastDay%, Demand())
    END IF

'Calculate soil moisture deficit for the period of interest.

    VIEW PRINT 1 TO 24
    CLS

    DO
    PRINT "Enter the beginning date (month and day) of the period of interest"
    PRINT "for which you want to estimate soil moisture conditions (e.g., 2, 10)"
    INPUT FPMonth%, FPDay%
    FirstPeriod% = JulianDate(FPMonth%, FPDay%)
    IF FirstPeriod% < FirstDay% THEN
        PRINT "ERROR--the date you have entered precedes the date of ";
        PRINT "the first climate record."
      ELSE
        EXIT DO
    END IF
    LOOP

    DO
    PRINT "Enter the last date (month and day) of the period of interest"
    PRINT "(e.g., 12, 31)"
    INPUT LPMonth%, LPDay%
    LastPeriod% = JulianDate(LPMonth%, LPDay%)
    IF LastPeriod% > LastDay% THEN
        PRINT "ERROR--the date you have entered comes after the date of ";
        PRINT "the last climate record."
      ELSE
        EXIT DO
    END IF
    LOOP
```

```
  PRINT "How many soils (combinations of soil types and field capacities)?"
  INPUT SoilTypes%

  FOR j = 1 TO SoilTypes%
  VIEW PRINT 1 TO 24
  CLS
  VIEW PRINT 1 TO 5

  DO
  PRINT "Enter the soil type (texture) for soil no."; j; " (e.g., 1)"
  PRINT "  where 1=fine textured (clays)"
  PRINT "        2=medium textured (silts)"
  PRINT "    and 3=coarse textured (sands)"
  INPUT SoilType
  IF SoilType < 1 OR SoilType > 3 THEN
    PRINT "ERROR--illegal soil type."
    ELSE
      EXIT DO
  END IF
  LOOP

  CLS

  PRINT "Enter the soil field capacity of soil no."; j; " (e.g., 3.5)"
  INPUT capacity
  CALL Calendar(FirstPeriod% - 1, m%, d%)
  PRINT "What was the soil moisture storage of soil no."; j;
  PRINT " on "; MonthID$(m%); d%; "? (e.g., 3.5)"
  INPUT SoilMoist
  VIEW PRINT 5 TO 20

IF out1 THEN
  CALL NewPage(Page%, STNAME$, LOCATION$, STATE$, Year%, FPMonth%, FPDay%,
               LPMonth%, LPDay%)
  PRINT #3, CHR$(13)
  PRINT #3, TAB(20); "For soil no. "; j; "with a ";
   SELECT CASE SoilType
    CASE 1    'Fine textured soils
      PRINT #3, "fine";
    CASE 2    'Medium textured soils
      PRINT #3, "medium";
    CASE 3    'Coarse textured soils
      PRINT #3, "coarse";
   END SELECT
  PRINT #3, " texture"
  PRINT #3, TAB(35); "and a storage capacity of "; capacity
  PRINT #3, TAB(20); "the following soil moisture storages were observed:"
  PRINT #3, CHR$(13)
  PRINT #3, TAB(24); "Date"; TAB(34); "Storage"
  PRINT #3, CHR$(13)
  PRINT #3, TAB(23); MonthID$(m%); d%; TAB(35); USING "##.##"; SoilMoist
END IF
```

```
first = FirstPeriod%
SoilStore(first - 1) = SoilMoist
Recharge(first - 1) = 0!
TotSurplus = 0!

fline = 0

DO

IF fline MOD 15 = 0 THEN fline = 0
fline = fline + 5
VIEW PRINT fline TO (fline + 5)
CLS
PRINT "Do you want to adjust estimates to an observed soil moisture"
PRINT "for another date within the period? (Type Y for yes; otherwise, type N) "
INPUT Adjust$
IF UCASE$(Adjust$) = "Y" THEN
    PRINT "Enter the observation date & observed soil moisture:";
    PRINT " (e.g., 6, 16, 1.8 )"
    INPUT CMonth%, CDay%, CSoilMoist
    CDATE = JulianDate(CMonth%, CDay%)

  IF out1 THEN
    PRINT #3, CHR$(13)
    PRINT #3, TAB(23); MonthID$(CMonth%); CDay%; TAB(35);
    PRINT #3, USING "##.##"; CSoilMoist
  END IF

   ELSE
    CDATE = LastPeriod%
END IF
VIEW PRINT 21 TO 24

FOR i = first TO CDATE
  k = i - 1
  IF Demand(i) > 0 THEN

' Evapotranspiration exceeds precipitation--take water from soil

      IF Recharge(k) > 0 THEN
          Depletion = UpperDepletion(SoilStore(k), Recharge(k), capacity, Demand(i))
          Recharge(i) = Recharge(k) - Depletion
          Depletion = MainDepletion(SoilStore(k), capacity, Recharge(i))
          SoilStore(i) = SoilStore(k) + Depletion
          IF Recharge(i) < 0 THEN
              Recharge(i) = 0!
            ELSE
              SoilStore(i) = SoilStore(k)
          END IF
        ELSE
          Depletion = MainDepletion(SoilStore(k), capacity, Demand(i))
          SoilStore(i) = SoilStore(k) - Depletion
          Recharge(i) = 0!
      END IF
```

```
        MoistDef(i) = Demand(i) - SoilStore(k) - Recharge(k) + SoilStore(i)
                      + Recharge(i)
        ELSE

' Precipitation exceeds evapotranspiration--add water to soil

          STDEF = SoilStore(k) + Recharge(k) - capacity
          IF Demand(i) < STDEF THEN

' Input exceeds soil moisture deficit
'   --set soil to max capacity and put excess into surplus

              SoilStore(i) = capacity
              Recharge(i) = 0!
              Surplus(i) = STDEF - Demand(i)
              TotSurplus = TotSurplus + Surplus(i)
            ELSE

' Input does not bring soil moisture up to max capacity
'    --add input to recharge storage

              Recharge(i) = Recharge(k) - Demand(i)

              SELECT CASE SoilType

        CASE 1    'Clays, fine textured soils

              IF Recharge(i) > 1 THEN
                 SoilStore(i) = SoilStore(k) + Recharge(i) - 1
                 Recharge(i) = 1
              ELSE
                 SoilStore(i) = SoilStore(k)
              END IF

        CASE 2    'Loams, medium textured soils

              IF Recharge(i) > 2 THEN
                 SoilStore(i) = SoilStore(k) + Recharge(i) - 2
                 Recharge(i) = 2
              ELSE
                 SoilStore(i) = SoilStore(k)
              END IF

        CASE 3    'Sands, coarse textured soils

                 SoilStore(i) = SoilStore(k)

        CASE ELSE    'Put everything into recharge when in doubt

                 SoilStore(i) = SoilStore(k)

                 END SELECT

          END IF
```

```
            MoistDef(i) = 0!
        END IF
        PRINT
        IF i > 1 THEN
            CumMoistDef(i) = CumMoistDef(k) + MoistDef(i)
          ELSE
            CumMoistDef(i) = MoistDef(i)
        END IF
      NEXT i

      IF CDATE = LastPeriod% THEN EXIT DO

      first = CDATE + 1
      SoilStore(first - 1) = CSoilMoist
      Recharge(first - 1) = 0!
      Surplus(first - 1) = 0!

      LOOP

      CLS
      PRINT CHR$(13): PRINT CHR$(13)
      IF out1 THEN
        PRINT "Please WAIT !  Sending output to the file: "; UCASE$(file3$)
      END IF
      VIEW PRINT 21 TO 22

      IF out1 THEN
'Output daily soil moisture deficit

        CALL NewPage(Page%, STNAME$, LOCATION$, STATE$, Year%, FPMonth%, FPDay%,
                     LPMonth%, LPDay%)
        PRINT #3, TAB(24); "Soil No. "; j; "   Storage Capacity = "; capacity; " inches"
        PRINT #3, CHR$(13)
        PRINT #3, TAB(20); "----- Daily Moisture Deficit (in./day) -----"
        CALL WriteVector(FirstPeriod%, LastPeriod%, MoistDef())

'Output cumulative soil moisture deficit

        CALL NewPage(Page%, STNAME$, LOCATION$, STATE$, Year%, FPMonth%, FPDay%,
                     LPMonth%, LPDay%)
        PRINT #3, TAB(24); "Soil No. "; j; "   Storage Capacity = "; capacity; " inches"
        PRINT #3, CHR$(13)
        PRINT #3, TAB(18); "----- Cumulative Moisture Deficit (in.) -----"
        CALL WriteVector(FirstPeriod%, LastPeriod%, CumMoistDef())

'Output main soil moisture storage

        CALL NewPage(Page%, STNAME$, LOCATION$, STATE$, Year%, FPMonth%, FPDay%,
                     LPMonth%, LPDay%)
        PRINT #3, TAB(24); "Soil No. "; j; "   Storage Capacity = "; capacity; " inches"
        PRINT #3, CHR$(13)
        PRINT #3, TAB(22); "------ Main Soil Storage (in.) ------"
        CALL WriteVector((FirstPeriod% - 1), LastPeriod%, SoilStore())
```

```
'Output recharge soil moisture storage
      CALL NewPage(Page%, STNAME$, LOCATION$, STATE$, Year%, FPMonth%, FPDay%,
                   LPMonth%, LPDay%)
      PRINT #3, TAB(24); "Soil No. "; j; "   Storage Capacity = "; capacity; " inches"
      PRINT #3, CHR$(13)
      PRINT #3, TAB(25); "------ Recharge Storage (in.) ------"
      CALL WriteVector((FirstPeriod% - 1), LastPeriod%, Recharge())

'Output daily water surplus
      CALL NewPage(Page%, STNAME$, LOCATION$, STATE$, Year%, FPMonth%, FPDay%,
                   LPMonth%, LPDay%)
      PRINT #3, TAB(24); "Soil No. "; j; "   Storage Capacity = "; capacity; " inches"
      PRINT #3, CHR$(13)
      PRINT #3, TAB(23); "------ Daily Surplus (in./day) ------"
      CALL WriteVector(FirstPeriod%, LastPeriod%, Surplus())
      PRINT #3, CHR$(13)
      PRINT #3, TAB(16); "Period Total Runoff (Surplus) = "; USING "###.##";
                TotSurplus;
      PRINT #3, " inches"

    END IF

    IF out2 THEN
      PRINT #4, "For soil no. "; j; "with a ";
        SELECT CASE SoilType
          CASE 1
            PRINT #4, "fine";
          CASE 2
            PRINT #4, "medium";
          CASE 3
            PRINT #4, "coarse";
        END SELECT
      PRINT #4, " texture and a storage capacity of "; capacity; "inches"
      PRINT #4, "day  min T  max T  ave T   prec length demand  defic cumdef mstore
                 rstore surpls"
      PRINT #4, "       (F)    (F)    (F)    (in)          (in)   (in)   (in)   (in)
                  (in)   (in)"
      PRINT #4, "--- ------ ------ ------ ------ ------ ------ ------ ------ ------
                 ------ ------"
      FOR i = FirstPeriod% TO LastPeriod%
        PRINT #4, USING "###"; i;
        PRINT #4, USING " ###.##"; MinT(i);
        PRINT #4, USING " ###.##"; MaxT(i);
        PRINT #4, USING " ###.##"; AveT(i);
        PRINT #4, USING " ###.##"; Prec(i);
        PRINT #4, USING " ###.##"; RelDayLeng(i);
        PRINT #4, USING " ###.##"; Demand(i);
        PRINT #4, USING " ###.##"; MoistDef(i);
        PRINT #4, USING " ###.##"; CumMoistDef(i);
        PRINT #4, USING " ###.##"; SoilStore(i);
        PRINT #4, USING " ###.##"; Recharge(i);
        PRINT #4, USING " ###.##"; Surplus(i)
      NEXT i
    END IF
```

```
FOR l = (FirstPeriod% - 1) TO LastPeriod%
  Surplus(l) = 0!
NEXT l

NEXT j

IF out1 THEN CLOSE #3
IF out2 THEN CLOSE #4

VIEW PRINT 1 TO 24
CLS
PRINT "Program calculations are complete"
IF out1 THEN
  PRINT "  Tabular listing saved as "; UCASE$(file3$)
END IF
IF out2 THEN
  PRINT "  ASCII data saved as "; UCASE$(file4$)
END IF

END
```

Subroutines:

```
SUB Calendar (jday%, m%, d%)

  SHARED NumDays%()
  FOR i = 1 TO 12
    days = days + NumDays%(i)
    diff = days - jday%
    IF diff >= 0 THEN
        m% = i
        d% = NumDays%(i) - diff
        EXIT FOR
    END IF
  NEXT i

END SUB


SUB DayLength (DLat, fday%, lday%, Length!())

'This sub calculates the hours of daylight and the relative daylength
'(hours of daylight/12) for a specific latitude and Julian date.
'Calculations assume a flat surface and do not take into account any
'shading due to a non-flat horizon or any local structures.  The program also
'assumes that the latitude is in the northern hemisphere.  For southern
'latitudes, the daylengths will be 1/2 year out of cycle.


    Lat = DegToRad(DLat)
    TanLat = TAN(Lat)

    FOR Day% = fday% TO lday%
        TanDecl = TAN(DegToRad(Declination(Day%)))
        LbyD = TanLat * TanDecl
        IF LbyD <> 0 THEN
            H = ATN(-1 * SQR(1 - LbyD * LbyD) / LbyD)
            H = RadToDeg(H)
            IF H < 0 THEN H = 180 + H
            Hours = 2 * H / 15
        ELSE
            Hours = 12
        END IF
        Length(Day%) = Hours / 12
     NEXT

END SUB
```

```
FUNCTION Declination! (Day%)          'computes the sun's angle of declination
                                      '(axial tilt) for a given day assuming
                                      'maximum angle (23.45 degrees) on June 22

  SHARED leapyear AS INTEGER
  IF NOT (leapyear) THEN
       Declination! = 23.45 * SIN((Day% - 81.75) * .01721421#)
    ELSE
       Declination! = 23.45 * SIN((Day% - 82.5) * .01716717#)
  END IF

END FUNCTION


FUNCTION DegToRad! (degrees!)         'converts degrees to radians

       DegToRad! = .01745329# * degrees!

END FUNCTION


FUNCTION JulianDate% (Month%, Day%)           'converts month and day
                                              'to Julian date
       SHARED NumDays%()
       FOR i% = 1 TO (Month% - 1)
             jday% = jday% + NumDays%(i%)
       NEXT i%
       JulianDate = jday% + Day%

END FUNCTION


FUNCTION MainDepletion (SStore, Cap, Deficit)

'This function calculates the amount of moisture depletion occurring
'in the main soil layer, based on main soil moisture storage (SStore),
'soil moisture holding capacity (Cap), and the amount of moisture
'demand (Deficit).  A different soil depletion curve is selected,
'based on the value of SoilType.  Curve forms are from Zahner, R. 1966.
'Refinement in empirical functions for realistic soil-moisture regimes
'under forest cover. pp. 261-274 In W.E. Sopper, ed. Proc., International
'Symposium on Forest Hydrology, Penn. State Univ., Pergamon Press.

  SHARED SoilType AS INTEGER

     ProMax = SStore / Cap

     SELECT CASE SoilType

        CASE 1   'Clays, fine textured soils
          IF ProMax >= .67 THEN
               MainDepletion = Deficit
          ELSE
             IF ProMax > .33 THEN
               MainDepletion = SStore * Deficit / Cap
             ELSE
               MainDepletion = .5 * SStore * Deficit / Cap
             END IF
          END IF

        CASE 2   'Loams, medium textured soils
          IF ProMax >= .5 THEN
               MainDepletion = Deficit
          ELSE
               MainDepletion = SStore * Deficit / Cap
```

```
        END IF

      CASE 3   'Sands, coarse textured soils
        IF ProMax >= .25 THEN
             MainDepletion = Deficit
        ELSE
             MainDepletion = .5 * SStore * Deficit / Cap
        END IF

      CASE ELSE   'Use loam curves when in doubt
        IF ProMax >= .5 THEN
             MainDepletion = Deficit
        ELSE
             MainDepletion = SStore * Deficit / Cap
        END IF

    END SELECT

END FUNCTION


SUB NewPage (Page%, STNAME$, LOCATION$, STATE$, Year%, fmonth%, fday%, lmonth%, lday%)

    PRINT #3, CHR$(12)
    PRINT #3, CHR$(13): PRINT #3, CHR$(13)
    PRINT #3, "                                          ";
    PRINT #3, "                                         ";
    PRINT #3, "Page "; Page%
    PRINT #3, "                              ";
    PRINT #3, "WATER BALANCE Program Output"
    PRINT #3, CHR$(13)
    PRINT #3, "                  ";
    PRINT #3, "SITE: "; STNAME$; "  LOCATION: ";
    PRINT #3, LOCATION$; ", "; UCASE$(STATE$)
    PRINT #3, CHR$(13)
    PRINT #3, "                        ";
    PRINT #3, "PERIOD:  "; fmonth%; "/"; fday%;
    PRINT #3, "/"; Year%; " through "; lmonth%; "/"; lday%; "/"; Year%
    PRINT #3, CHR$(13)

    Page% = Page% + 1

END SUB
```

```
FUNCTION RadToDeg! (Radians!)           'converts radians to degrees
        RadToDeg! = 57.29577951# * Radians!
END FUNCTION


FUNCTION UpperDepletion (SStore, RStore, Cap, Deficit)

'This function calculates the amount of moisture depletion occurring
'in the upper soil layer, based on main soil moisture storage (SStore),
'recharge moisture storage (RStore), soil moisture holding capacity (Cap),
'and the amount of moisture demand (Deficit).  A different soil depletion
'curve is selected, based on the value of SoilType.

  SHARED SoilType AS INTEGER

     SELECT CASE SoilType

        CASE 1    'Clays, fine textured soils
           UpperDepletion = Deficit

        CASE 2    'Loams, medium textured soils
           UpperDepletion = Deficit

        CASE 3    'Sands, coarse textured soils
           UpperDepletion = Deficit

        CASE ELSE

     END SELECT

END FUNCTION


FUNCTION WhichDay% (jday%)

  SHARED NumDays%()

  FOR i = 1 TO 12
    days = days + NumDays%(i)
    IF days >= jday% THEN
       WhichDay% = NumDays%(i) - days + jday%
       EXIT FOR
    END IF
  NEXT i

END FUNCTION
```

```
FUNCTION WhichMonth% (jday%)

  SHARED NumDays%()
  FOR i = 1 TO 12
    days = days + NumDays%(i)
    IF days >= jday% THEN
       WhichMonth% = i
       EXIT FOR
    END IF
  NEXT i

END FUNCTION


SUB WriteVector (FirstDay%, LastDay%, Vector())

    PRINT #3, CHR$(13): PRINT #3, CHR$(13)
    PRINT #3, "      ";
    FOR k = 0 TO 9
      PRINT #3, USING "      #"; k;
    NEXT k
    PRINT #3, CHR$(13)
    CKLINE = INT(FirstDay% / 10)
      PRINT #3, CHR$(13)
      PRINT #3, USING " ####"; CKLINE * 10;
      PRINT #3, "   ";
      Blanks = FirstDay% MOD 10
      FOR i = 1 TO Blanks
        PRINT #3, "       ";
      NEXT i
    FOR i = FirstDay% TO LastDay%
      jj = INT(i / 10)
      IF (jj > CKLINE) THEN
        CKLINE = jj
        PRINT #3, CHR$(13)
        PRINT #3, USING " ####"; CKLINE * 10;
        PRINT #3, "   ";
      END IF
      PRINT #3, USING " ###.##"; Vector(i);
    NEXT i
    PRINT #3, CHR$(13): PRINT #3, CHR$(13)

END SUB
```

The prediction model for mean annual precipitation at a forested site from base station weather using elevation as a predictor

Dependent Variable: MAP Mean Annual Precipitation (in)

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
Model	3	16820.18493057	5606.72831019
Error	65	2482.07356798	38.18574720
Corrected Total	68	19302.25849855	

F VALUE	PR > F	R-SQUARE
146.83	0.0001	0.871410

C.V.	ROOT MSE	MAP MEAN
15.9937	6.17946172	38.63681159

SOURCE	DF	TYPE I SS	F VALUE	PR > F
Area	1	2946.84883030	77.17	0.0001
Elevation	1	12722.03164231	333.16	0.0001
Area*Elevation	1	1151.30445796	30.15	0.0001

SOURCE	DF	TYPE III SS	F VALUE	PR > F
Area	1	4.20640412	0.11	0.7410
Elevation	1	13574.87825981	355.50	0.0001
Area*Elevation	1	1151.30445796	30.15	0.0001

PARAMETER		ESTIMATE	T FOR H0: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
Intercept		0.67995220	0.21	0.8371	3.29374951
Area	NId	1.46431449	0.33	0.7410	4.41193910
	CId	0.00000000	.	.	.
Elevation		0.00651966	10.22	0.0001	0.00063815
Area*	NId	0.00535764	5.49	0.0001	0.00097573
Elevation	CId	0.00000000	.	.	.

Weather Stations used in climate prediction

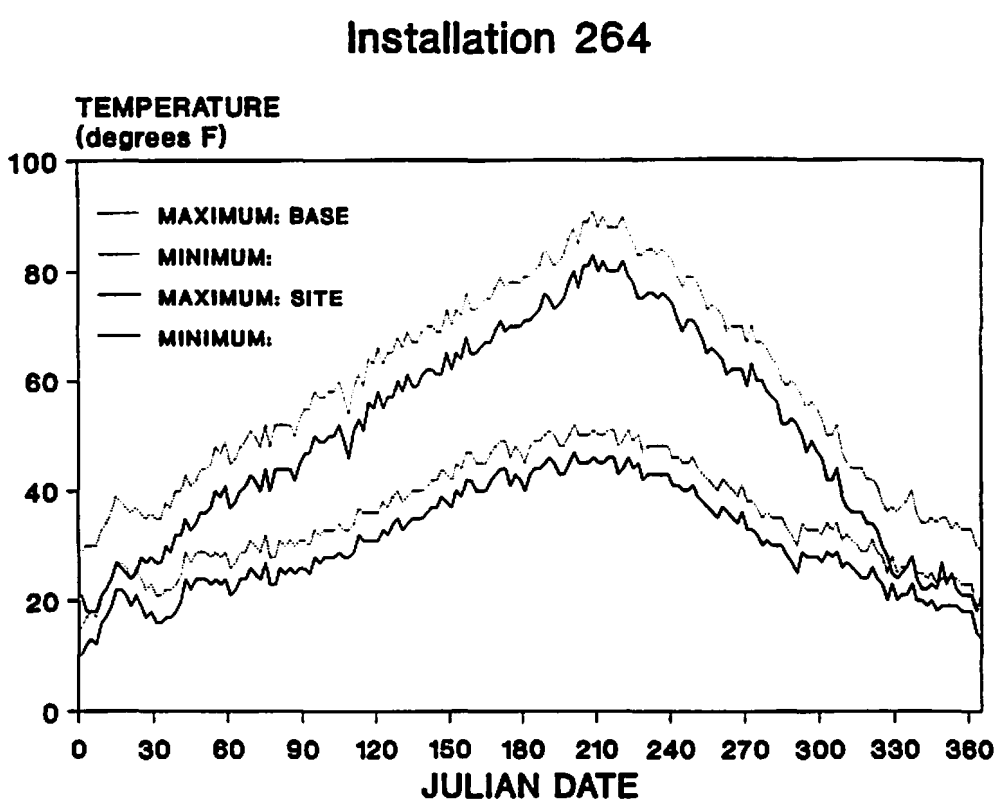
National Weather Service stations:

ID	Name	Elevation	Latitude	Longitude
0528	**AVERY RANGER STN 2**	**2390**	**47.25**	**115.92**
0667	**BAYVIEW MODEL BASIN**	**2075**	**47.98**	**116.55**
1079	**BONNERS FERRY 1 SW**	**1860**	**48.68**	**116.32**
1180	BROWNLEE DAM	1844	44.83	116.87
1363	CABINET GORGE	2260	48.08	116.07
1408	CAMBRIDGE	2650	44.57	116.68
1514	**CASCADE 1 NW**	**4896**	**44.53**	**116.05**
1636	**CENTERVILLE ARBAUGH RANCH**	**4300**	**43.90**	**115.85**
1956	COEUR D'ALENE R S	2158	47.68	116.75
2159	COTTONWOOD 2 SW	3750	46.03	116.38
2187	COUNCIL	2950	44.73	116.43
2246	CRAIGMONT	3750	46.23	116.48
2575	DIXIE	5620	45.55	115.47
2875	ELK CITY R S	4058	45.82	115.43
2892	**ELK RIVER 1 S**	**2918**	**46.77**	**116.18**
3448	GARDEN VALLEY R S	3212	44.07	115.92
3771	GRANGEVILLE	3360	45.92	116.13
3780	GRANGEVILLE 11 SE	4227	45.82	115.95
4150	**HEADQUARTERS**	**3138**	**46.63**	**115.80**
4442	**IDAHO CITY**	**3965**	**43.83**	**115.83**
4831	**KELLOGG**	**2320**	**47.55**	**116.17**
5414	LOWMAN	3920	44.08	115.60
5708	**MC CALL**	**5025**	**44.90**	**116.12**
6152	MOSCOW - UNIV OF IDAHO	2660	46.73	116.97
6230	MULLAN	3317	47.47	115.80
6388	**NEW MEADOWS RANGER STN**	**3870**	**44.97**	**116.28**
6424	NEZPERCE	3145	46.25	116.25
6590	OLA 4 S	2990	44.13	116.28
7046	**PIERCE**	**3190**	**46.50**	**115.80**
7049	PIERCE	3170	46.50	115.80
7264	PORTHILL	1775	49.00	116.50
7301	POTLATCH	2600	46.97	116.88
7386	**PRIEST RIVER EXP STN**	**2380**	**48.35**	**116.83**
7706	RIGGINS	1800	45.42	116.30
8062	**SAINT MARIES**	**2220**	**47.32**	**116.57**
8137	**SANDPOINT KSPT**	**2100**	**48.30**	**116.57**
9498	WALLACE WOODLAND PARK	2940	47.50	115.88
9560	WARREN	5907	45.27	115.67
9846	WINCHESTER 1 ESE	3940	46.22	116.62
9951	YELLOW PINE 7 S	5070	44.87	115.52

Note: stations in **bold** were used as base stations for predicting climatic data for the Idaho Douglas-fir installations.

Soil Conservation Service Sno-tel stations:

ID	Name	Elevation	Latitude	Longitude
15F04S	ATLANTA SUMMIT SNOTEL	7580	43.75	115.23
15E11S	BANNER SUMMIT SNOTEL	7040	44.30	115.23
16E11S	BEAR BASIN PILLOW	5350	44.95	116.15
16A08S	BEAR MOUNTAIN PILLOW	5400	48.30	116.08
16E10S	BEAR SADDLE SNOTEL	6180	44.60	116.97
15E02S	BIG CREEK SUMMIT PILLOW	6580	44.63	115.80
16D09S	BRUNDAGE RESERVOIR	6300	45.05	116.13
15C16S	COOL CREEK	6280	46.77	115.30
15E08S	COZY COVE SNOTEL	5380	44.28	115.65
15C09S	CRATER MEADOWS SNOTEL	5690	46.57	115.28
15E04S	DEADWOOD SUMMIT SNOTEL	6860	44.55	115.57
16C15S	ELK BUTTE SNOTEL	5380	46.83	116.12
15F14S	GRAHAM GUARD STA SNOTEL	5690	43.95	115.27
15C06S	HEMLOCK BUTTE SNOTEL	5810	46.48	115.63
15B21S	HUMBOLDT GULCH SNOTEL	4250	47.53	115.78
15E09S	JACKSON PEAK SNOTEL	7070	44.05	115.45
15B02S	LOOKOUT SNOTEL	5140	47.45	115.70
15B14S	LOST LAKE SNOTEL	6110	47.08	115.97
15F01S	MOORES CREEK SUMMIT SNOTEL	6100	43.92	115.67
16A04S	MOSQUITO RIDGE SNOTEL	5200	48.05	116.23
15D06S	MOUNTAIN MEADOWS SNOTEL	6360	45.70	115.23
16A10S	SCHWEITZER BASIN SNOTEL	6090	48.37	116.63
15D01S	SECESH SUMMIT SNOTEL	6520	45.18	115.97
15C04S	SHANGHI SUMMIT SNOTEL	4570	46.57	115.75
16C01S	SHERWIN PILLOW	3200	46.95	116.33
16E05S	SQUAW FLAT PILLOW	6240	44.77	116.25
15B09S	SUNSET SNOTEL	5540	47.55	115.82
15F05S	TRINITY MTN SNOTEL	7770	43.63	115.43
16D08S	WEST BRANCH SNOTEL	5560	45.07	116.43



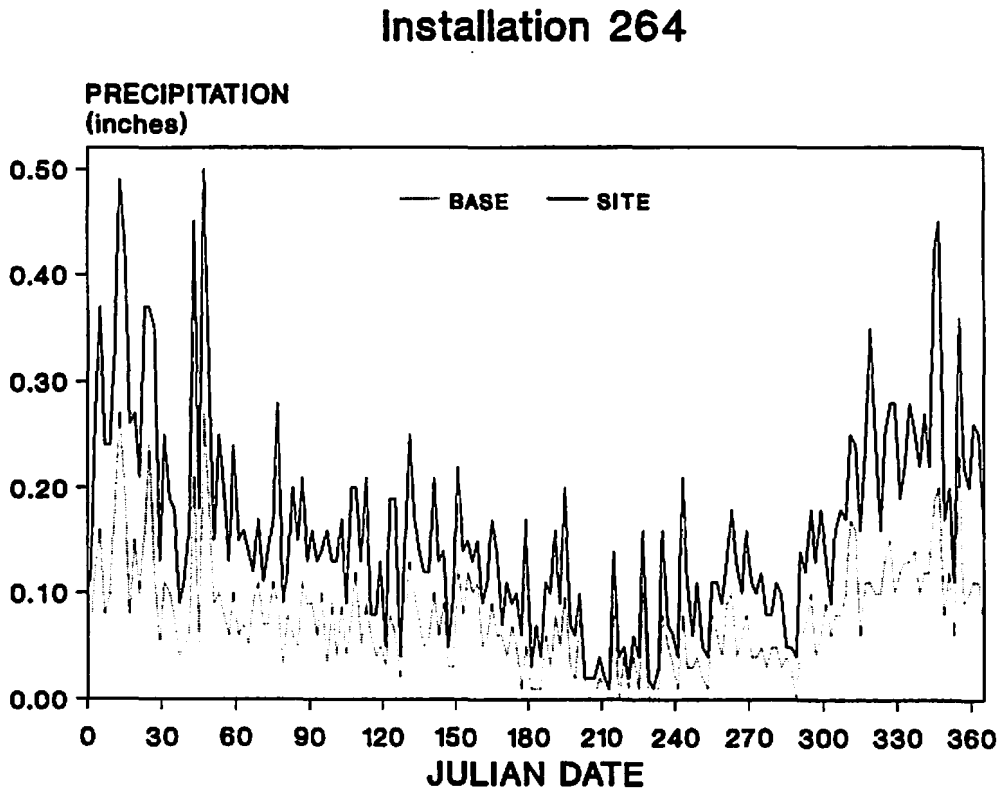
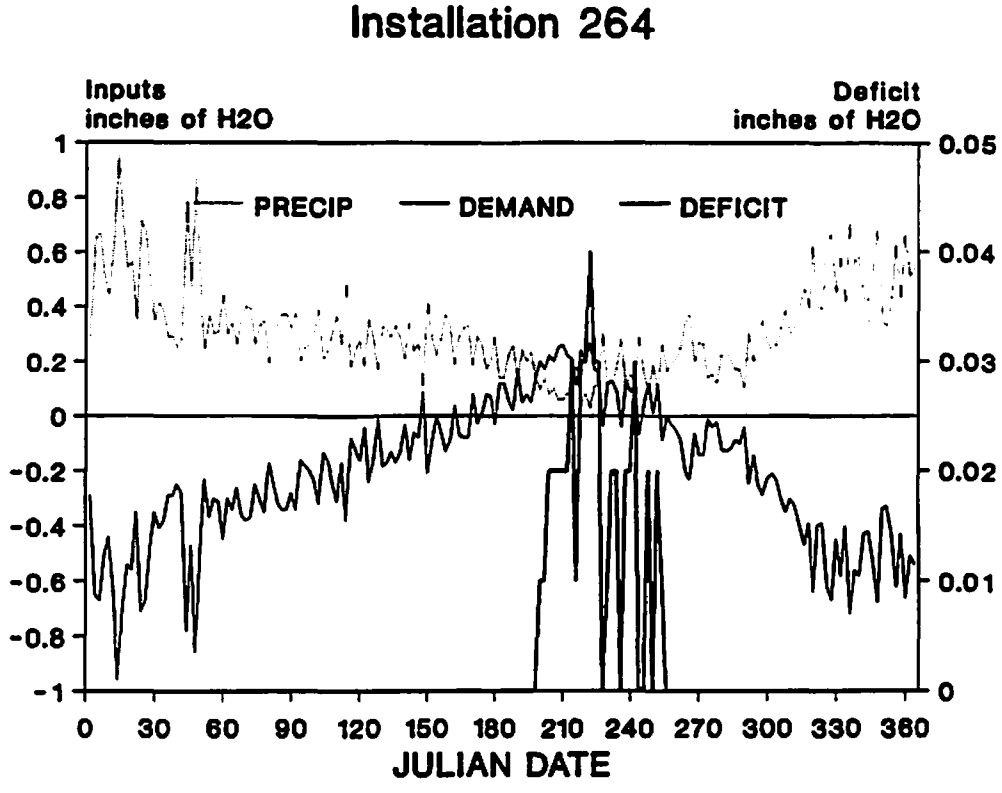


Figure 16. **The relationship between daily base station and on-site weather for Douglas-fir installation 264. The upper panel is temperature while the lower is precipitation.**



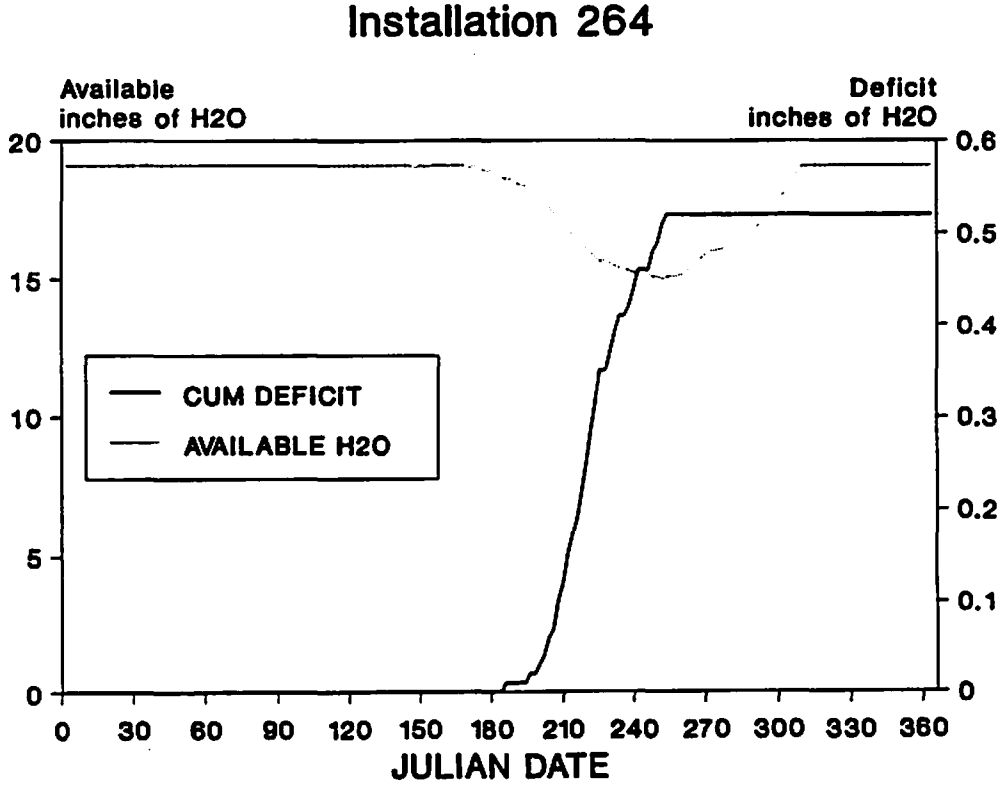
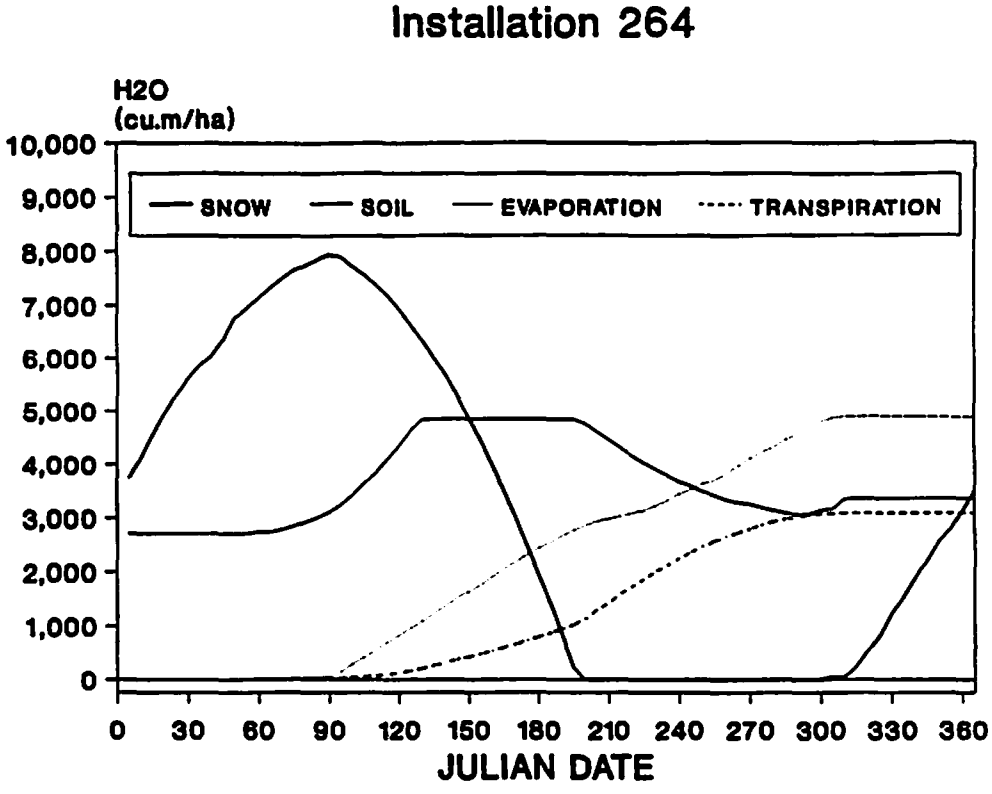


Figure 17. **Various input and output variables from a soil moisture budget program for Douglas-fir installation 264, during an "average" year. Daily fluctuations are shown in the top panel and cumulative behavior is illustrated in the lower panel.**



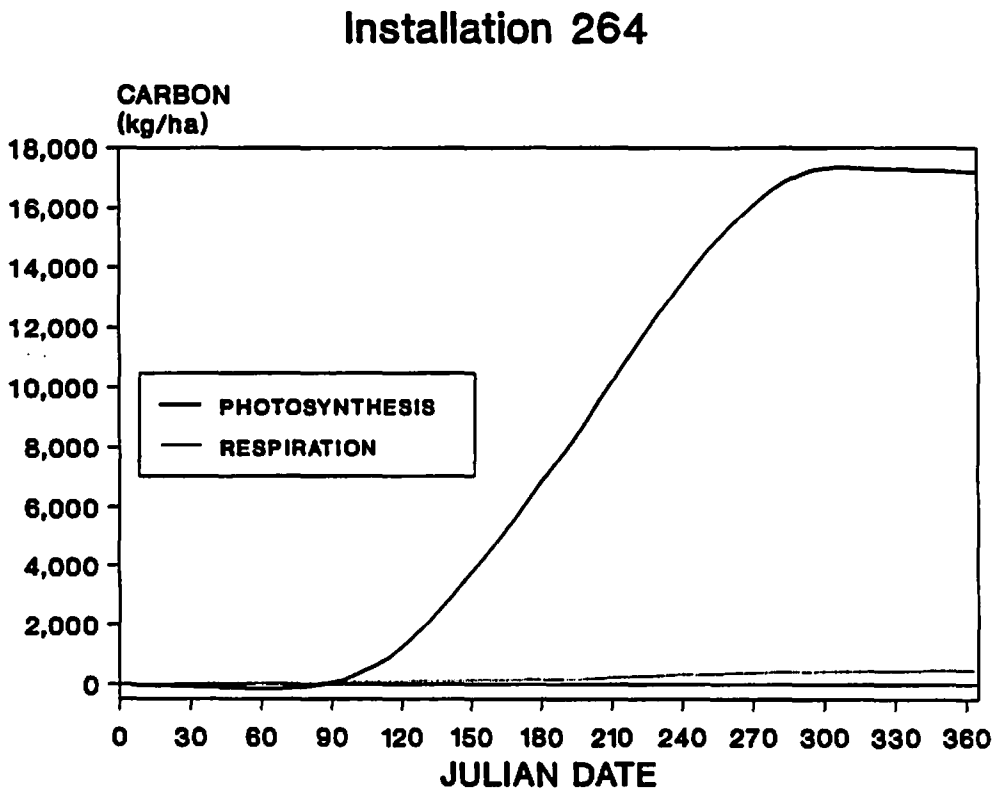
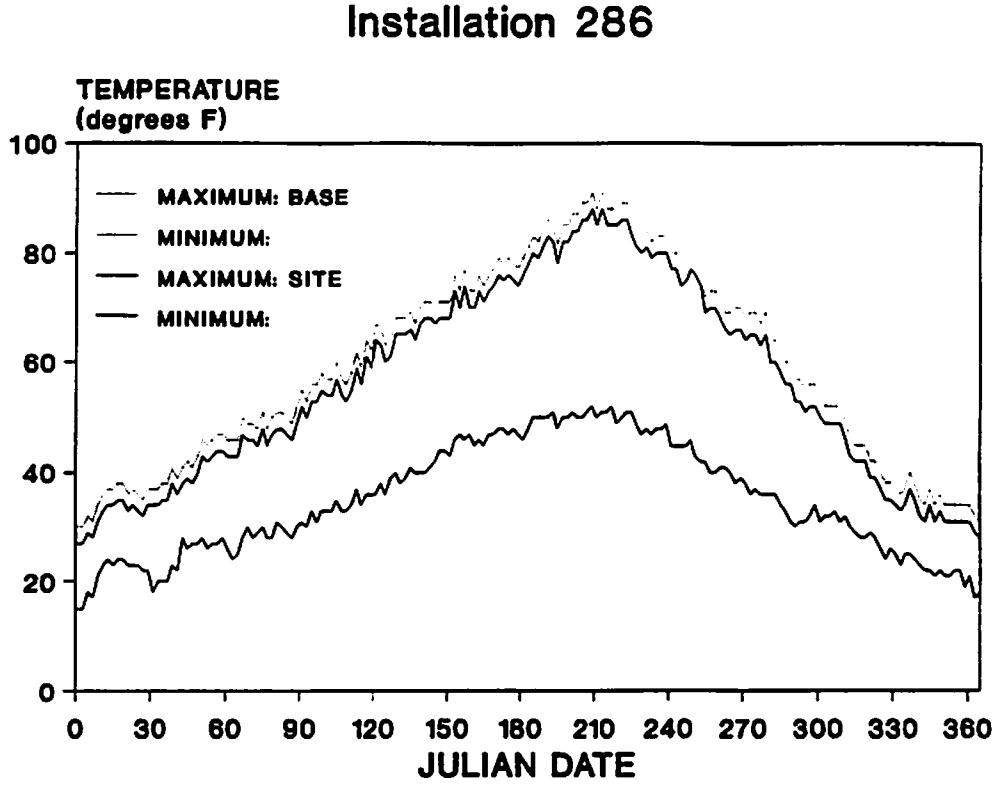


Figure 18. **FOREST-BGC model outputs during an "average" year for Douglas-fir installation 264. Snowpack, soil moisture, evaporation, and transpiration are shown in the upper panel, while photosynthesis and respiration are shown in the lower panel.**



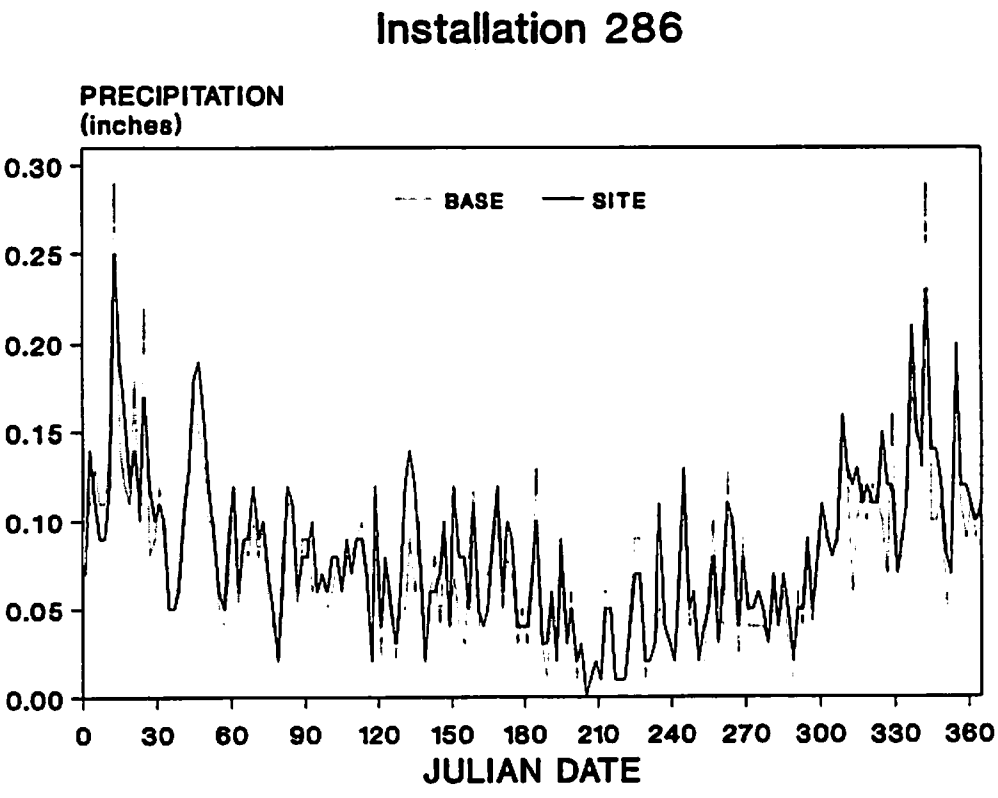
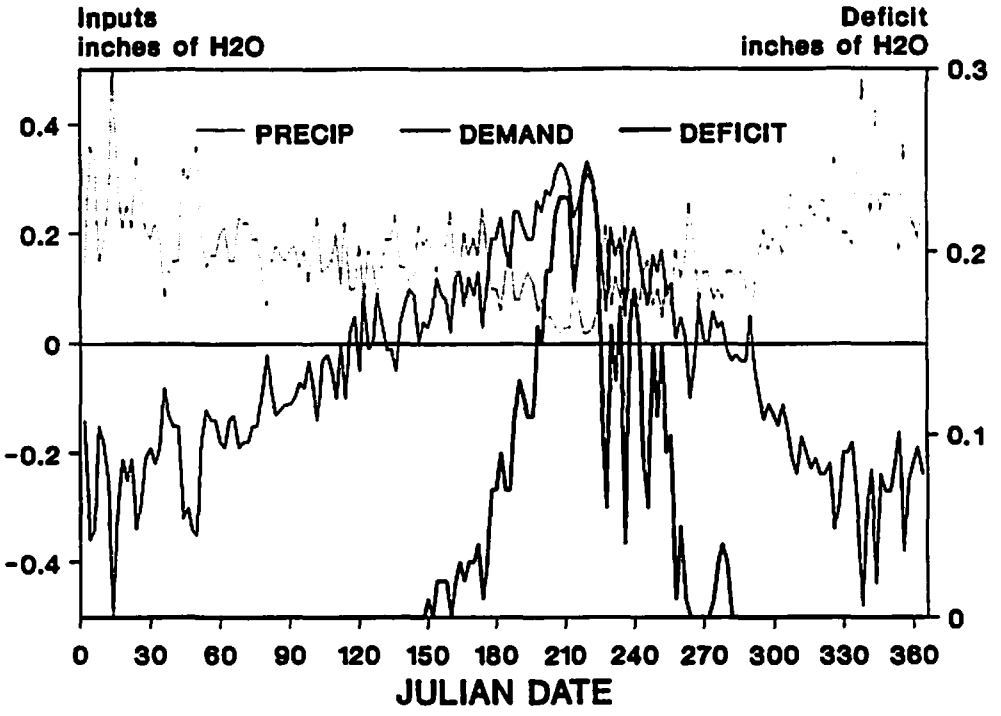


Figure 19. **The relationship between daily base station and on-site weather for Douglas-fir installation 286: The upper panel is temperature while the lower is precipitation.**



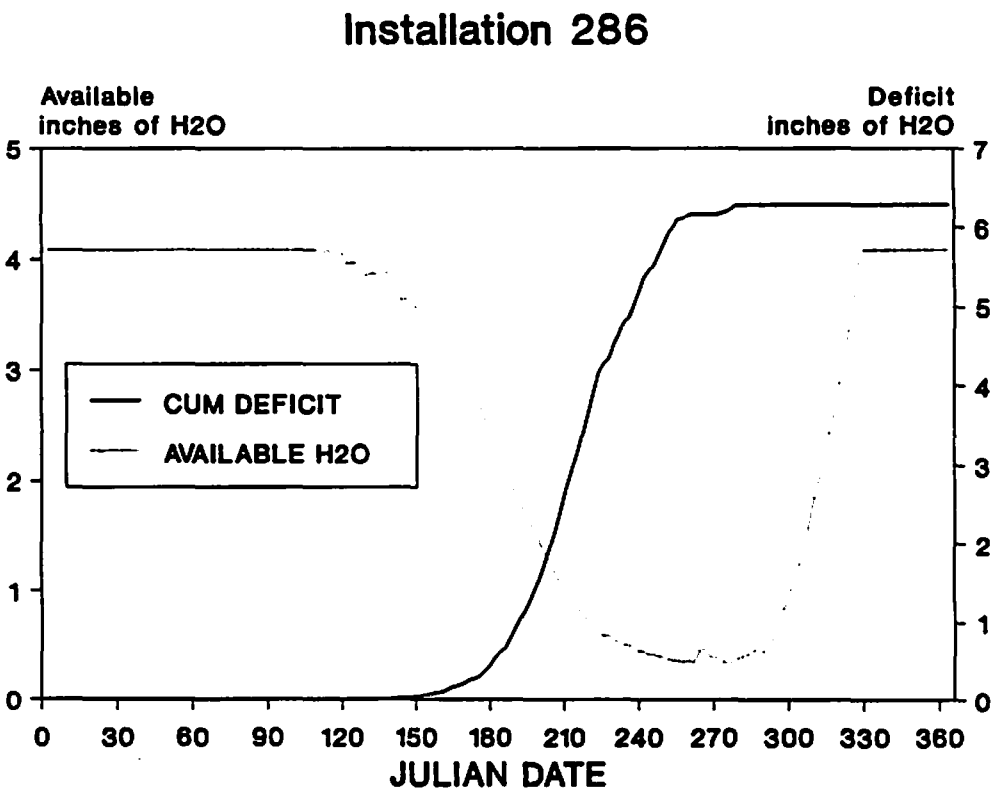
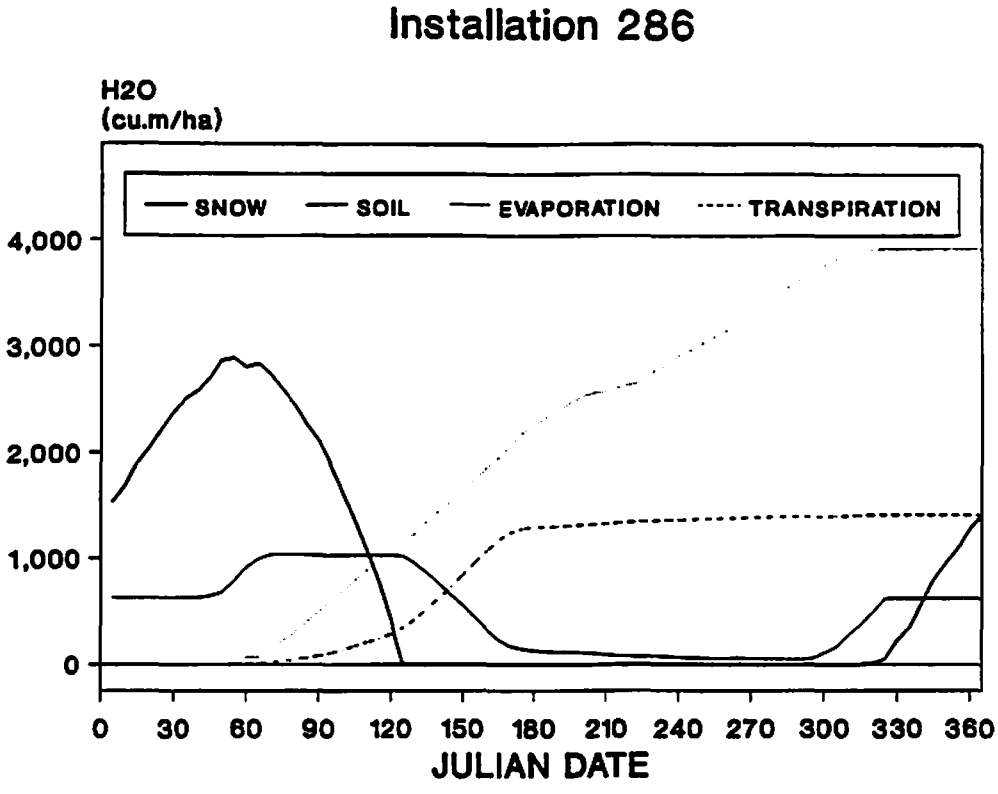


Figure 20. **Various input and output variables from a soil moisture budget program for Douglas-fir installation 286, during an "average" year. Daily fluctuations are shown in the top panel and cumulative behavior is illustrated in the lower panel.**



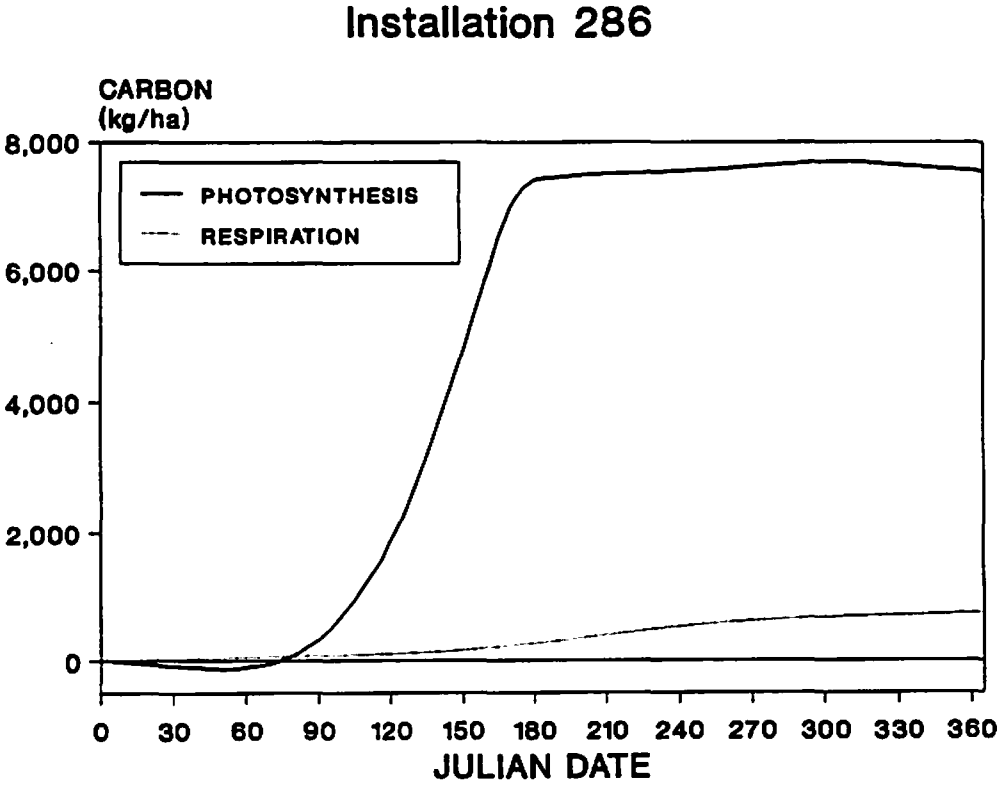


Figure 21. **FOREST-BGC model outputs during an "average" year for Douglas-fir installation 286. Snowpack, soil moisture, evaporation, and transpiration are shown in the upper panel, while photosynthesis and respiration are shown in the lower panel.**

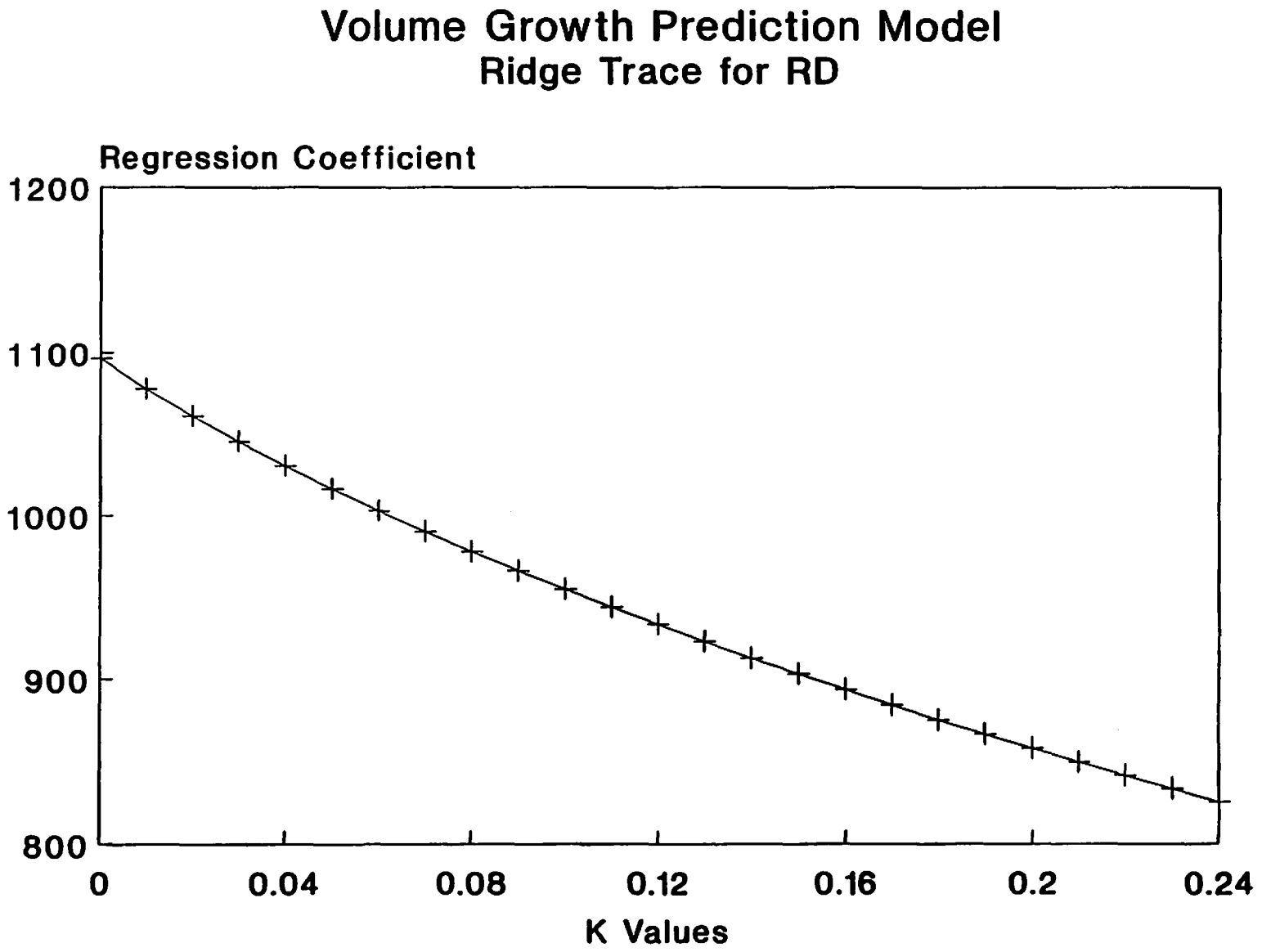


Figure 22. Ridge trace for relative density.

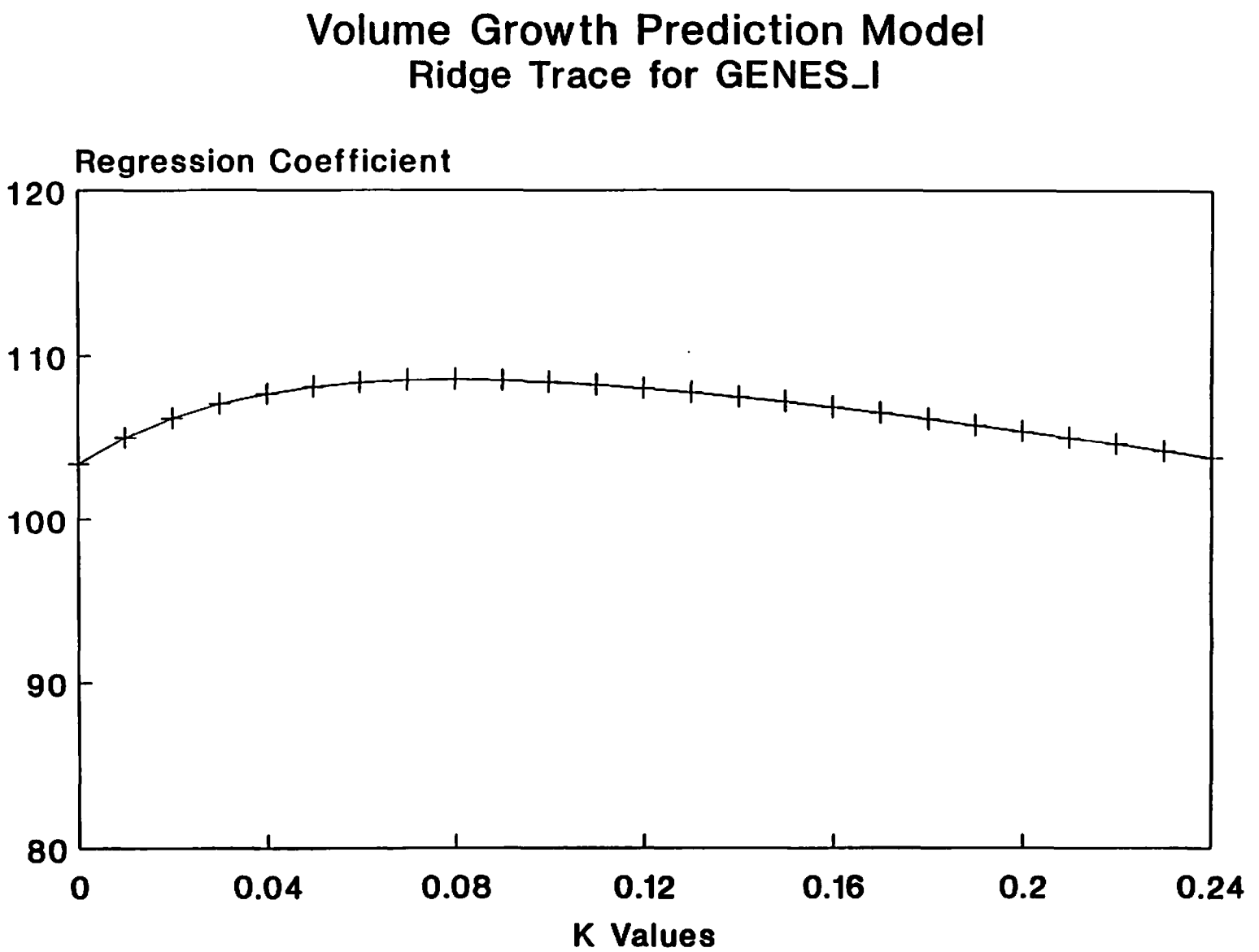


Figure 23. Ridge trace for genetic index.

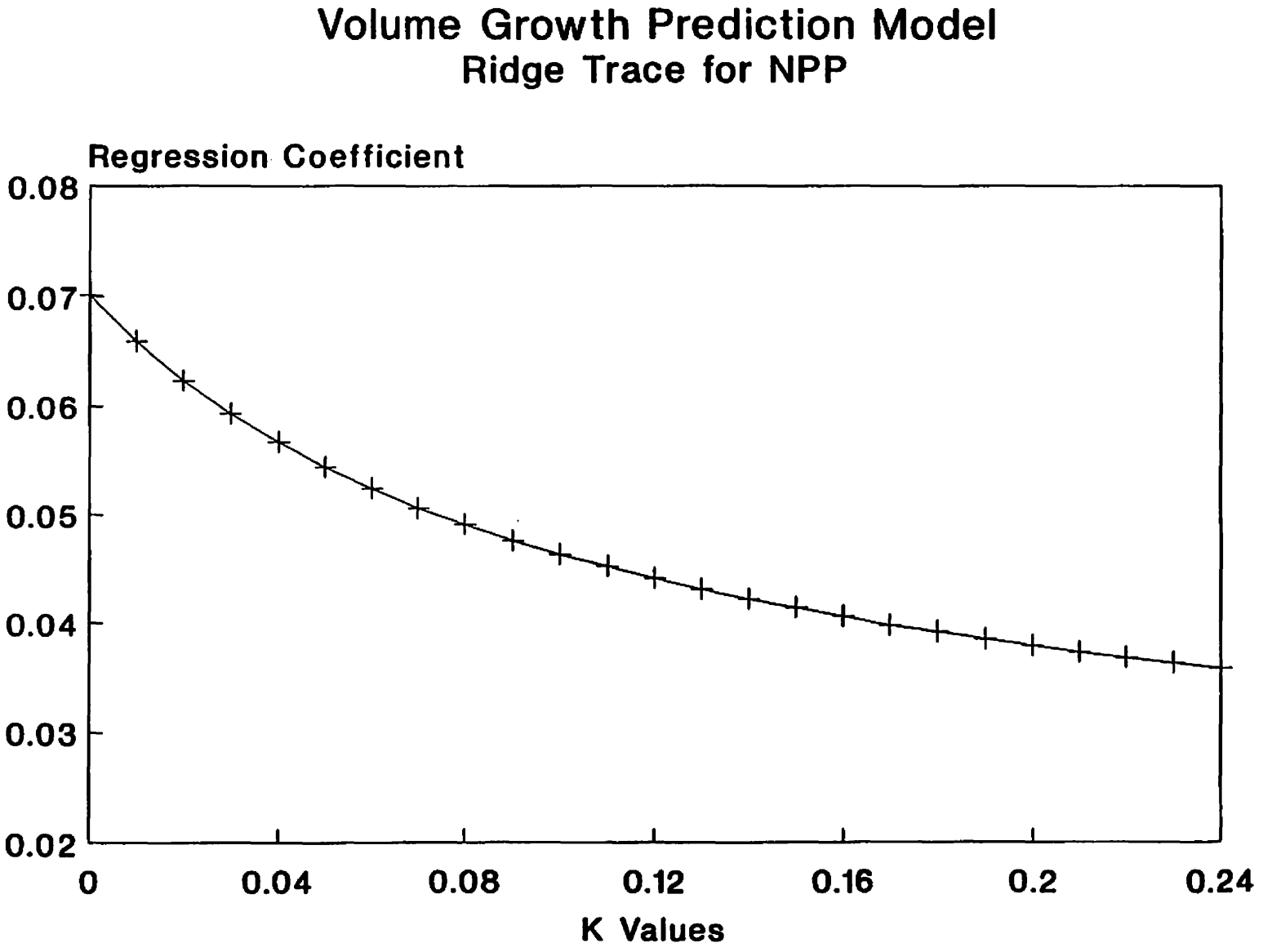


Figure 24. Ridge trace for net primary production.

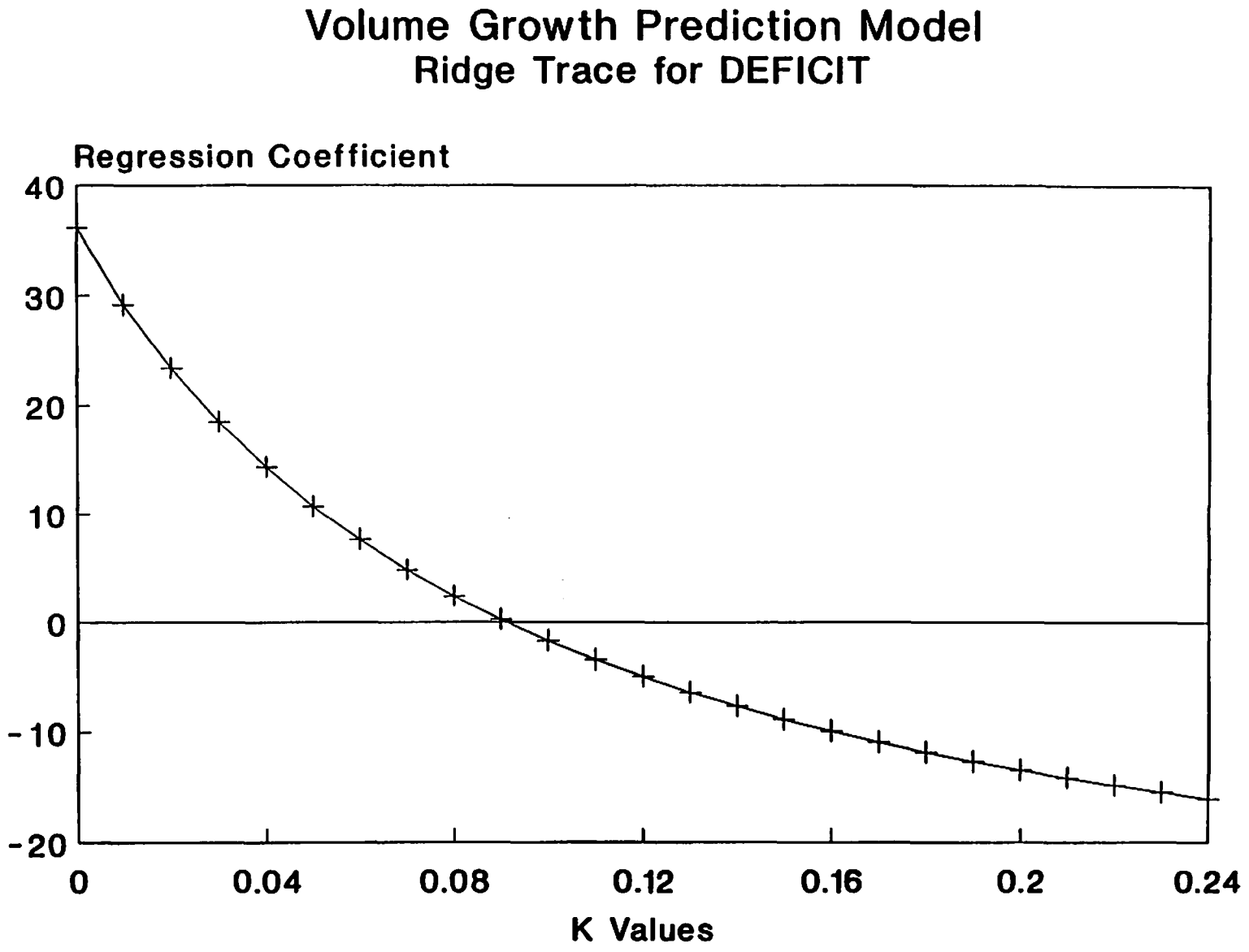


Figure 25. Ridge trace for soil moisture deficit.

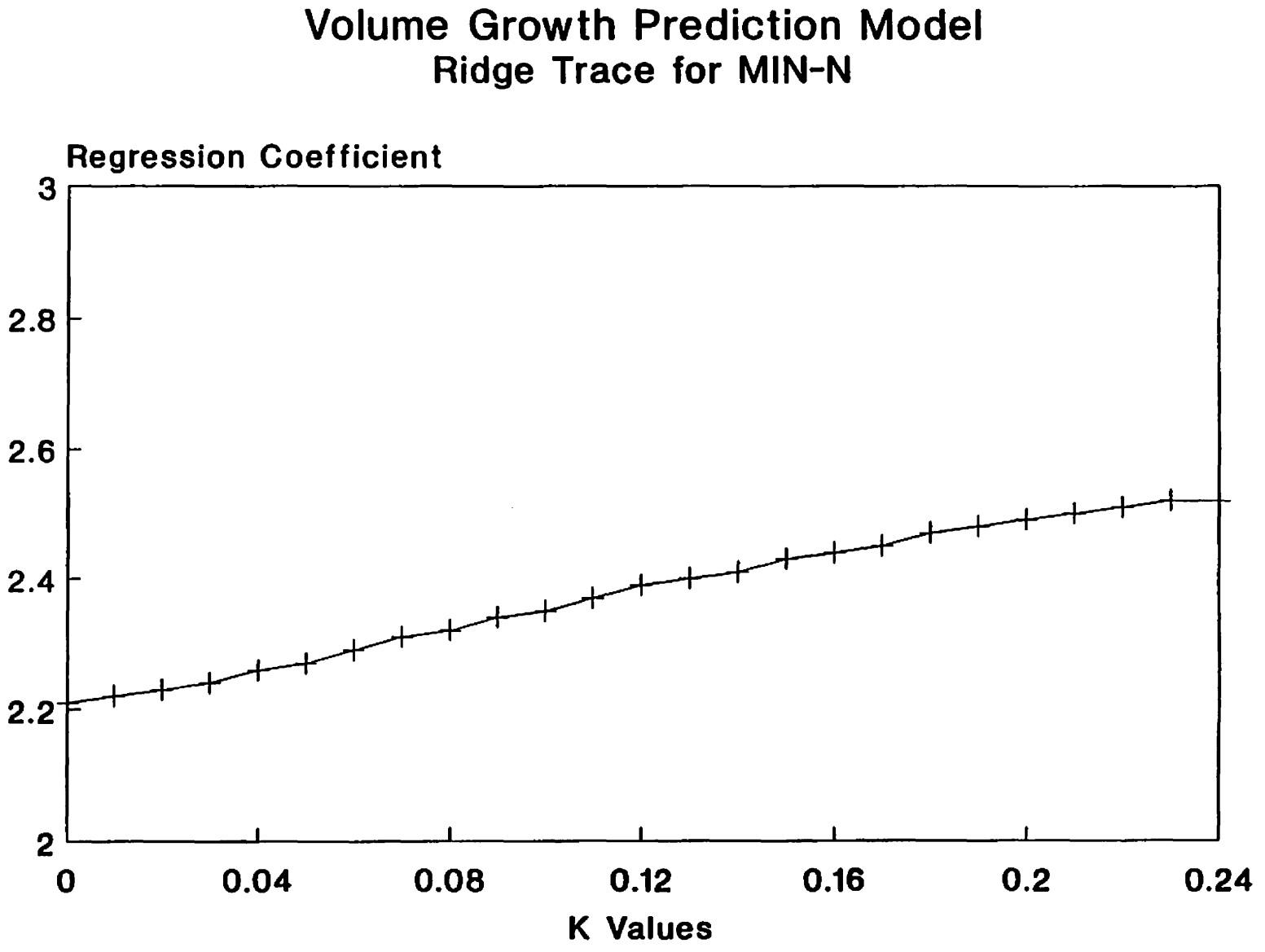


Figure 26. Ridge trace for soil mineralizable nitrogen.

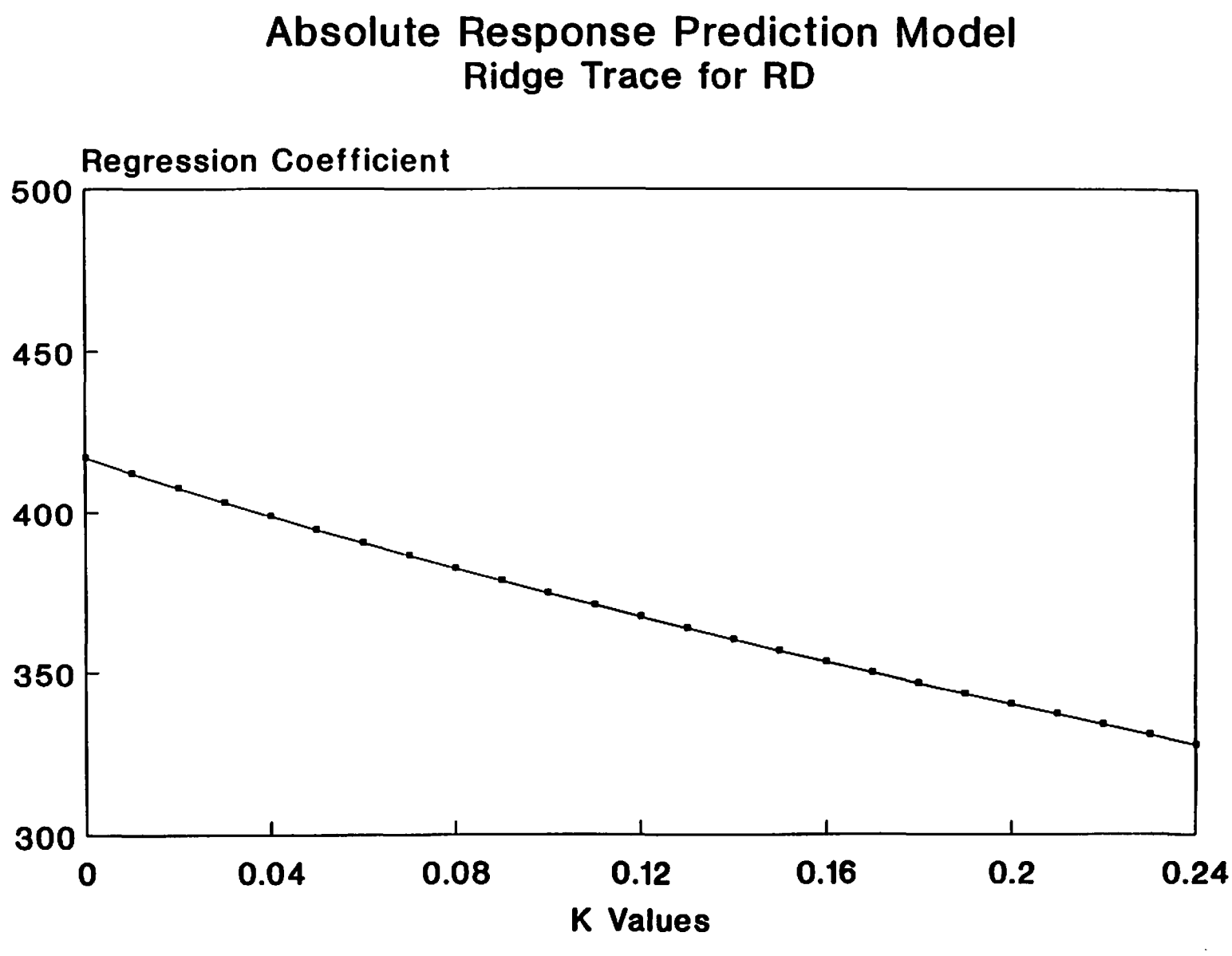


Figure 27. Ridge trace for relative density.

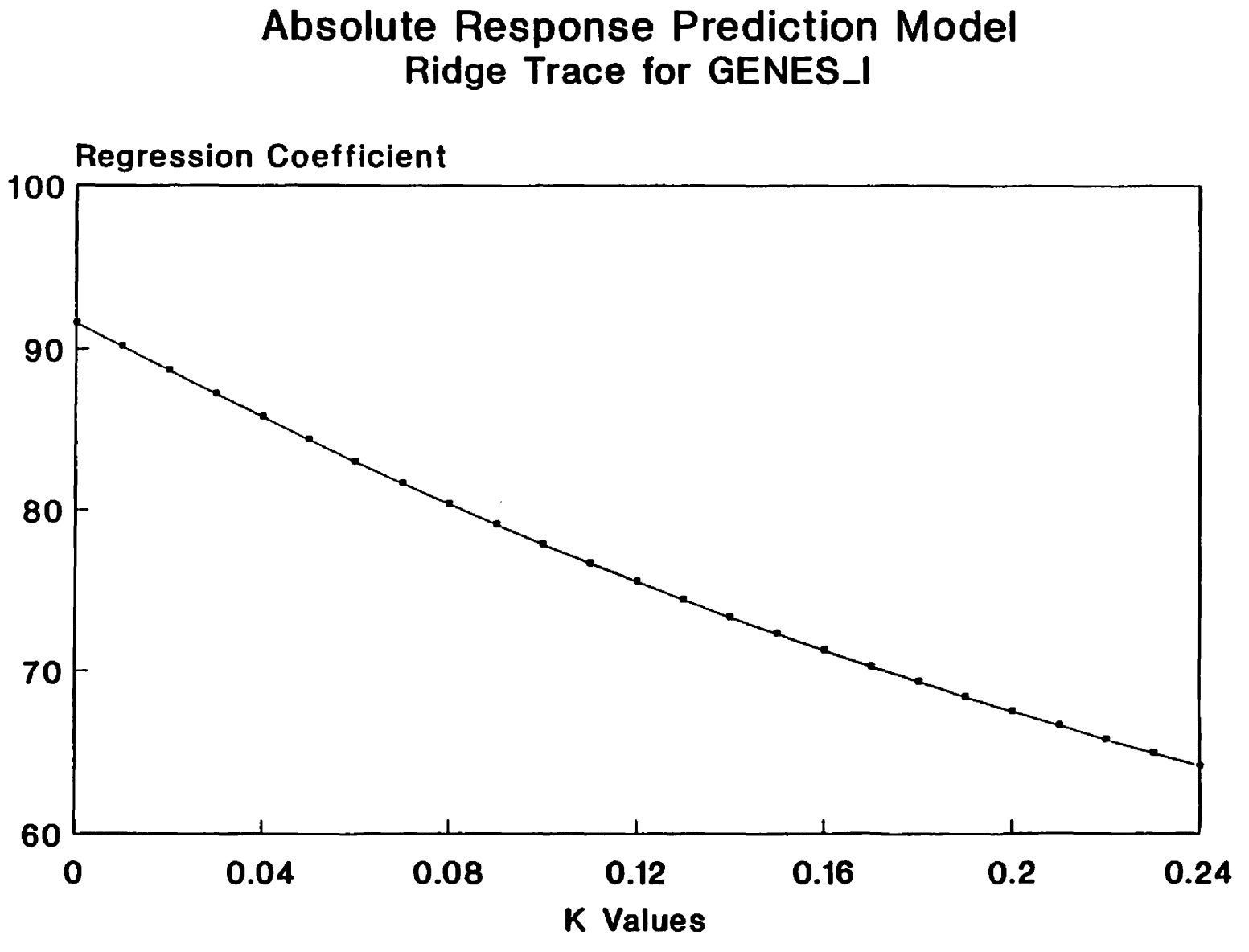


Figure 28. Ridge trace for genetic index.

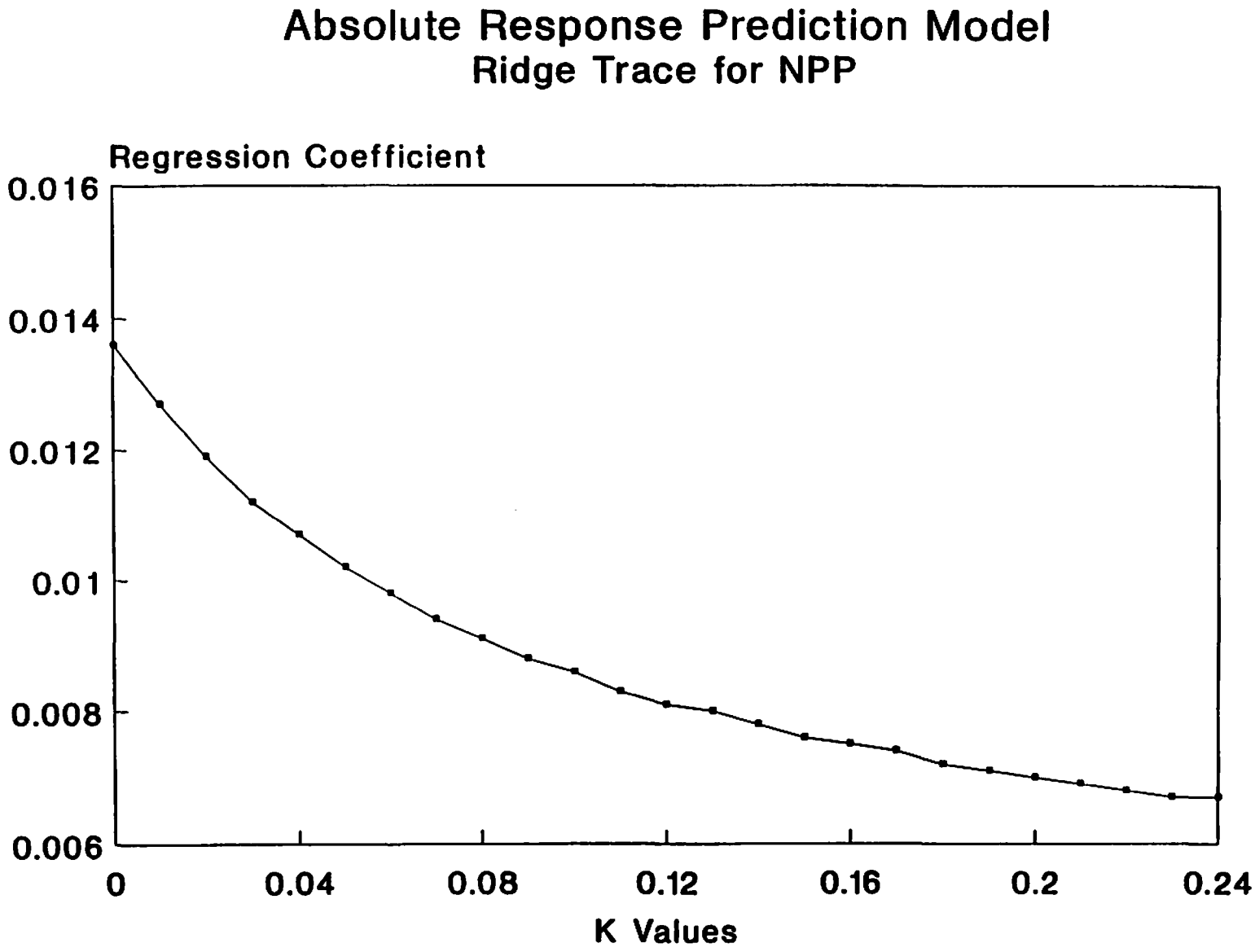


Figure 29. Ridge trace for net primary production.

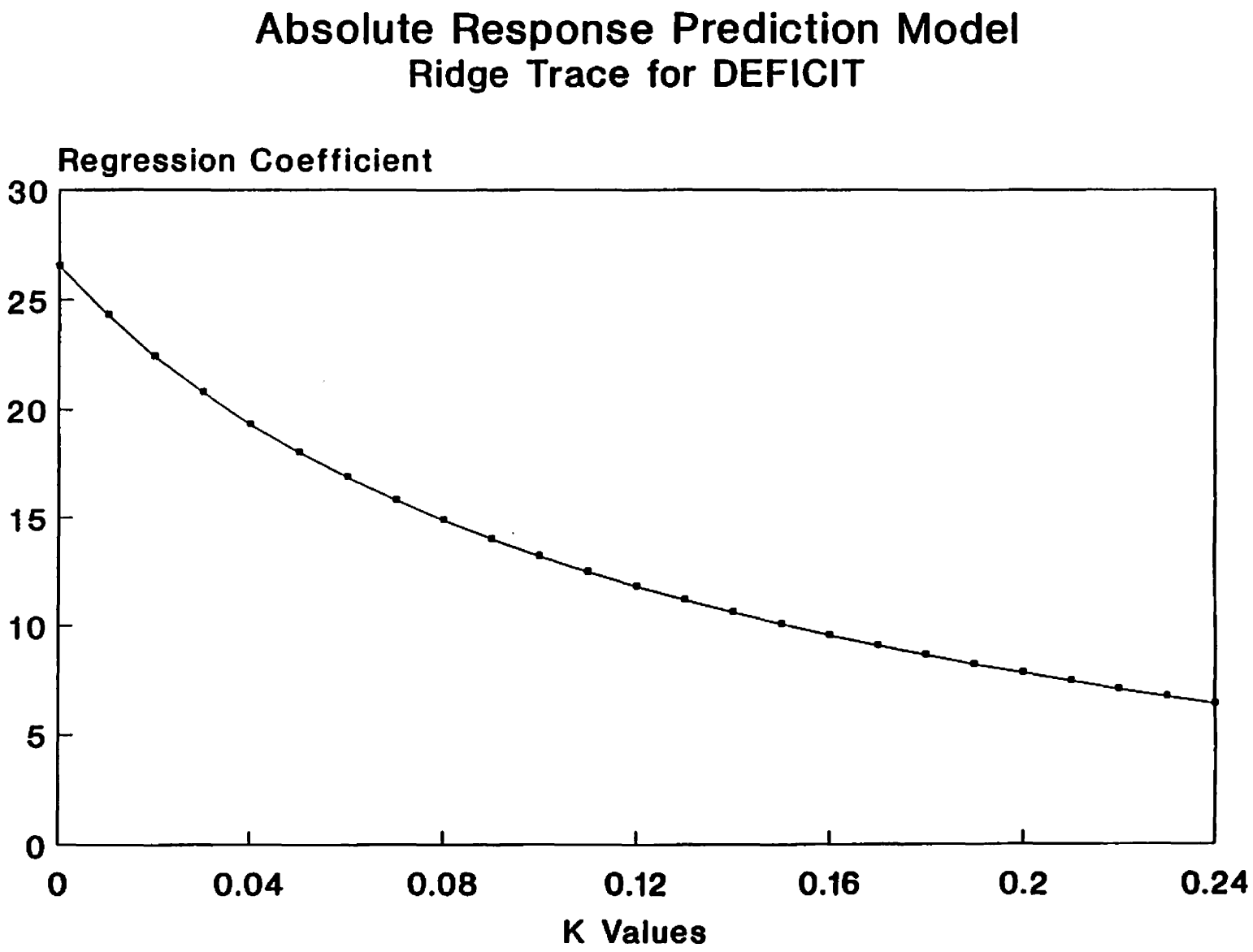


Figure 30. Ridge trace for soil moisture deficit.

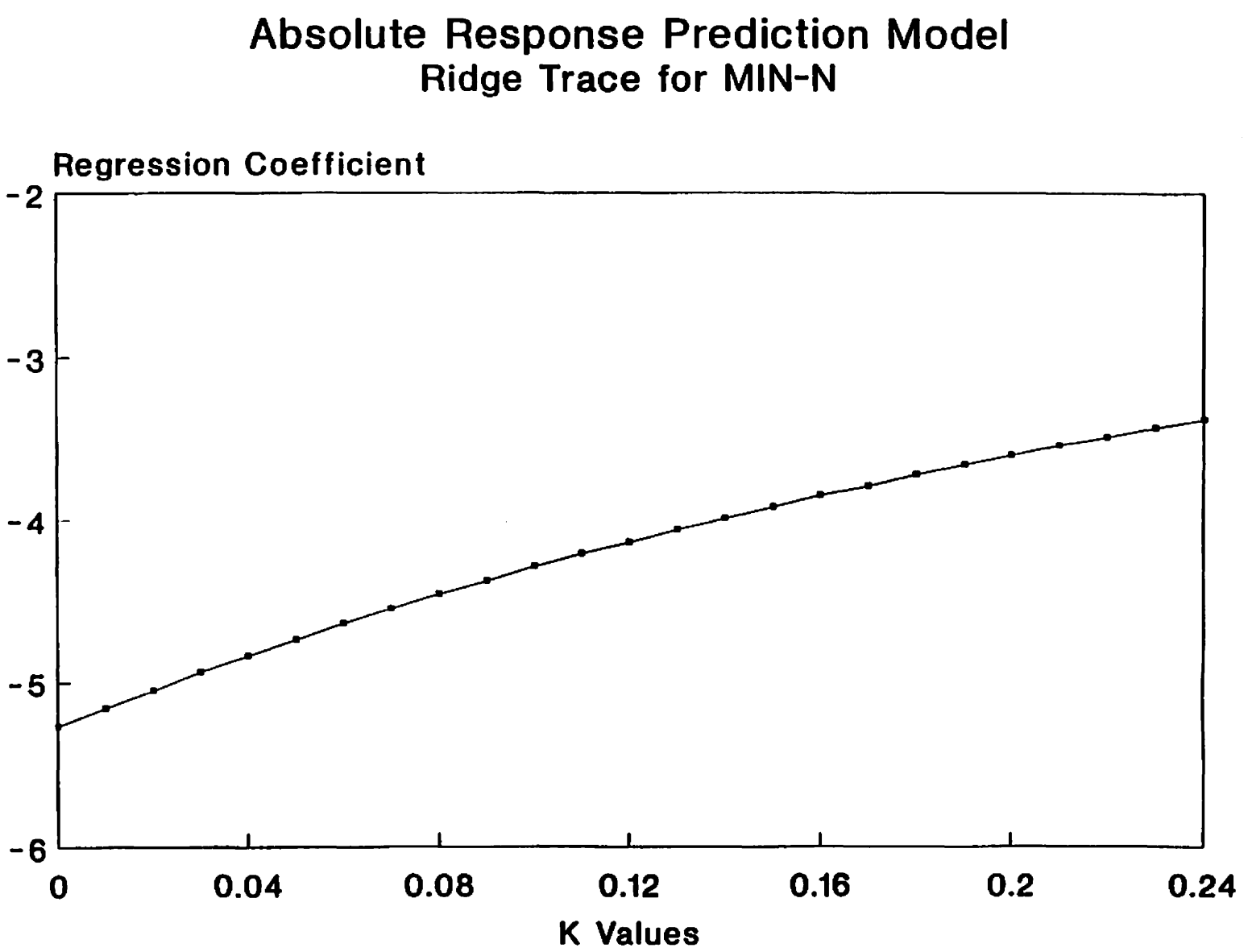


Figure 31. Ridge trace for soil mineralizable nitrogen.

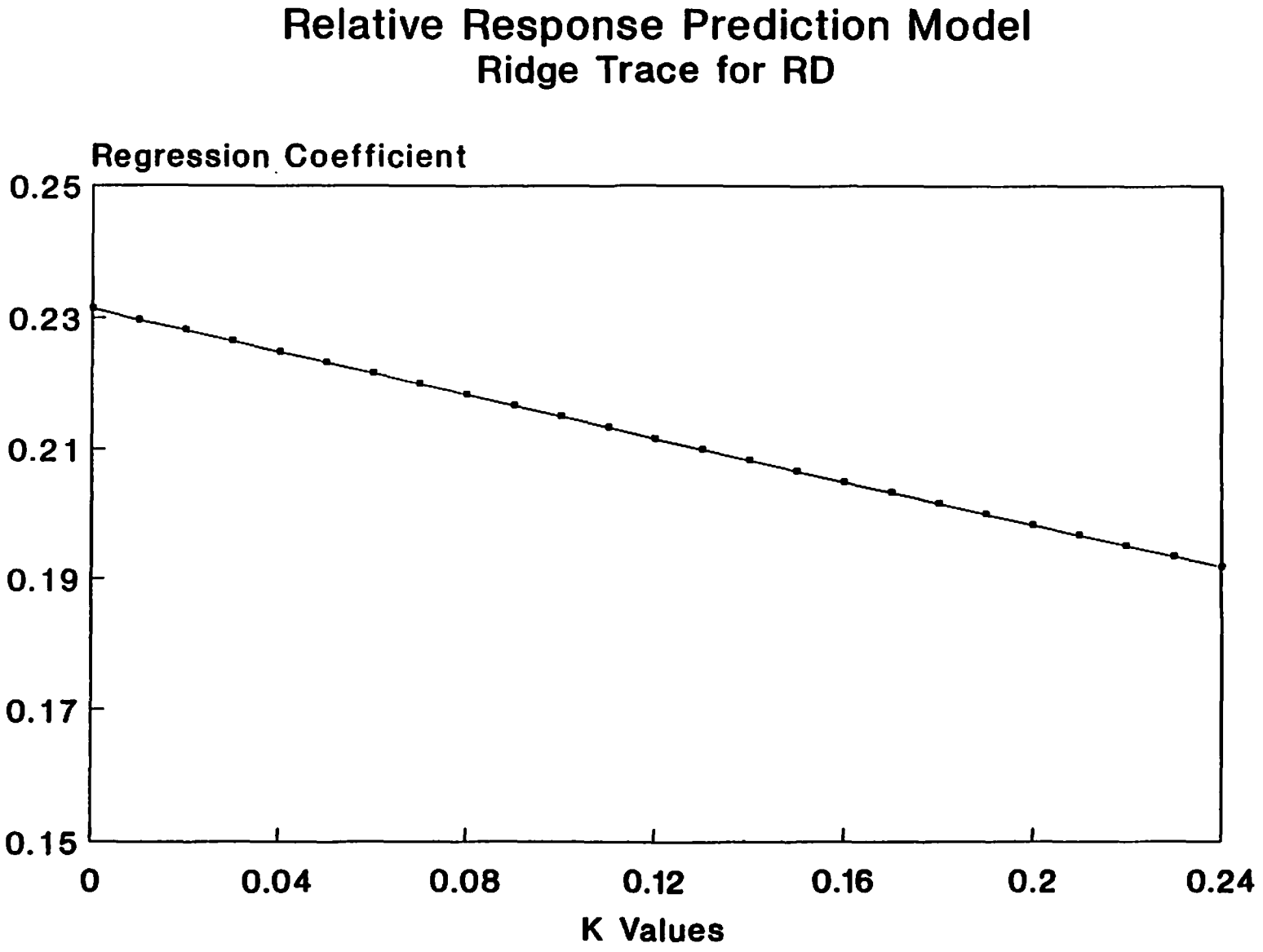


Figure 32. Ridge trace for relative density.

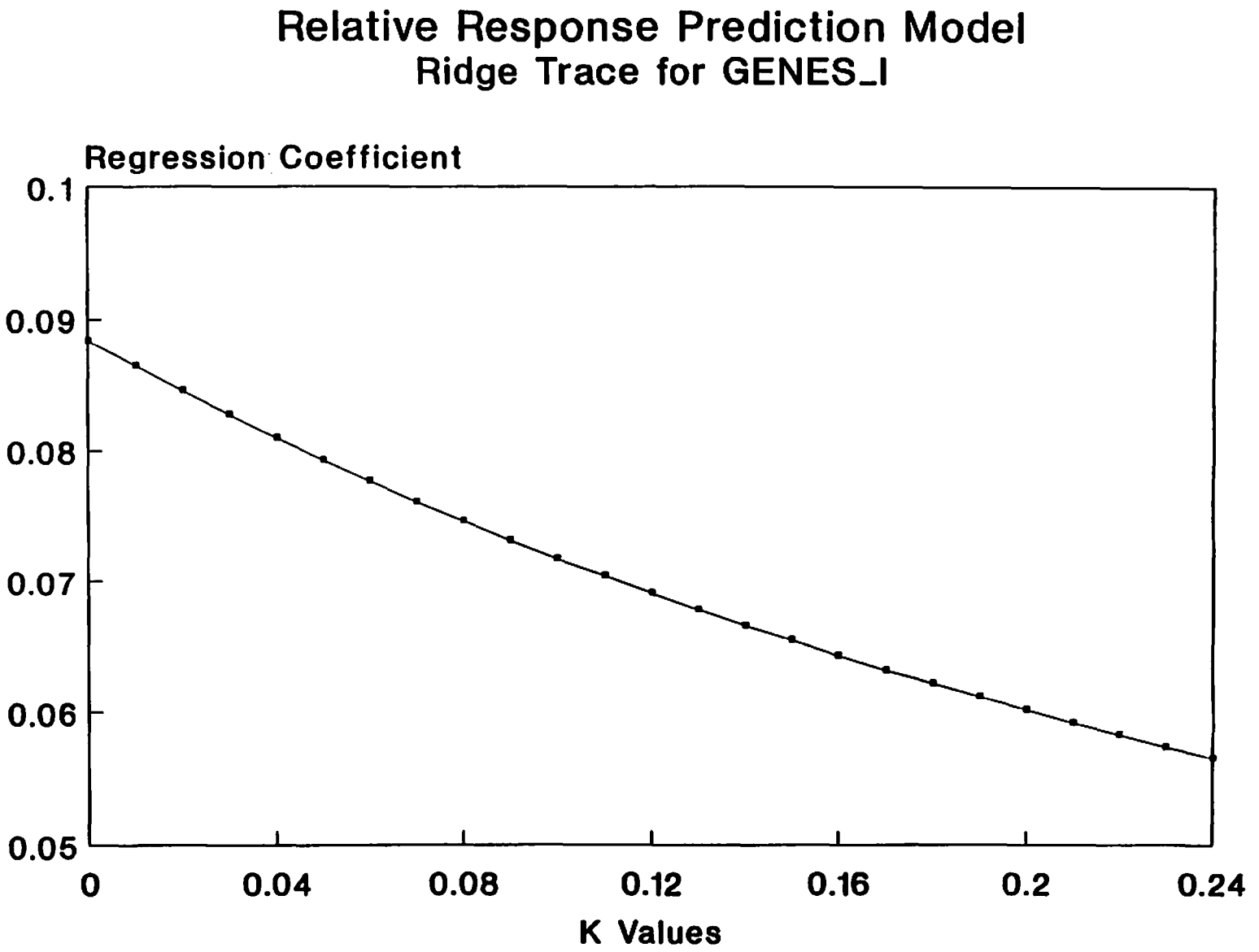


Figure 33. Ridge trace for genetic index.

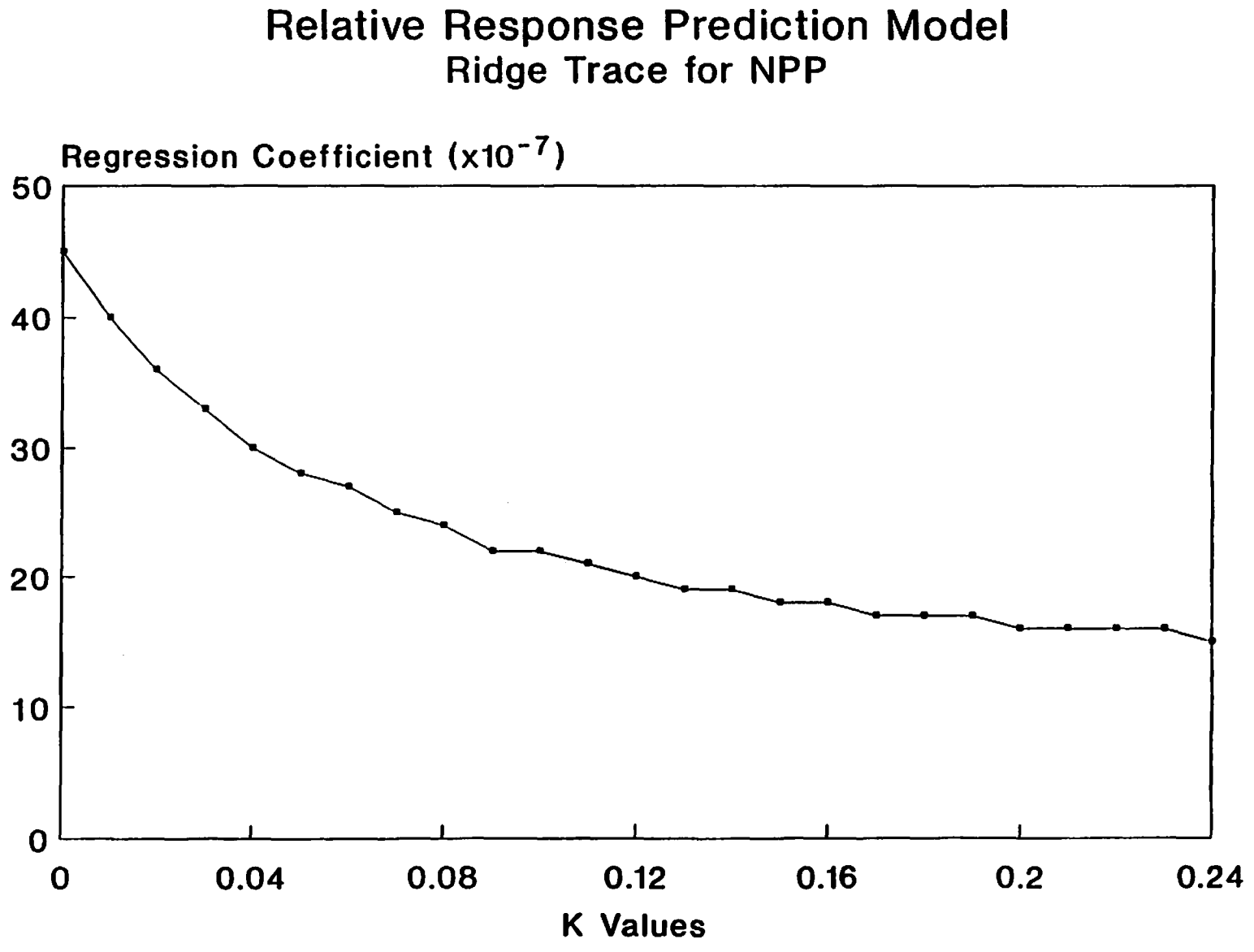


Figure 34. Ridge trace for net primary production.

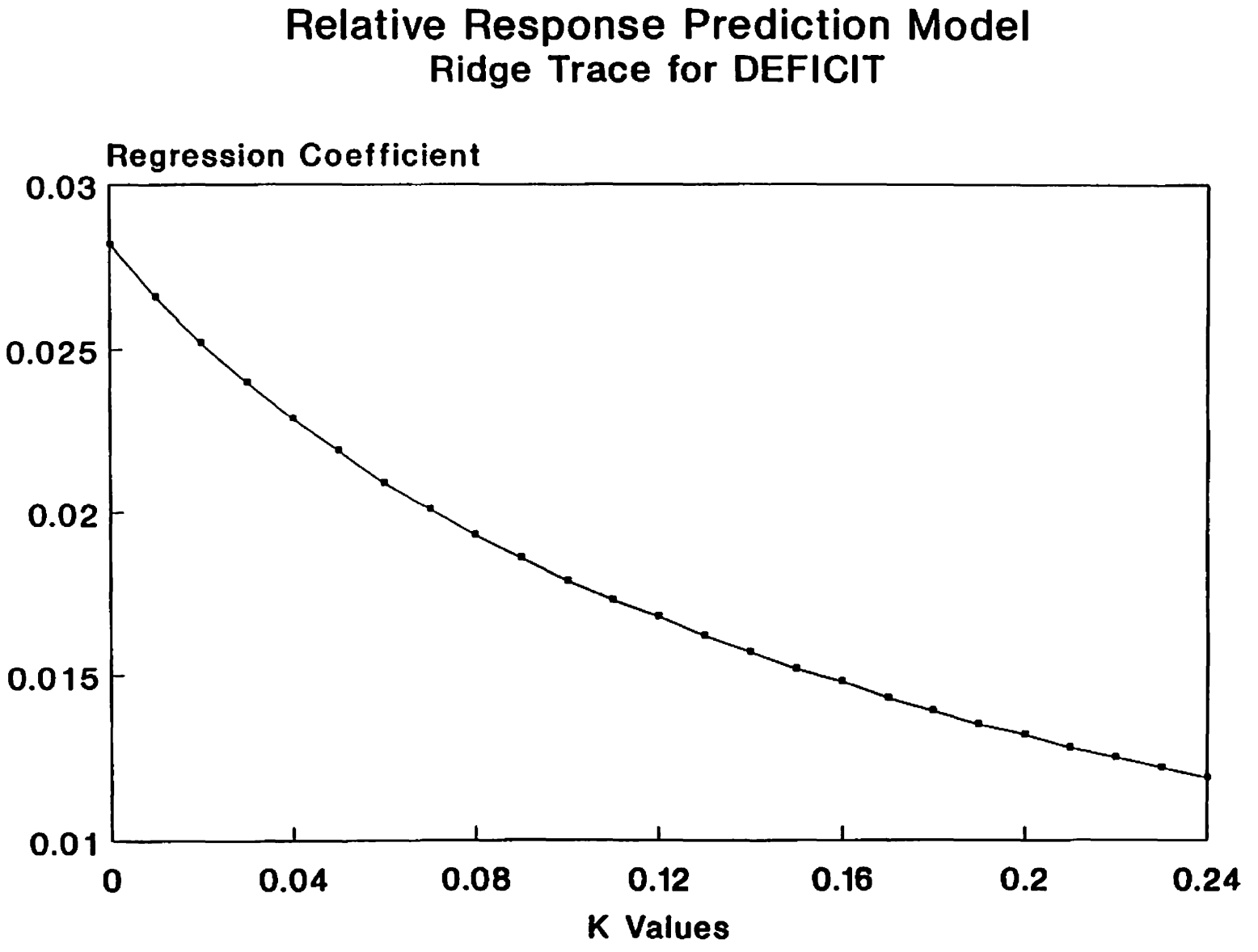


Figure 35. Ridge trace for soil moisture deficit.

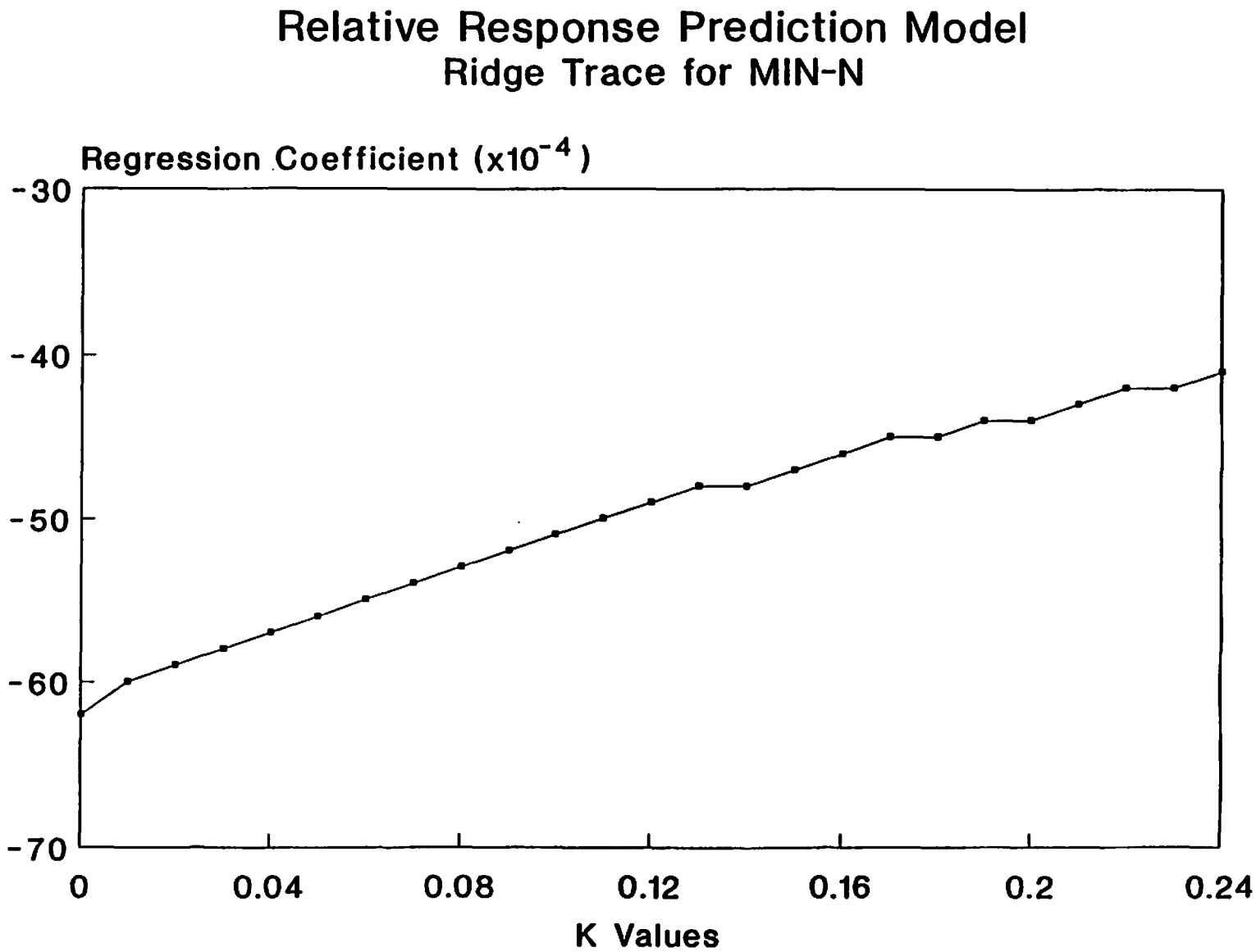


Figure 36. Ridge trace for soil mineralizable nitrogen.