

**ANALYSIS OF ICP LICHEN
BIO-MONITORING DATA**

STATISTICAL REPORT

Prepared for

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Petersburg, Alaska**

August 2006

By



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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Executive Summary

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II. EXECUTIVE SUMMARY

This is a report of the results of analysis of lichen chemistry data from monitoring sites in the Tongass National Forest, Alaska. After consultation with the client, questions of interest were defined. The report includes a summary of the project, discussion of the structure of the data and explanatory and response variables, and the statistical procedures employed in the analysis. Data set used was provided in several Excel spreadsheets by Karen Dillman, USDA Forest Service, Tongass National Forest, Petersburg, Alaska.

Results are reported in chapters for each element analyzed, arranged by All Species analyses, *Alectoria sarmentosa* analysis, *Hypogymnia* species analysis, *Lobaria oregana* analysis, and *Platismatia glauca* analysis. Each analysis includes a summary table for Wilderness and Non-Wilderness averages by year. These tables include the mean, standard error and 95% confidence interval for the reported means. The results of paired t-tests, where appropriate, are reported. The summary statistics are followed by graphs depicting element content by Year, Latitude, Longitude, Precipitation, and LOG-Elevation. The graphs include the threshold value for “pristine” (client defined) sites.

A list of Literature Cited is included in the last chapter. A copy of this Report and Excel data files are provided on the enclosed CD. This work is in fulfillment of USDA Purchase Order Number AG-0116-P-06-0004.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Introduction

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III. INTRODUCTION

Summary of the experiment and objectives

The United States Congress enacted the Clean Air Act (CAA) in 1970 and its amendments in 1977 and 1990 in response to an increased awareness of the nationwide consequences of air pollution and environmental degradation. Biomonitoring can provide a sensitive overview of air quality, detect fairly small changes in air quality geographically or over time (Geiser et al., 1994a). Lichens can accumulate pollutants from the air, and studies have shown the usefulness of lichens to monitor air pollutants by translating pollutant concentration numbers to tangible effects on biological systems.

A 1994 inventory listed 453 lichen species from 112 genera within the Tongass National Forest (Geiser et al. 1994b). Monitoring sites have been established where lichen samples can be collected and later analyzed for pollutant concentrations. Sampling was conducted from 1989 to 2005, and the samples were evaluated for their chemical composition. The data were submitted to Pacific Analytics for statistical analysis.

Project objectives are:

1. Estimate baseline thresholds in four species of lichens for 27 different elements at “pristine” sites. These are sites relatively unaffected by human disturbance.
2. Determine relationships between element content and several physiographic site characteristics.
3. Detect trends of element content in lichens over time. .

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Statistical Procedures

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IV. Statistical Procedures

Paired t-tests

Nine of the sites that were visited during 1989-1992 were revisited in 2002-2005 (Table IV-1). Paired t-tests of these sites were used to determine if element content in lichens changed in pre-2000 and post-2000 samples. Paired t-tests are used where the entities measured in each sample are pairwise dependent. The goal is to test whether the mean difference between paired values is significantly different from zero (Ramsey and Schafer 1997). Nitrogen was analyzed from lichens in only 5 of the nine sites (bold Table IV-1)

Table V-2. Revisited Sites from which data were used for paired t-tests. Sites in bold are those where Nitrogen analysis was repeated.

TNF033
TNF069
TNF101
TNF116
TNF145
TNF146
TNF159
TNF189
TNF190

Thresholds

Thresholds of element content for “pristine” sites were estimated for each element and lichen species by using the non-parametric 97.5% quantile in the data recorded sites that are relatively free of human disturbance and pollution.

Software used for all statistical analyses was S-Plus 2000 (MathSoft 1988-1999).

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Percent Sulfur

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V. SUMMARY OF PERCENT SULFUR DATA ANALYSIS

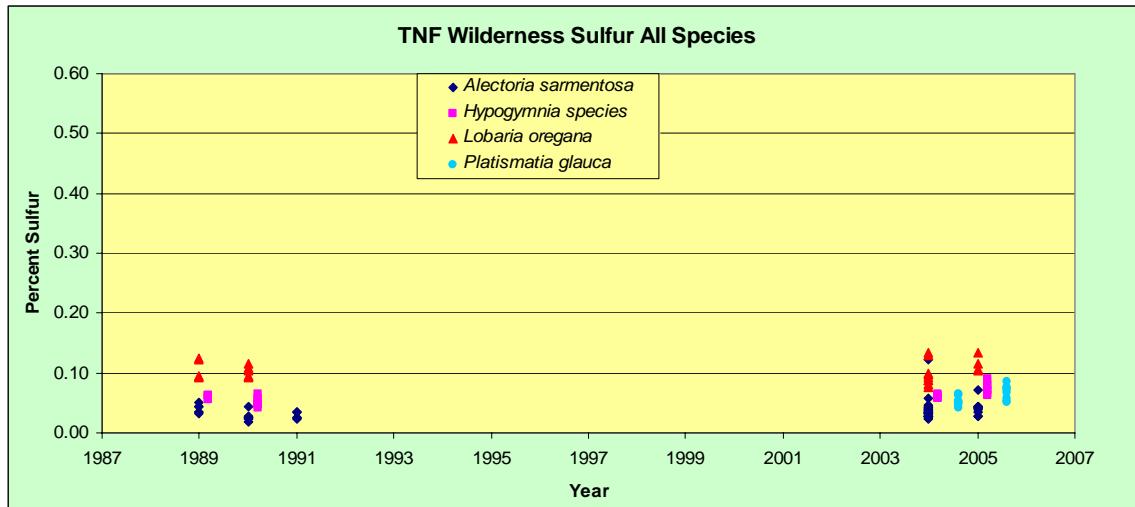


Figure V-1. Wilderness plot means of Percent Sulfur in All Species per year.

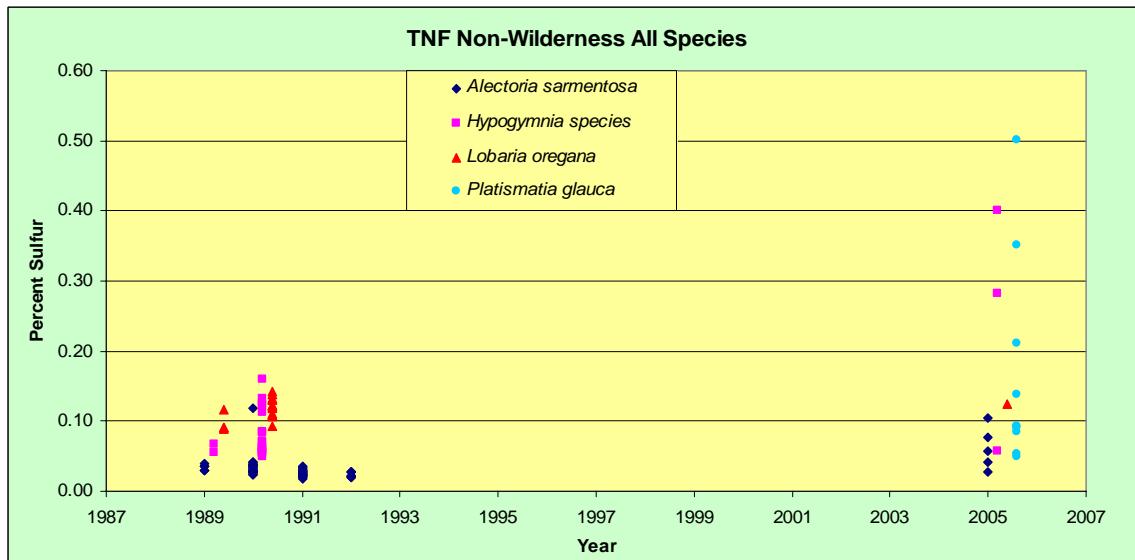


Figure V-2. Non-Wilderness plot means of Percent Sulfur in All Species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Percent Sulfur

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Alectoria sarmentosa

Table V-2. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Percent Sulfur content of *Alectoria sarmentosa* per year.

Percent Sulfur				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	0.0344	0.0019	0.0292	0.0395
1989	Wilderness	0.0402	0.0030	0.0326	0.0478
1990	Non-Wilderness	0.0352	0.0033	0.0283	0.0420
1990	Wilderness	0.0264	0.0030	0.0190	0.0338
1991	Non-Wilderness	0.0259	0.0011	0.0236	0.0281
1991	Wilderness	0.0287	0.0027	0.0213	0.0361
1992	Non-Wilderness	0.0236	0.0011	0.0210	0.0262
2004	Wilderness	0.0386	0.0039	0.0304	0.0467
2005	Non-Wilderness	0.0592	0.0113	0.0302	0.0883
2005	Wilderness	0.0418	0.0039	0.0329	0.0506

Summary of Statistical Tests:

$$t = -1.6884, \text{ df} = 8, \text{ p-value} = 0.1298$$

There is no evidence of a difference in Percent Sulfur content in *Alectoria sarmentosa* from pre-2000 and post 2000 samples (p-value = 0.1298).

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Percent Sulfur

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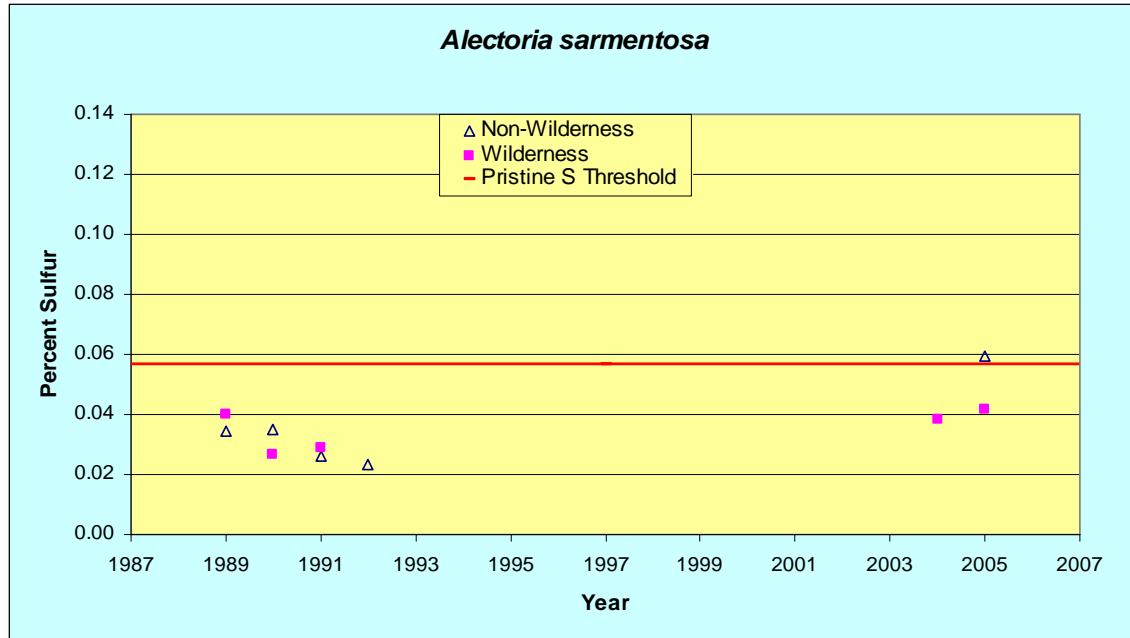


Figure V-3. Wilderness and Non-Wilderness yearly means of Percent Sulfur in *Alectoria sarmentosa* per year.

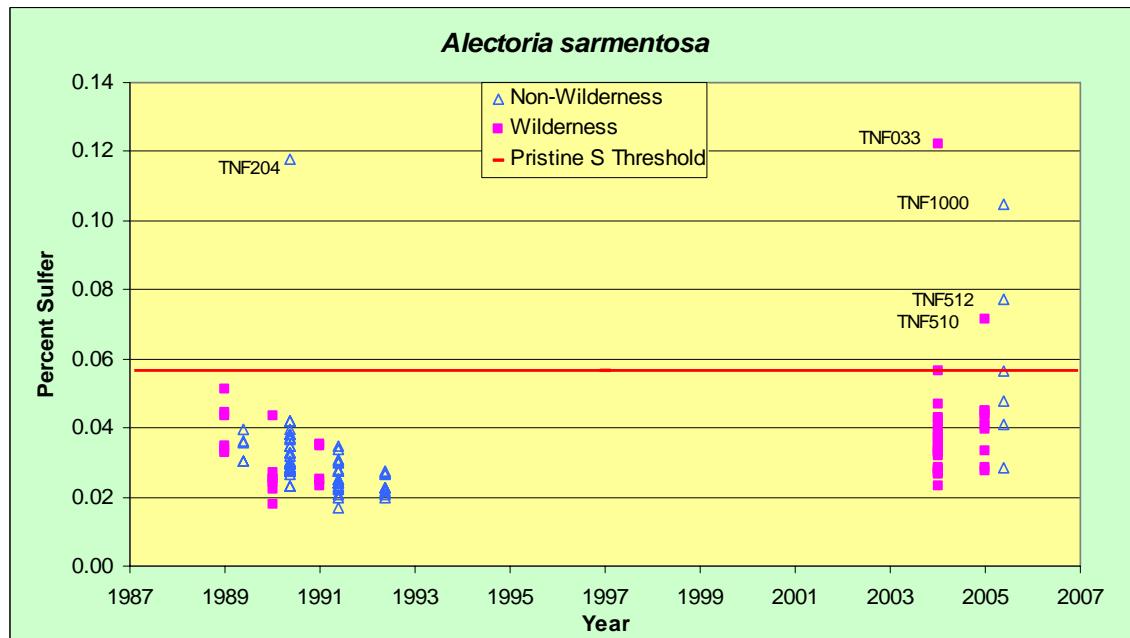


Figure V-4. Wilderness and Non-Wilderness plot means of Percent Sulfur in *Alectoria sarmentosa* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Percent Sulfur

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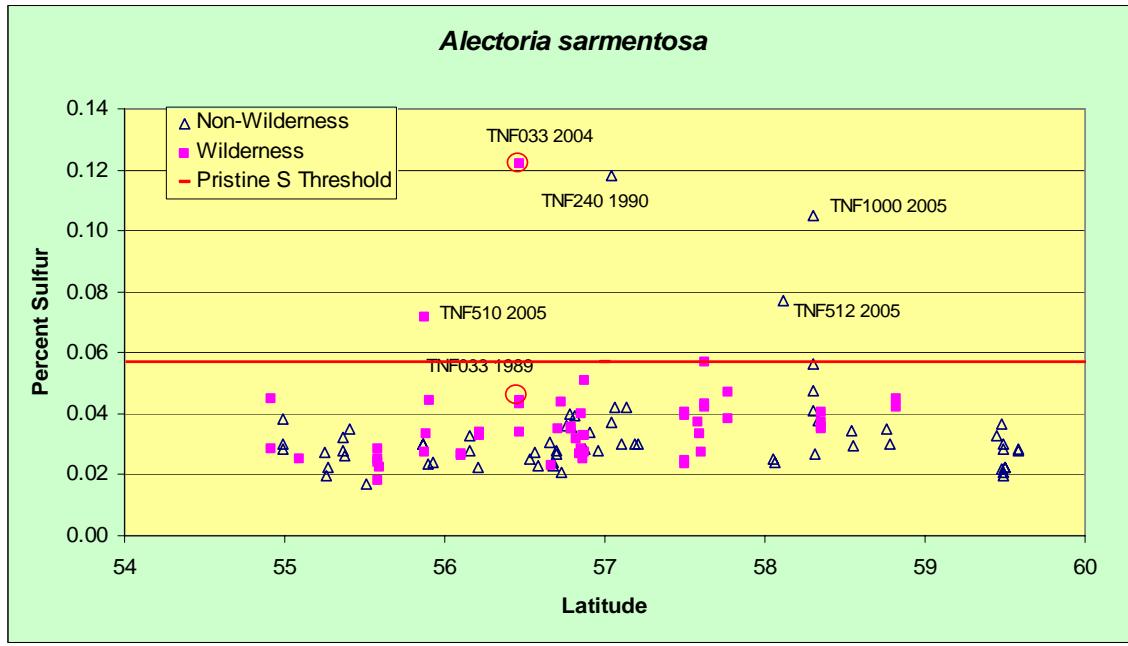


Figure V-5. Wilderness and Non-Wilderness plot means of Percent Sulfur in *Alectoria sarmentosa* vs. plot Latitude.

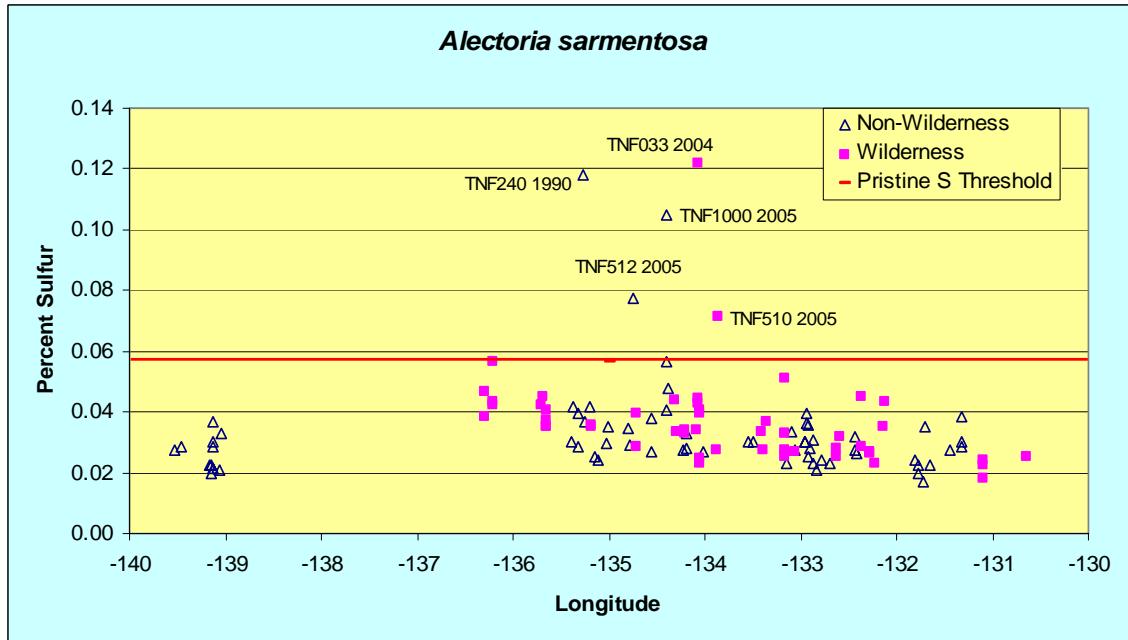


Figure V-6. Wilderness and Non-Wilderness plot means of Percent Sulfur in *Alectoria sarmentosa* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Percent Sulfur

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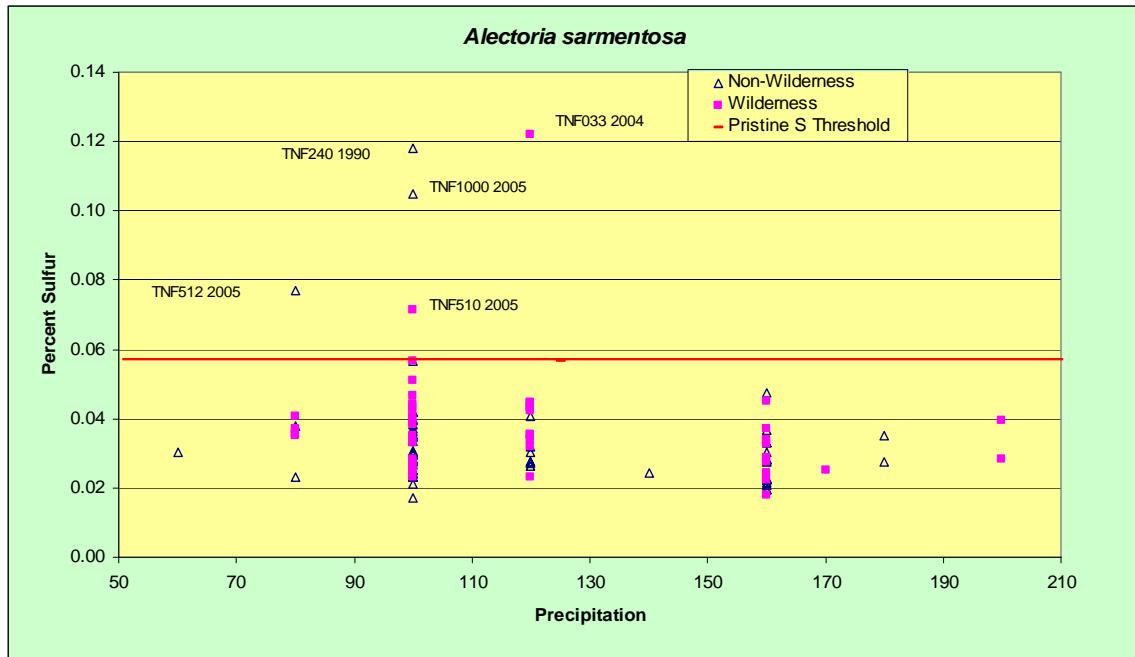


Figure V-7. Wilderness and Non-Wilderness plot means of Percent Sulfur in *Alectoria sarmentosa* vs. plot Precipitation.

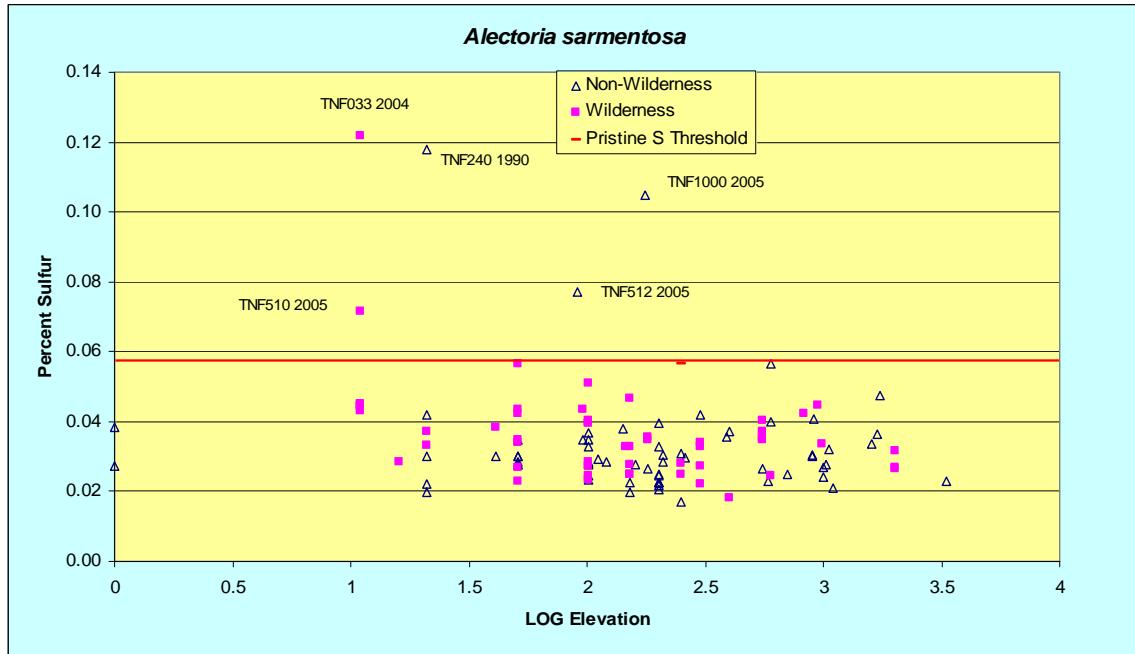


Figure V-8. Wilderness and Non-Wilderness plot means of Percent Sulfur in *Alectoria sarmentosa* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Percent Sulfur

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Hypogymnia species

In this series, all of the *Hypogymnia* species were included as a group.

Table V-3. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Percent Sulfur content of *Hypogymnia species* per year.

Percent Sulfur				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	0.0620	0.0060	-0.0142	0.1382
1989	Wilderness	0.0599	0.0014	0.0560	0.0637
1990	Non-Wilderness	0.0821	0.0078	0.0656	0.0986
1990	Wilderness	0.0511	0.0030	0.0438	0.0585
2004	Wilderness	0.0603	0.0012	0.0572	0.0634
2005	Non-Wilderness	0.2466	0.1004	-0.1854	0.6786
2005	Wilderness	0.0746	0.0032	0.0673	0.0820

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Percent Sulfur

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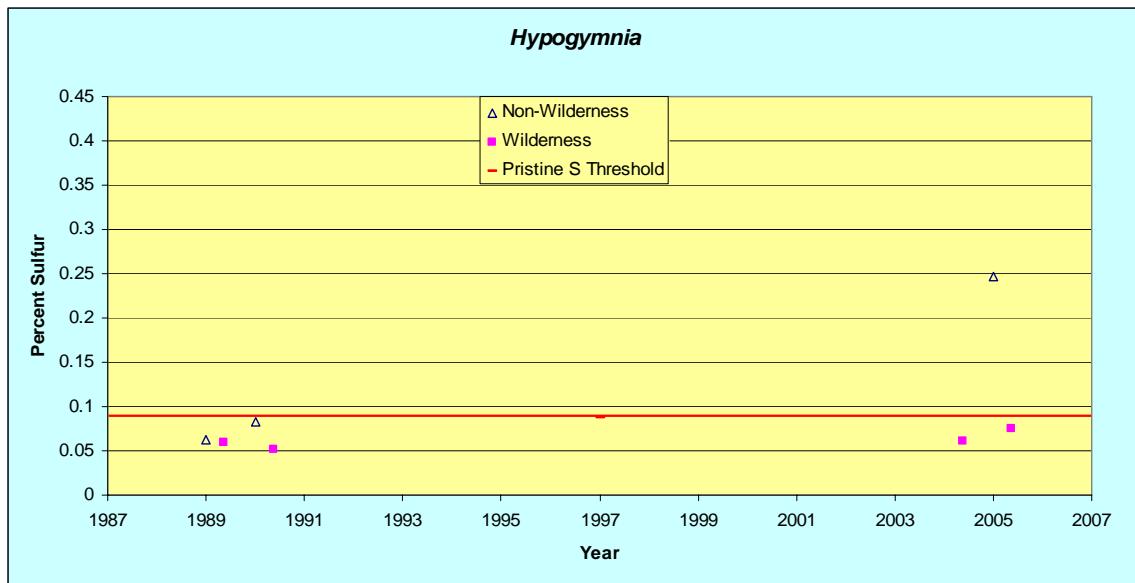


Figure V-9. Wilderness and Non-Wilderness yearly means of Percent Sulfur in *Hypogymnia* species per year.

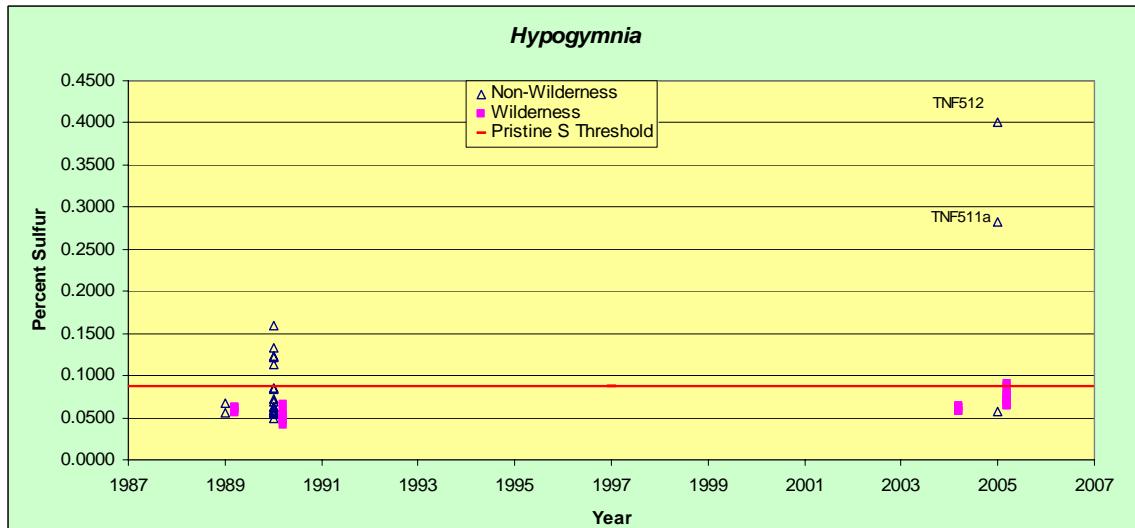


Figure V-10. Wilderness and Non-Wilderness plot means of Percent Sulfur in *Hypogymnia* species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Percent Sulfur

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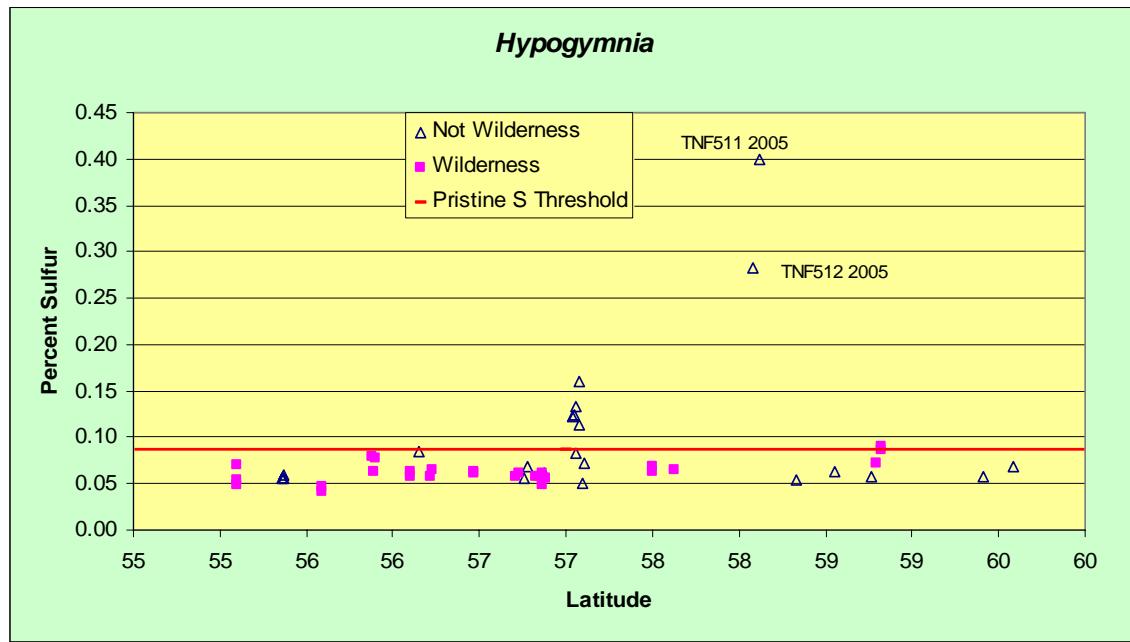


Figure V-11. Wilderness and Non-Wilderness plot means of Percent Sulfur in *Hypogymnia* species vs. plot Latitude.

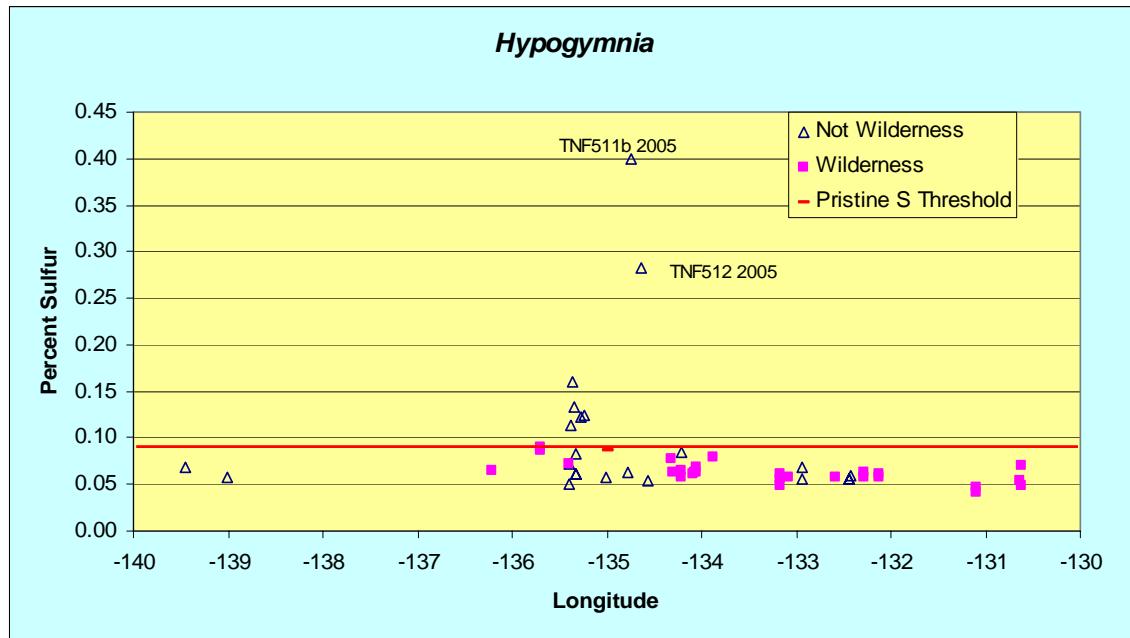


Figure V-12. Wilderness and Non-Wilderness plot means of Percent Sulfur in *Hypogymnia* species vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Percent Sulfur

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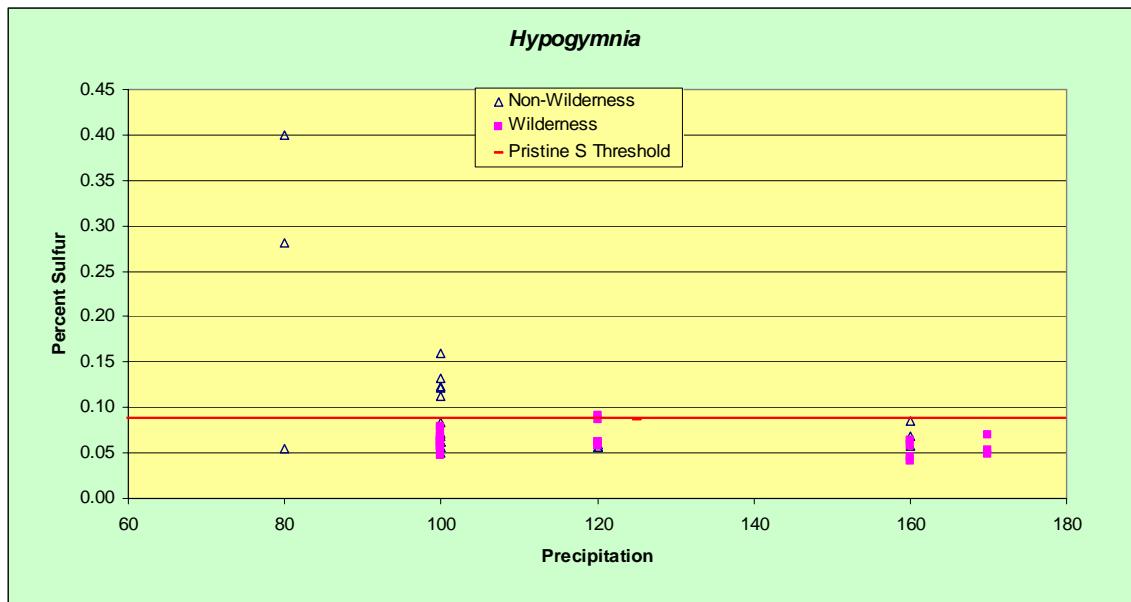


Figure V-13. Wilderness and Non-Wilderness plot means of Percent Sulfur in *Hypogymnia* species vs. plot Precipitation.

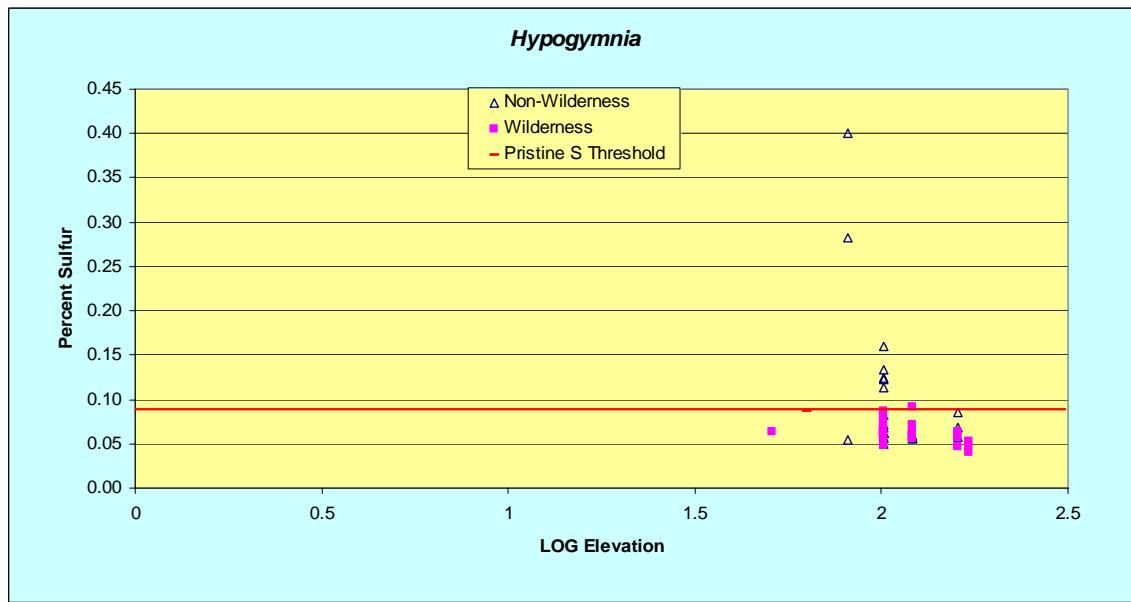


Figure V-14. Wilderness and Non-Wilderness plot means of Percent Sulfur in *Hypogymnia* species vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Percent Sulfur

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Lobaria oregana

Table V-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Percent Sulfur content of *Lobaria oregana* per year.

Percent Sulfur				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	0.0966	0.0065	0.0760	0.1172
1989	Wilderness	0.1055	0.0073	0.0851	0.1259
1990	Non-Wilderness	0.1203	0.0038	0.1122	0.1285
1990	Wilderness	0.1016	0.0036	0.0922	0.1109
2004	Wilderness	0.0980	0.0067	0.0824	0.1136
2005	Non-Wilderness	0.1242	NA	NA	NA
2005	Wilderness	0.1147	0.0067	0.0932	0.1361

Summary of Statistical Tests:

$$t = -0.1448, df = 8, p\text{-value} = 0.8884$$

There is no evidence of a difference in Percent Sulfur content in *Lobaria oregana* from pre-2000 and post 2000 samples (p-value = 0.8884).

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Percent Sulfur

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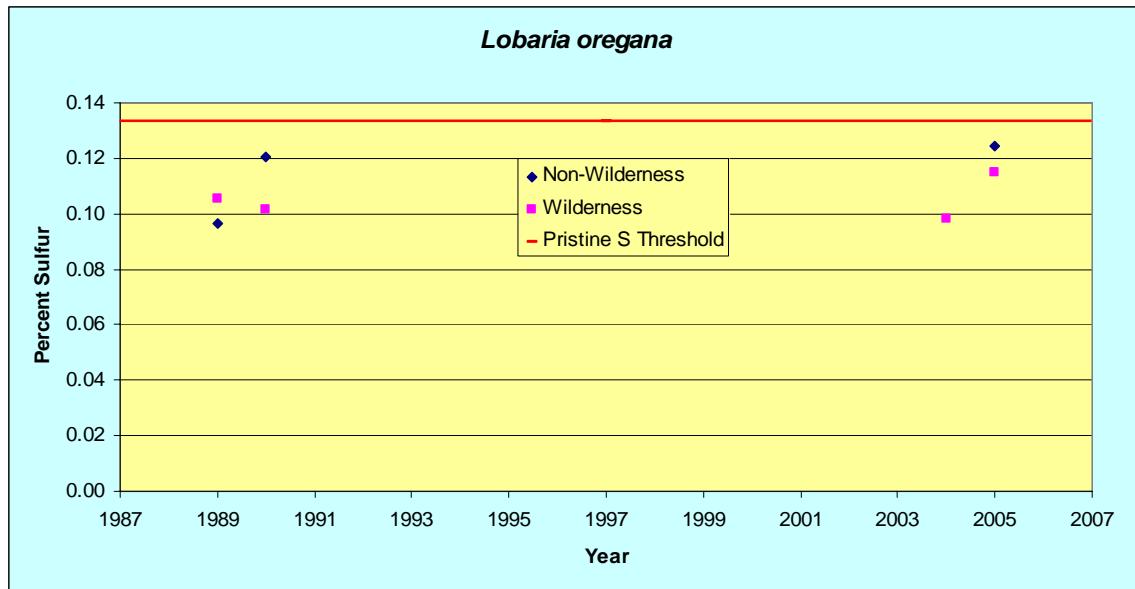


Figure V-15. Wilderness and Non-Wilderness yearly means of Percent Sulfur in *Lobaria oregana* per year.

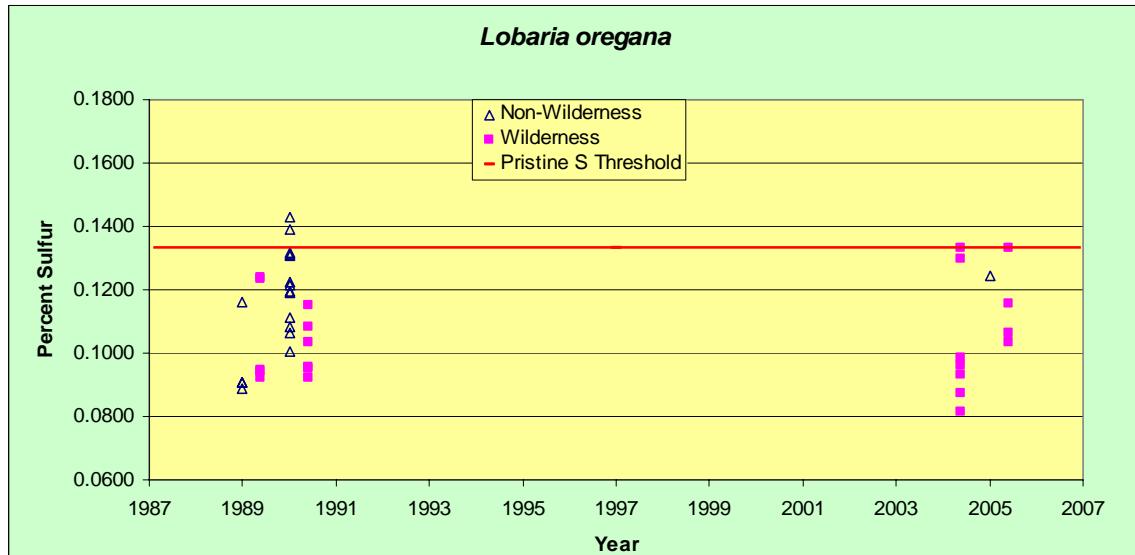


Figure V-16. Wilderness and Non-Wilderness plot means of Percent Sulfur in *Lobaria oregana* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Percent Sulfur

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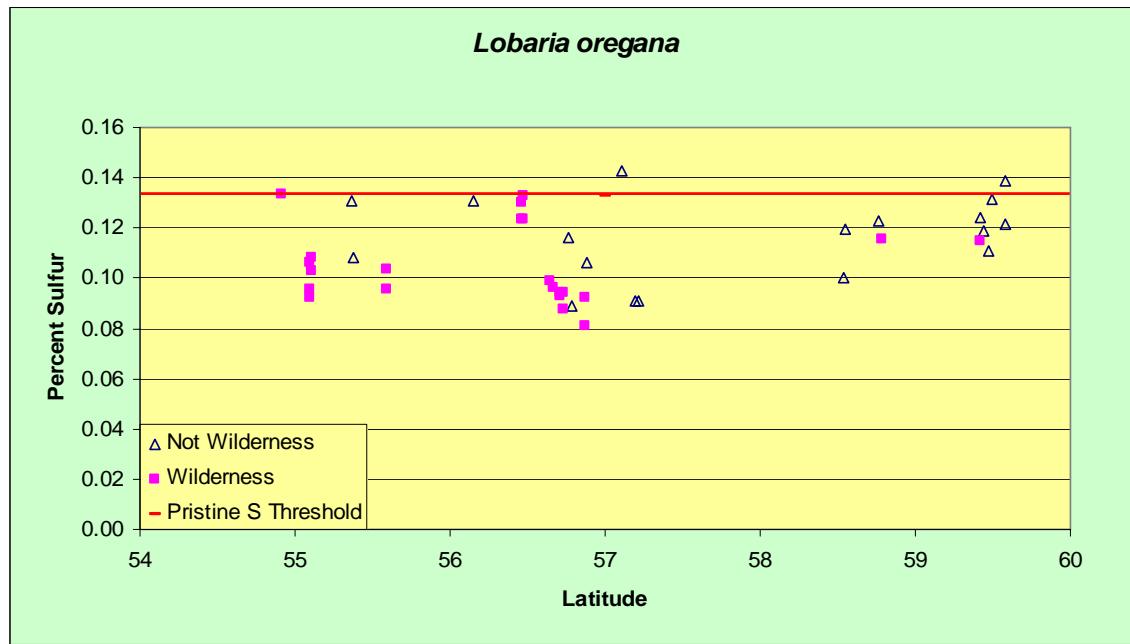


Figure V-17. Wilderness and Non-Wilderness plot means of Percent Sulfur in *Lobaria oregana* vs. plot Latitude.

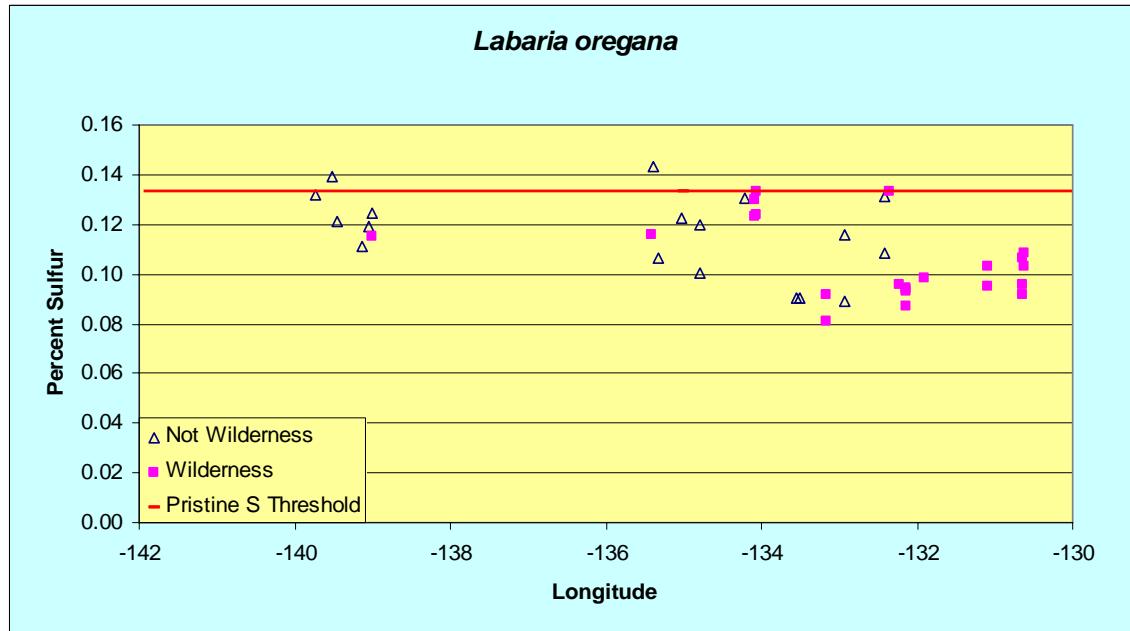


Figure V-18. Wilderness and Non-Wilderness plot means of Percent Sulfur in *Lobaria oregana* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Percent Sulfur

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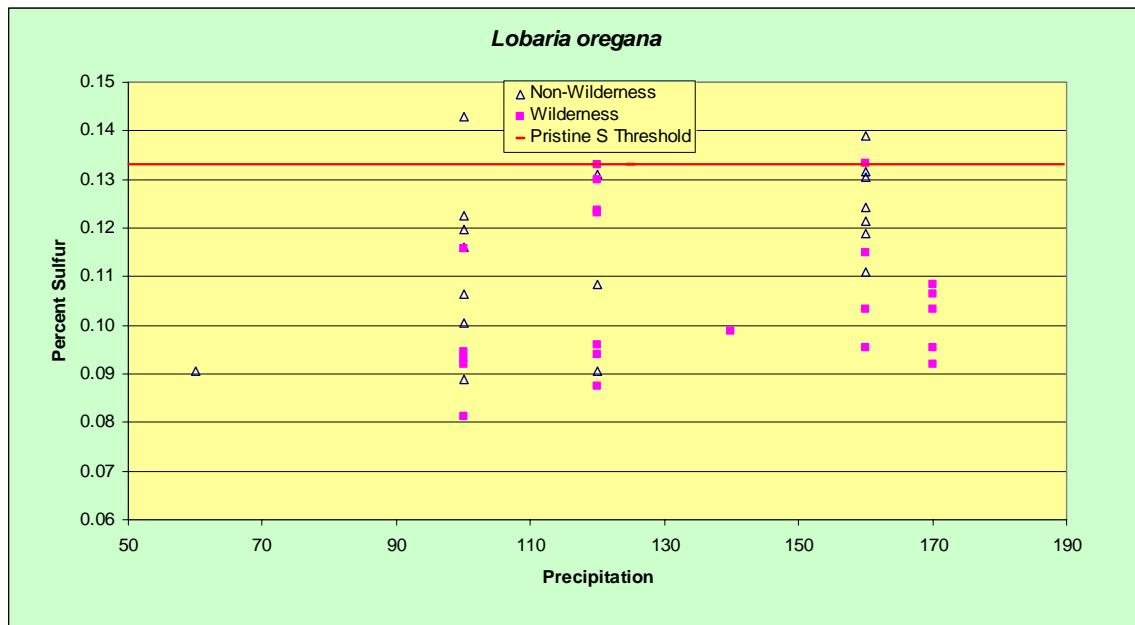


Figure V-19. Wilderness and Non-Wilderness plot means of Percent Sulfur in *Lobaria oregana* vs. plot Precipitation.

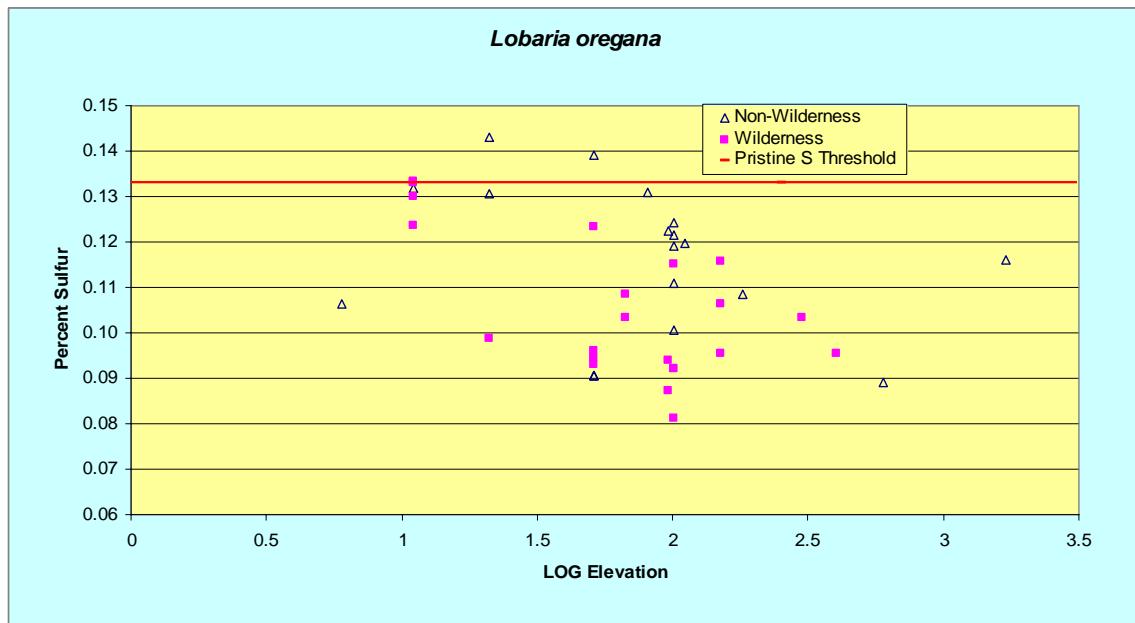


Figure V-20. Wilderness and Non-Wilderness plot means of Percent Sulfur in *Lobaria oregana* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Percent Sulfur

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Platismatia glauca

Table V-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Percent Sulfur content of *Platismatia glauca* per year.

Percent Sulfur				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	0.053483	0.002511	0.047802	0.059164
2005	Non-Wilderness	0.166472	0.046996	0.06016	0.272784
2005	Wilderness	0.066829	0.004328	0.056595	0.077063

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Percent Sulfur

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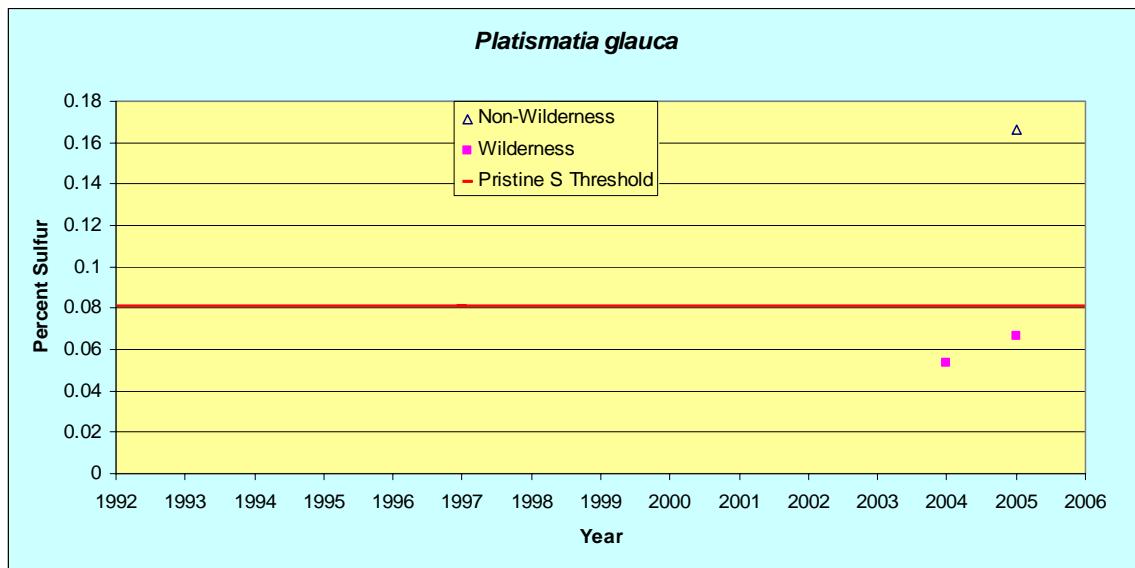


Figure V-21. Wilderness and Non-Wilderness yearly means of Percent Sulfur in *Platismatia glauca* per year.

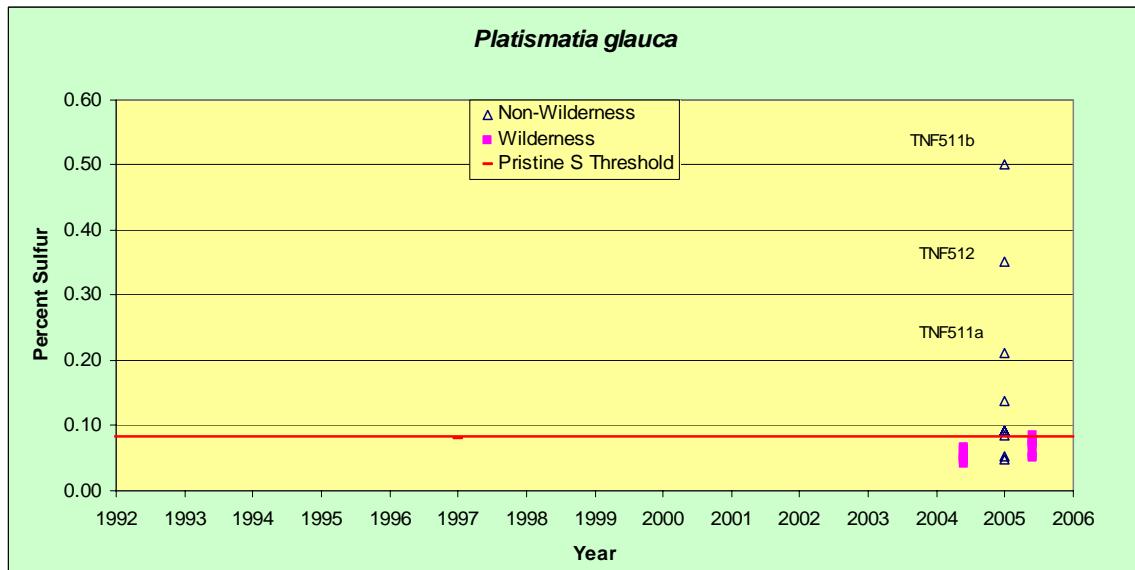


Figure V-22. Wilderness and Non-Wilderness plot means of Percent Sulfur in *Platismatia glauca* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Percent Sulfur

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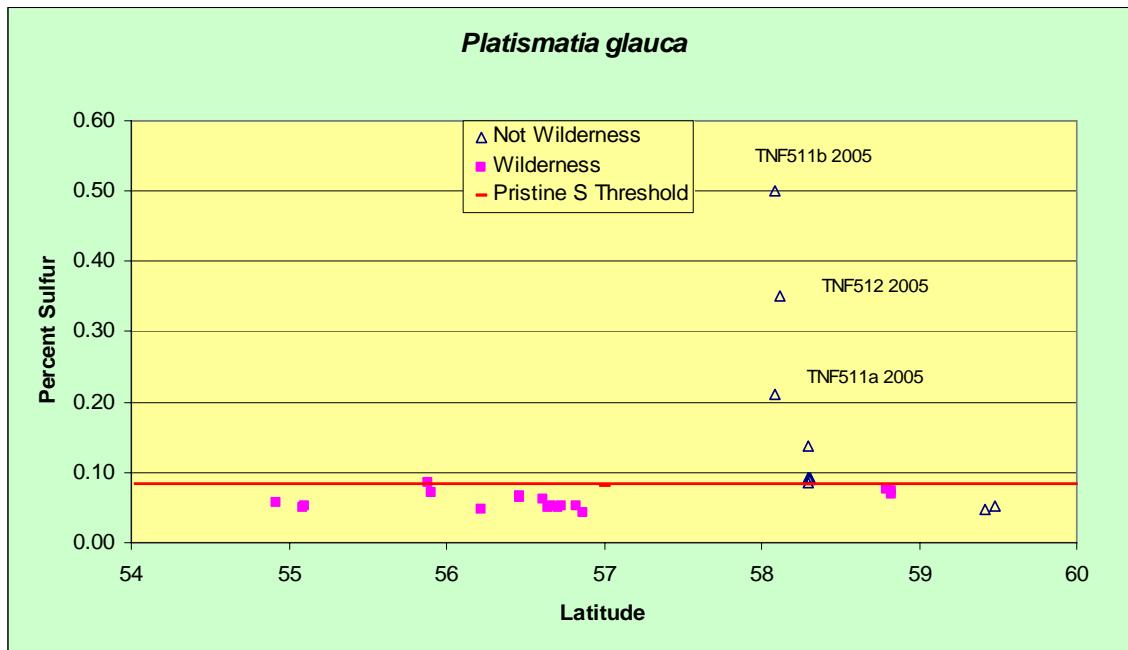


Figure V-23. Wilderness and Non-Wilderness plot means of Percent Sulfur in *Platismatia glauca* vs. plot Latitude.

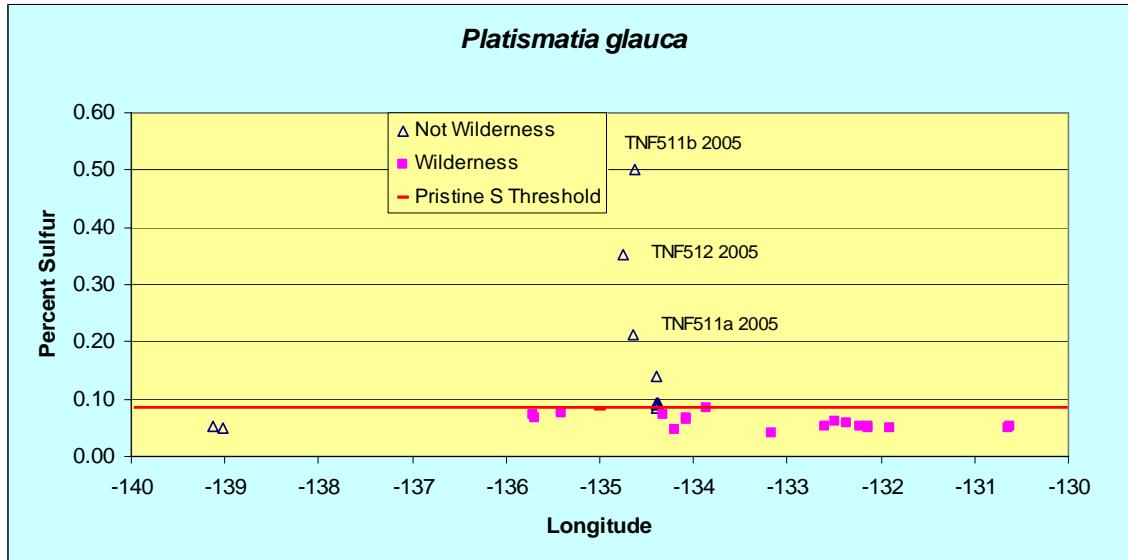


Figure V-24. Wilderness and Non-Wilderness plot means of Percent Sulfur in *Platismatia glauca* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Percent Sulfur

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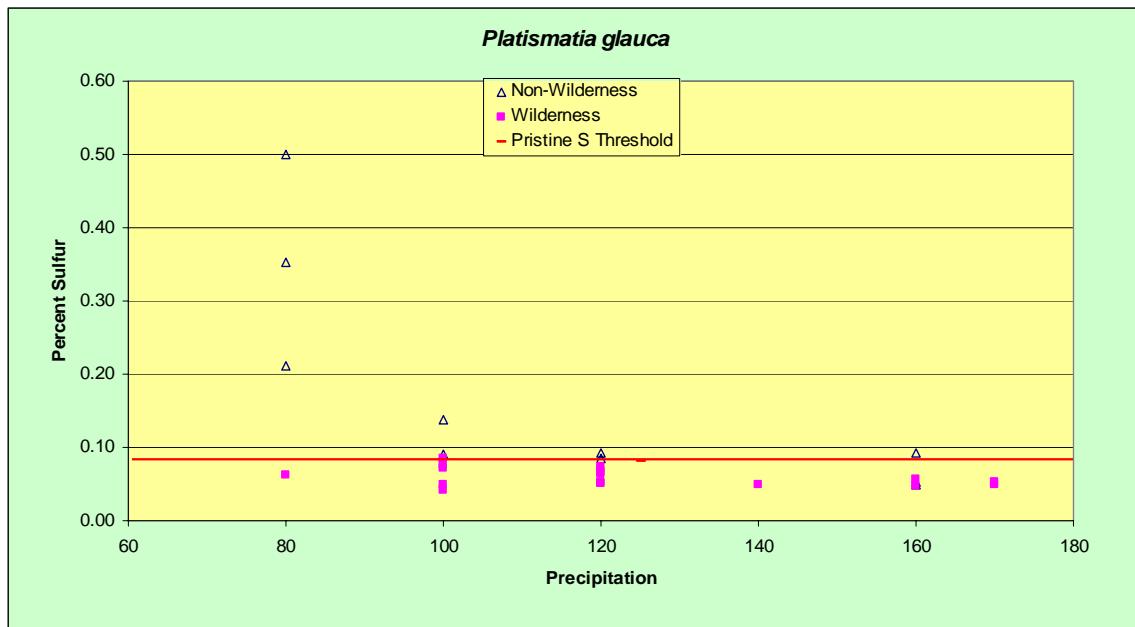


Figure V-25. Wilderness and Non-Wilderness plot means of Percent Sulfur in *Platismatia glauca* vs. plot Precipitation.

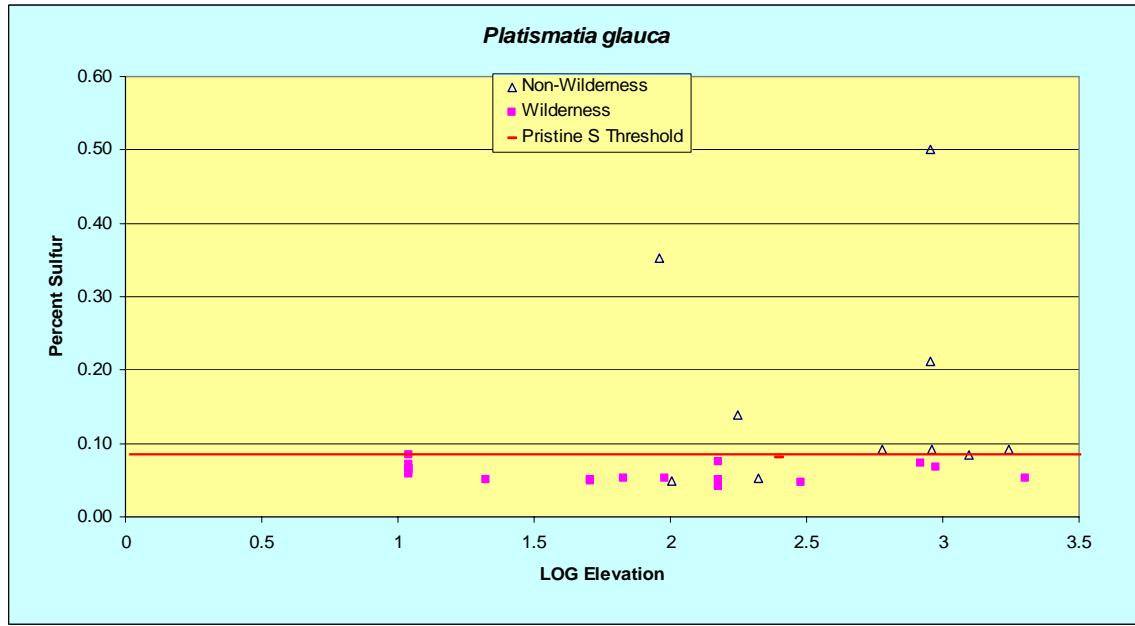


Figure V-26. Wilderness and Non-Wilderness plot means of Percent Sulfur in *Platismatia glauca* vs. plot Log-Elevation.

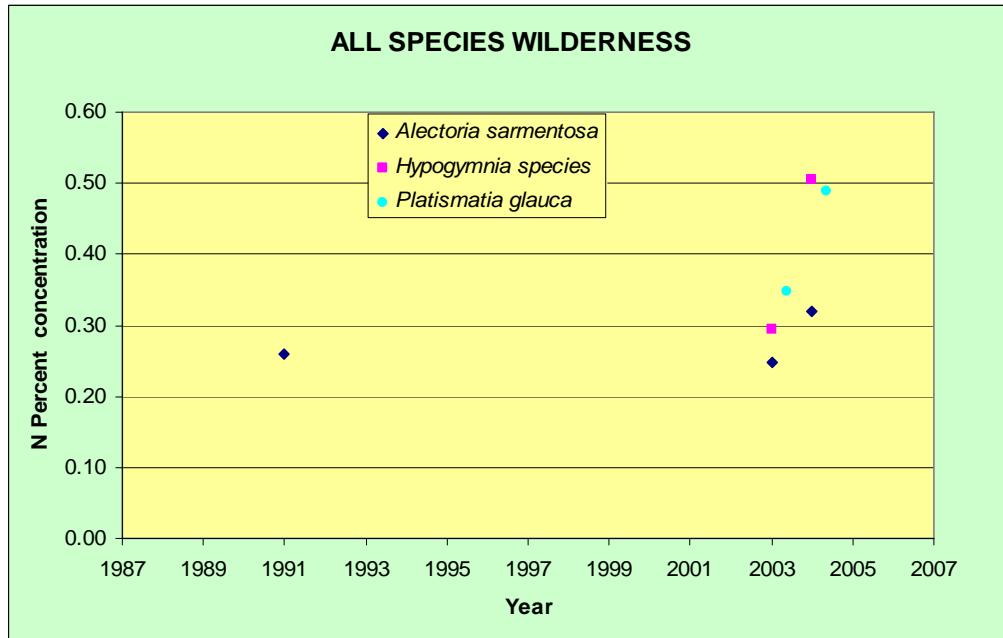
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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

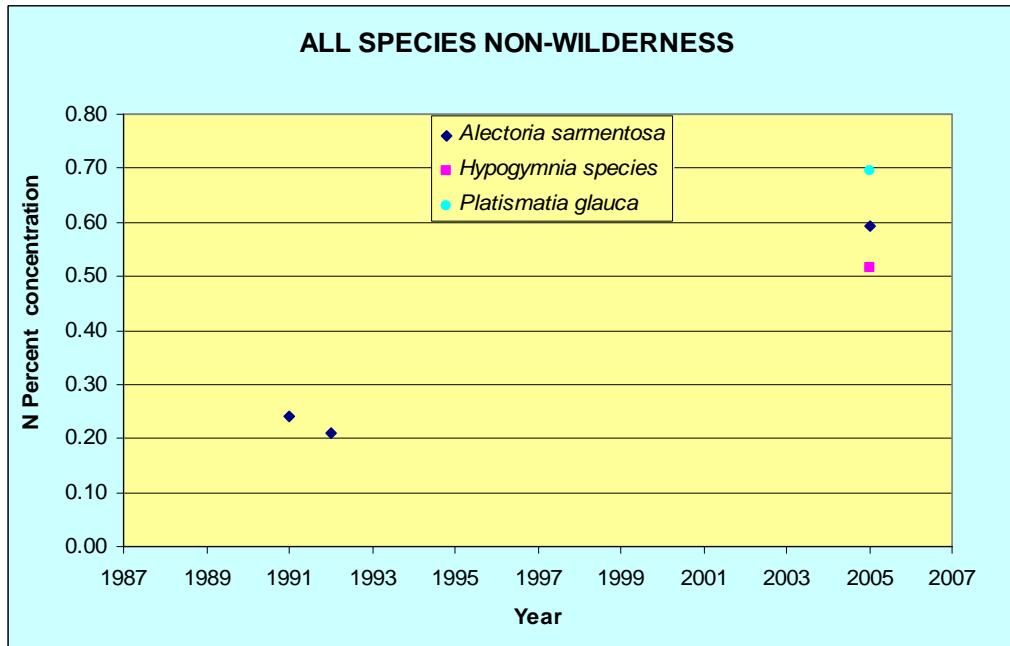
Percent Nitrogen

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VI. SUMMARY OF PERCENT NITROGEN DATA ANALYSIS



**Figure VI-1. Wilderness plot means of Percent Nitrogen
in All Species per year.**



**Figure VI-2. Non-Wilderness plot means of Percent Nitrogen
in All Species per year.**

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Percent Nitrogen

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Alectoria sarmentosa

Summary Statistics:

Table VI-2. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Percent Nitrogen content of *Alectoria sarmentosa* per year.

Percent Notrogen				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1991	Non-Wilderness	0.24	0.0082	0.2236	0.2578
1991	Wilderness	0.26	0.0184	0.2089	0.3111
1992	Non-Wilderness	0.24	0.0082	0.2236	0.2578
2003	Wilderness	0.25	0.0724	-0.6719	1.1684
2004	Wilderness	0.32	0.0084	0.3031	0.3378
2005	Wilderness	0.46	0.0503	0.3453	0.5730
2005	Non-Wilderness	0.59	0.1142	0.2996	0.8865

Summary of Statistical Tests:

$$t = -0.9604, \text{ df} = 4, \text{ p-value} = 0.3912$$

There is no evidence of a difference in Percent Nitrogen content in *Alectoria sarmentosa* from pre-2000 and post 2000 samples (p-value = 0.3912).

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Percent Nitrogen

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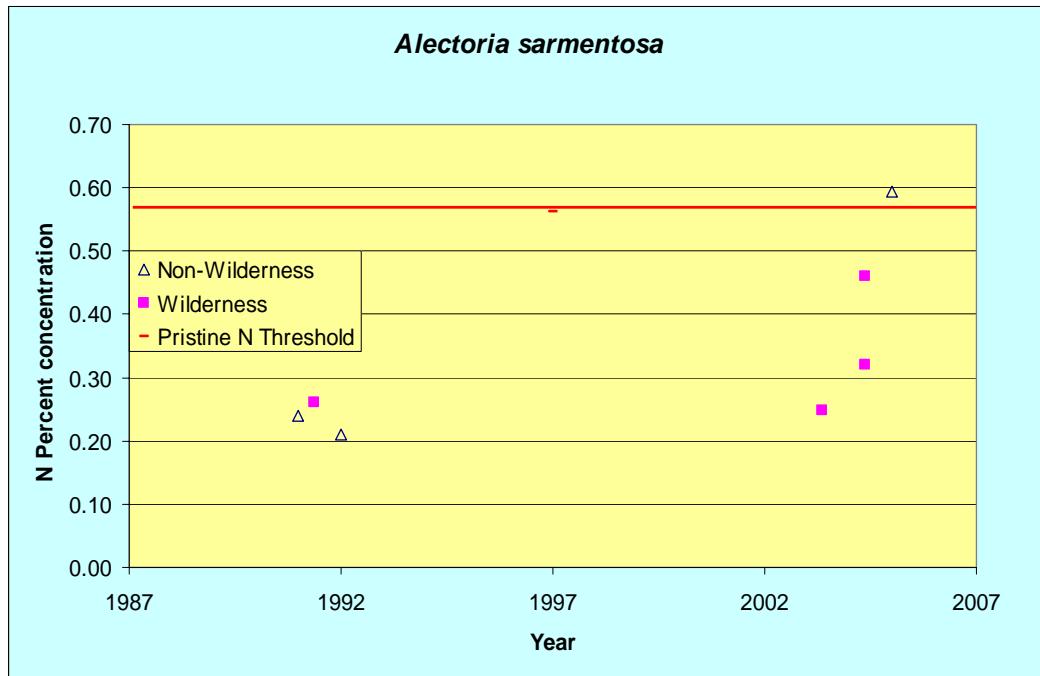


Figure VI-3. Wilderness and Non-Wilderness yearly means of Percent Nitrogen in *Alectoria sarmentosa* per year.

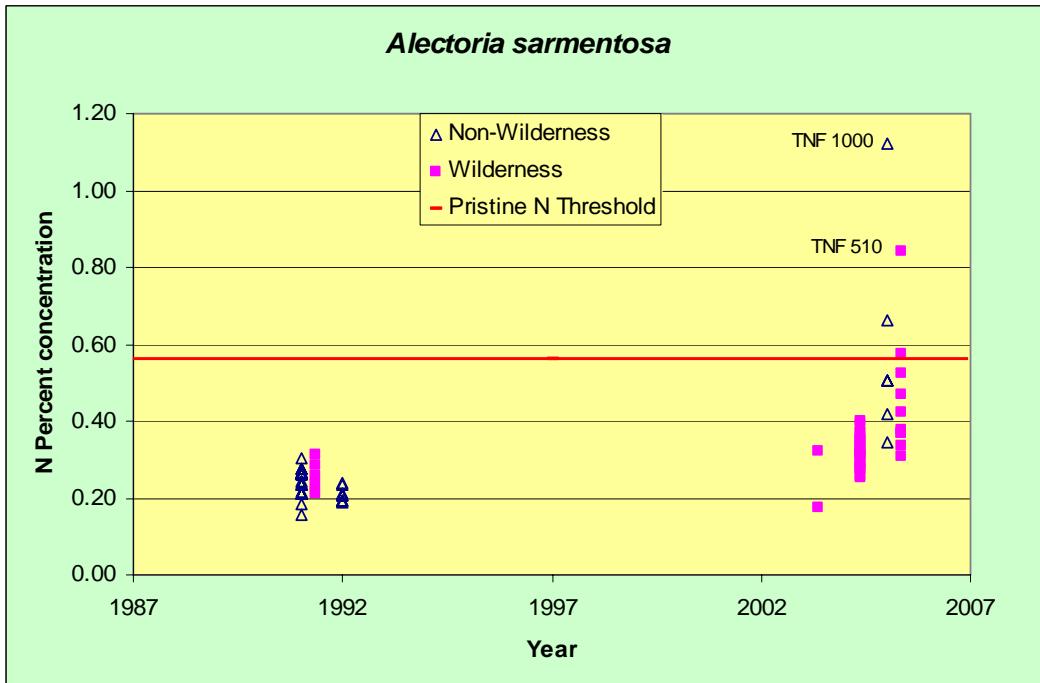


Figure VI-4. Wilderness and Non-Wilderness plot means of Percent Nitrogen in *Alectoria sarmentosa* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Percent Nitrogen

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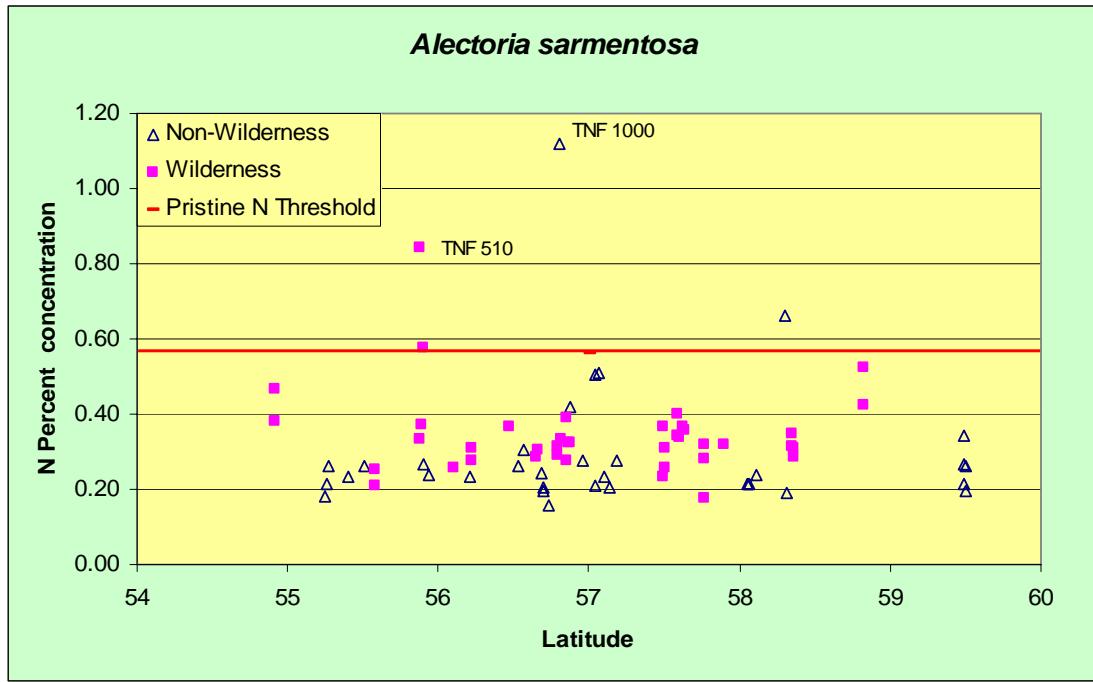


Figure VI-5. Wilderness and Non-Wilderness plot means of Percent Nitrogen in *Alectoria sarmentosa* vs. plot Latitude.

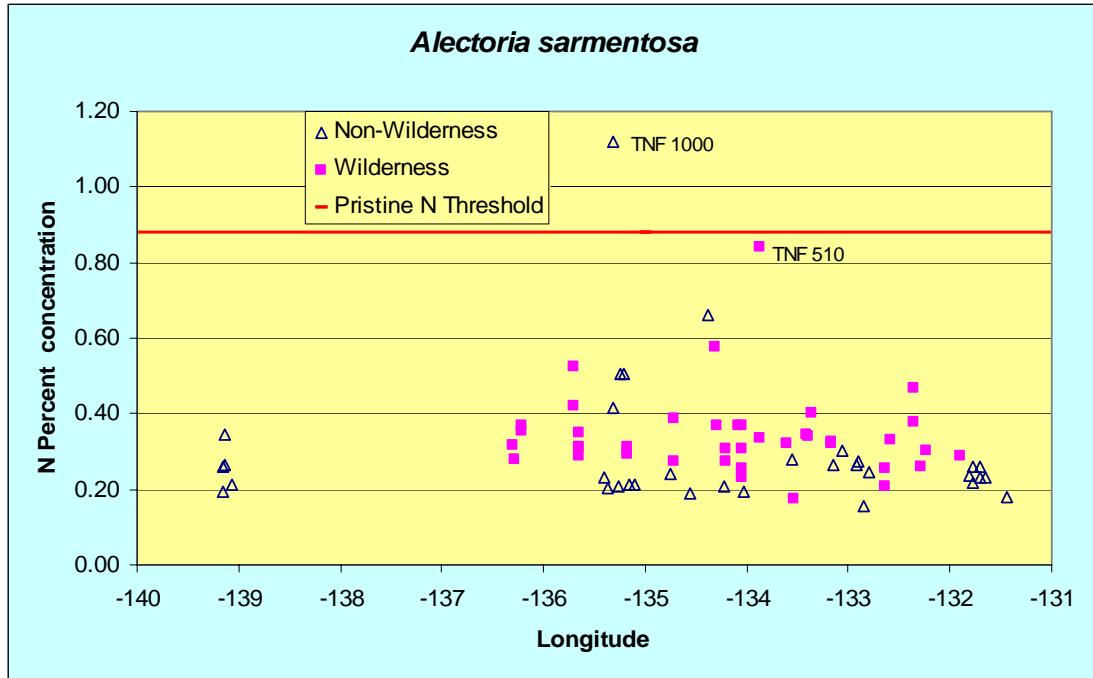


Figure VI-6. Wilderness and Non-Wilderness plot means of Percent Nitrogen in *Alectoria sarmentosa* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Percent Nitrogen

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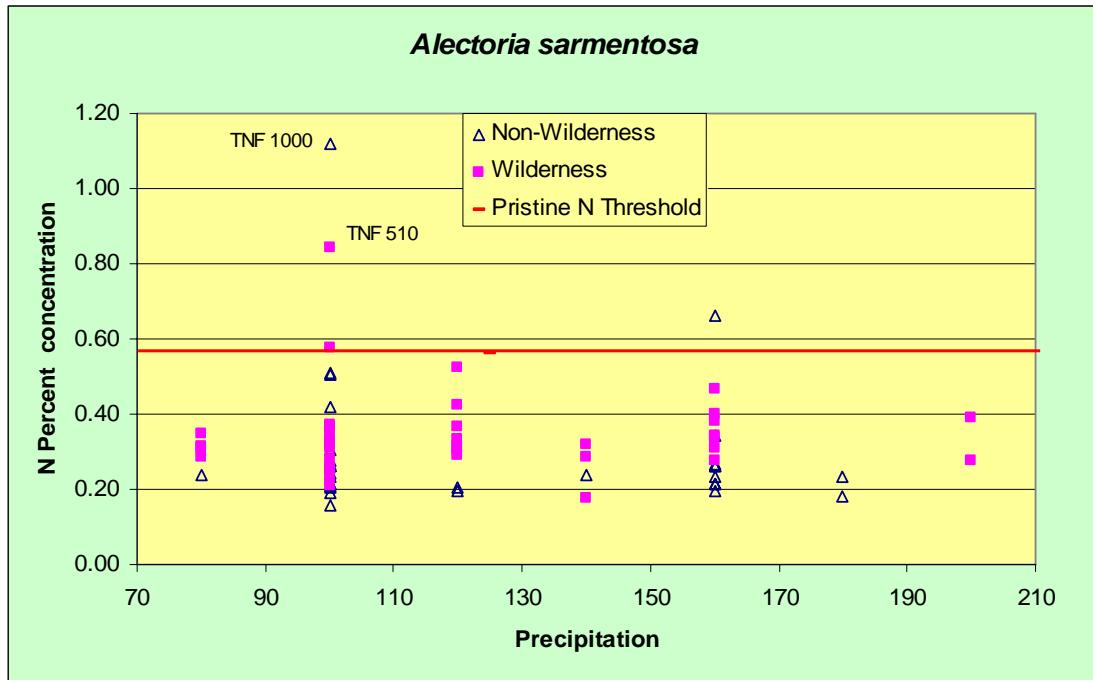


Figure VI-7. Wilderness and Non-Wilderness plot means of Percent Nitrogen in *Alectoria sarmentosa* vs. plot Precipitation.

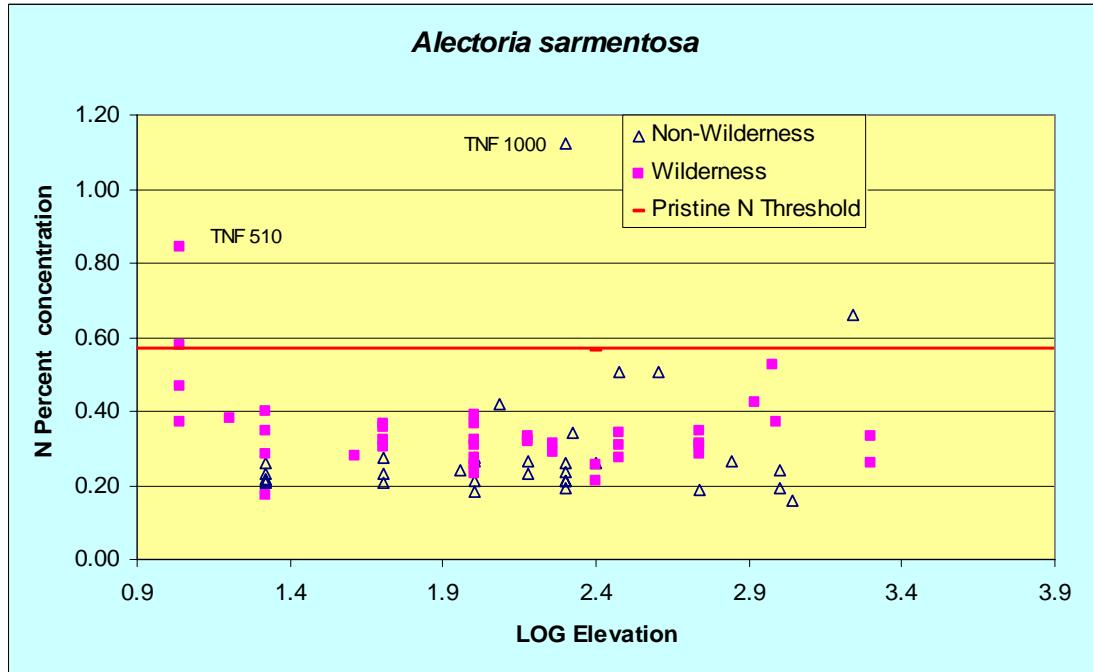


Figure VI-8. Wilderness and Non-Wilderness plot means of Percent Nitrogen in *Alectoria sarmentosa* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Percent Nitrogen

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Hypogymnia species

In this series, all of the *Hypogymnia* species were included as a group.

Table VI-3. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Percent Nitrogen content of *Hypogymnia species* per year.

Percent Nitrogen				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2003	Wilderness	0.29	NA	NA	NA
2004	Wilderness	0.50	0.0144	0.4670	0.5409
2005	Wilderness	0.65	0.0495	0.5393	0.7676
2005	Non-Wilderness	0.71	0.0465	0.5067	0.9069

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Percent Nitrogen

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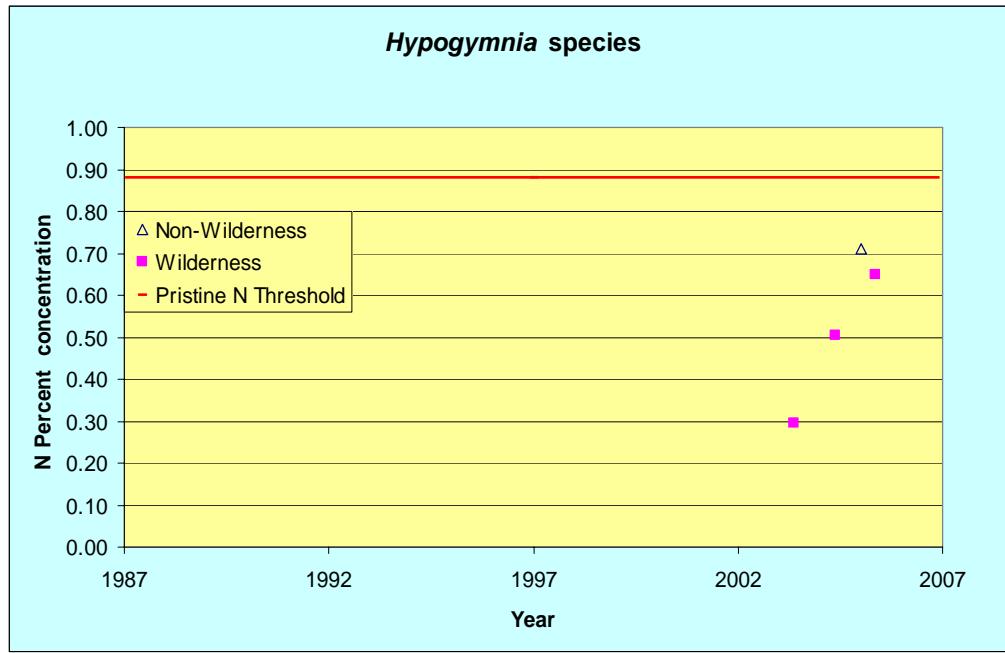


Figure VI-9. Wilderness and Non-Wilderness yearly means of Percent Nitrogen in *Hypogymnia* species per year.

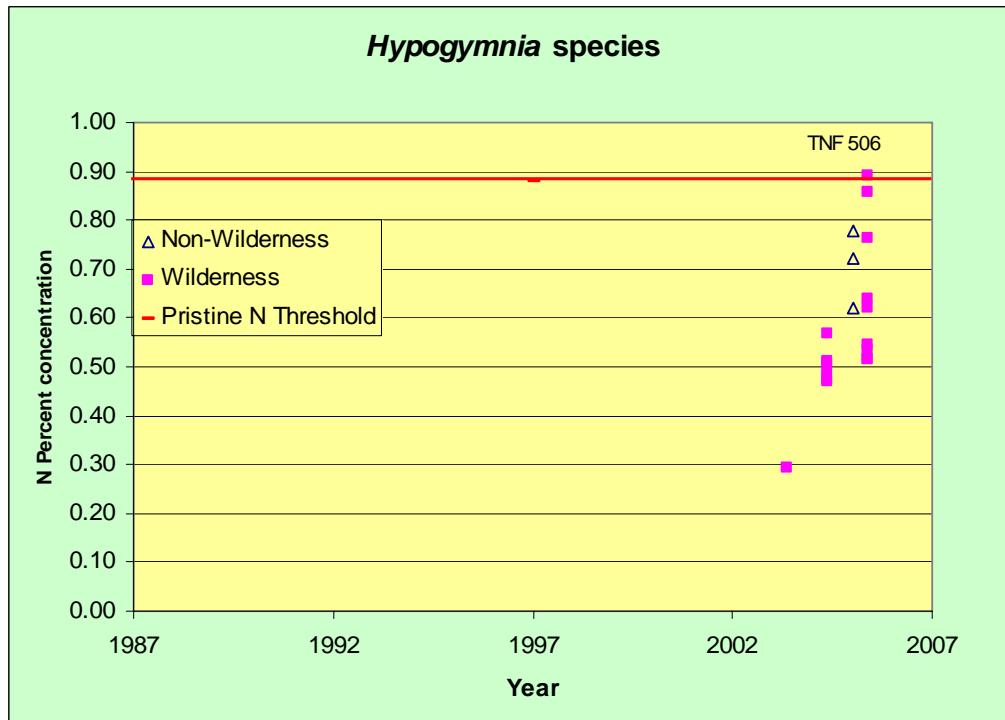


Figure VI-10. Wilderness and Non-Wilderness plot means of Percent Nitrogen in *Hypogymnia* species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Percent Nitrogen

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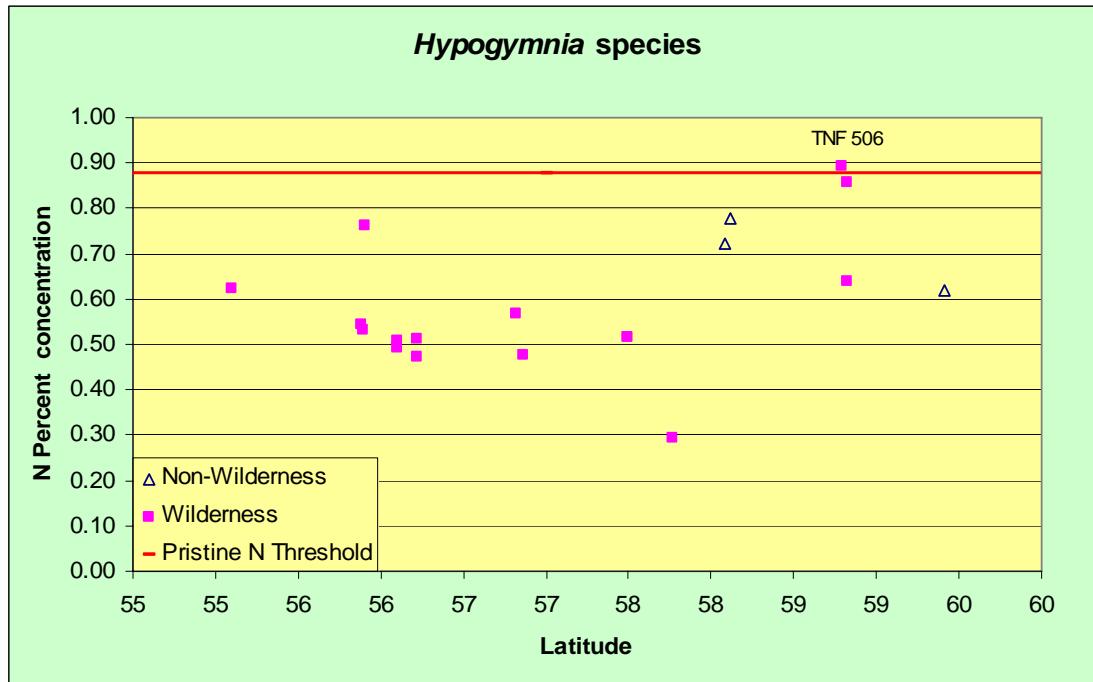


Figure VI-11. Wilderness and Non-Wilderness plot means of Percent Nitrogen in *Hypogymnia* species vs. plot Latitude.

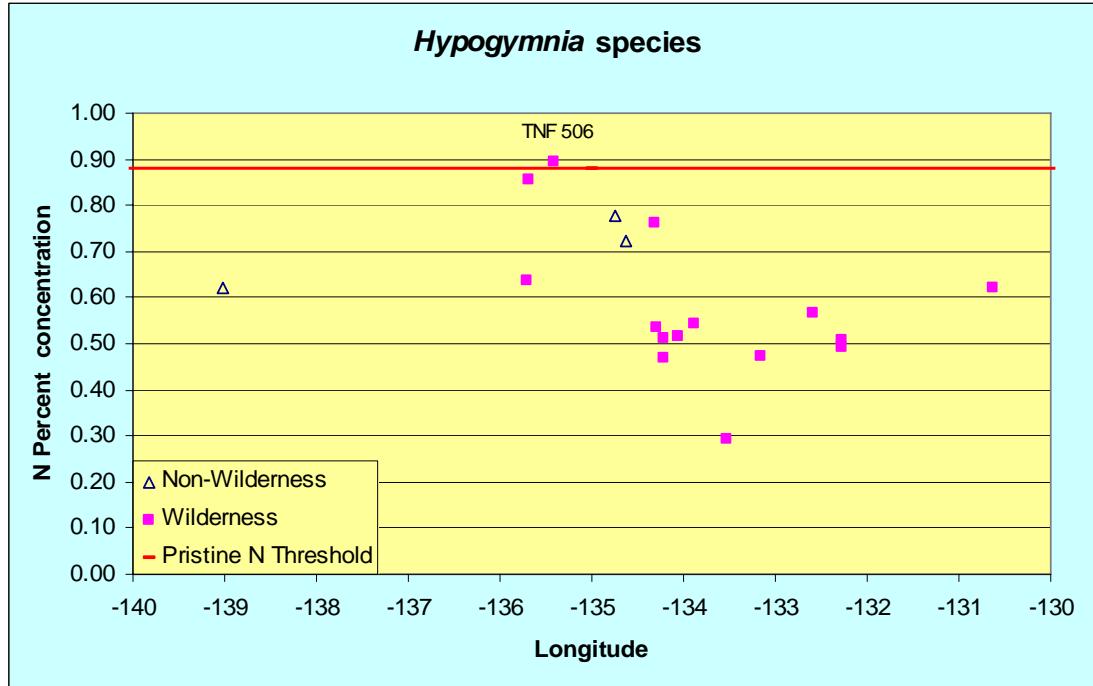


Figure VI-12. Wilderness and Non-Wilderness plot means of Percent Nitrogen in *Hypogymnia* species vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Percent Nitrogen

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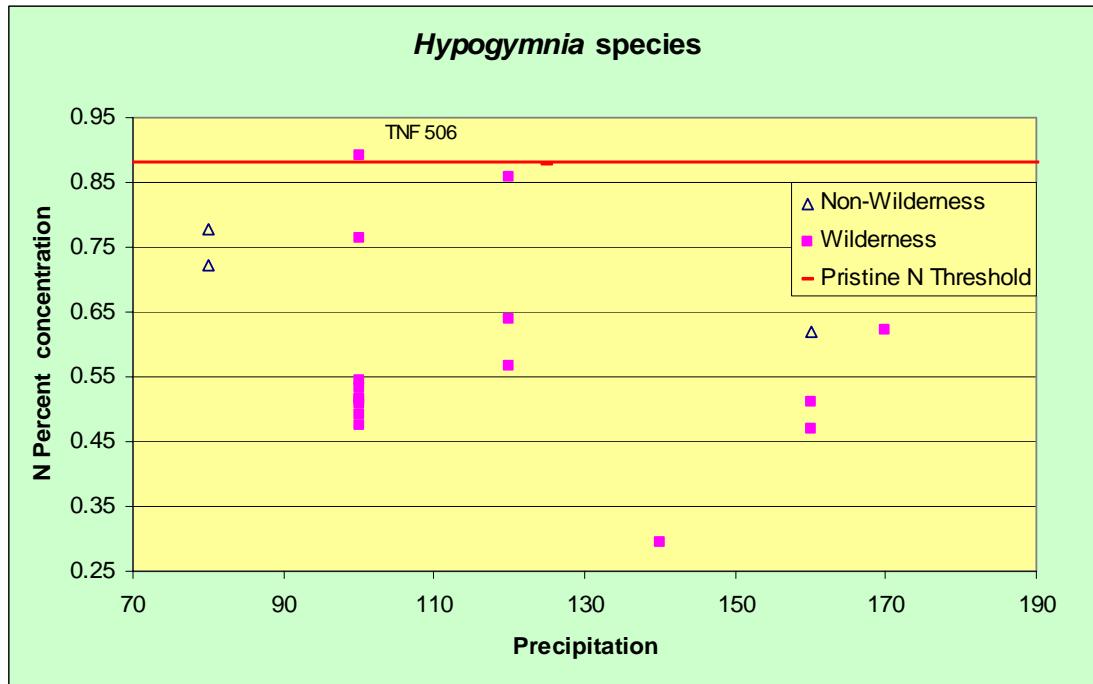


Figure VI-13. Wilderness and Non-Wilderness plot means of Percent Nitrogen in *Hypogymnia* species vs. plot Precipitation.

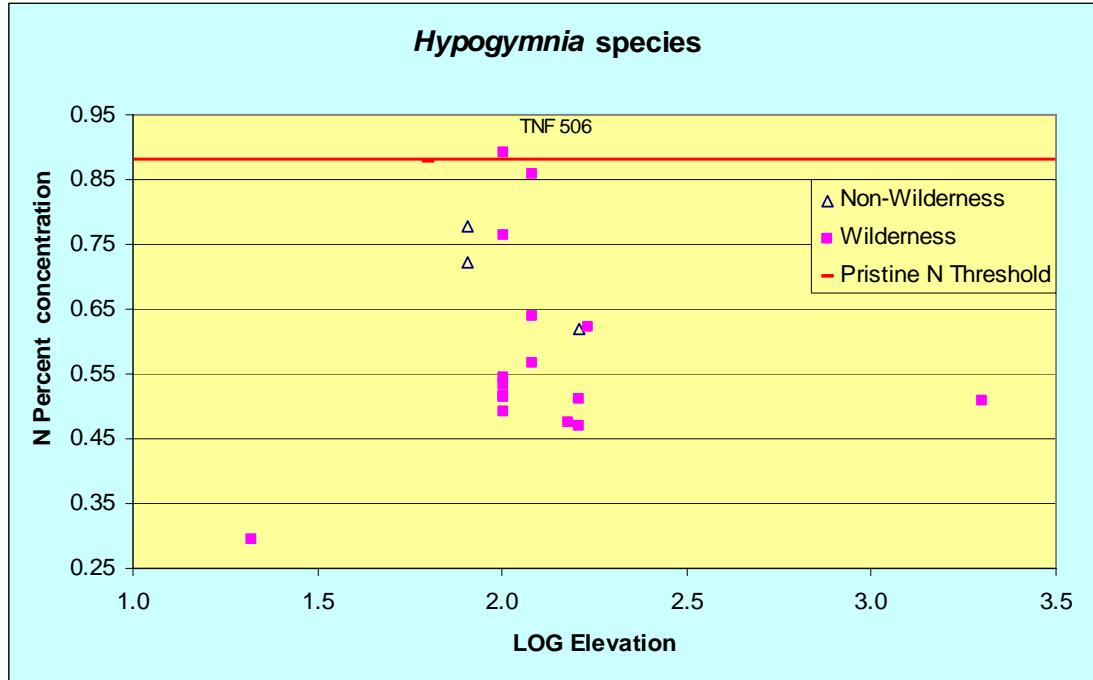


Figure VI-14. Wilderness and Non-Wilderness plot means of Percent Nitrogen in *Hypogymnia* species vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Percent Nitrogen

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Platismatia glauca

Table VI-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Percent Nitrogen content of *Platismatia glauca* per year.

Percent Nitrogen				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2003	Wilderness	0.35	NA	NA	NA
2004	Wilderness	0.49	0.0192	0.4435	0.5321
2005	Wilderness	0.64	0.0379	0.5529	0.7321
2005	Non-Wilderness	0.73	0.0520	0.6118	0.8472

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Percent Nitrogen

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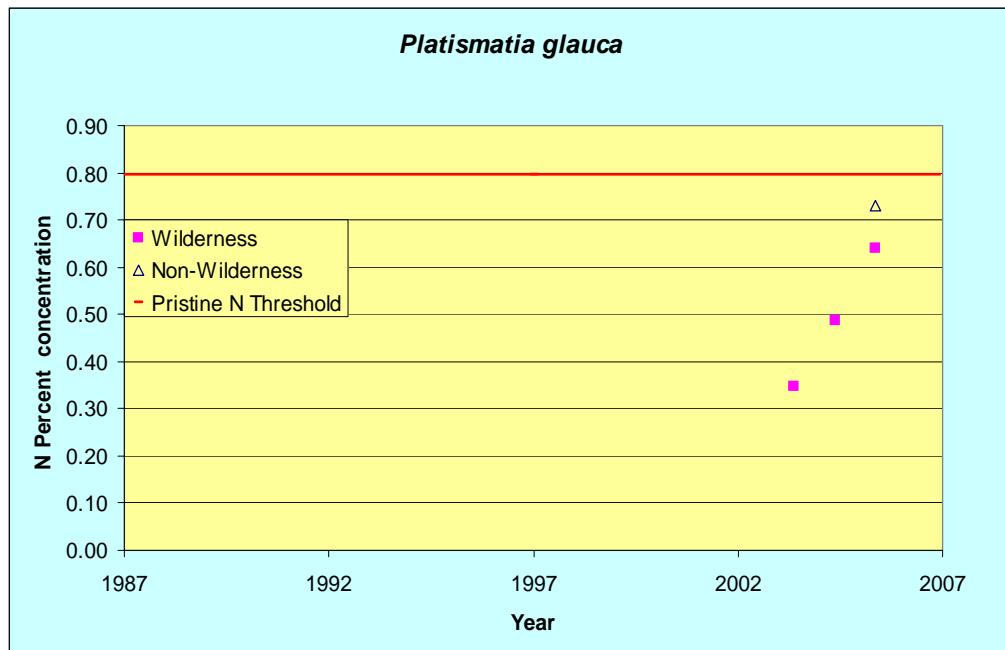


Figure VI-15. Wilderness and Non-Wilderness yearly means of Percent Nitrogen in *Platismatia glauca* per year.

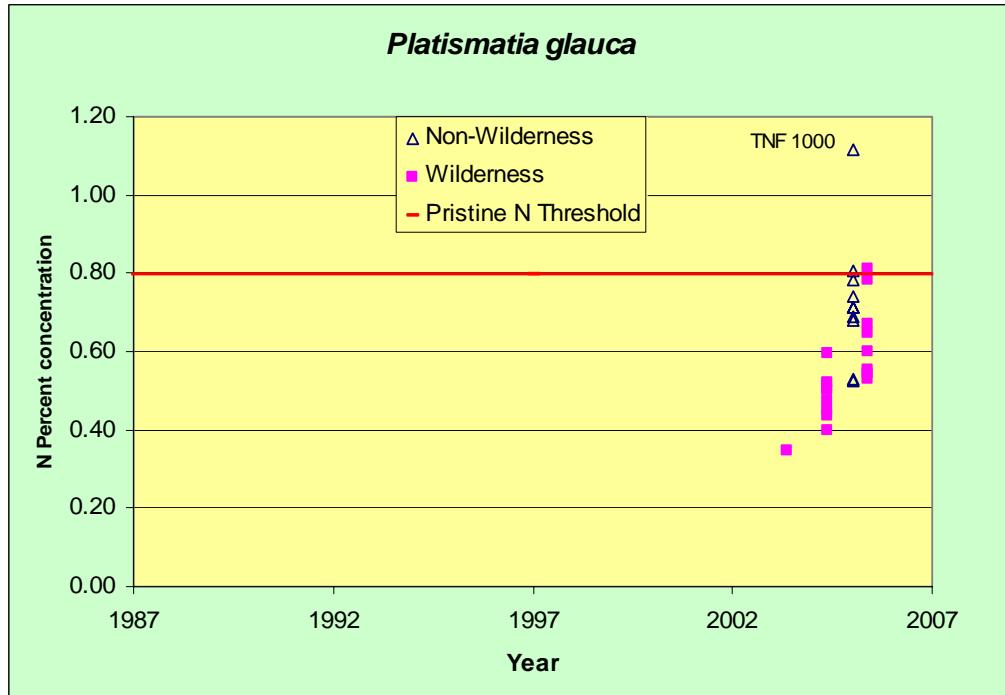


Figure VI-16. Wilderness and Non-Wilderness plot means of Percent Nitrogen in *Platismatia glauca* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Percent Nitrogen

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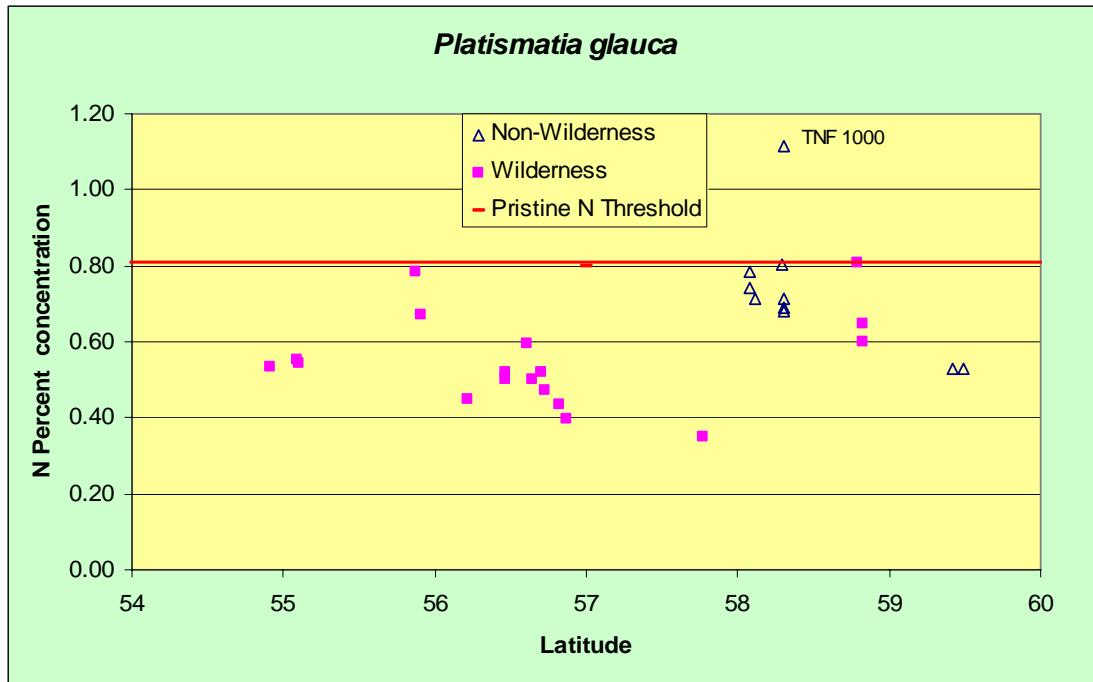


Figure VI-17. Wilderness and Non-Wilderness plot means of Percent Nitrogen in *Platismatia glauca* vs. plot Latitude.

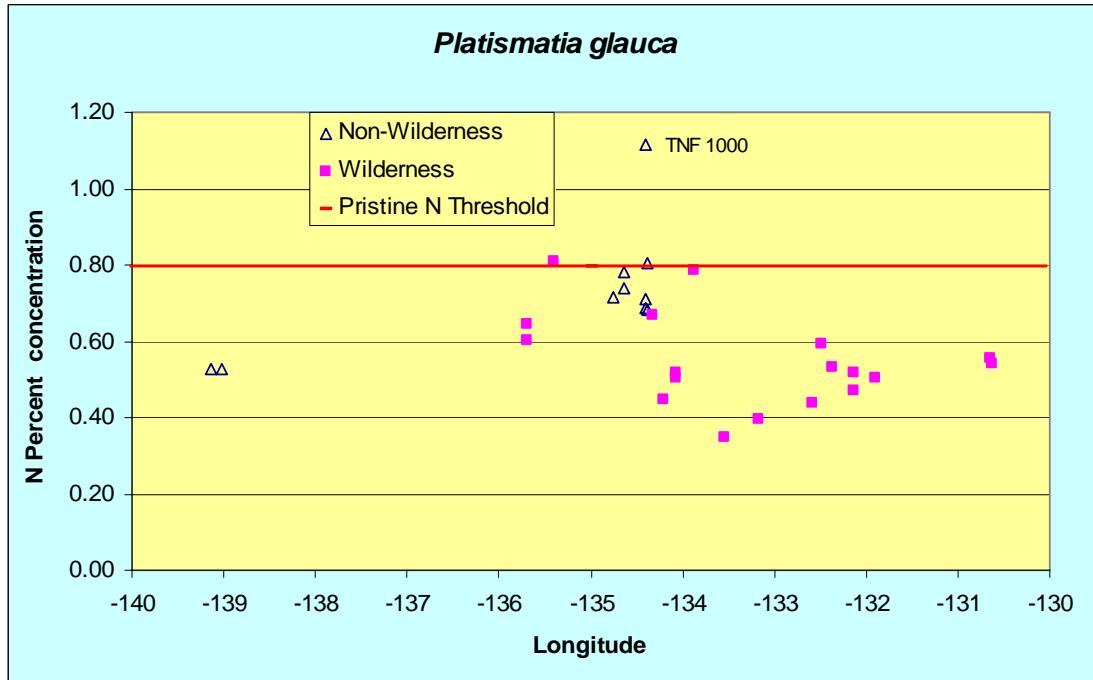


Figure VI-18. Wilderness and Non-Wilderness plot means of Percent Nitrogen in *Platismatia glauca* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Percent Nitrogen

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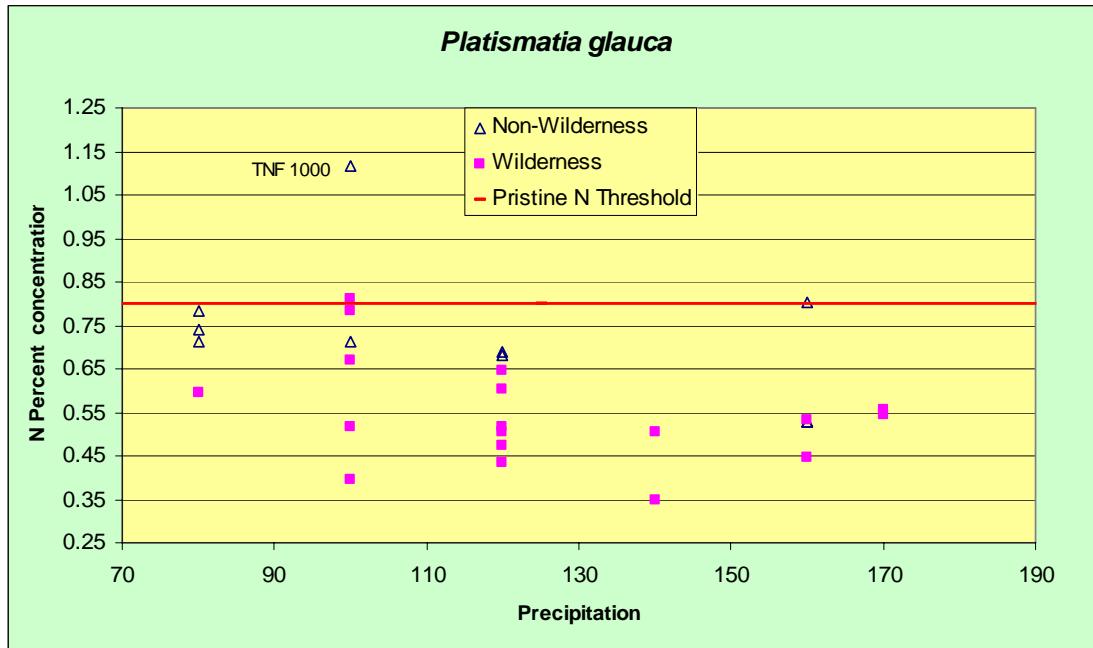


Figure VI-19. Wilderness and Non-Wilderness plot means of Percent Nitrogen in *Platismatia glauca* vs. plot Precipitation.

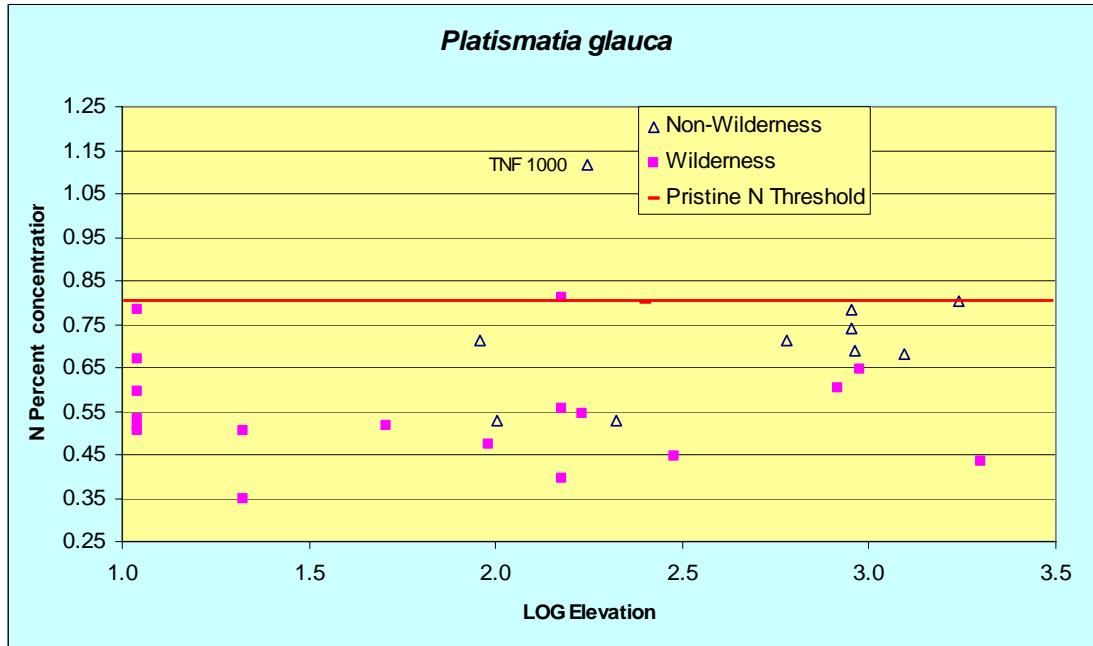


Figure VI-20. Wilderness and Non-Wilderness plot means of Percent Nitrogen in *Platismatia glauca* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA AL PPM

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VII. SUMMARY OF A1 PPM DATA ANALYSIS

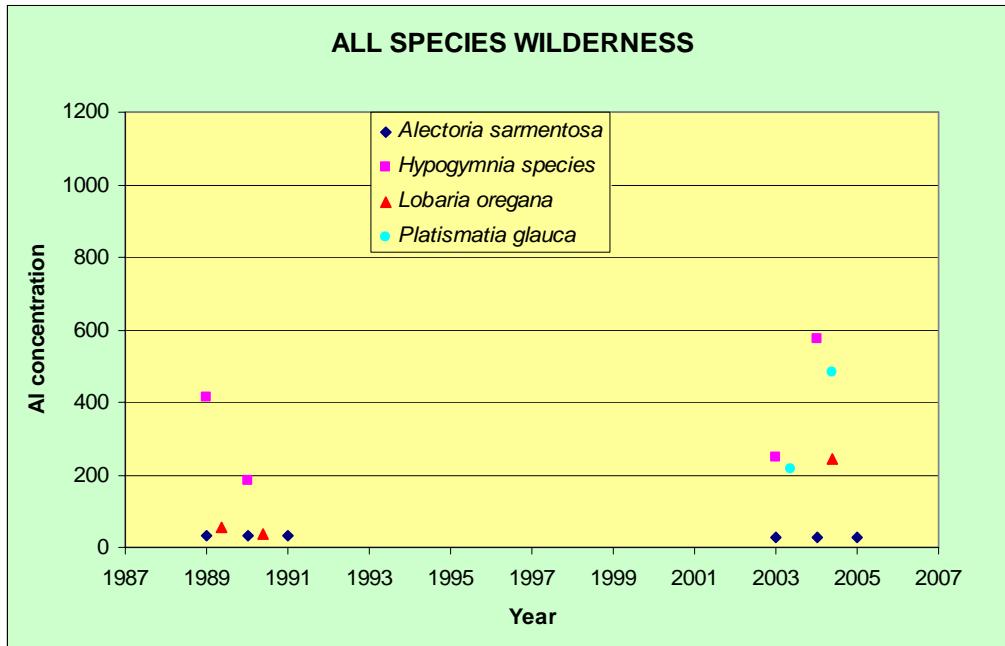


Figure VII-1. Wilderness plot means of Al ppm in *All Species* per year.

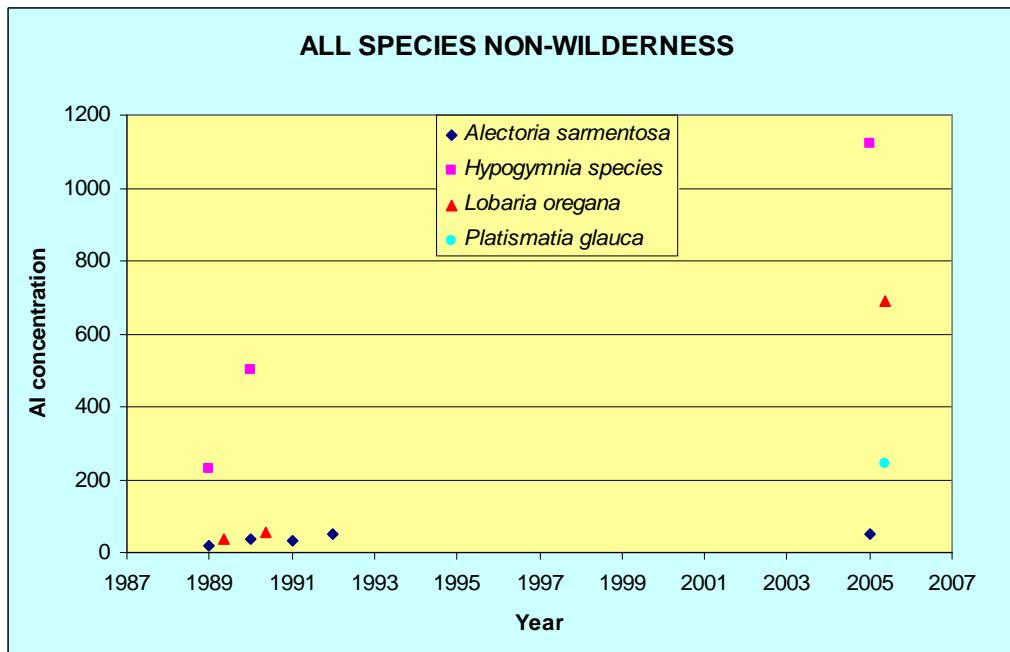


Figure VII-2. Non-Wilderness plot means of Al ppm in *All Species* per year.

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**ANALYSIS OF ICP LICHEN BIO-MONITORING DATA
AL PPM**

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Alectoria sarmentosa

Summary Statistics:

Table VII-2. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Al ppm content of *Alectoria sarmentosa* per year.

Al ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	20.44	3.8508	9.7485	31.13
1989	Wilderness	31.61	2.3594	25.5455	37.6768
1990	Non-Wilderness	39.00	3.8960	30.9901	47.0066
1990	Wilderness	30.64	4.2295	20.2942	40.9929
1991	Non-Wilderness	33.60	3.4532	26.3451	40.8549
1991	Wilderness	32.50	7.1454	12.6625	52.3401
1992	Non-Wilderness	52.0302	13.7371	19.5470	84.5133
2003	Wilderness	28.17	11.1950	0	170.4120
2004	Wilderness	27.10	2.2231	22.5006	31.6982
2005	Non-Wilderness	50.47	13.9491	14.6127	86.3273

Summary of Statistical Tests:

$$t = -0.2644, df = 8, p\text{-value} = 0.7981$$

There is no evidence of a difference in Al ppm content in *Alectoria sarmentosa* from pre-2000 and post 2000 samples (p-value = 0.7981).

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA AL PPM

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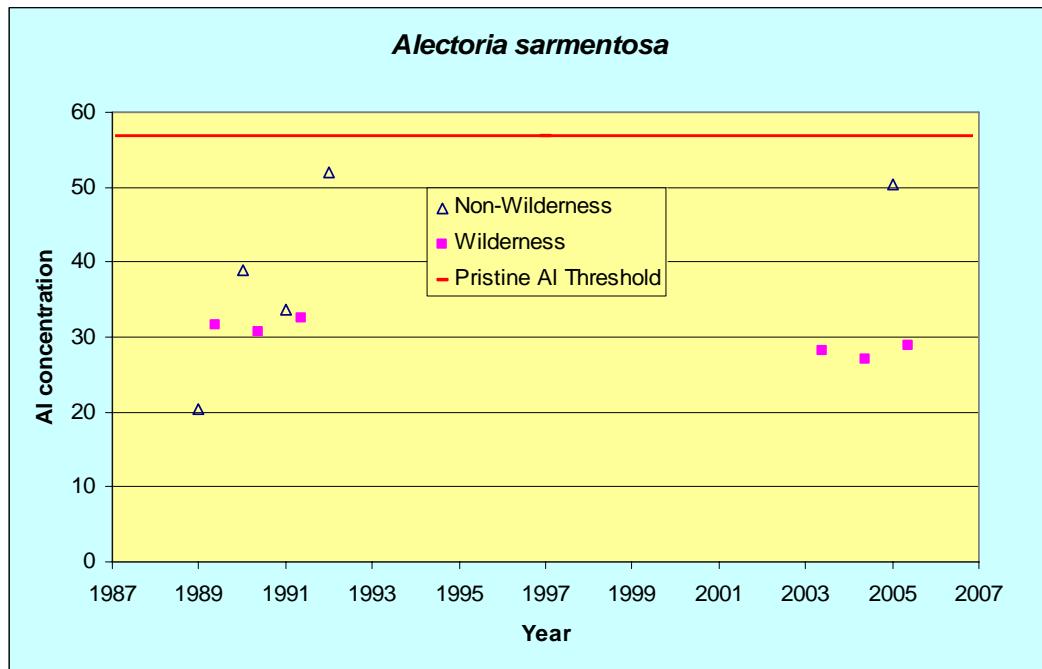


Figure VII-3. Wilderness and Non-Wilderness yearly means of Al ppm in *Alectoria sarmentosa* per year.

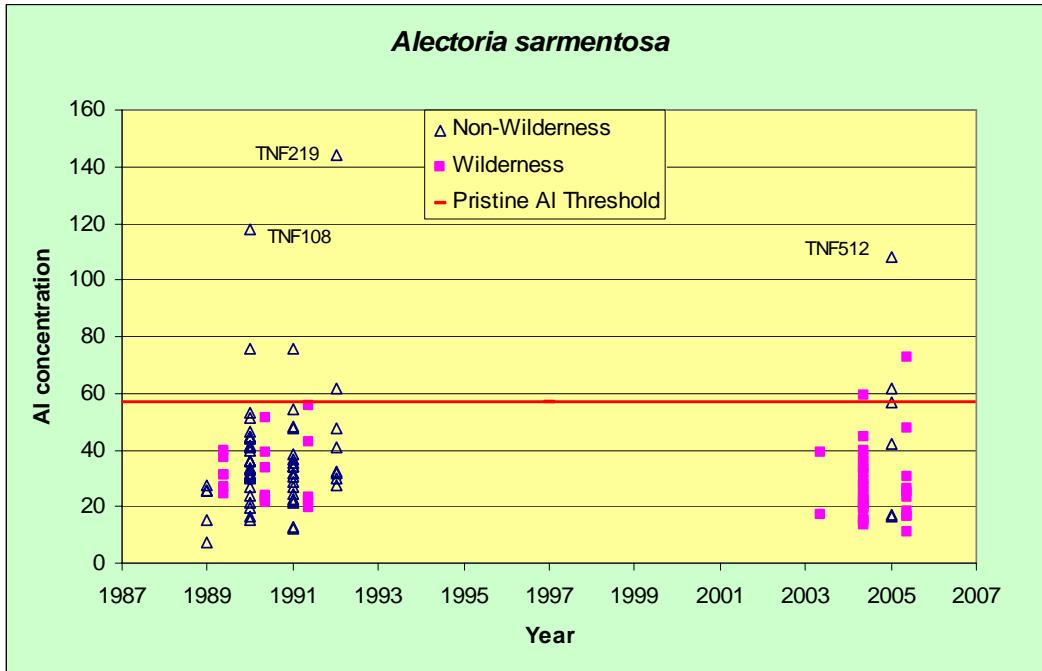
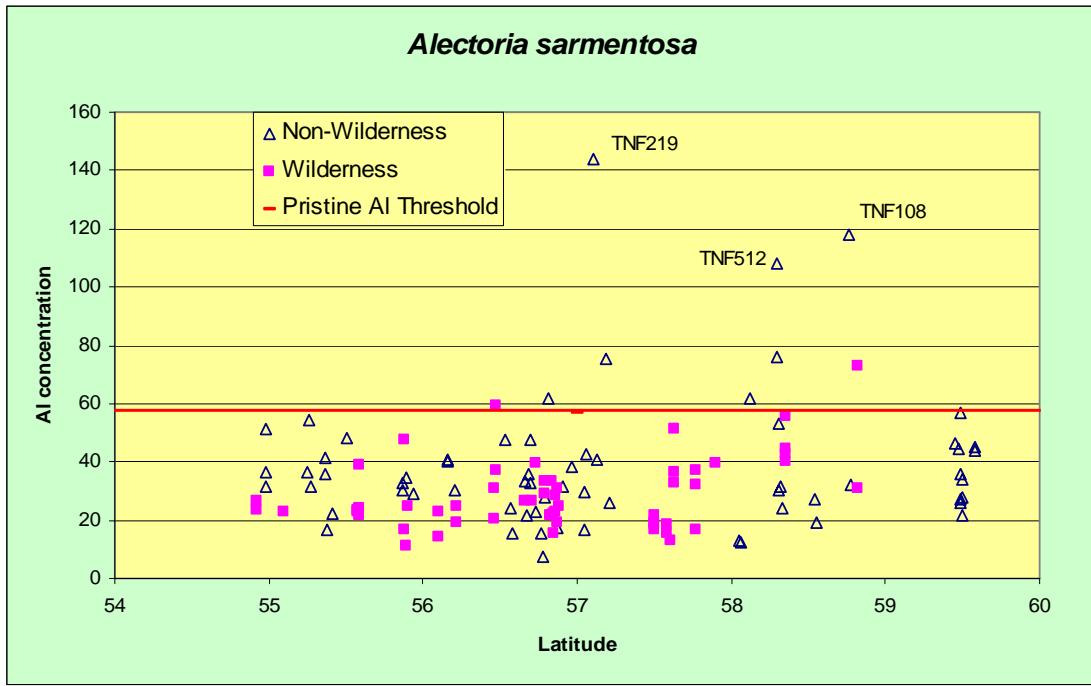


Figure VII-4. Wilderness and Non-Wilderness plot means of Al ppm in *Alectoria sarmentosa* per year.

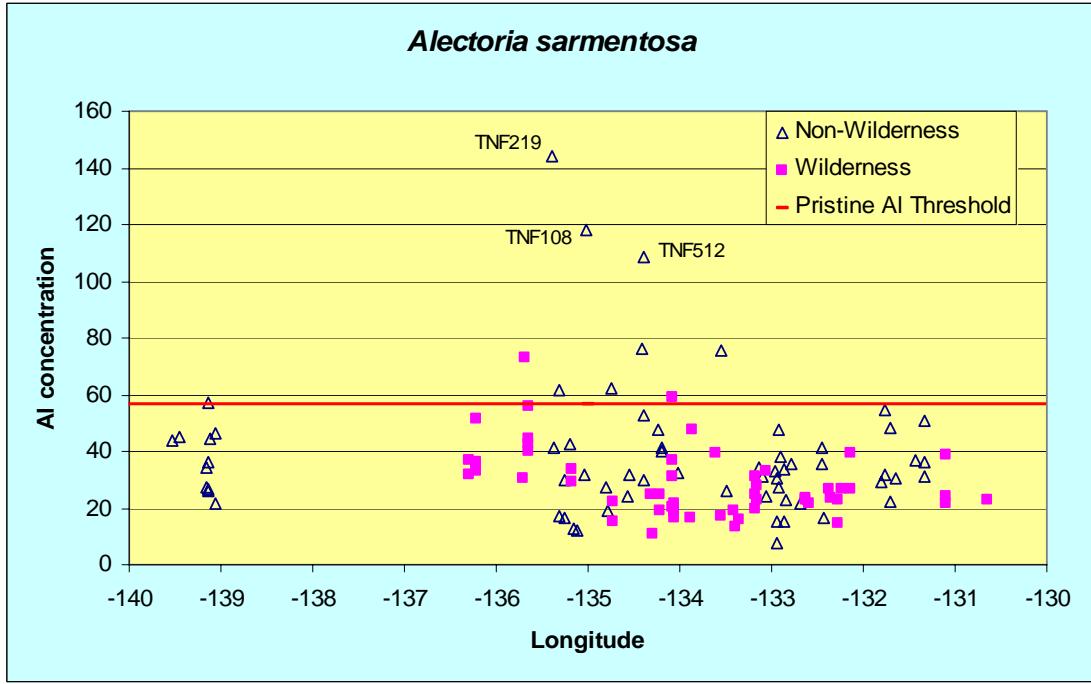
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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA AL PPM

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**Figure VII-5. Wilderness and Non-Wilderness plot means of Al ppm
in *Alectoria sarmentosa* vs. plot Latitude.**



**Figure VII-6. Wilderness and Non-Wilderness plot means of Al ppm
in *Alectoria sarmentosa* vs. plot Longitude.**

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA AL PPM

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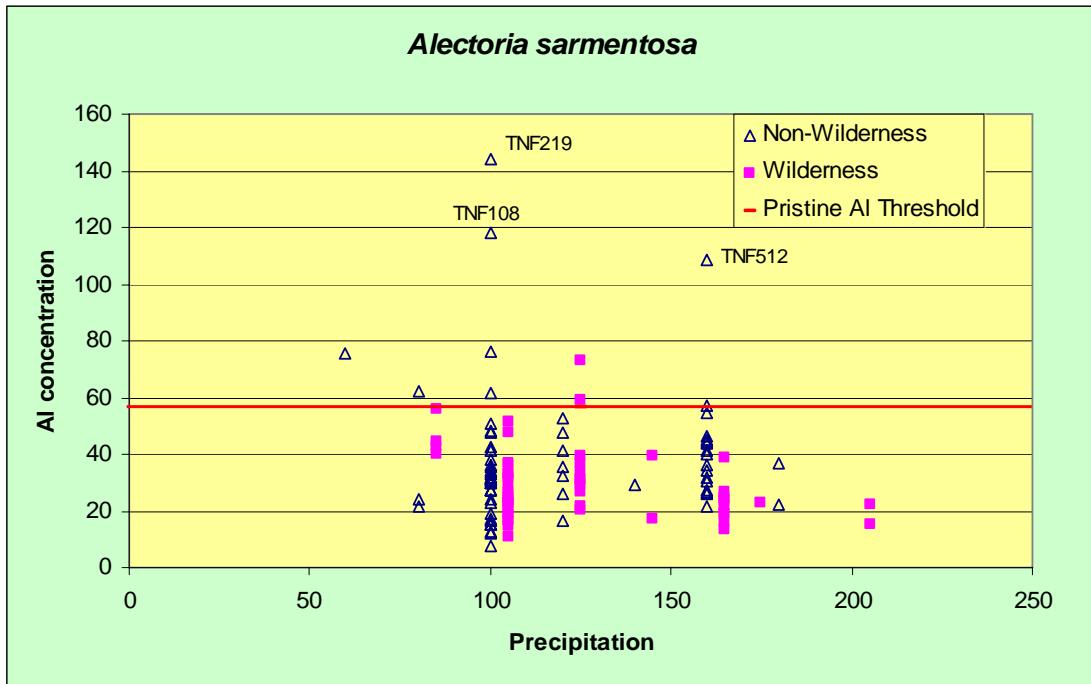


Figure VII-7. Wilderness and Non-Wilderness plot means of Al ppm in *Alectoria sarmentosa* vs. plot Precipitation.

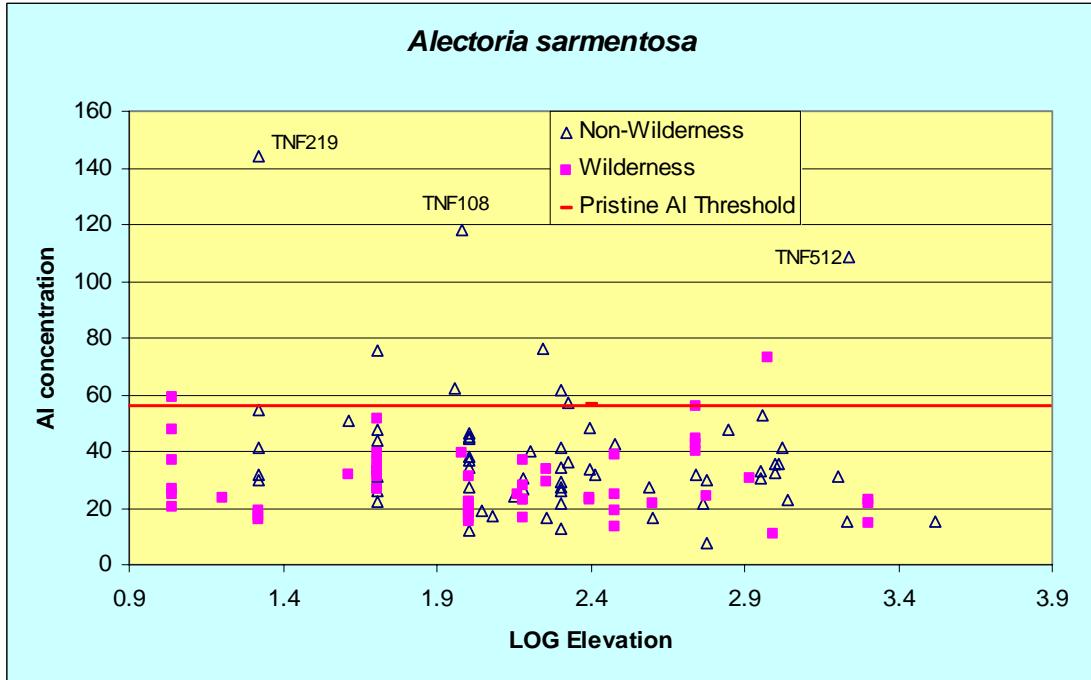


Figure VII-8. Wilderness and Non-Wilderness plot means of Al ppm in *Alectoria sarmentosa* vs. plot Log-Elevation.

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**ANALYSIS OF ICP LICHEN BIO-MONITORING DATA
AL PPM**

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Hypogymnia species

In this series, all of the *Hypogymnia* species were included as a group.

Table VII-3. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Al ppm content of *Hypogymnia species* per year.

Percent Sulfur				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	229.50	205.5000	0	2840.6250
1989	Wilderness	411.83	142.6811	15.6871	807.9796
1990	Non-Wilderness	502.16	78.3077	337.6395	666.6763
1990	Wilderness	185.71	11.4701	157.6480	213.7806
2003	Wilderness	246.07	na	na	na
2004	Wilderness	572.74	104.7184	303.5572	841.9314
2005	Non-Wilderness	1,122.16	294.7619	0	2390.4146
2005	Wilderness	443.83	110.8418	188.2312	699.4344

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA AL PPM

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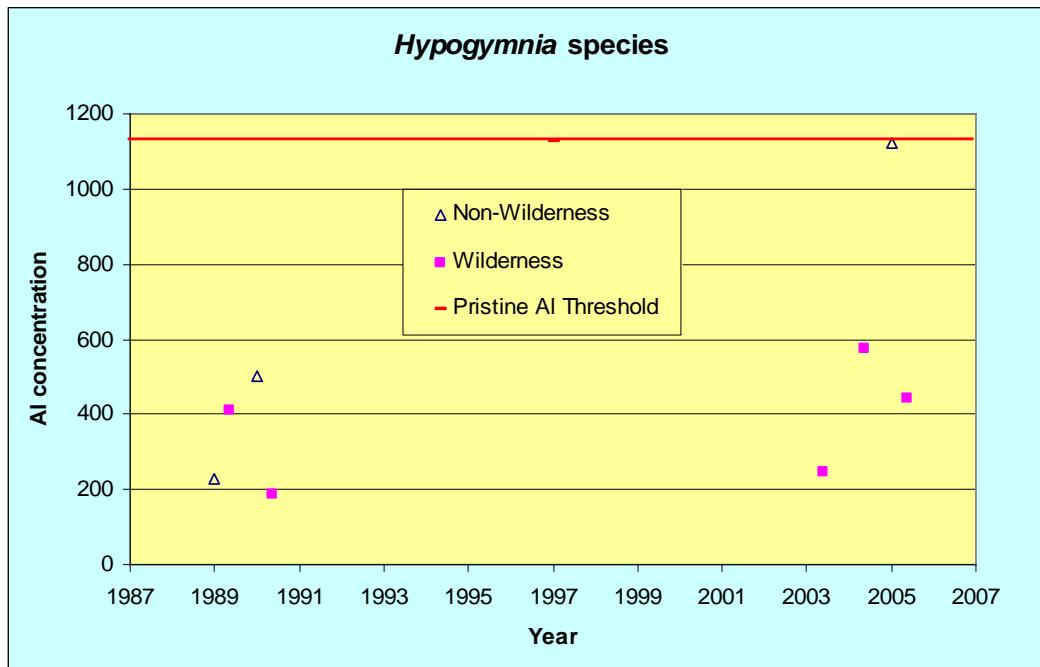


Figure VII-9. Wilderness and Non-Wilderness yearly means of Al ppm in *Hypogymnia* species per year.

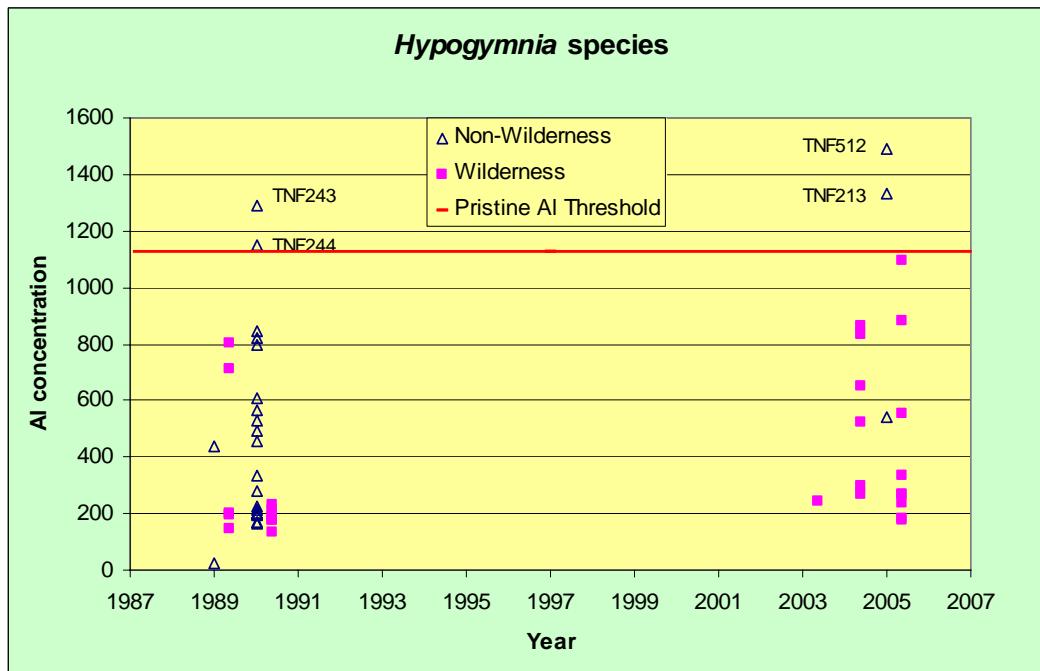


Figure VII-10. Wilderness and Non-Wilderness plot means of Al ppm in *Hypogymnia* species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA AL PPM

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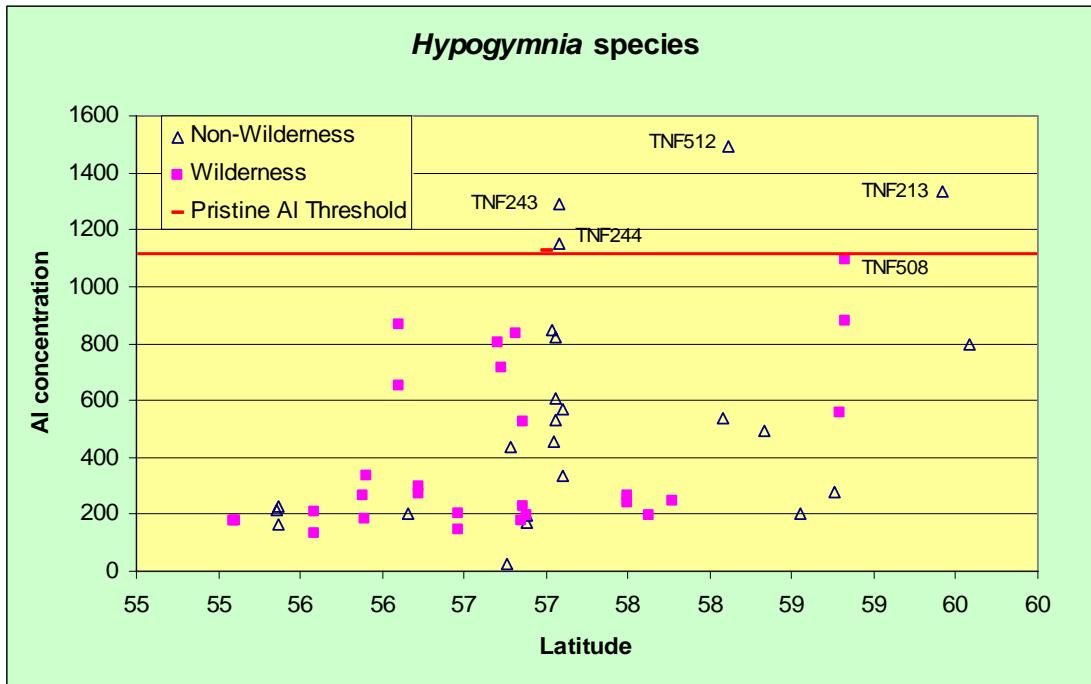


Figure VII-11. Wilderness and Non-Wilderness plot means of Al ppm in *Hypogymnia* species vs. plot Latitude.

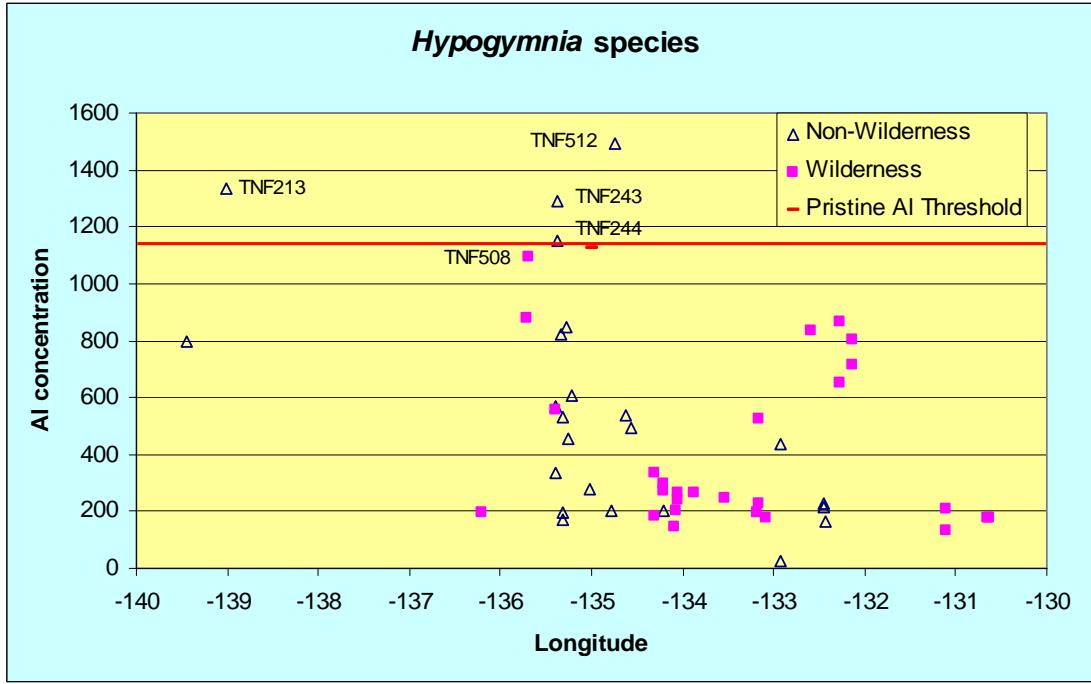


Figure VII-12. Wilderness and Non-Wilderness plot means of Al ppm in *Hypogymnia* species vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA AL PPM

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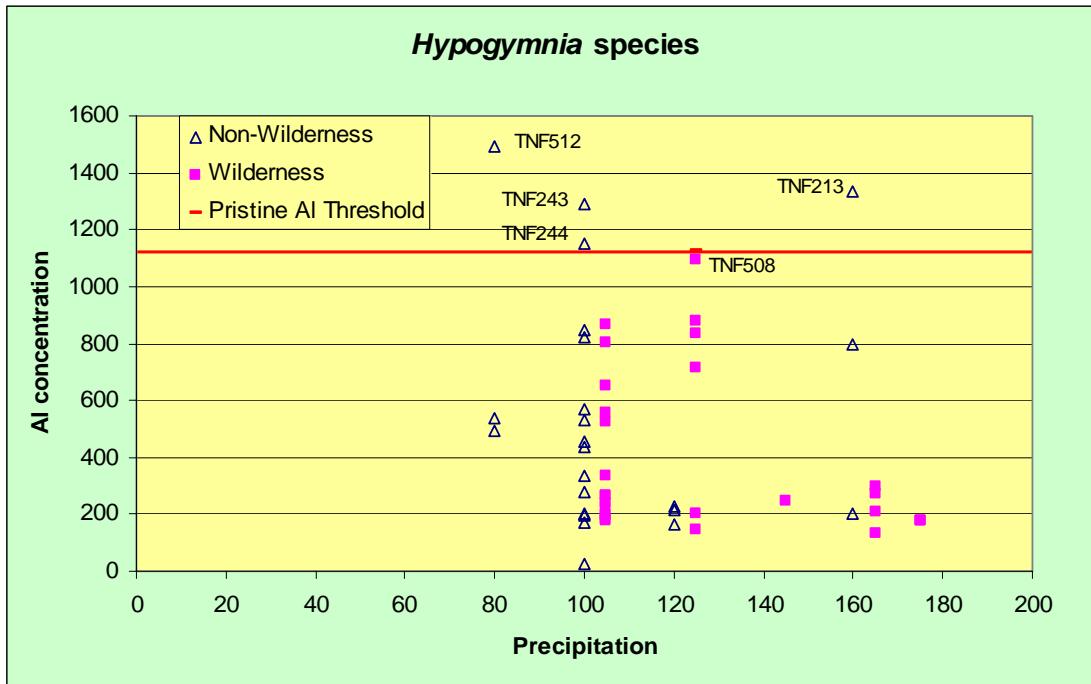


Figure VII-13. Wilderness and Non-Wilderness plot means of Al ppm in *Hypogymnia* species vs. plot Precipitation.

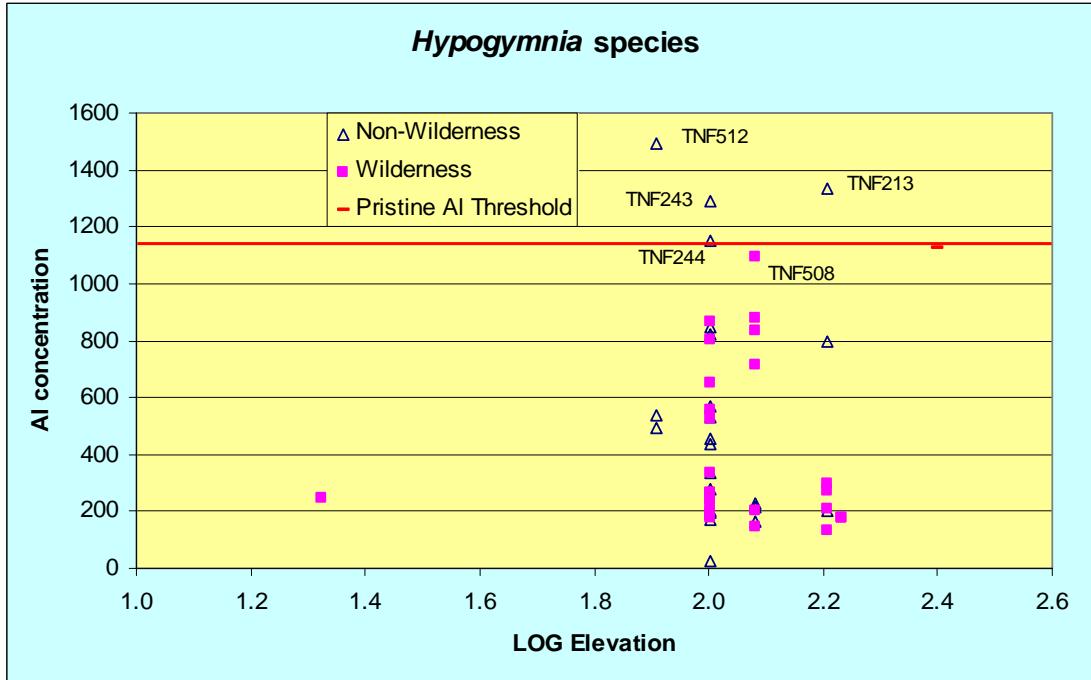


Figure VII-14. Wilderness and Non-Wilderness plot means of Al ppm in *Hypogymnia* species vs. plot Log-Elevation.

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**ANALYSIS OF ICP LICHEN BIO-MONITORING DATA
AL PPM**

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Lobaria oregana

Table VII-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Al ppm content of *Lobaria oregana* per year.

Percent Sulfur				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	35.08	12.3516	0	74.3917
1989	Wilderness	57.15	15.2926	14.6874	99.6057
1990	Non-Wilderness	55.69	11.2639	31.1439	80.2279
1990	Wilderness	37.93	17.2154	0	82.1850
2004	Wilderness	242.58	72.9612	64.0497	421.1091
2005	Non-Wilderness	689.71	NA	NA	NA
2005	Wilderness	98.79	44.7471	0	241.1986

Summary of Statistical Tests:

$$t = -1.9293, \text{ df} = 4, \text{ p-value} = 0.1259$$

There is no evidence of a difference in Al ppm content in *Lobaria oregana* from pre-2000 and post 2000 samples (p-value = 0.1259).

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA AL PPM

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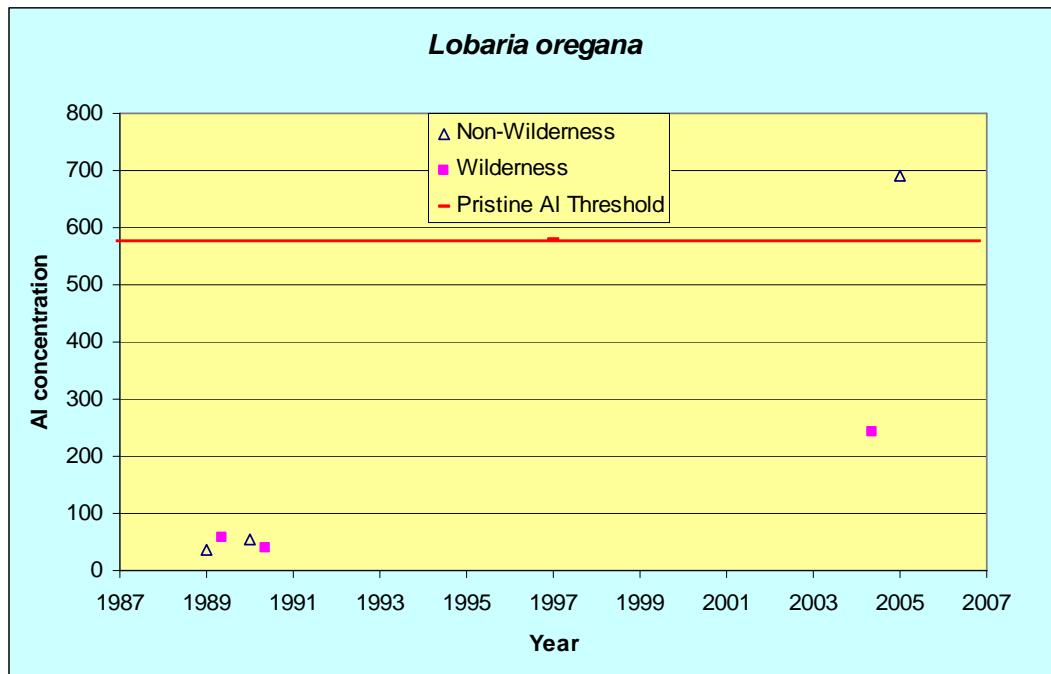


Figure VII-15. Wilderness and Non-Wilderness yearly means of Al ppm in *Lobaria oregana* per year.

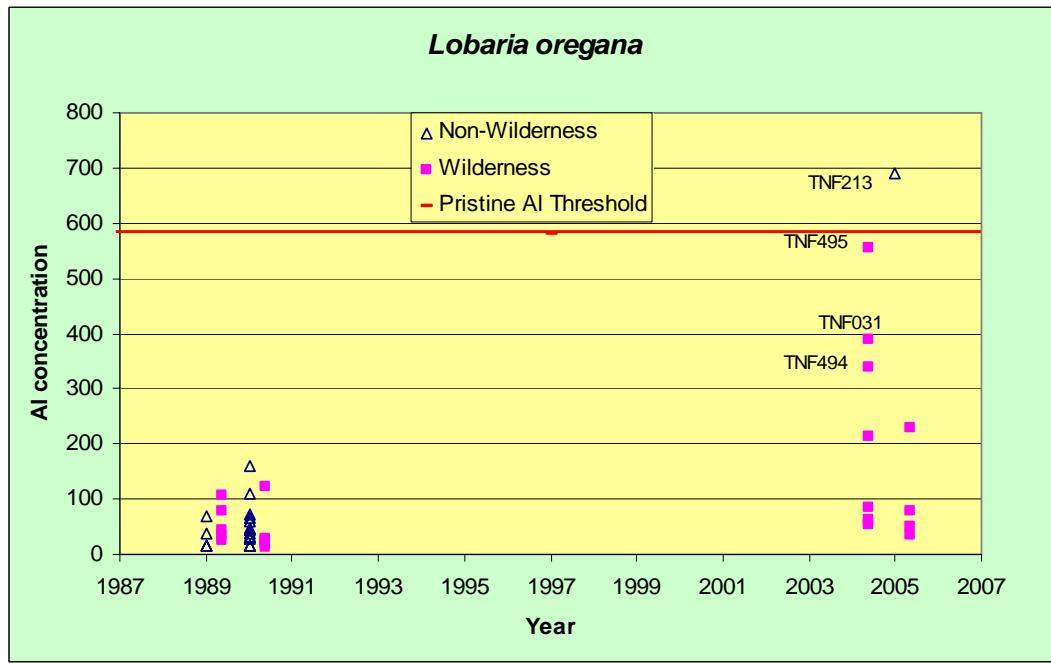


Figure VII-16. Wilderness and Non-Wilderness plot means of Al ppm in *Lobaria oregana* per year.

ANALYSIS OF ICP LICHEN BIO-MONITORING DATA AL PPM

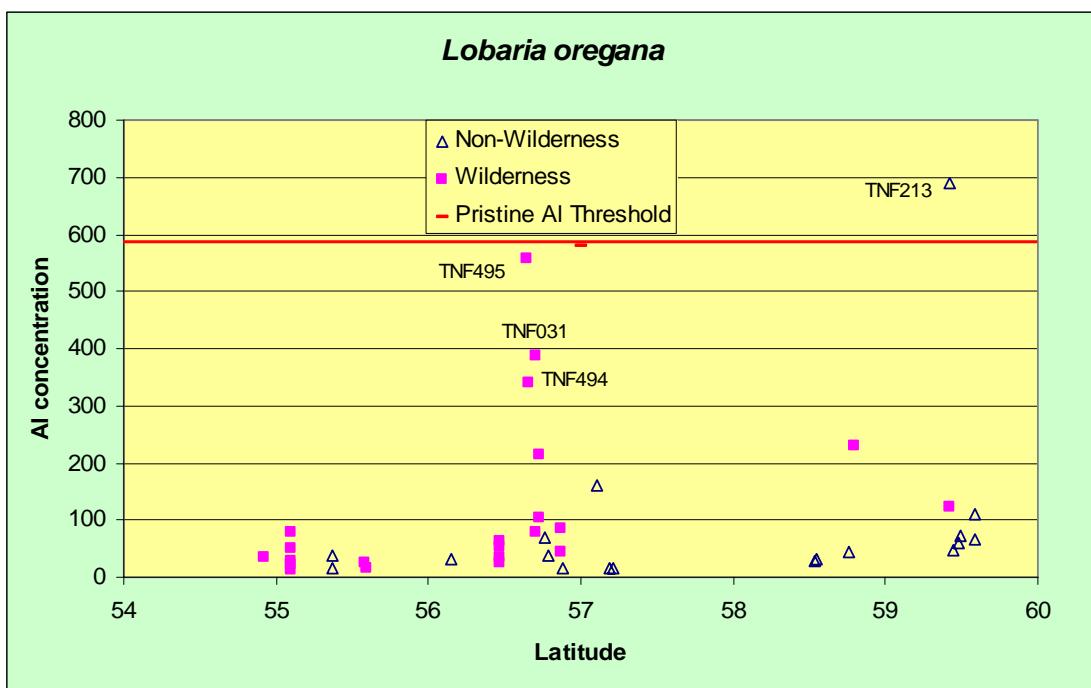


Figure VII-17. Wilderness and Non-Wilderness plot means of Al ppm in *Lobaria oregana* vs. plot Latitude.

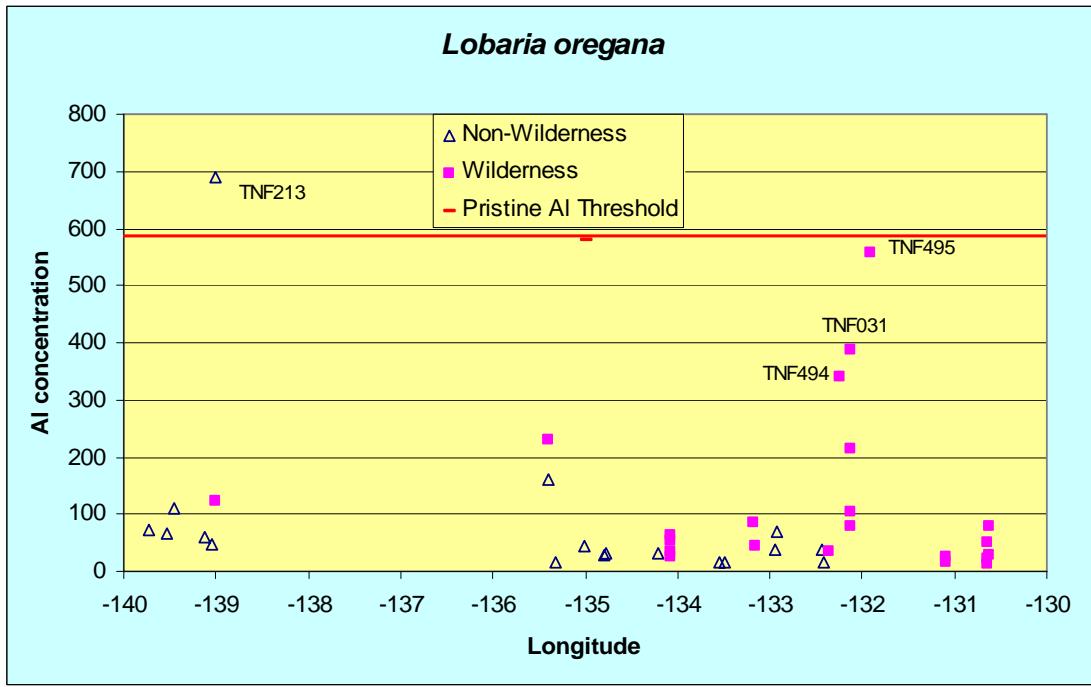


Figure VII-18. Wilderness and Non-Wilderness plot means of Al ppm in *Lobaria oregana* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA AL PPM

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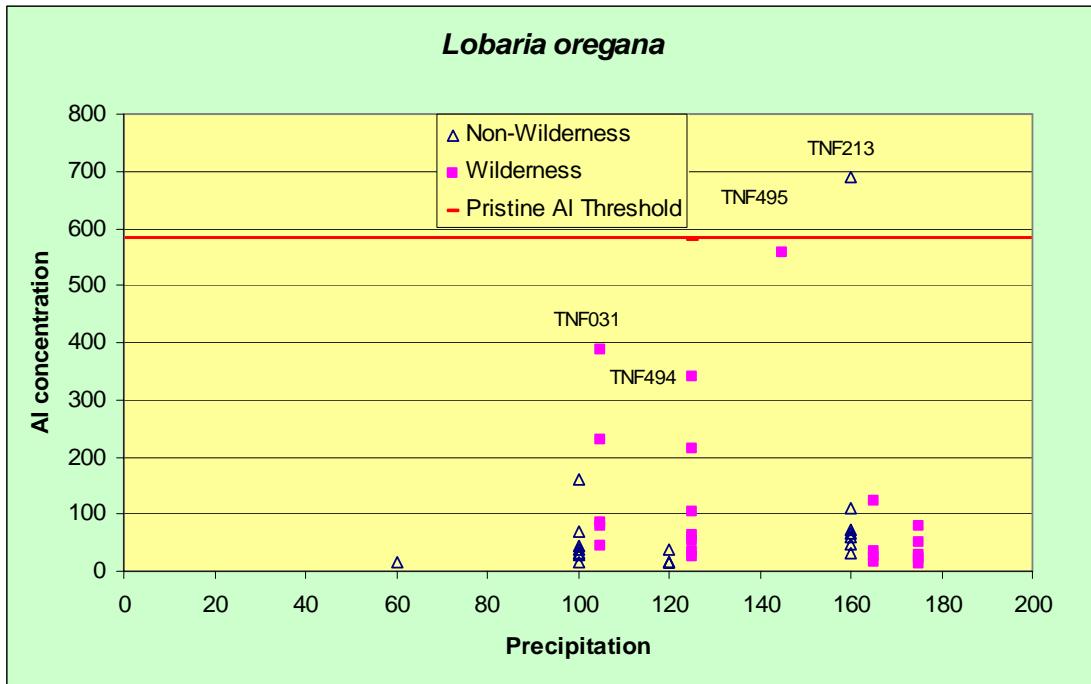


Figure VII-19. Wilderness and Non-Wilderness plot means of Al ppm in *Lobaria oregana* vs. plot Precipitation.

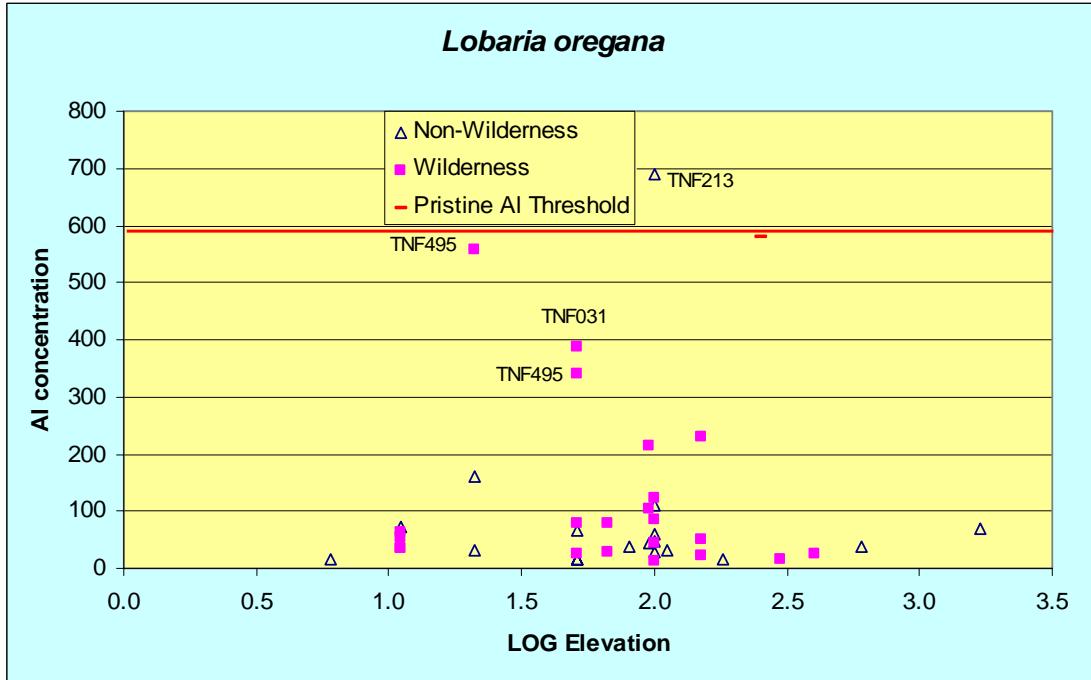


Figure VII-20. Wilderness and Non-Wilderness plot means of Al ppm in *Lobaria oregana* vs. plot Log-Elevation.

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**ANALYSIS OF ICP LICHEN BIO-MONITORING DATA
AL PPM**

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Platismatia glauca

Table VII-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Al ppm content of *Platismatia glauca* per year.

Percent Sulfur				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2003	Wilderness	213.86	na	na	na
2004	Wilderness	483.88	88.8447	282.8962	684.8574
2005	Non-Wilderness	781.3696	97.6291	560.5172	1002.2219

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA AL PPM

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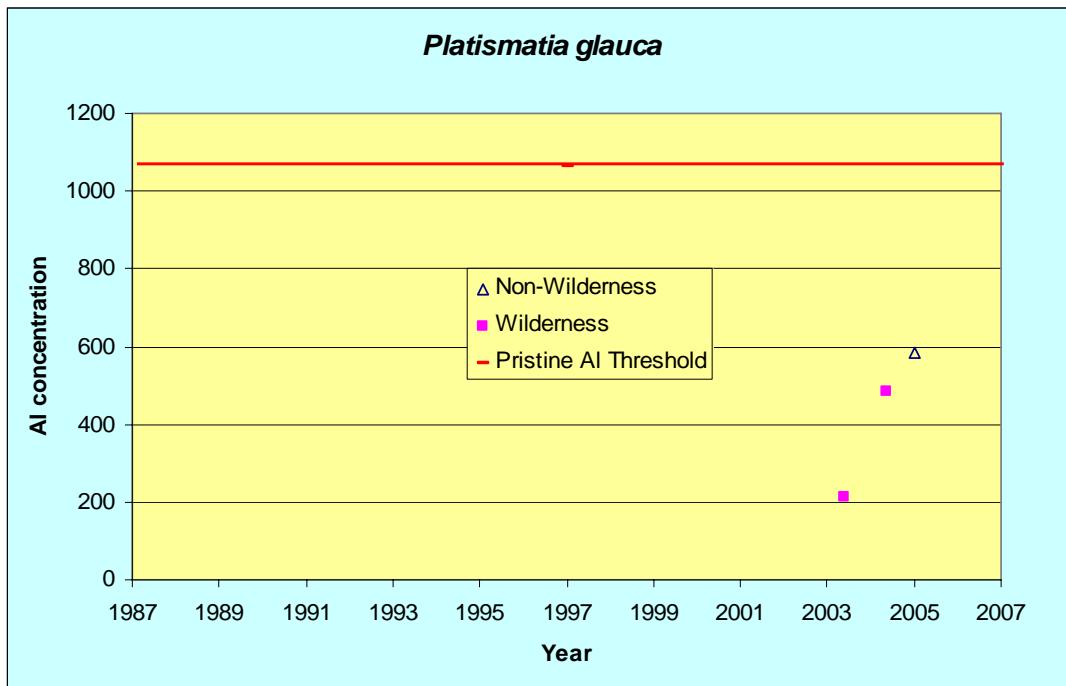


Figure VII-21. Wilderness and Non-Wilderness yearly means of Al ppm in *Platismatia glauca* per year.

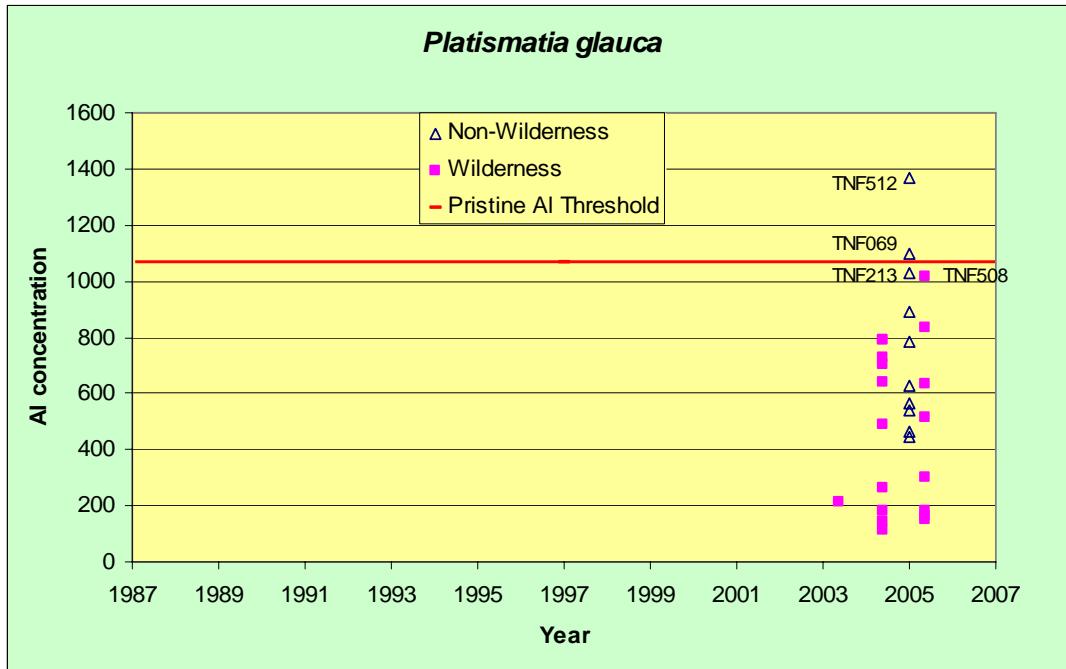


Figure VII-22. Wilderness and Non-Wilderness plot means of Al ppm in *Platismatia glauca* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA AL PPM

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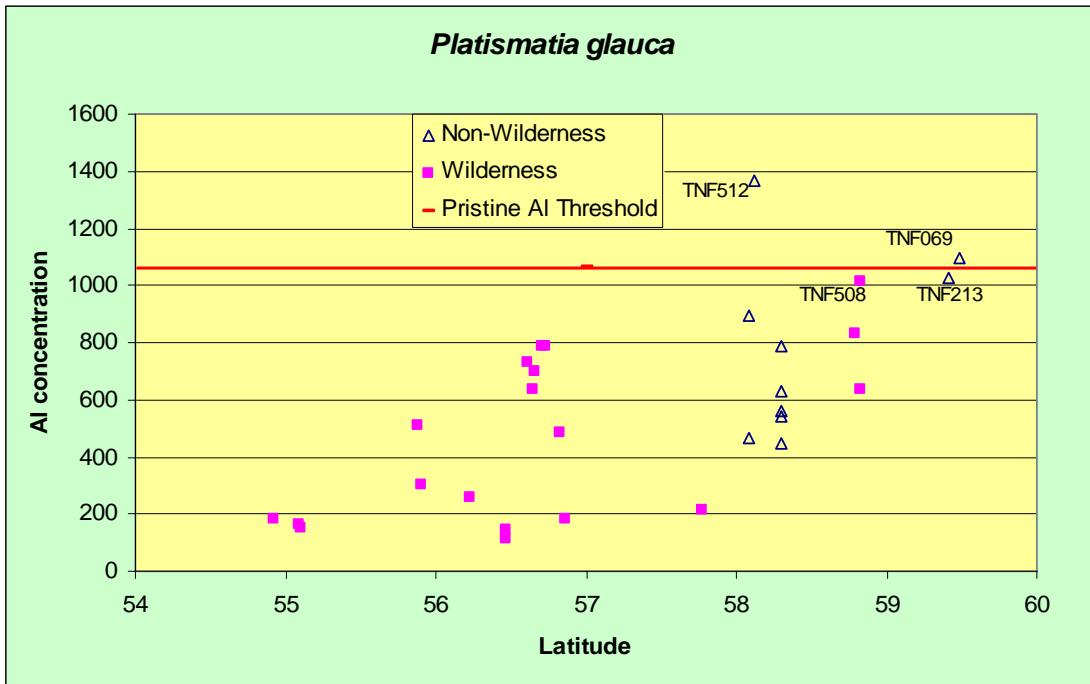


Figure VII-23. Wilderness and Non-Wilderness plot means of Al ppm in *Platismatia glauca* vs. plot Latitude.

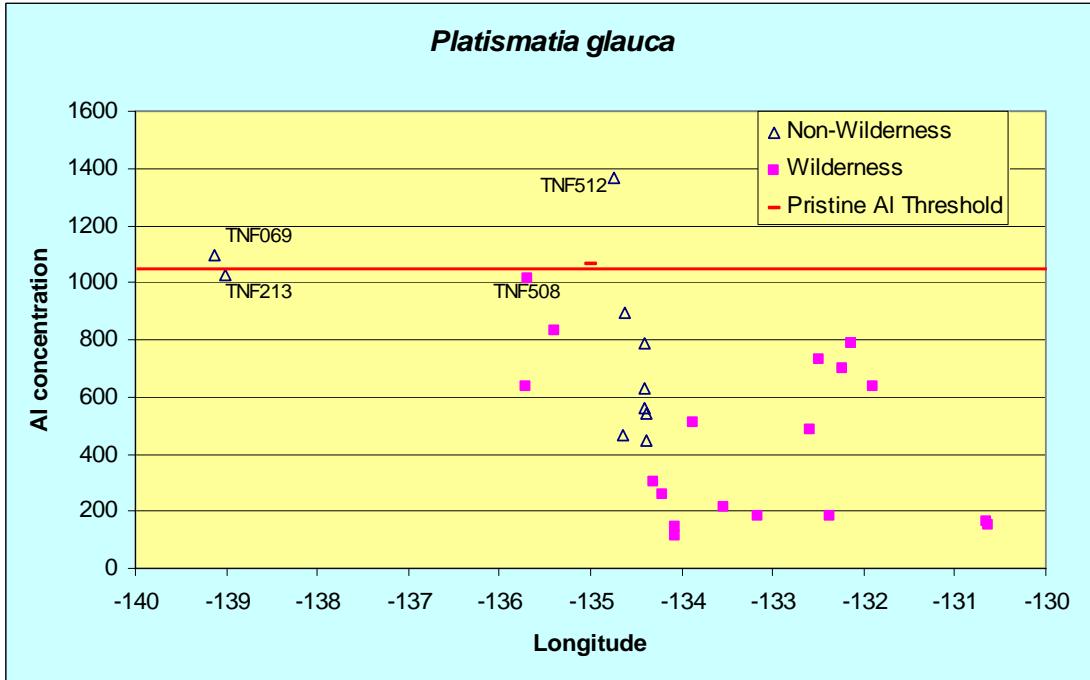


Figure VII-24. Wilderness and Non-Wilderness plot means of Al ppm in *Platismatia glauca* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA AL PPM

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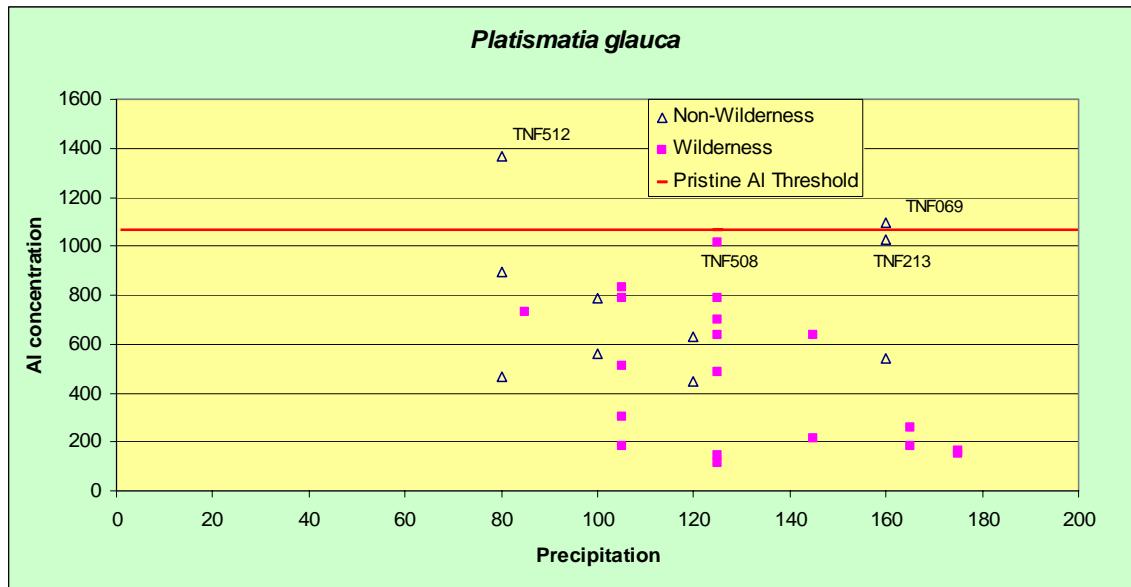


Figure VII-25. Wilderness and Non-Wilderness plot means of Al ppm in *Platismatia glauca* vs. plot Precipitation.

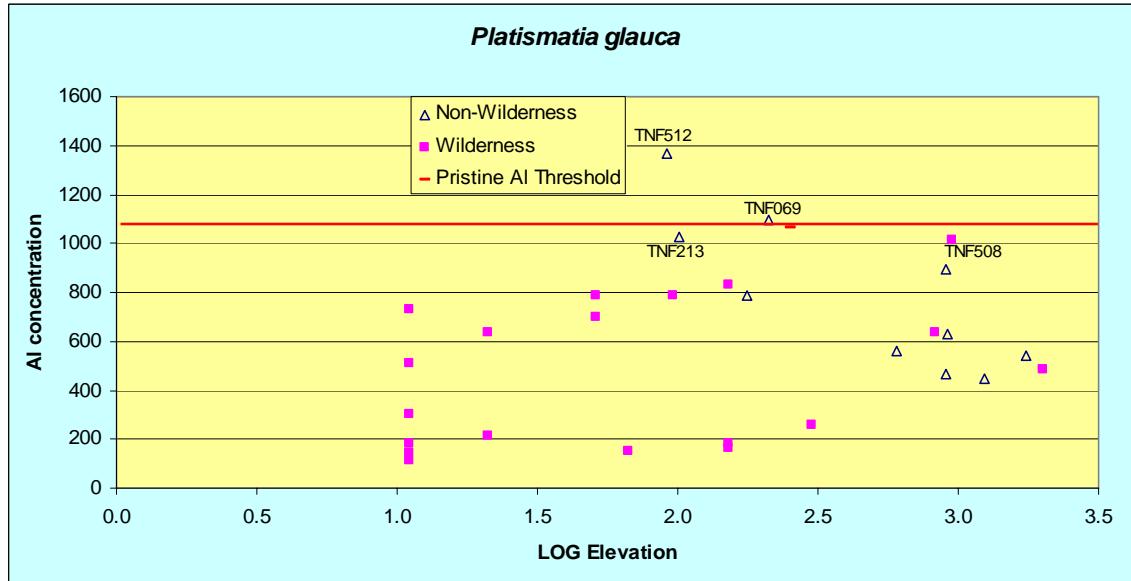


Figure VII-26. Wilderness and Non-Wilderness plot means of Al ppm in *Platismatia glauca* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

B ppm

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VIII. SUMMARY OF B PPM DATA ANALYSIS

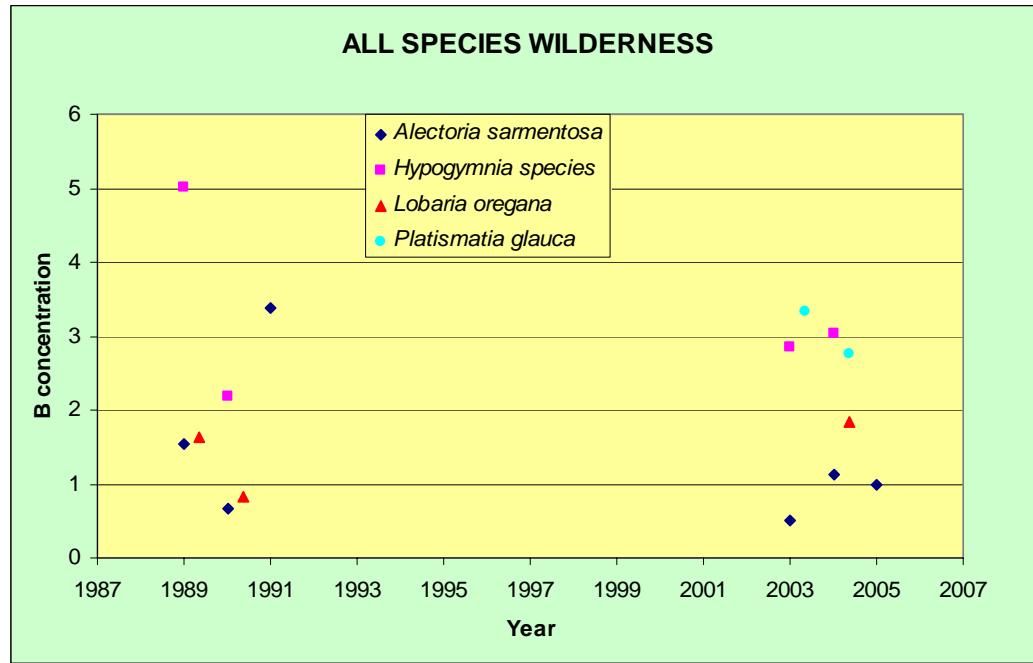


Figure VIII-27. Wilderness plot means of B ppm in All Species per year.

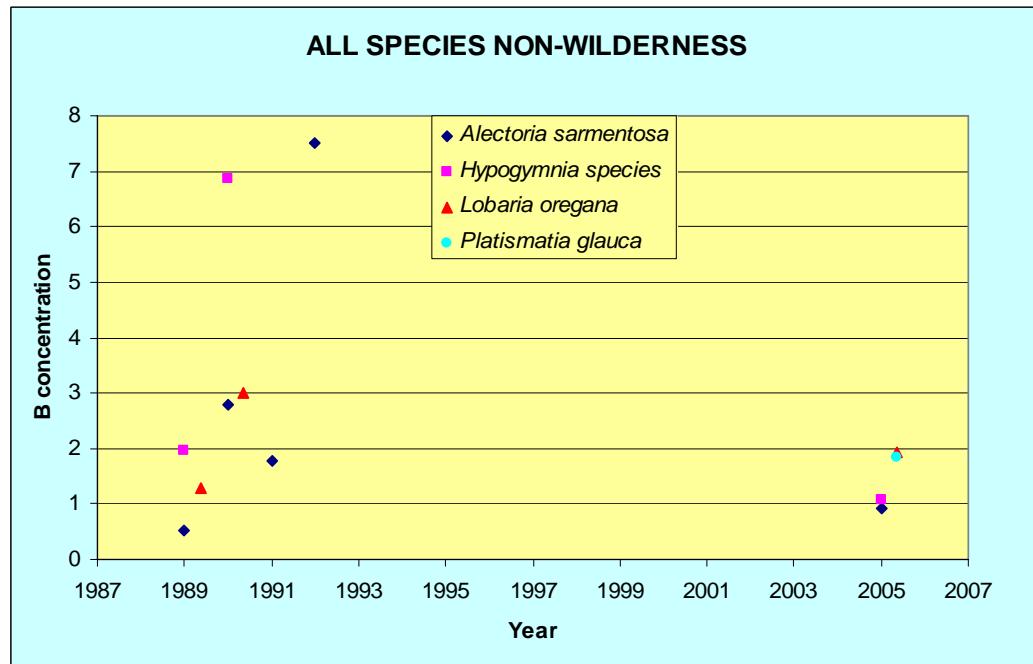


Figure VIII-28. Non-Wilderness plot means of B ppm in All Species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

B ppm

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Alectoria sarmentosa

Summary Statistics:

Table VIII-2. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the B ppm content of *Alectoria sarmentosa* per year.

B ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	0.53	0.0586	0.3626	0.6878
1989	Wilderness	1.54	0.5888	0.0263	3.0535
1990	Non-Wilderness	2.78	0.7734	1.1994	4.3790
1990	Wilderness	0.66	0.1238	0.3587	0.9646
1991	Non-Wilderness	1.77	0.1778	1.3973	2.1443
1991	Wilderness	3.37	1.5110	0	7.5697
1992	Non-Wilderness	7.50	1.9605	2.8674	12.1389
2003	Wilderness	0.50	0.0362	0.0366	0.9557
2004	Wilderness	1.22	0.1280	0.8574	1.3870
2005	Non-Wilderness	0.92	0.0905	0.6893	1.1545
2005	Wilderness	0.99	0.1800	0.5786	1.3929

Summary of Statistical Tests:

$$t = 1.2005, df = 8, p\text{-value} = 0.2643$$

There is no evidence of a difference in B ppm content in *Alectoria sarmentosa* from pre-2000 and post 2000 samples (p-value = 0.2643).

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

B ppm

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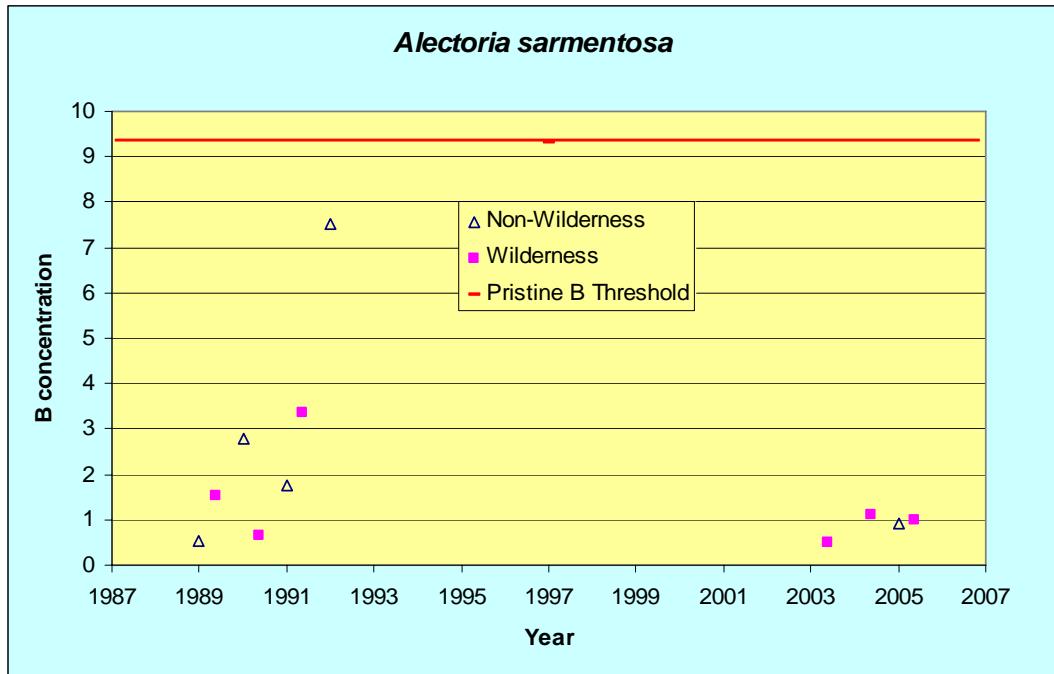


Figure VIII-3. Wilderness and Non-Wilderness yearly means of B ppm in *Alectoria sarmentosa* per year.

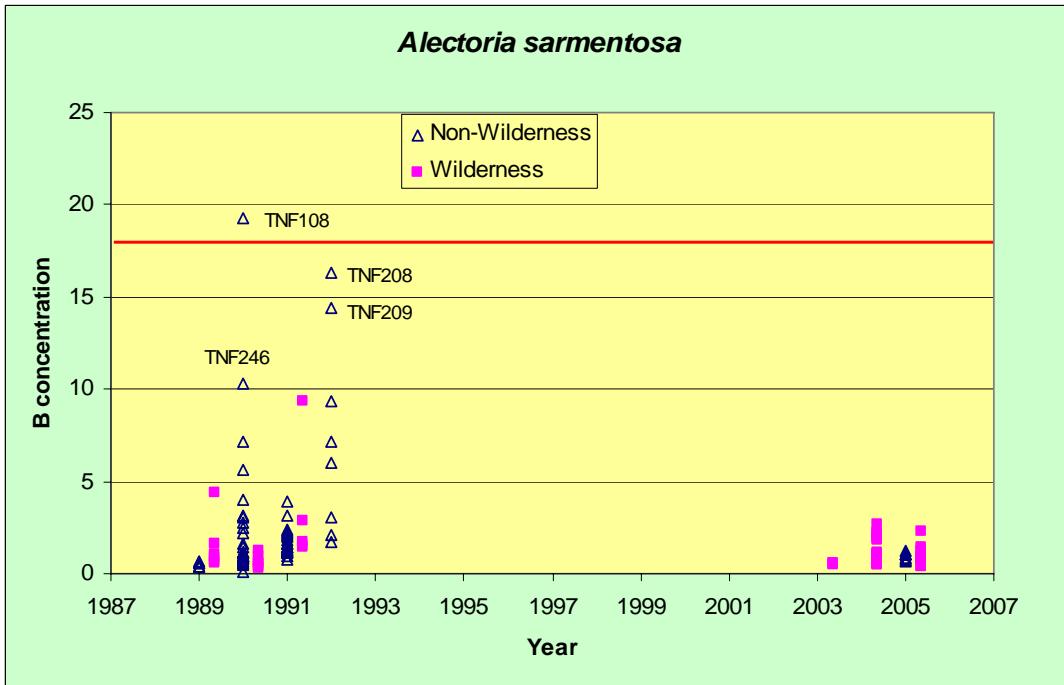


Figure VIII-4. Wilderness and Non-Wilderness plot means of B ppm in *Alectoria sarmentosa* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA B ppm

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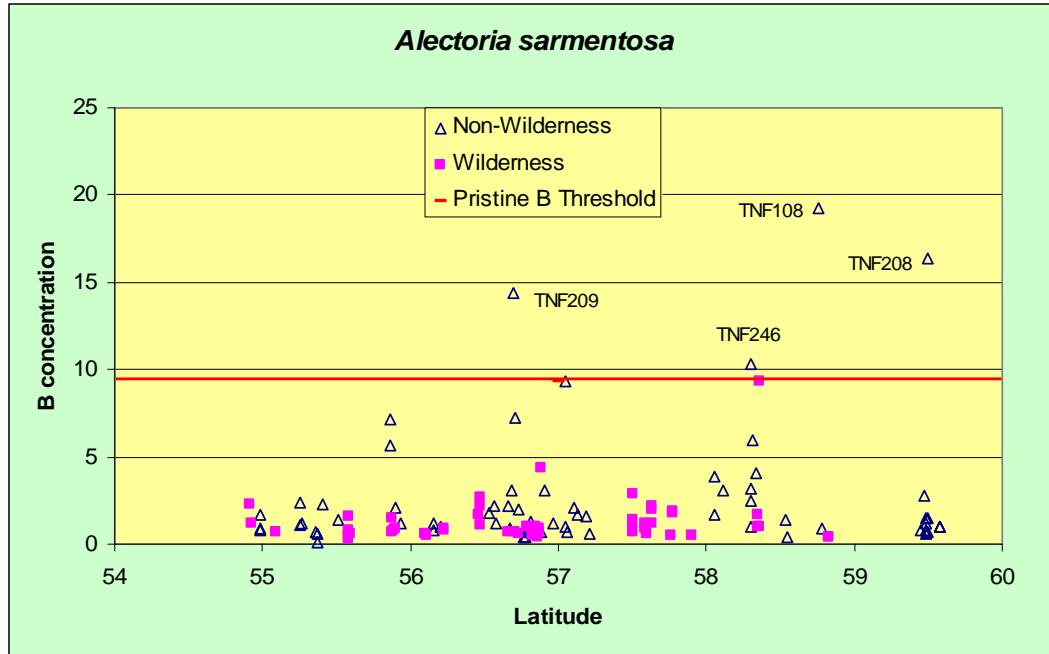


Figure VIII-5. Wilderness and Non-Wilderness plot means of B ppm in *Alectoria sarmentosa* vs. plot Latitude.

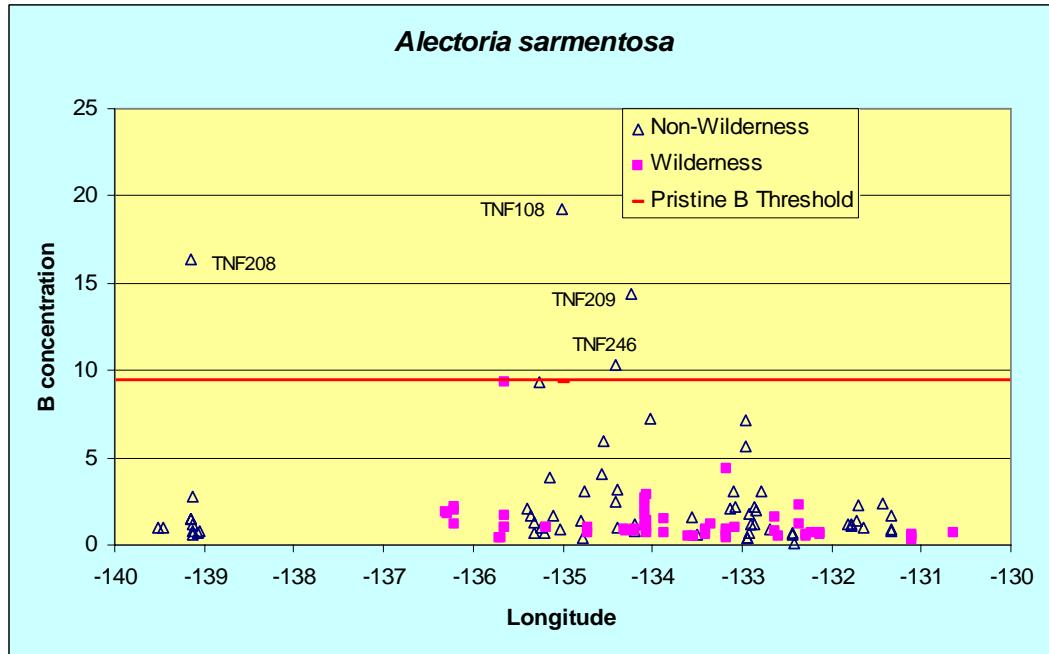


Figure VIII-6. Wilderness and Non-Wilderness plot means of B ppm in *Alectoria sarmentosa* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA B ppm

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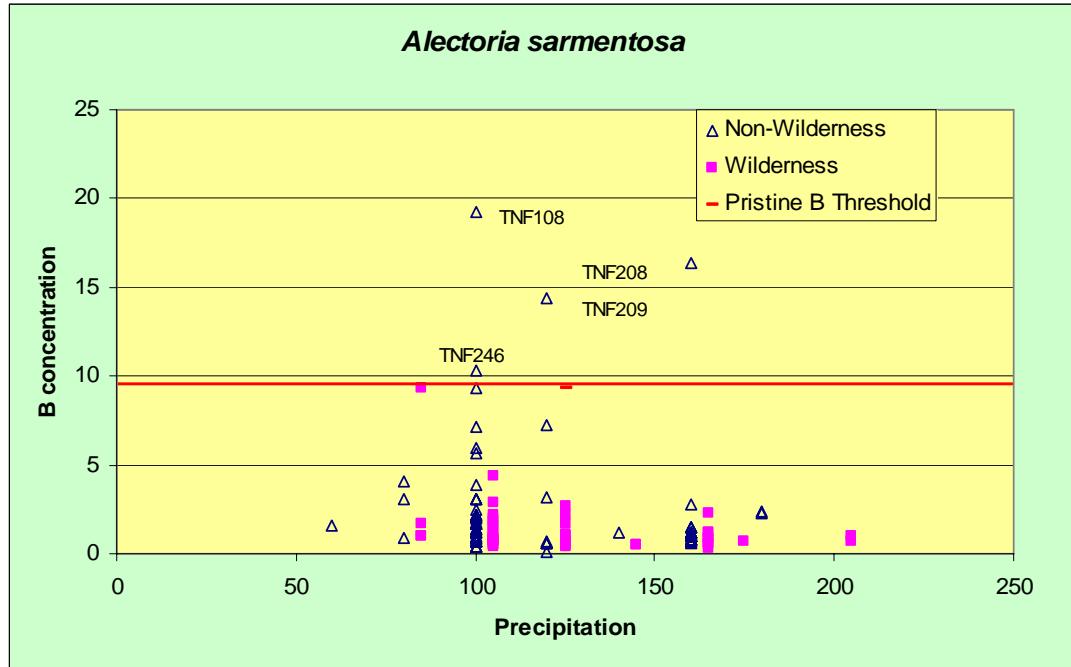


Figure VIII-7. Wilderness and Non-Wilderness plot means of B ppm in *Alectoria sarmentosa* vs. plot Precipitation.

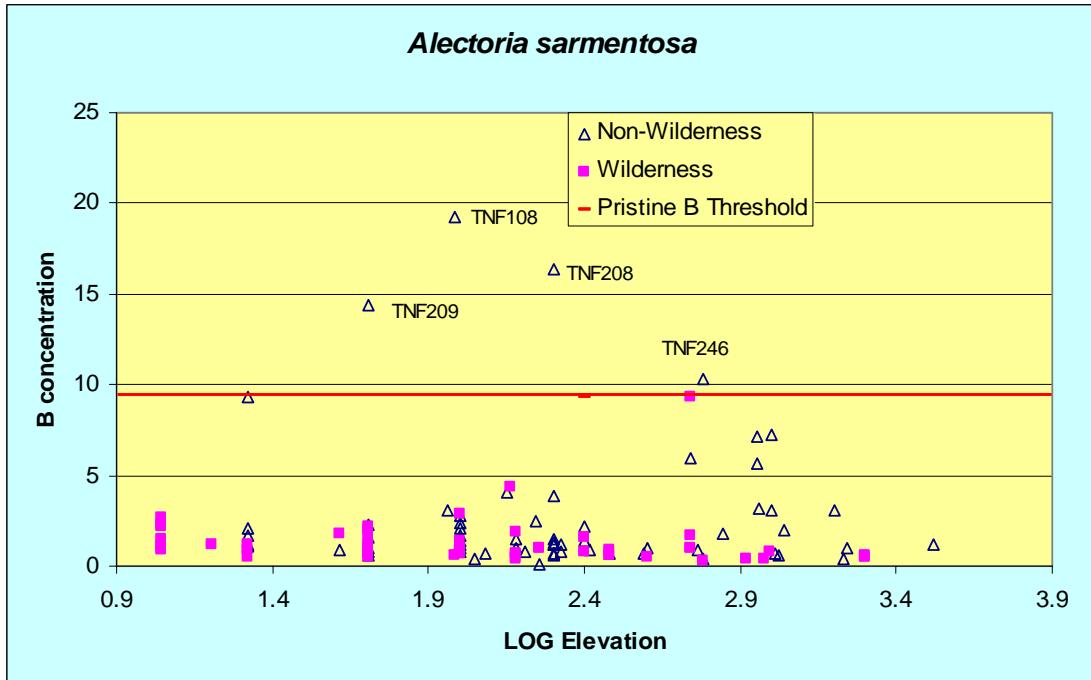


Figure VIII-8. Wilderness and Non-Wilderness plot means of B ppm in *Alectoria sarmentosa* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

B ppm

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Hypogymnia species

In this series, all of the *Hypogymnia* species were included as a group.

Table VIII-3. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the B ppm content of *Hypogymnia species* per year.

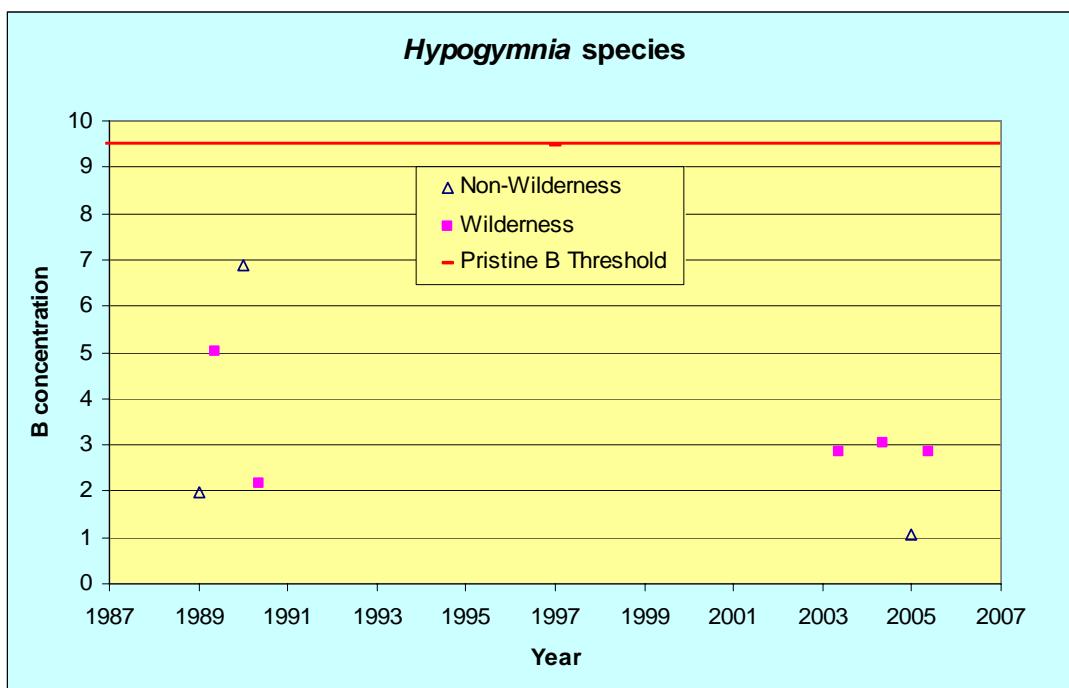
B ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	1.97	1.56	0	21.7917
1989	Wilderness	5.01	1.1197	1.9060	8.1236
1990	Non-Wilderness	6.87	0.8718	5.0392	8.7024
1990	Wilderness	2.18	0.4829	0.9978	3.3612
2003	Wilderness	2.86	na	na	na
2004	Wilderness	3.04	0.3202	2.2151	3.8615
2005	Non-Wilderness	1.08	0.5080	0	3.2650
2005	Wilderness	2.87	0.4287	1.8815	3.8586

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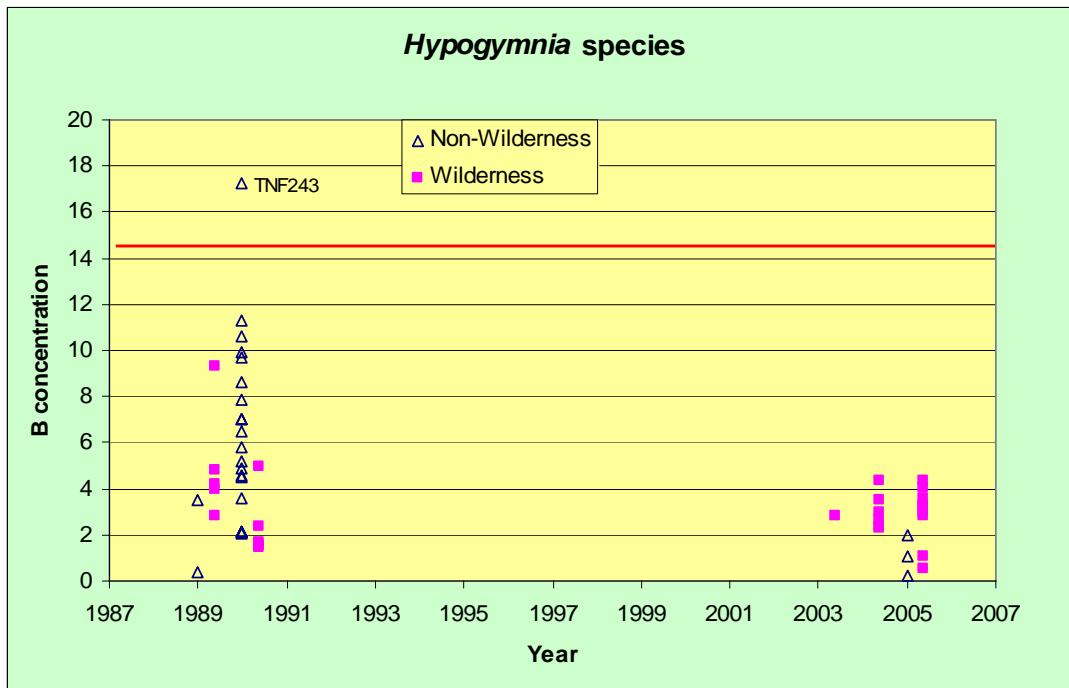
ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

B ppm

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**Figure VIII-9. Wilderness and Non-Wilderness yearly means of B ppm
in *Hypogymnia* species per year.**



**Figure VIII-10. Wilderness and Non-Wilderness plot means of B ppm
in *Hypogymnia* species per year.**

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

B ppm

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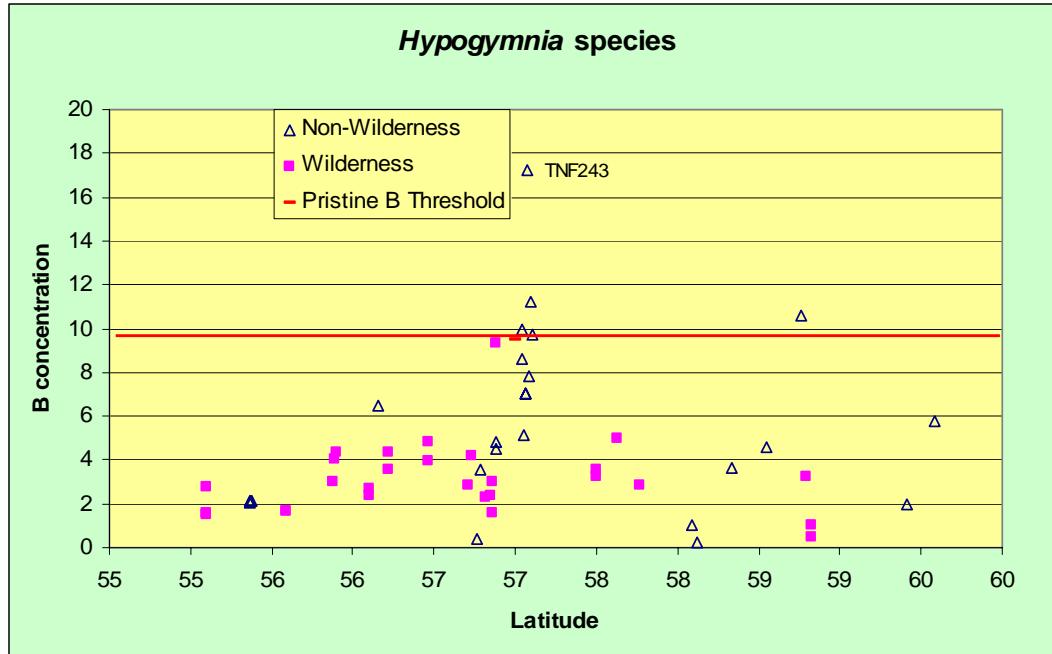


Figure VIII-11. Wilderness and Non-Wilderness plot means of B ppm in *Hypogymnia species* vs. plot Latitude.

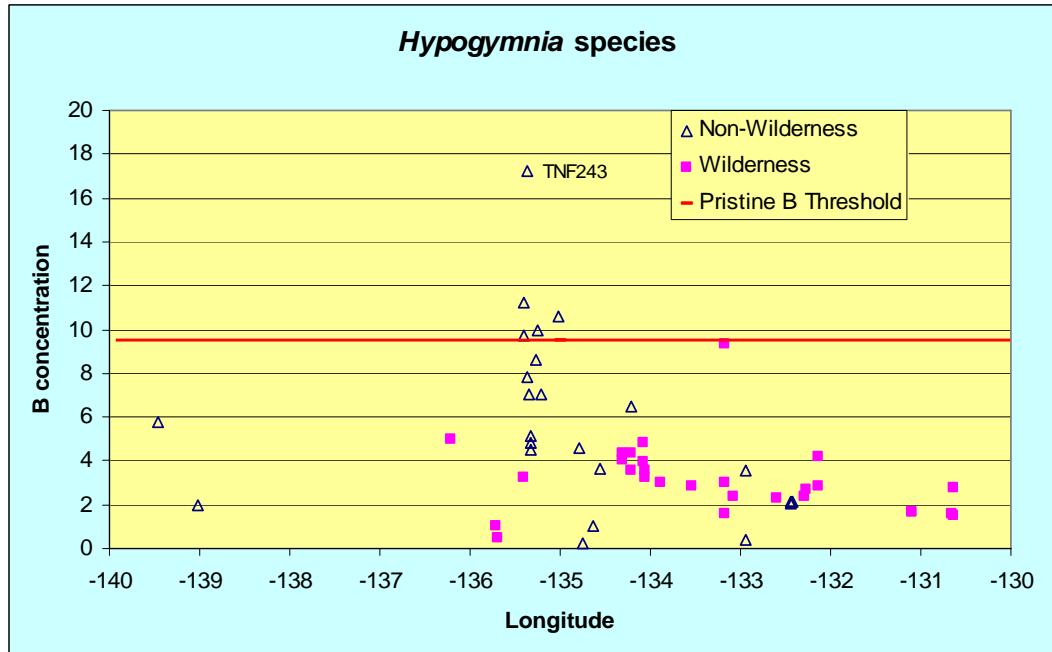


Figure VIII-12. Wilderness and Non-Wilderness plot means of B ppm in *Hypogymnia species* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

B ppm

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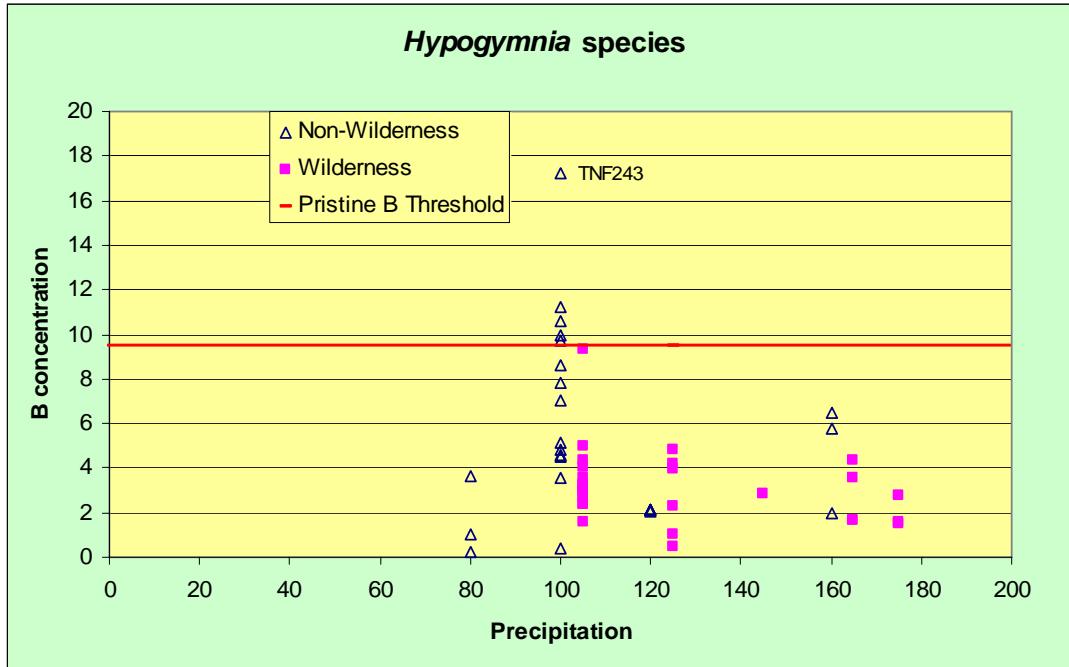


Figure VIII-13. Wilderness and Non-Wilderness plot means of B ppm in *Hypogymnia species* vs. plot Precipitation.

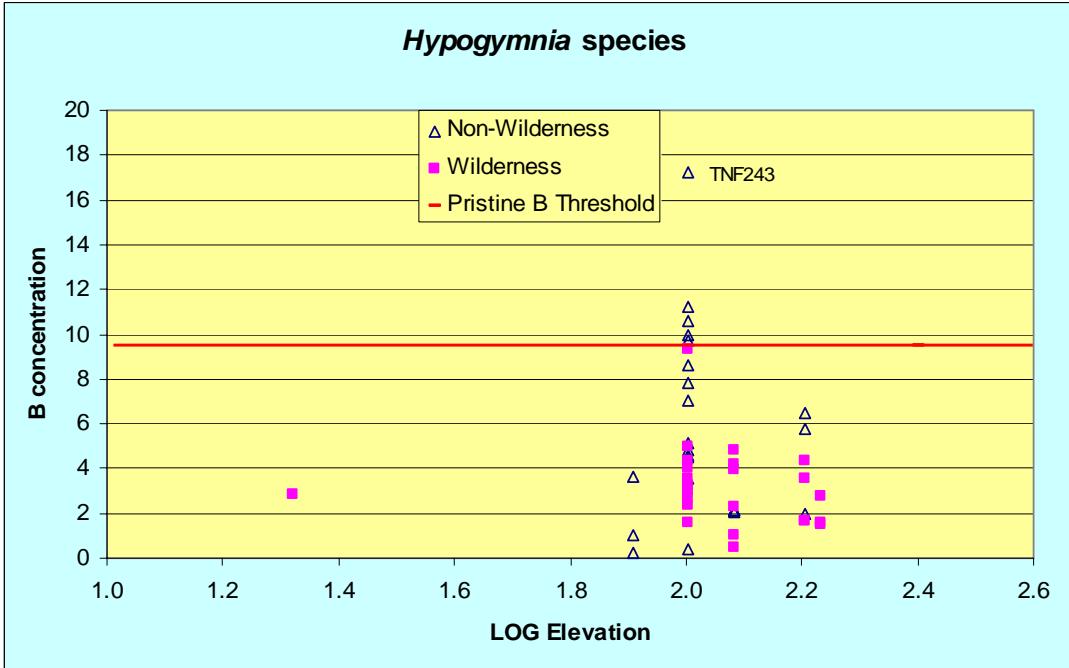


Figure VIII-14. Wilderness and Non-Wilderness plot means of B ppm in *Hypogymnia species* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

B ppm

██

Lobaria oregana

Table VIII-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the B ppm content of *Lobaria oregana* per year.

B ppmr				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	1.27	0.0419	1.1408	1.4075
1989	Wilderness	1.63	0.2415	0.9576	2.2988
1990	Non-Wilderness	3.00	0.7282	1.4169	4.5900
1990	Wilderness	0.84	0.1442	0.4670	1.2083
2004	Wilderness	1.84	0.4057	0.8450	2.8304
2005	Non-Wilderness	1.93	na	na	na
2005	Wilderness	1.59	0.3193	0.5711	2.6036

Summary of Statistical Tests:

$$t = -1.4197, \text{ df} = 4, \text{ p-value} = 0.2287$$

There is no evidence of a difference in B ppm content in *Lobaria oregana* from pre-2000 and post 2000 samples (p-value = 0.2287).

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

B ppm

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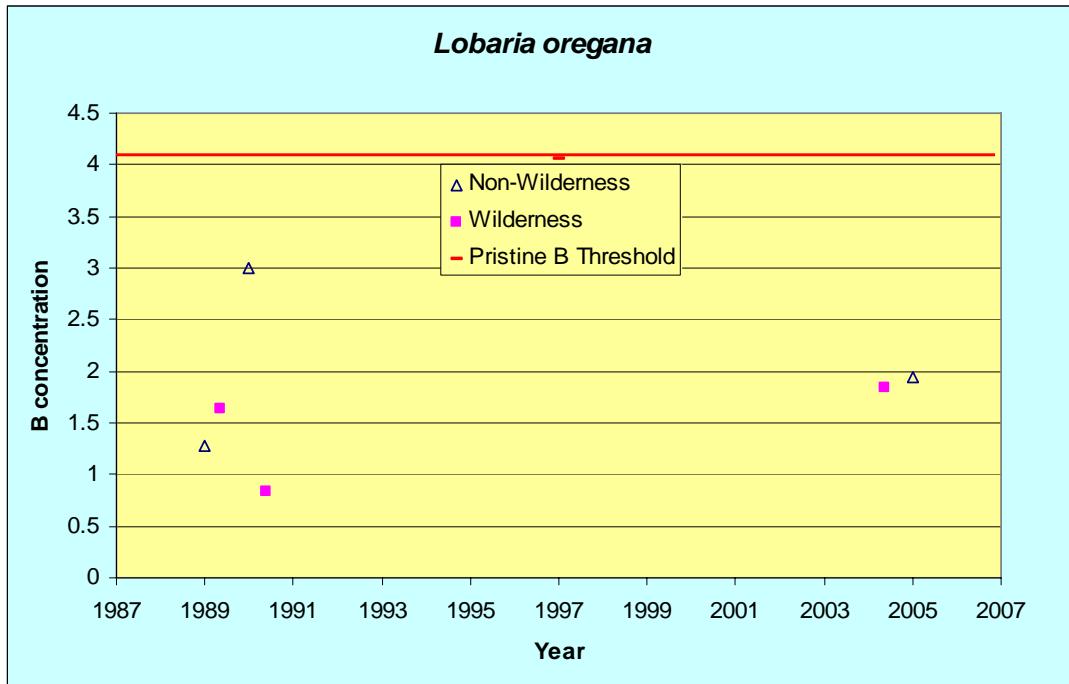


Figure VIII-15. Wilderness and Non-Wilderness yearly means of B ppm in *Lobaria oregana* per year.

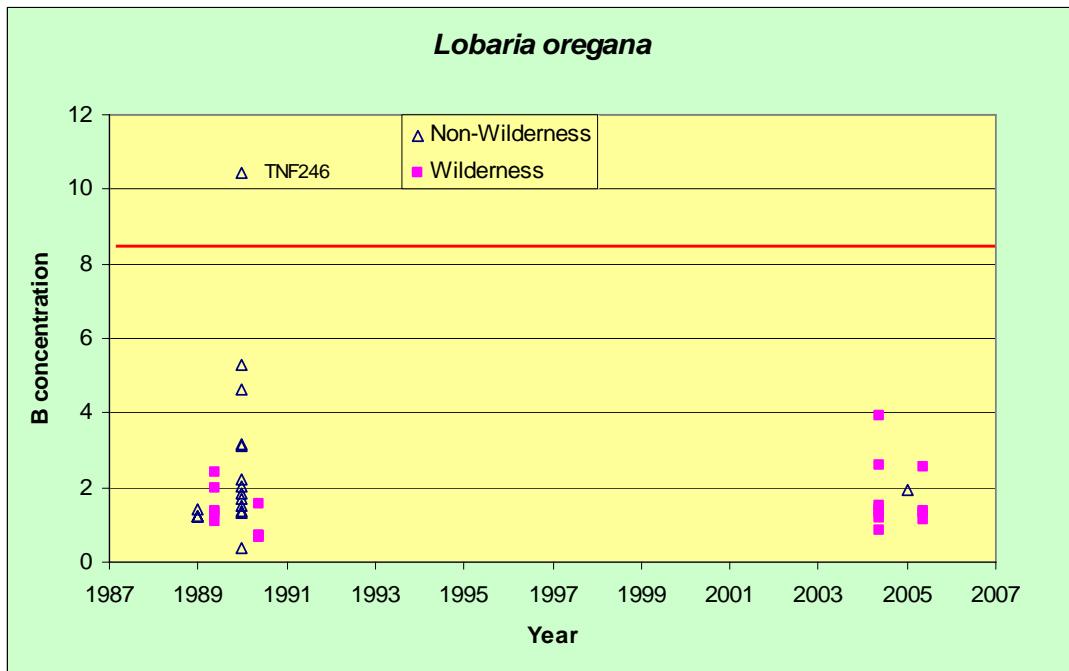


Figure VIII-16. Wilderness and Non-Wilderness plot means of B ppm in *Lobaria oregana* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA B ppm

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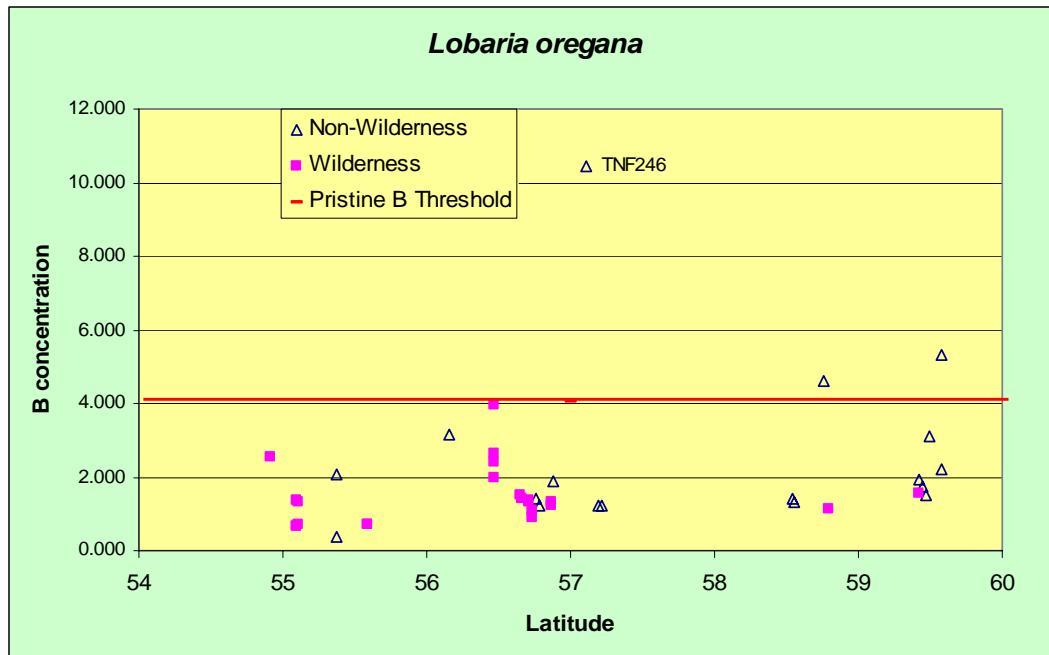


Figure VIII-17. Wilderness and Non-Wilderness plot means of B ppm in *Lobaria oregana* vs. plot Latitude.

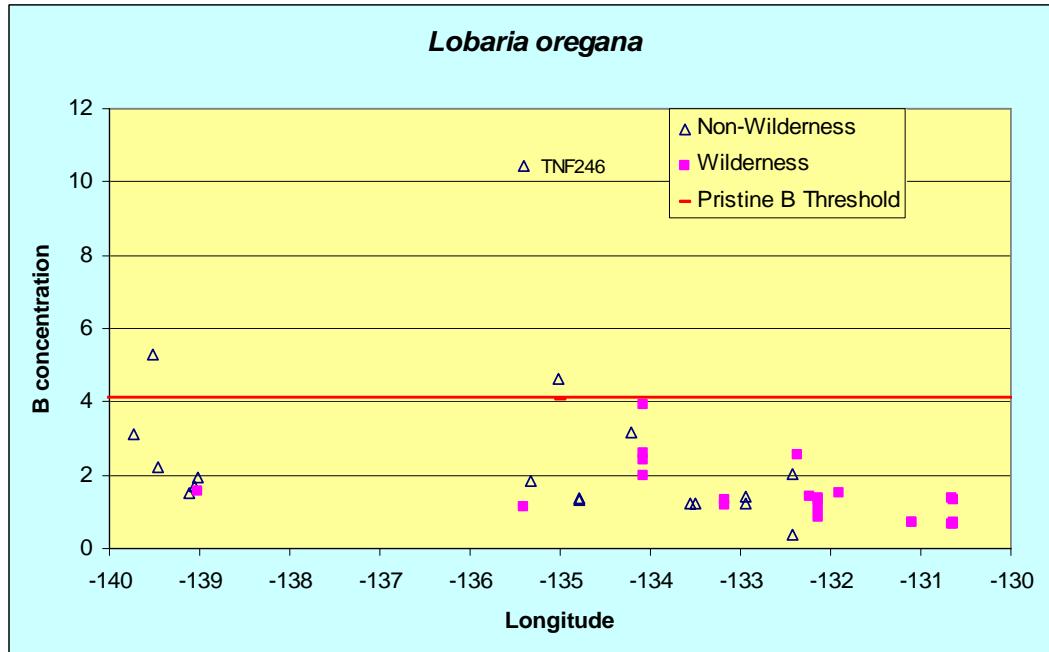


Figure VIII-18. Wilderness and Non-Wilderness plot means of B ppm in *Lobaria oregana* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

B ppm

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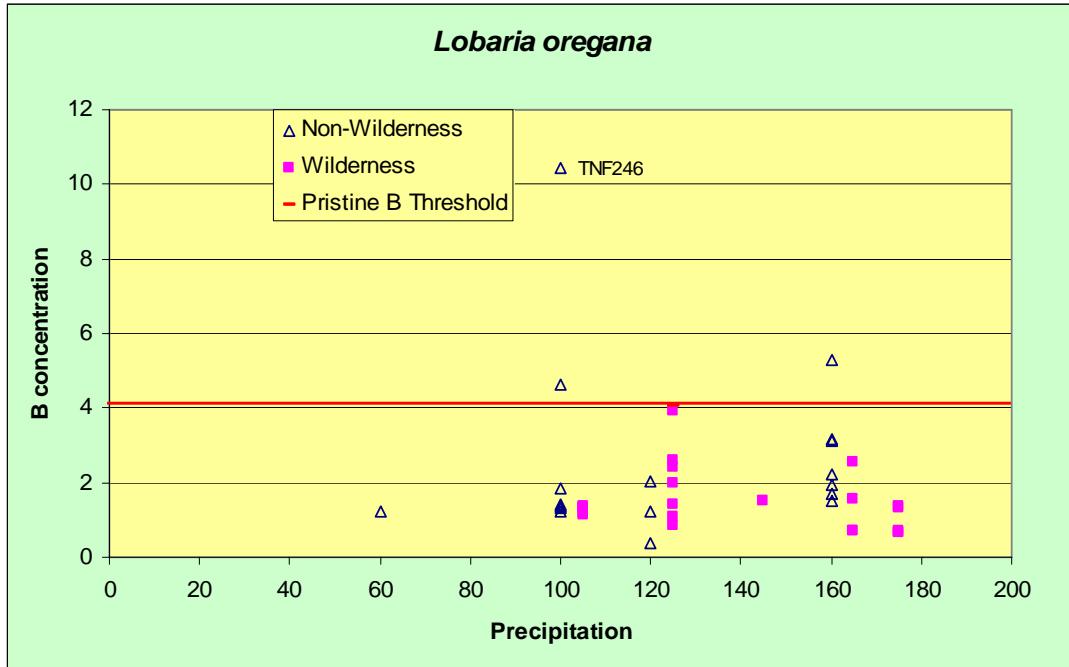


Figure VIII-19. Wilderness and Non-Wilderness plot means of B ppm in *Lobaria oregana* vs. plot Precipitation.

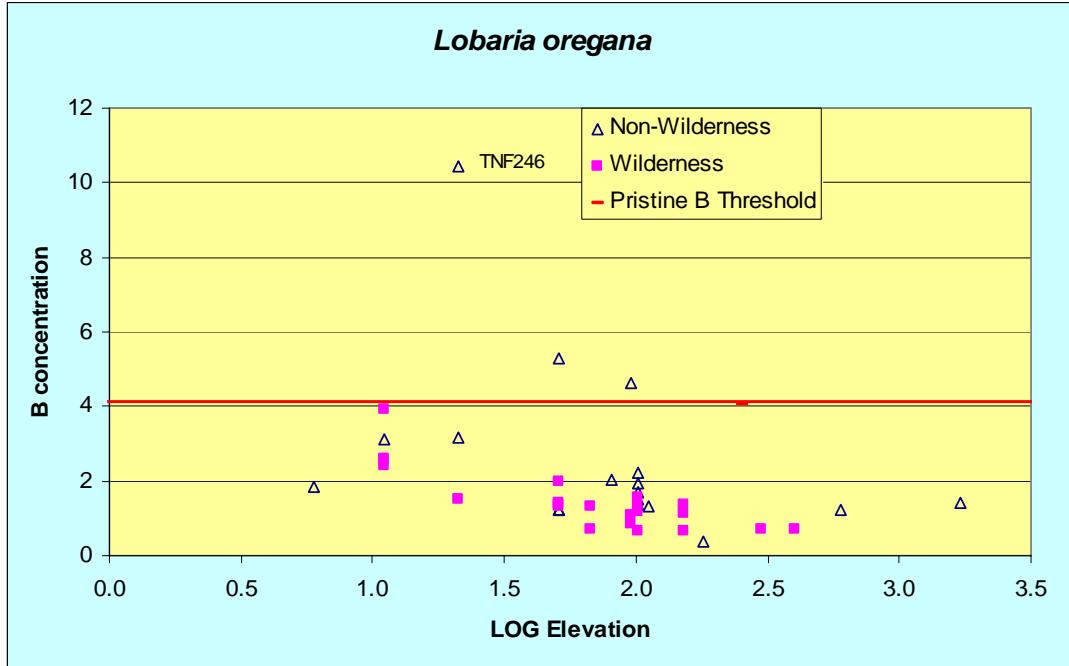


Figure VIII-20. Wilderness and Non-Wilderness plot means of B ppm in *Lobaria oregana* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

B ppm

██

Platismatia glauca

Table VIII-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the B ppm content of *Platismatia glauca* per year.

B ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2003	Wilderness	3.33	na	na	na
2004	Wilderness	2.75	0.5855	1.4256	4.0747
2005	Non-Wilderness	1.73	0.3344	0.9751	2.4879
2005	Wilderness	2.77	0.6650	1.1995	4.3447

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA B ppm

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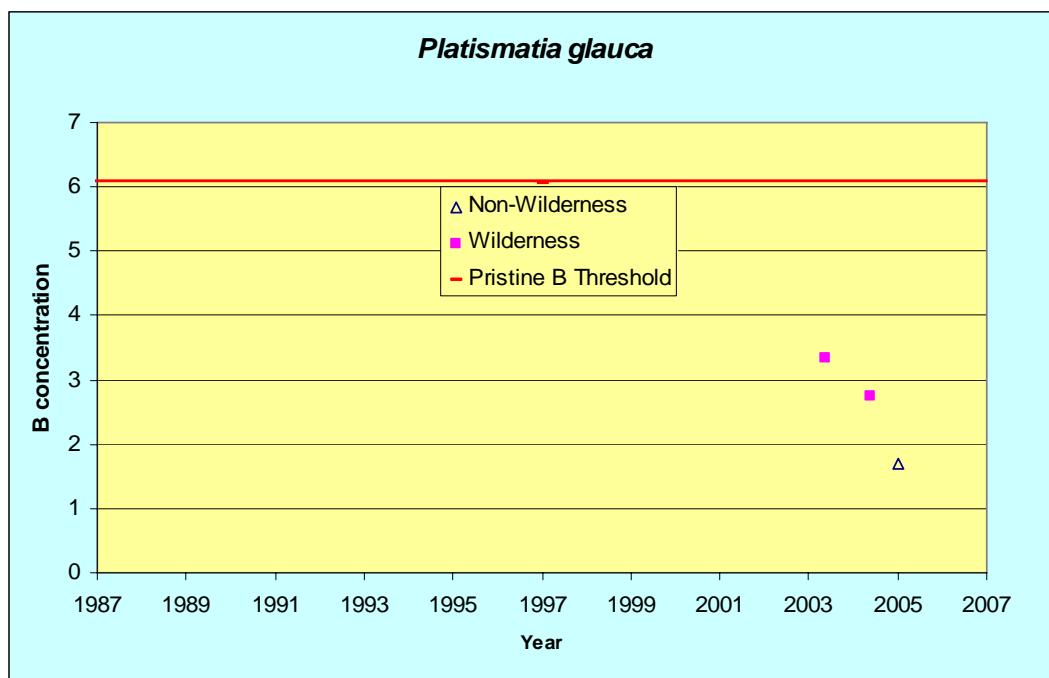


Figure VIII-21. Wilderness and Non-Wilderness yearly means of B ppm in *Platismatia glauca* per year.

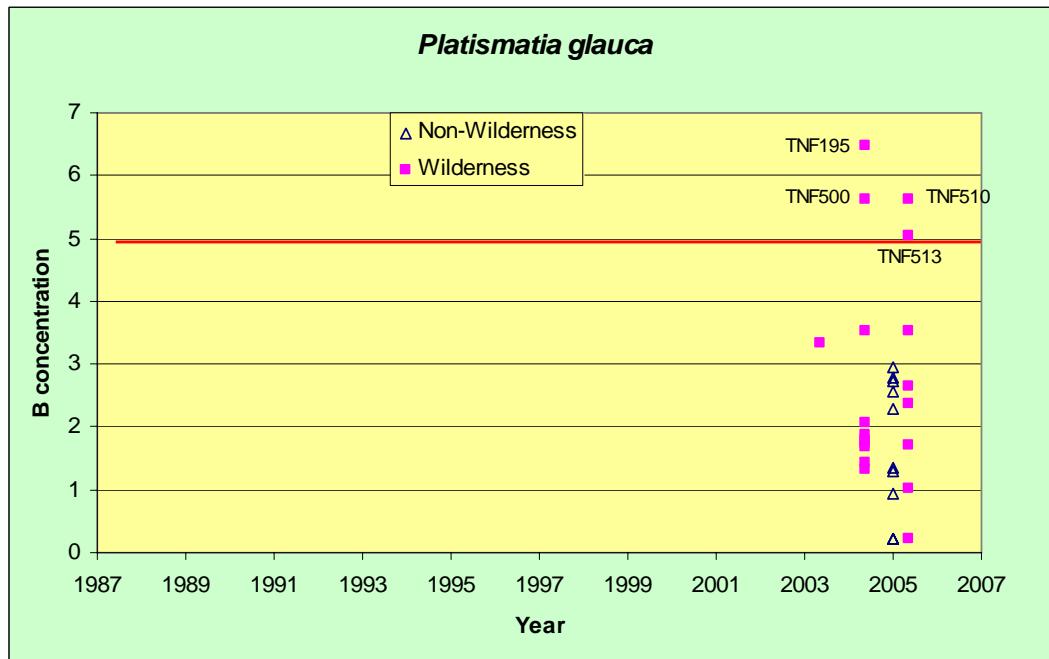


Figure VIII-22. Wilderness and Non-Wilderness plot means of B ppm in *Platismatia glauca* per year.

ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

B ppm

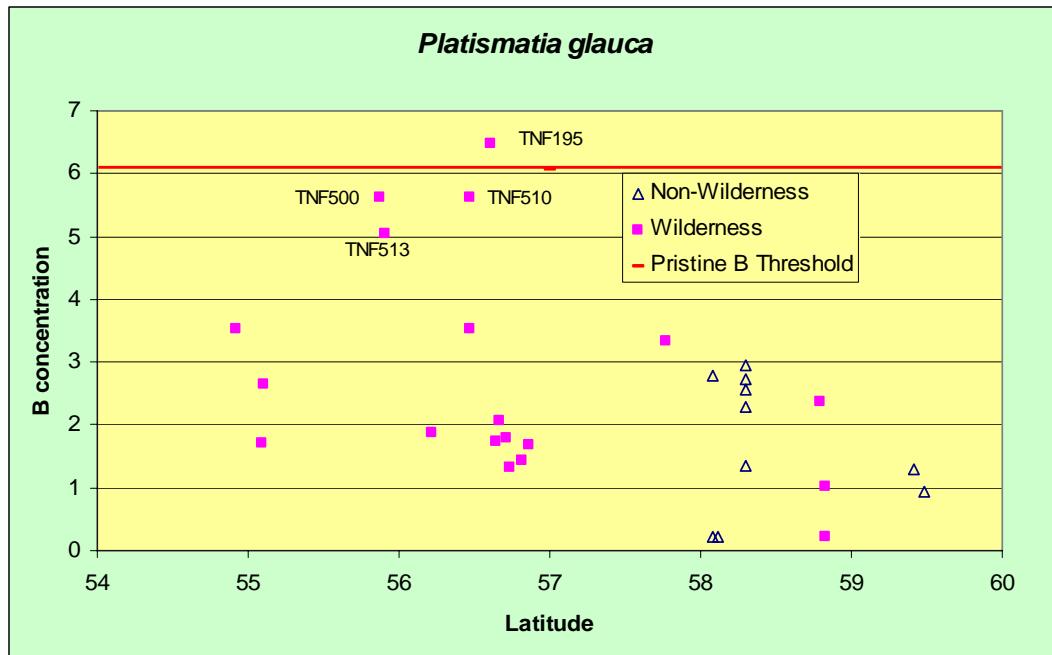


Figure VIII-23. Wilderness and Non-Wilderness plot means of B ppm in *Platismatia glauca* vs. plot Latitude.

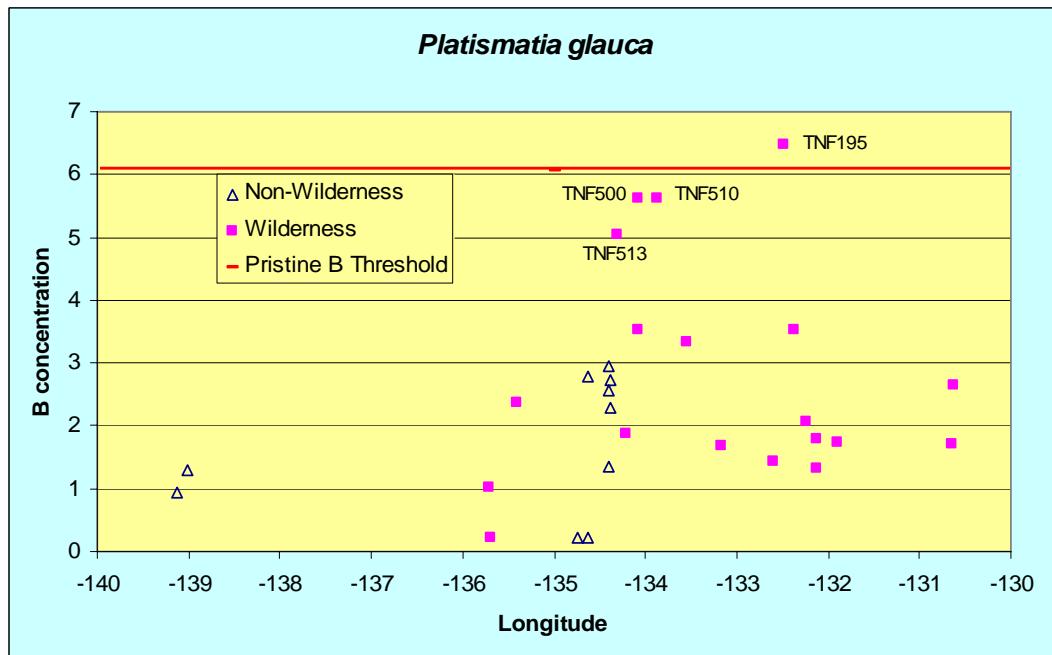


Figure VIII-24. Wilderness and Non-Wilderness plot means of B ppm in *Platismatia glauca* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

B ppm

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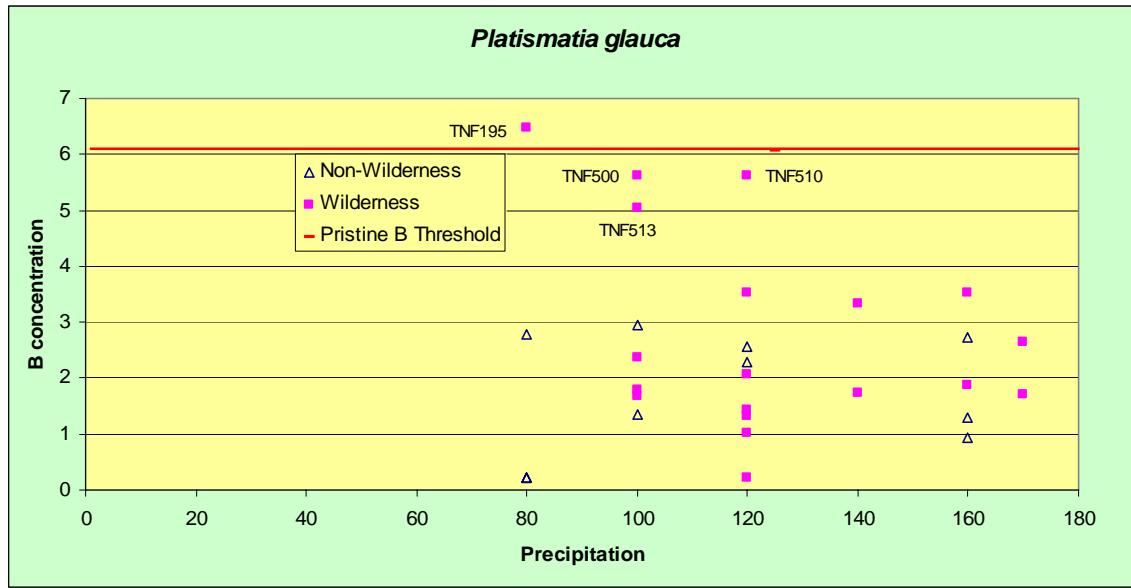


Figure VIII-25. Wilderness and Non-Wilderness plot means of B ppm
in *Platismatia glauca* vs. plot Precipitation.

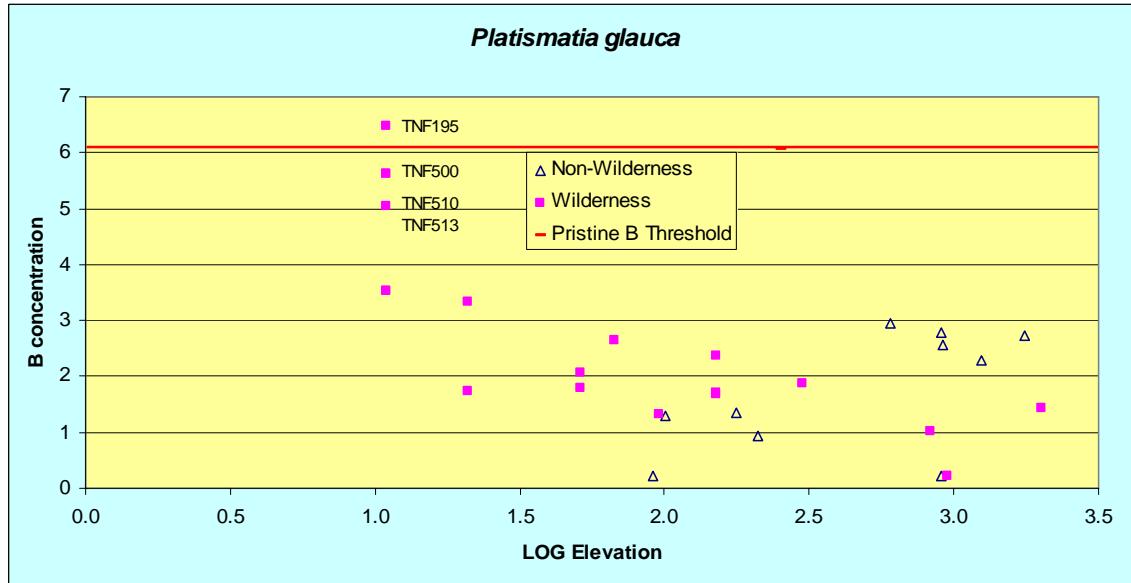


Figure VIII-26. Wilderness and Non-Wilderness plot means of B ppm
in *Platismatia glauca* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ba ppm

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IX. SUMMARY OF Ba PPM DATA ANALYSIS

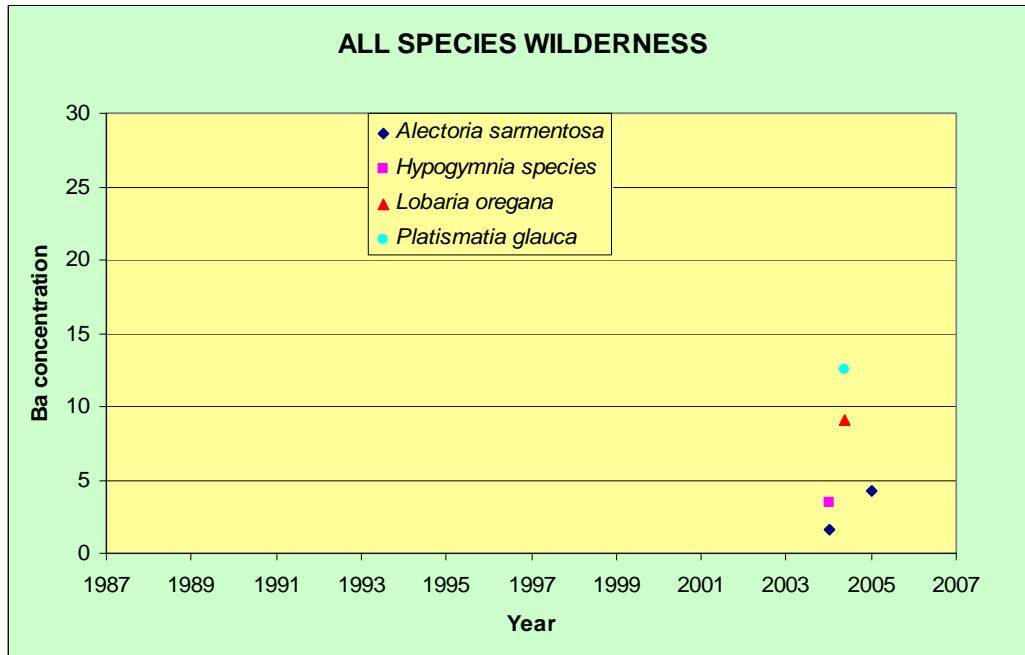


Figure XI-27. Wilderness plot means of Ba ppm
in All Species per year.

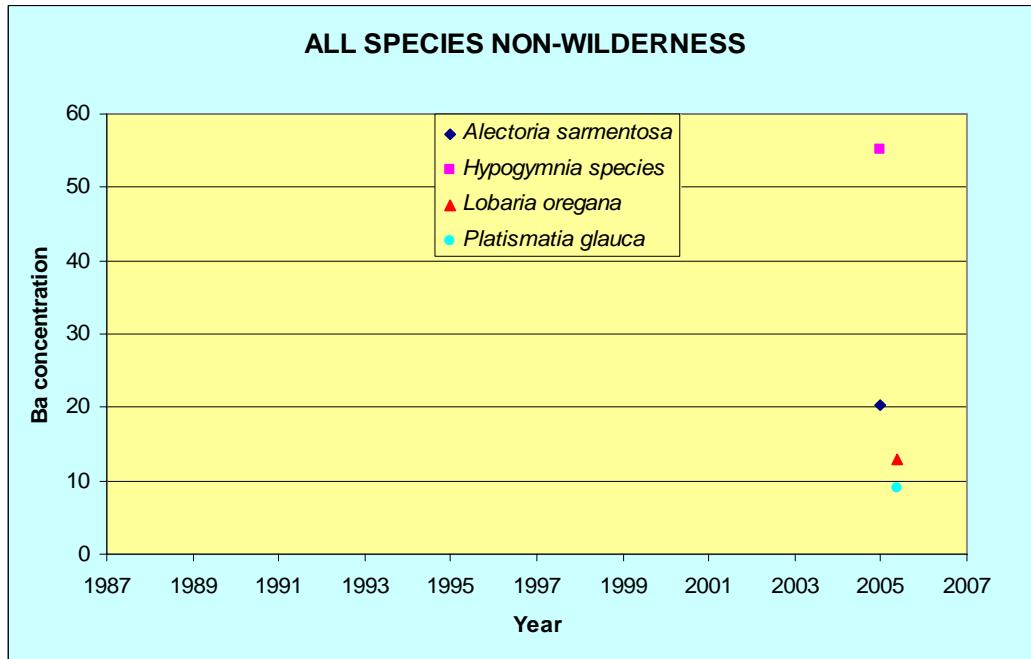


Figure XI-28. Non-Wilderness plot means of Ba ppm
in All Species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ba ppm

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Alectoria sarmentosa

Summary Statistics:

Table XI-2. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Ba ppm content of *Alectoria sarmentosa* per year.

Ba ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	1.65	0.5999	0.4113	2.8934
2005	Non-Wilderness	20.39	13.2402	0	54.4205
2005	Wilderness	4.28	2.1299	0	9.0980

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ba ppm

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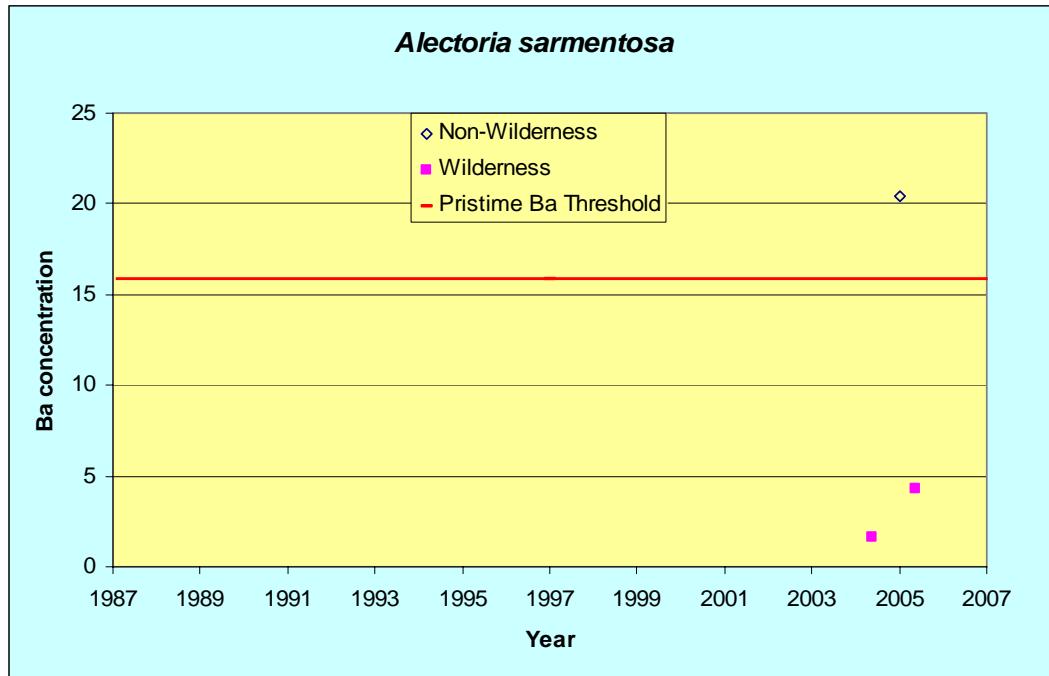


Figure XI-3. Wilderness and Non-Wilderness yearly means of Ba ppm in *Alectoria sarmentosa* per year.

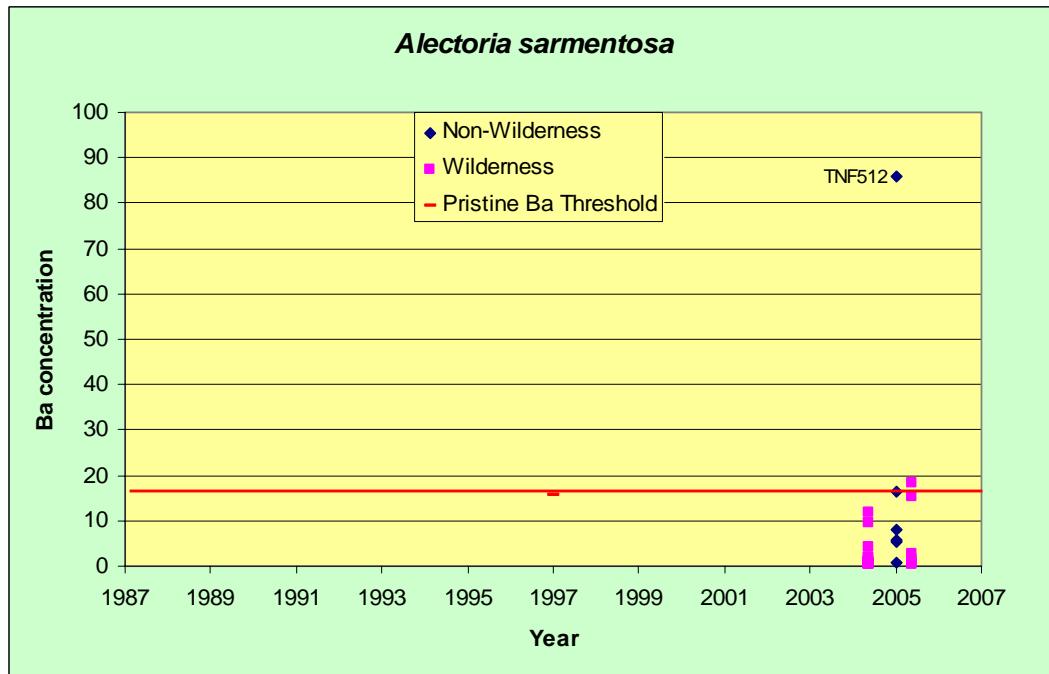


Figure XI-4. Wilderness and Non-Wilderness plot means of Ba ppm in *Alectoria sarmentosa* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ba ppm

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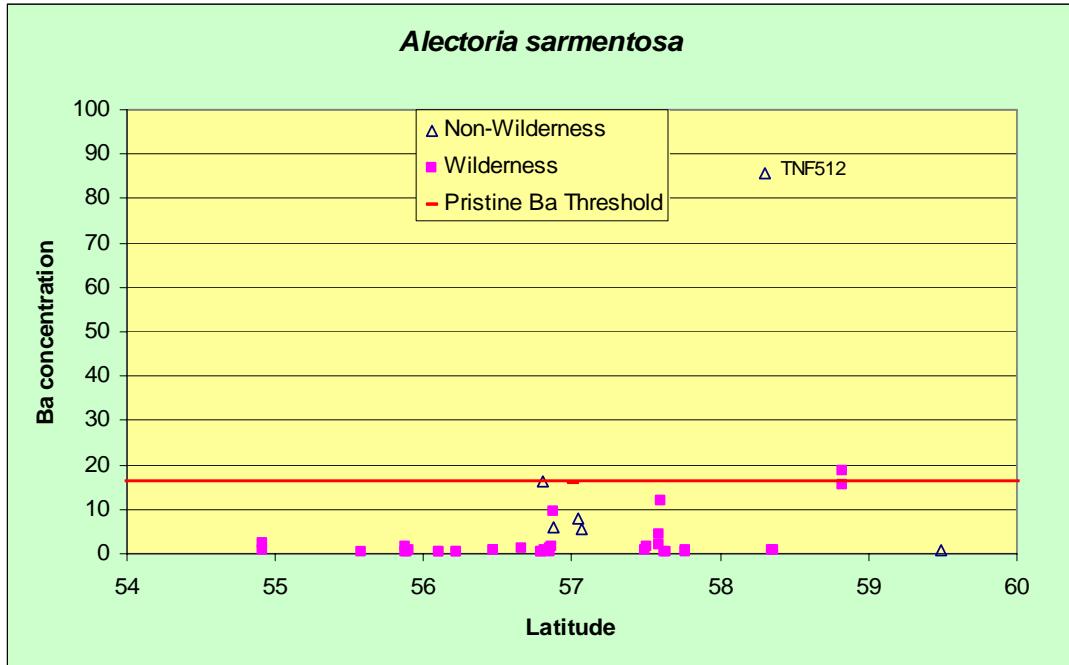


Figure XI-5. Wilderness and Non-Wilderness plot means of Ba ppm in *Alectoria sarmentosa* vs. plot Latitude.

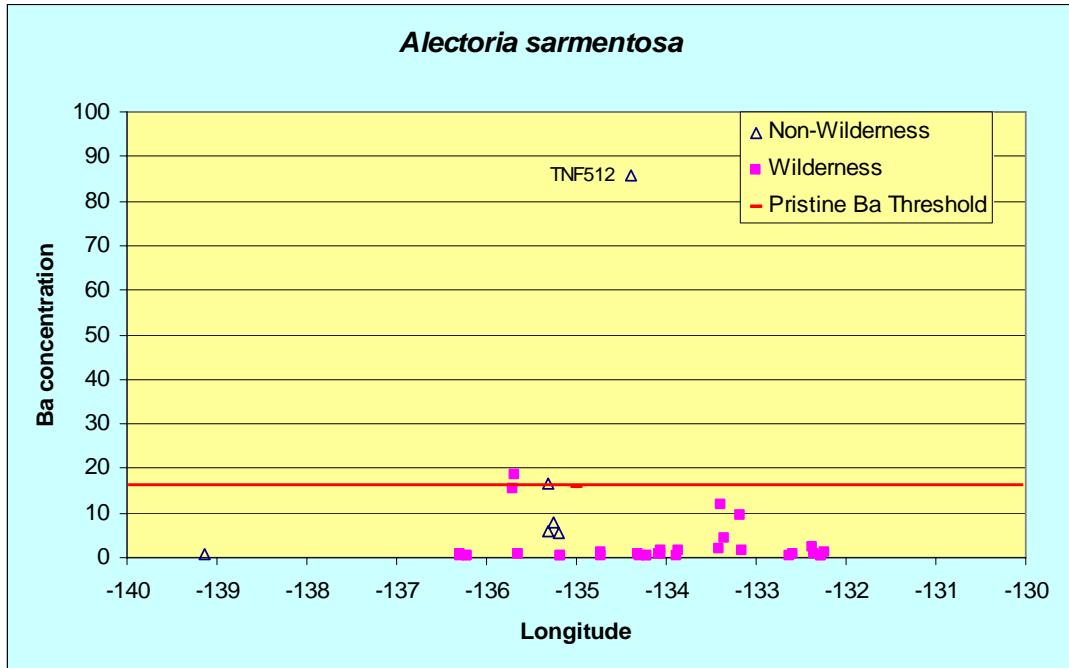


Figure XI-6. Wilderness and Non-Wilderness plot means of Ba ppm in *Alectoria sarmentosa* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ba ppm

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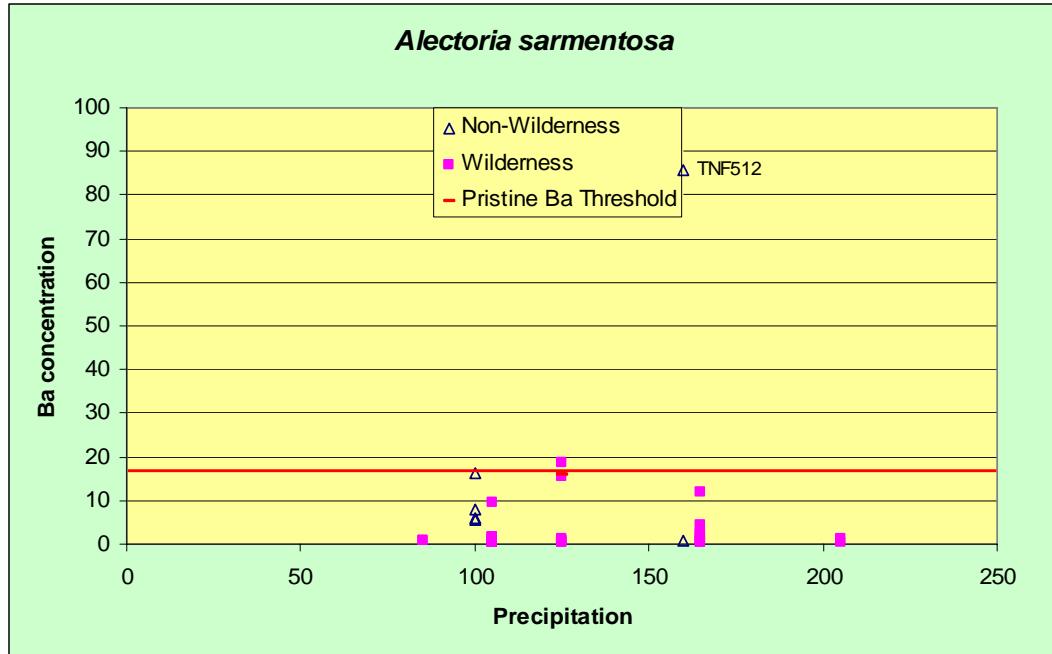


Figure XI-7. Wilderness and Non-Wilderness plot means of Ba ppm in *Alectoria sarmentosa* vs. plot Precipitation.

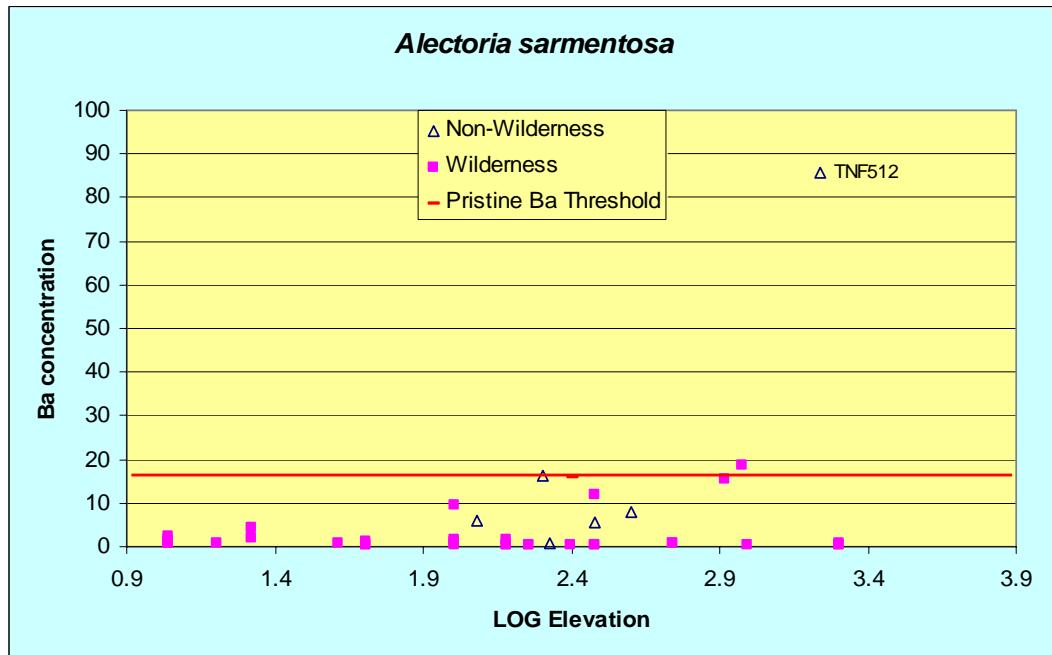


Figure XI-8. Wilderness and Non-Wilderness plot means of Ba ppm in *Alectoria sarmentosa* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ba ppm

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Hypogymnia species

In this series, all of the *Hypogymnia* species were included as a group.

Table XI-3. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Ba ppm content of *Hypogymnia species* per year.

Percent Sulfur				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	3.50	0.6441	1.8491	5.1605
2005	Non-Wilderness	55.13	9.0562	16.1617	94.0930
2005	Wilderness	25.42	9.1365	4.3554	46.4929

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ba ppm

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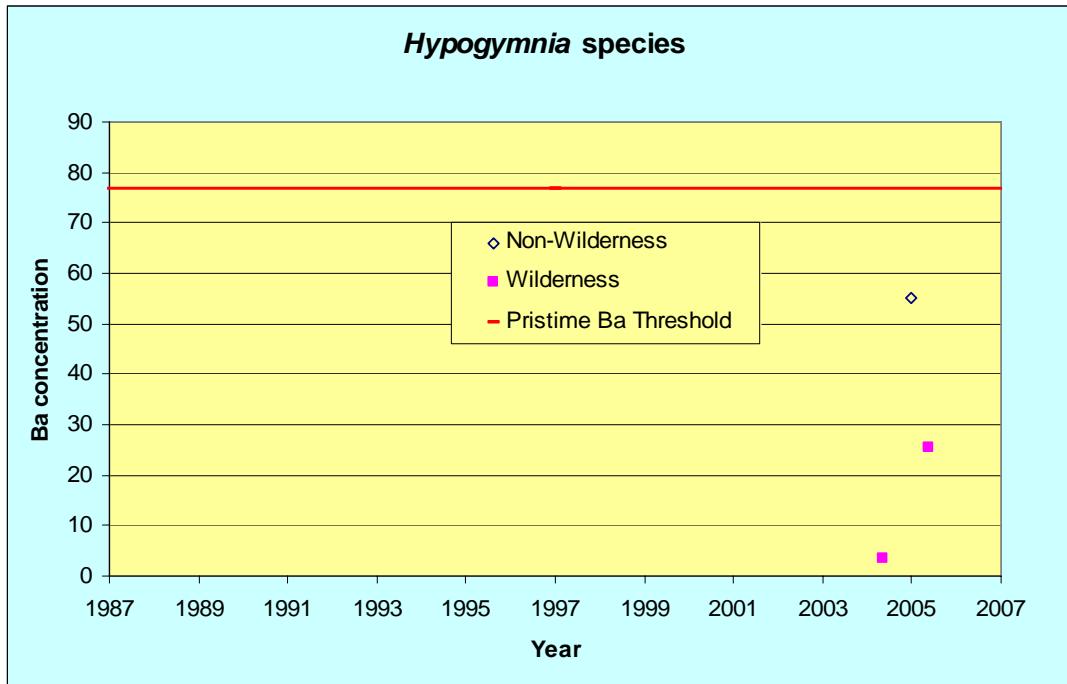


Figure XI-9. Wilderness and Non-Wilderness yearly means of Ba ppm in *Hypogymnia* species per year.

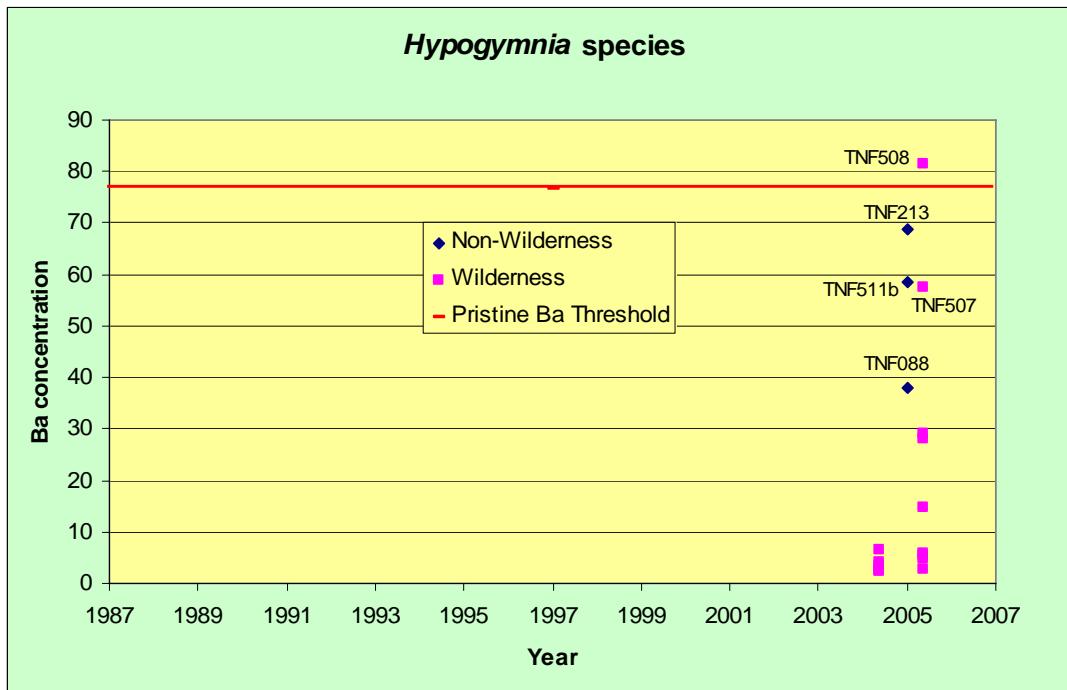


Figure XI-10. Wilderness and Non-Wilderness plot means of Ba ppm in *Hypogymnia* species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ba ppm

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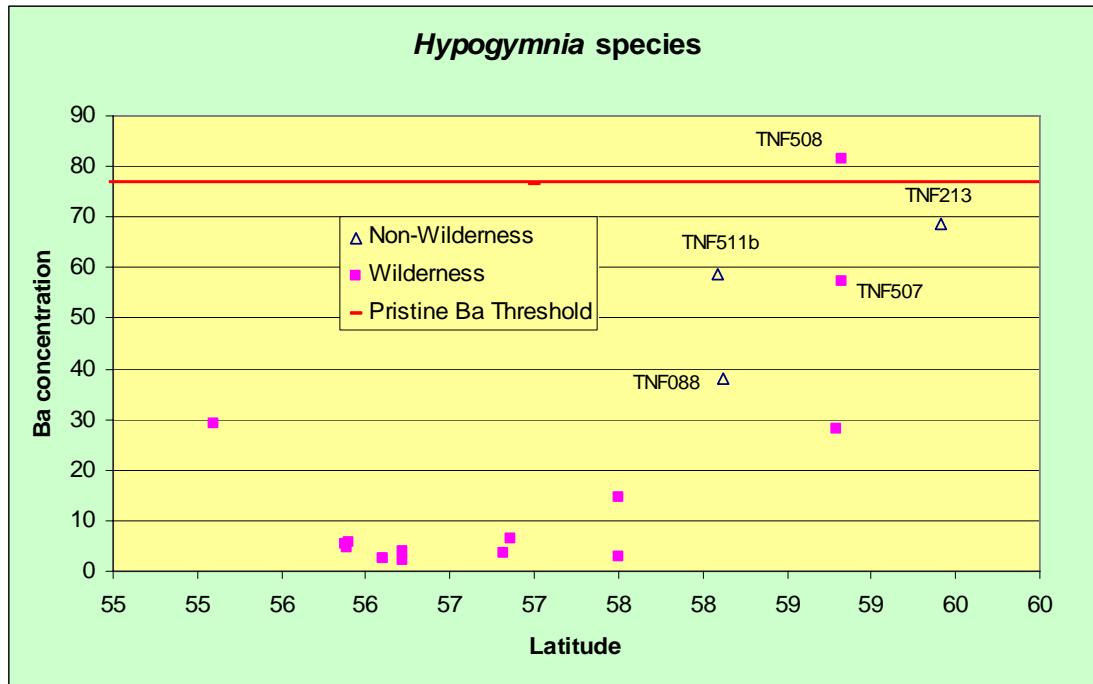


Figure XI-11. Wilderness and Non-Wilderness plot means of Ba ppm in *Hypogymnia* species vs. plot Latitude.

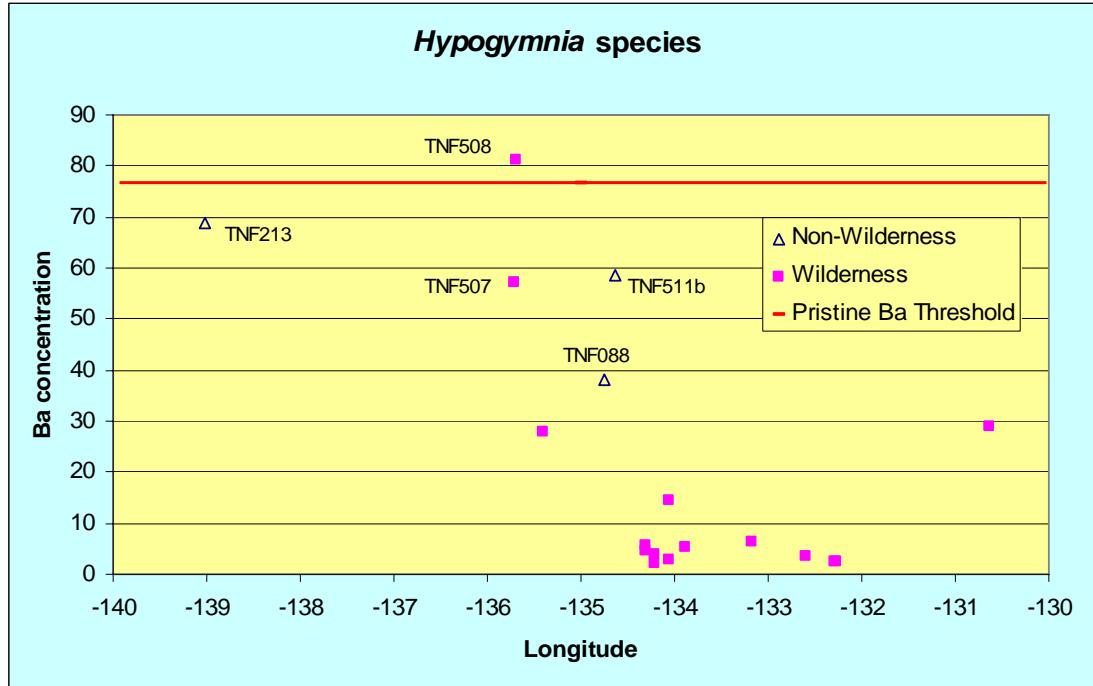


Figure XI-12. Wilderness and Non-Wilderness plot means of Ba ppm in *Hypogymnia* species vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ba ppm

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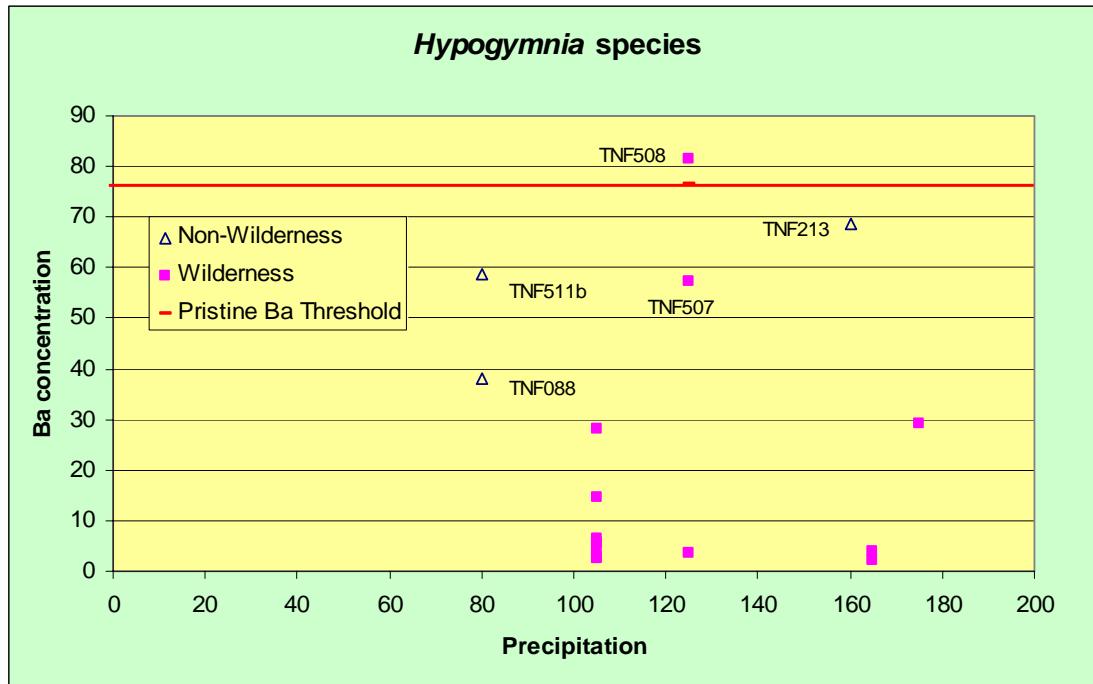


Figure XI-13. Wilderness and Non-Wilderness plot means of Ba ppm
in *Hypogymnia* species vs. plot Precipitation.

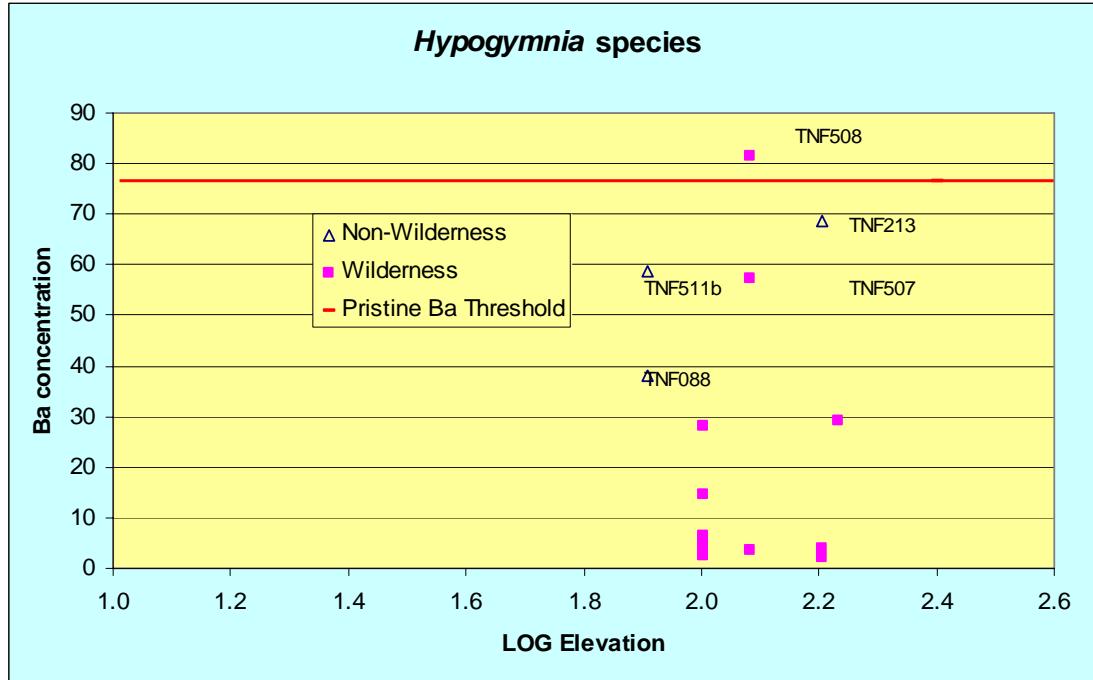


Figure XI-14. Wilderness and Non-Wilderness plot means of Ba ppm
in *Hypogymnia* species vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ba ppm

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Lobaria oregana

Table XI-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Ba ppm content of *Lobaria oregana* per year.

Ba ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	9.03	2.5273	2.8483	15.2166
2005	Non-Wilderness	12.98	NA	NA	NA
2005	Wilderness	4.13	3.1883	-6.0131	14.2803

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ba ppm

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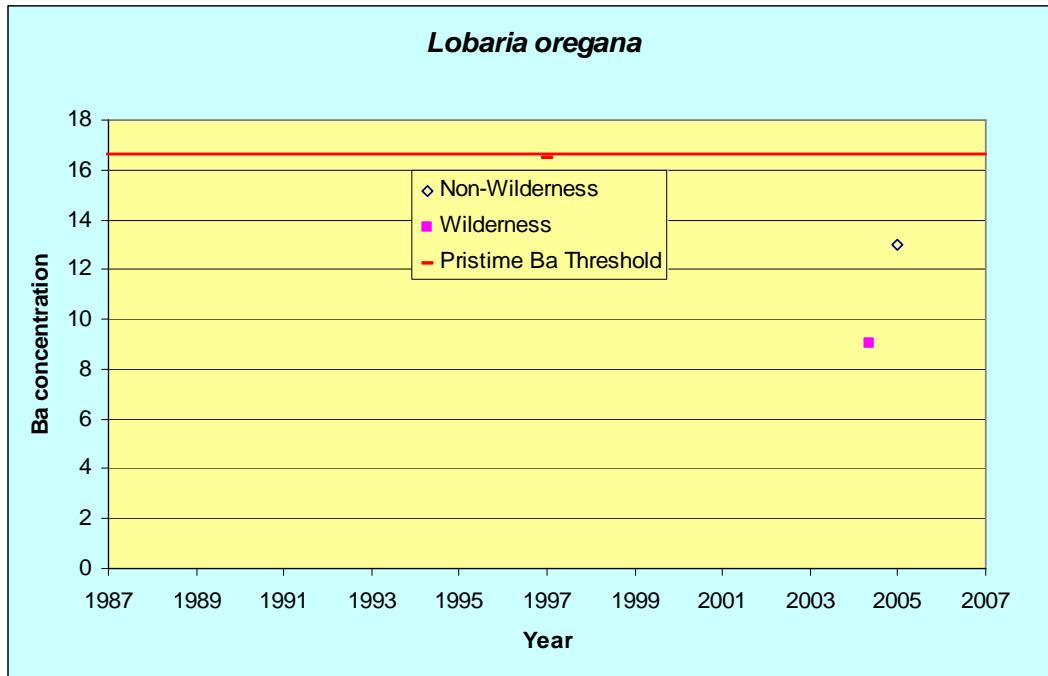


Figure XI-15. Wilderness and Non-Wilderness yearly means of Ba ppm in *Lobaria oregana* per year.

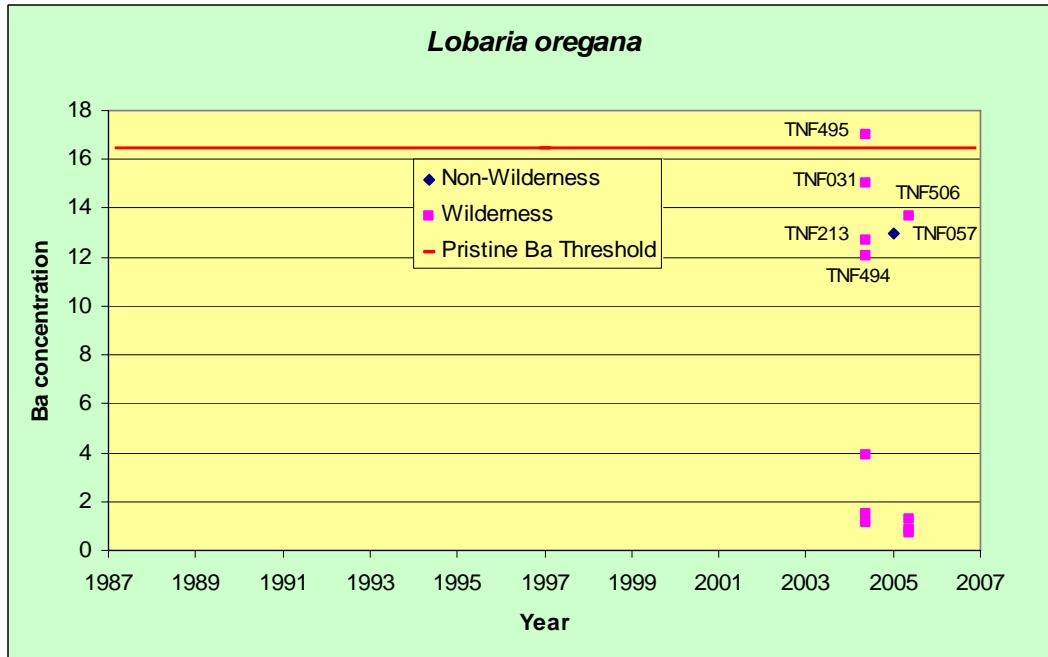


Figure XI-16. Wilderness and Non-Wilderness plot means of Ba ppm in *Lobaria oregana* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ba ppm

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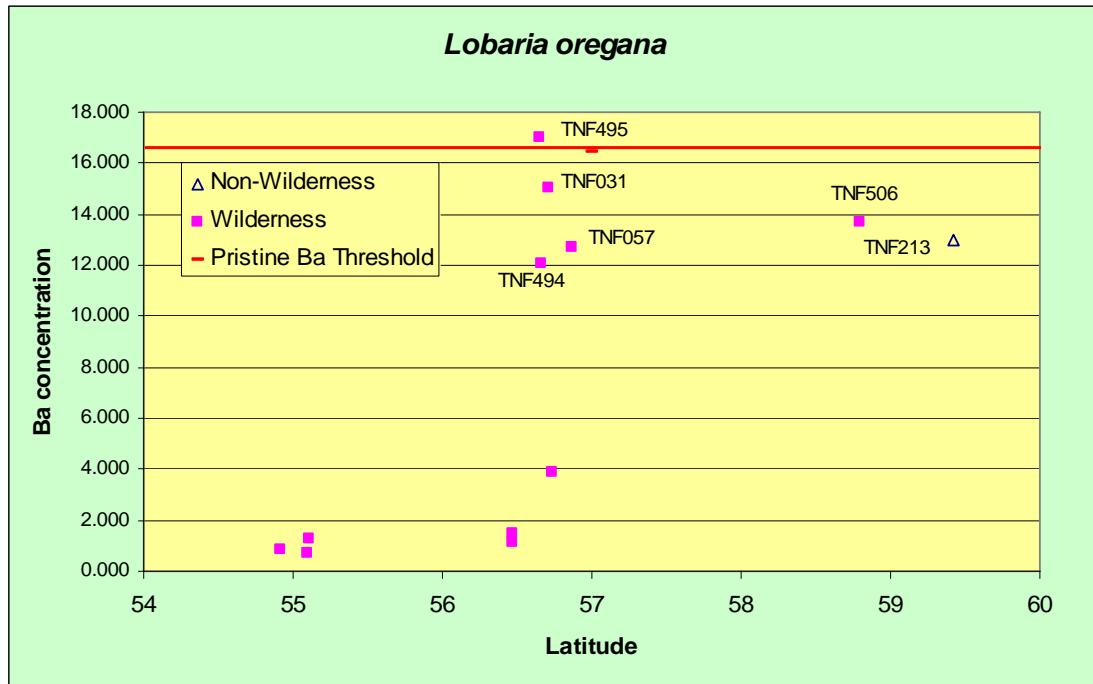


Figure XI-17. Wilderness and Non-Wilderness plot means of Ba ppm in *Lobaria oregana* vs. plot Latitude.

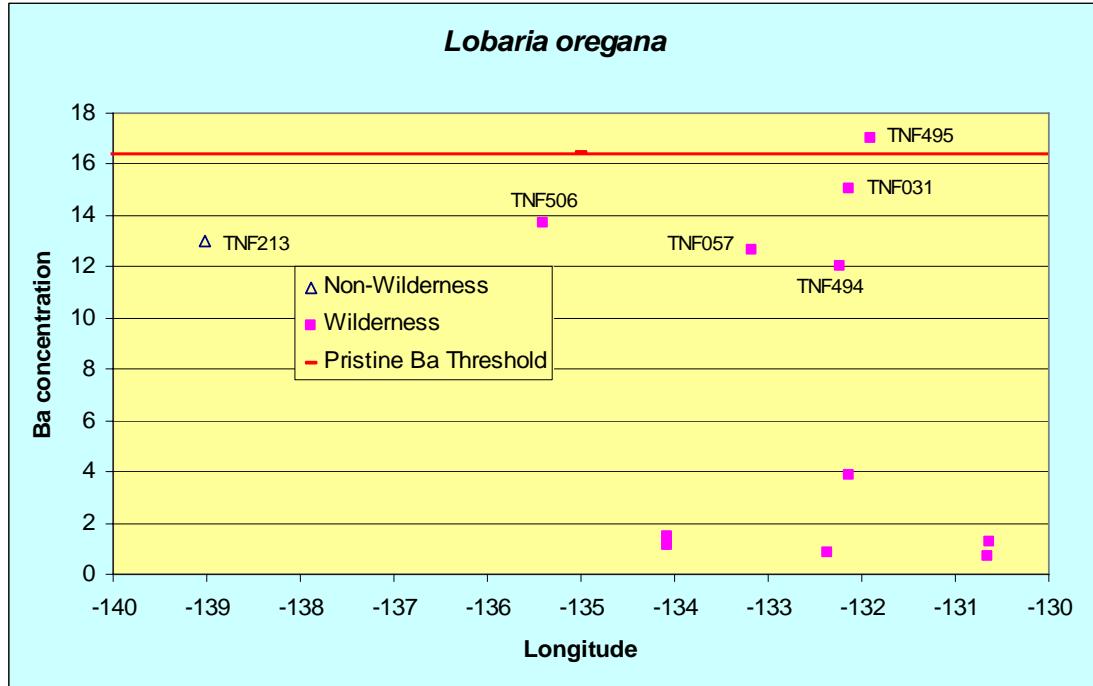


Figure XI-18. Wilderness and Non-Wilderness plot means of Ba ppm in *Lobaria oregana* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ba ppm

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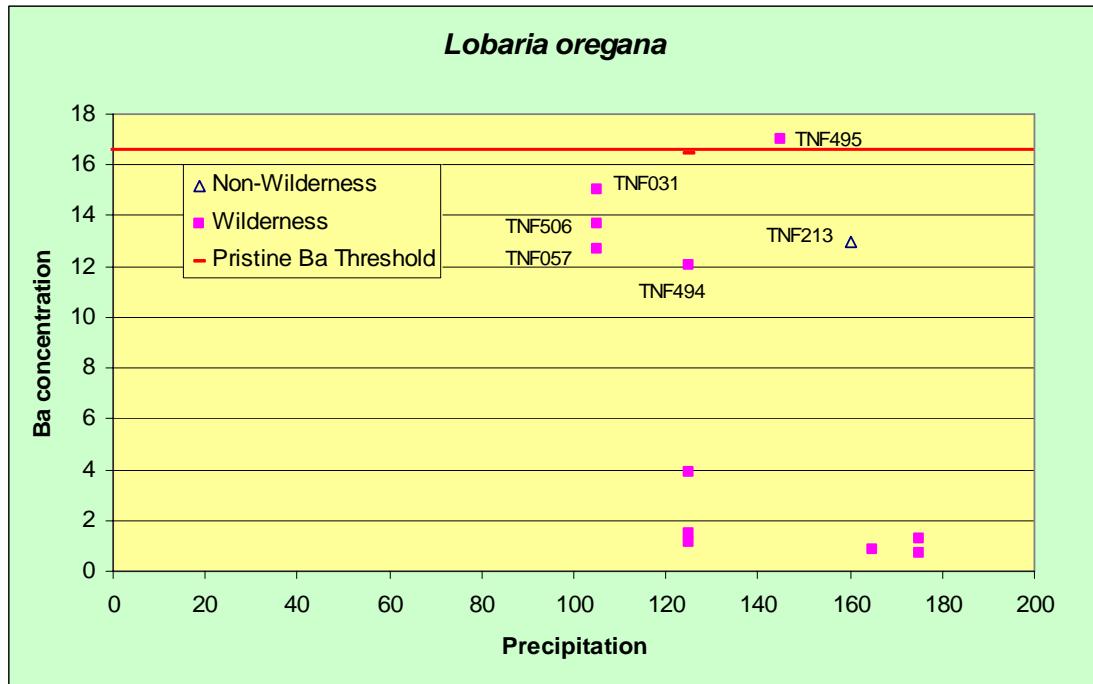


Figure XI-19. Wilderness and Non-Wilderness plot means of Ba ppm in *Lobaria oregana* vs. plot Precipitation.

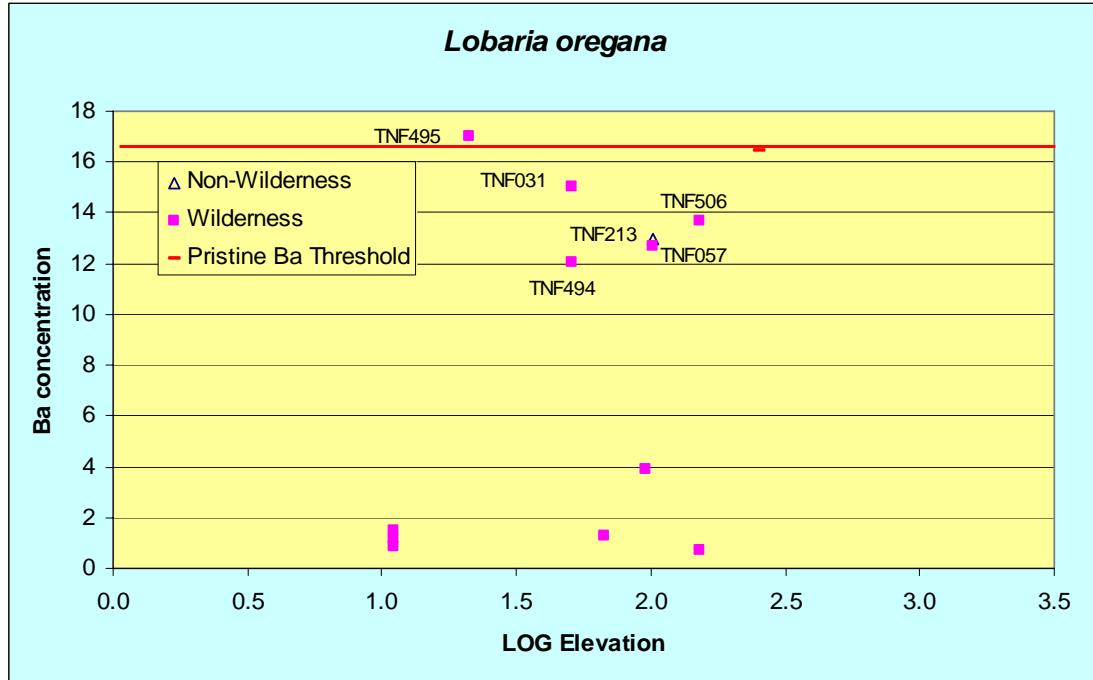


Figure XI-20. Wilderness and Non-Wilderness plot means of Ba ppm in *Lobaria oregana* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ba ppm

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Platismatia glauca

Table XI-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Ba ppm content of *Platismatia glauca* per year.

Ba ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	12.49	3.6615	4.2085	20.7742
2005	Non-Wilderness	38.39	5.3959	26.1874	50.6000
2005	Wilderness	23.15	7.3451	5.7827	40.5196

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ba ppm

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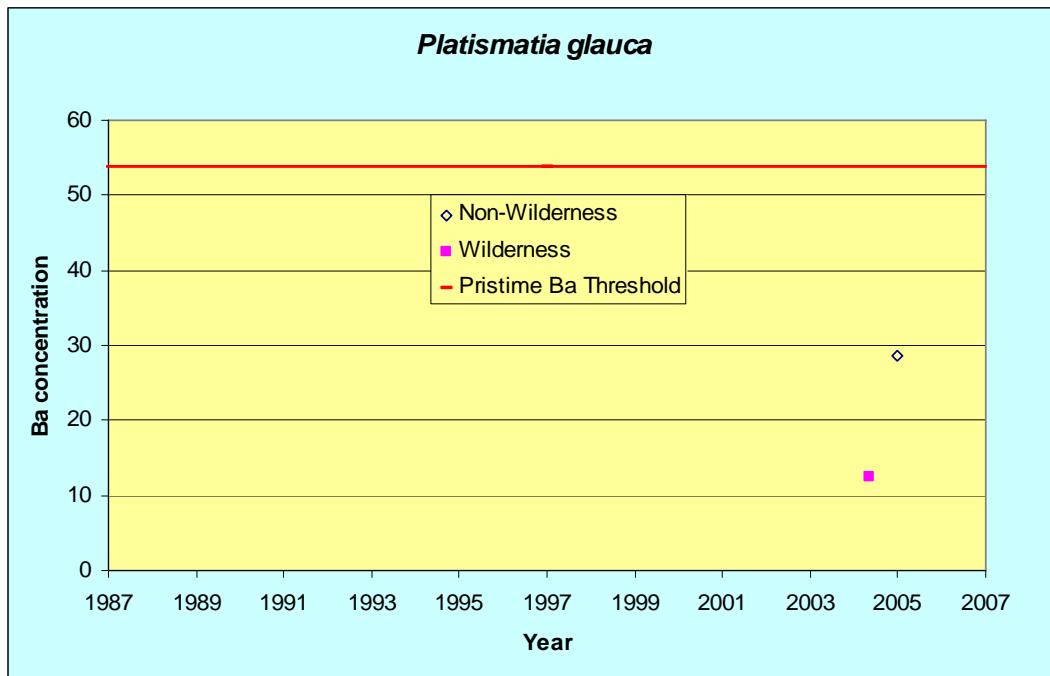


Figure XI-21. Wilderness and Non-Wilderness yearly means of Ba ppm
in *Platismatia glauca* per year.

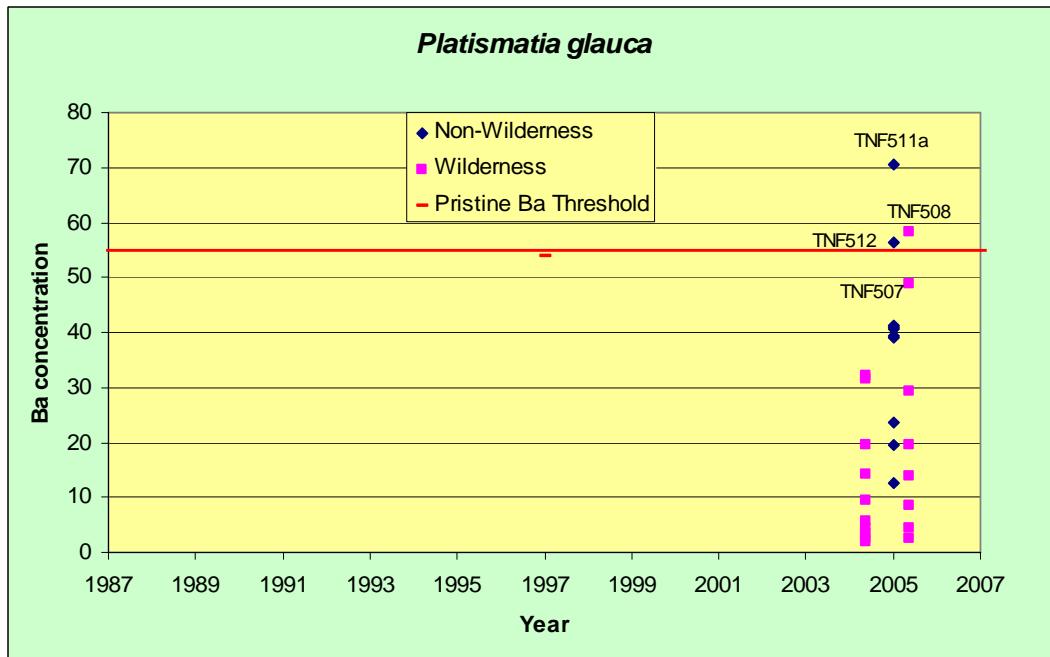


Figure XI-22. Wilderness and Non-Wilderness plot means of Ba ppm
in *Platismatia glauca* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ba ppm

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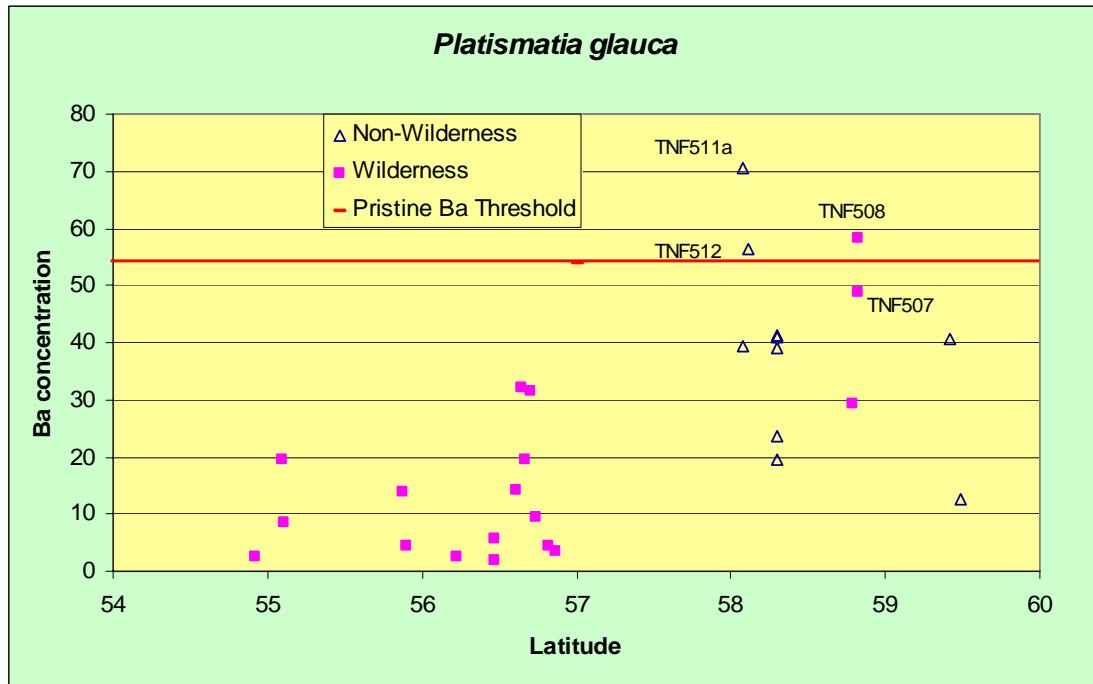


Figure XI-23. Wilderness and Non-Wilderness plot means of Ba ppm in *Platismatia glauca* vs. plot Latitude.

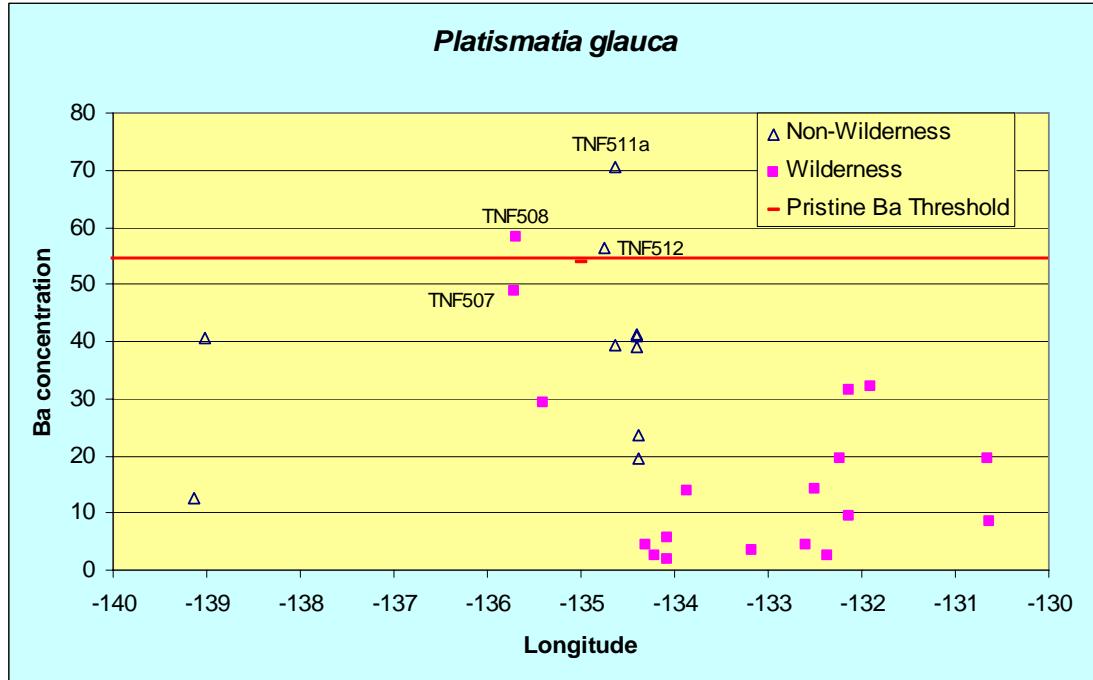


Figure XI-24. Wilderness and Non-Wilderness plot means of Ba ppm in *Platismatia glauca* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ba ppm

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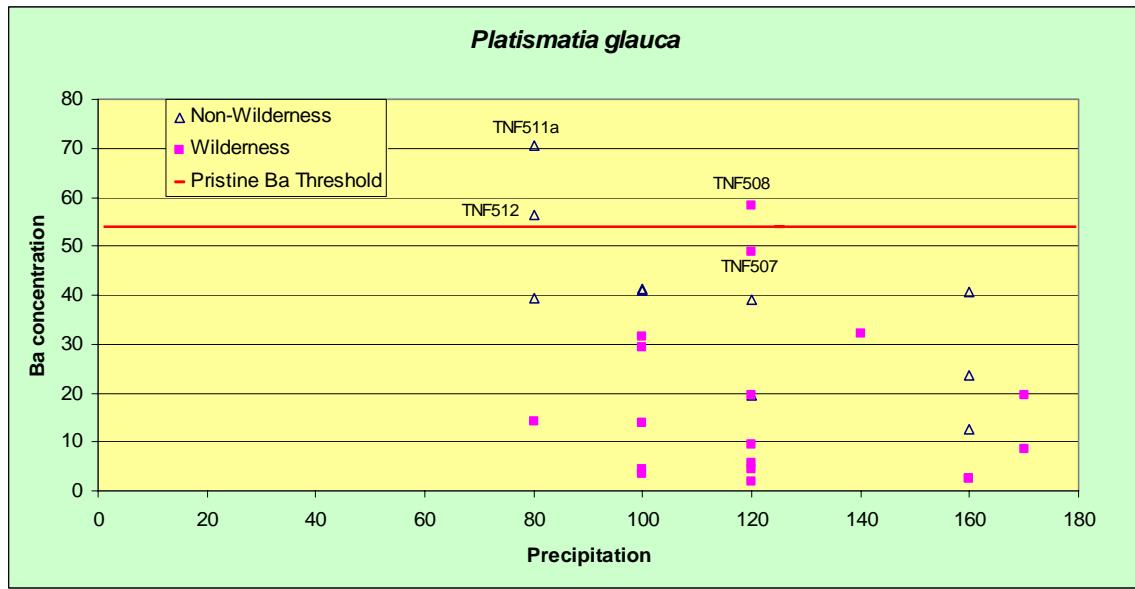


Figure XI-25. Wilderness and Non-Wilderness plot means of Ba ppm in *Platismatia glauca* vs. plot Precipitation.

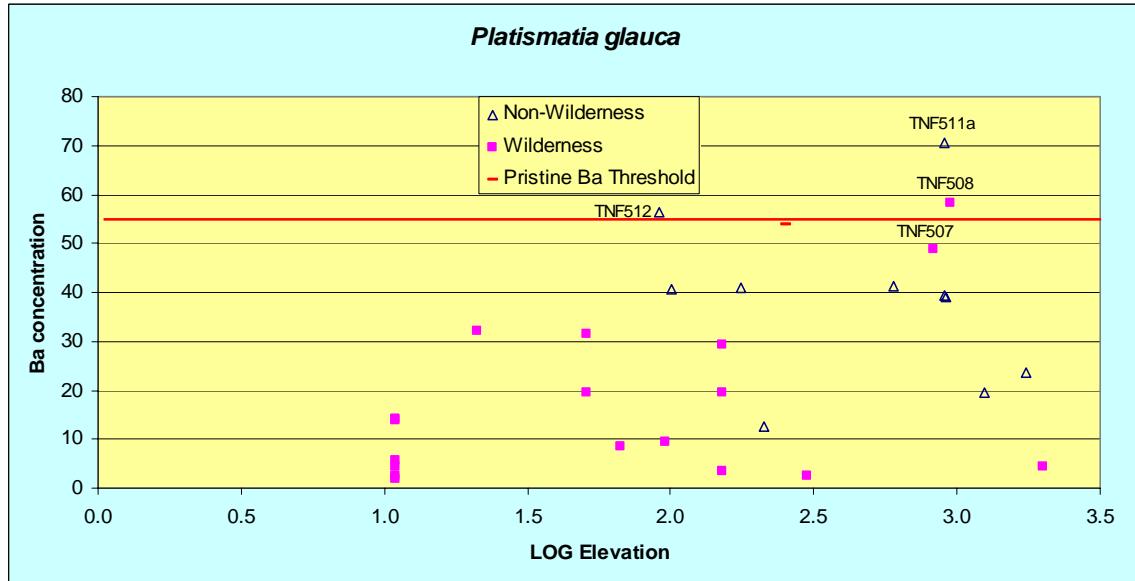


Figure XI-26. Wilderness and Non-Wilderness plot means of Ba ppm in *Platismatia glauca* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Be ppm

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X. SUMMARY OF BE PPM DATA ANALYSIS

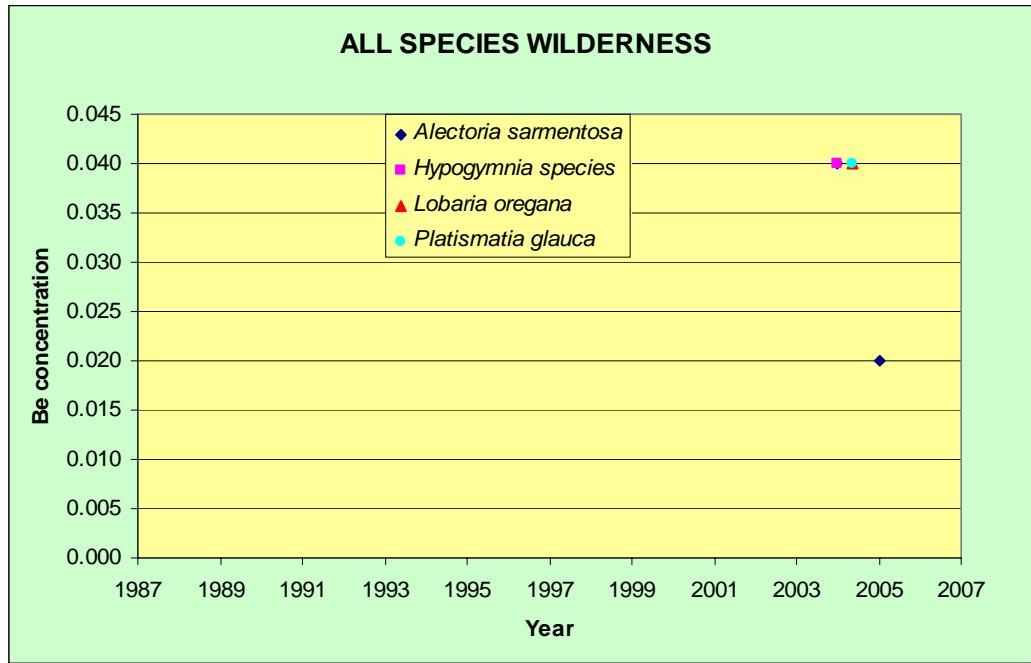


Figure X-27. Wilderness plot means of Be ppm
in All Species per year.

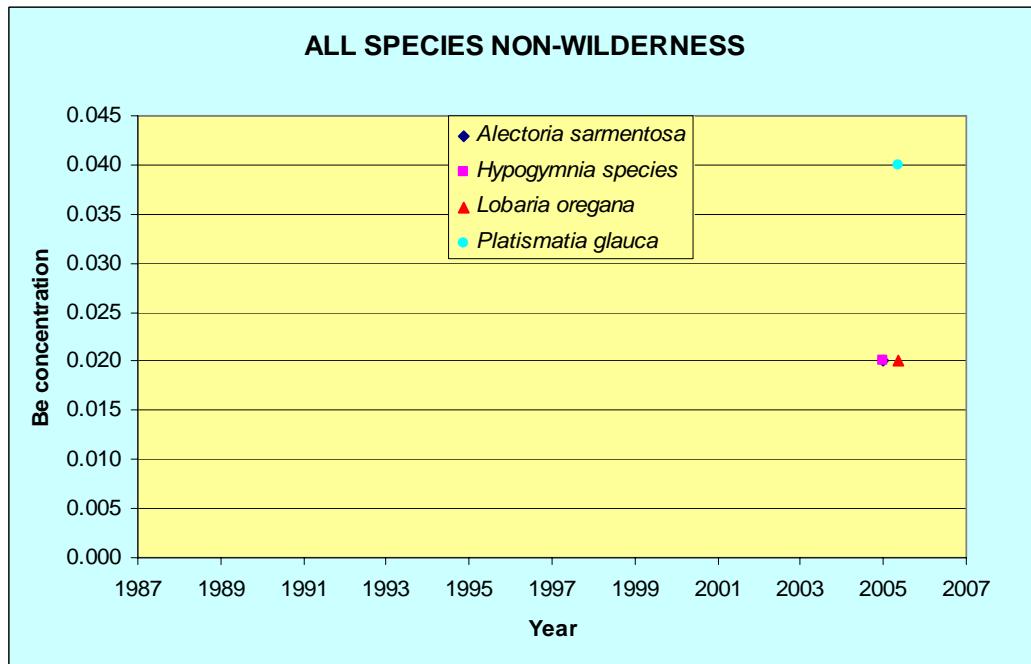


Figure X-28. Non-Wilderness plot means of Be ppm
in All Species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Be ppm

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Alectoria sarmentosa

Summary Statistics:

Table X-2. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Be ppm content of *Alectoria sarmentosa* per year.

Be ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	0.04	0.0000	0.0400	0.0400
2005	Non-Wilderness	0.02	0.0000	0.0200	0.0200
2005	Wilderness	0.02	0.0000	0.0200	0.0200

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Be ppm

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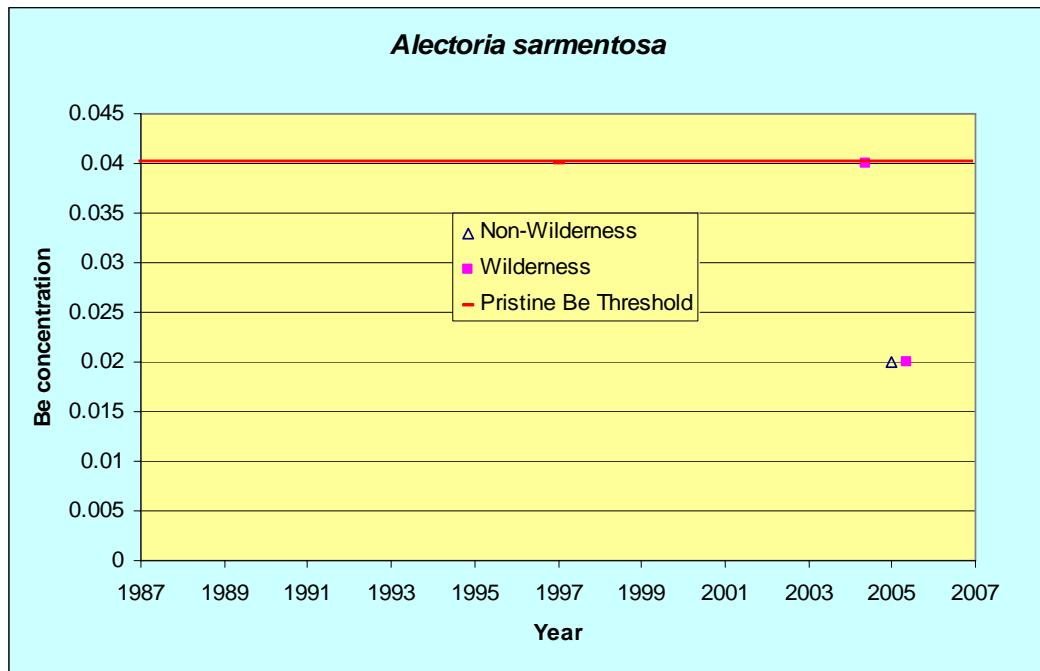


Figure X-3. Wilderness and Non-Wilderness yearly means of Be ppm in *Alectoria sarmentosa* per year.

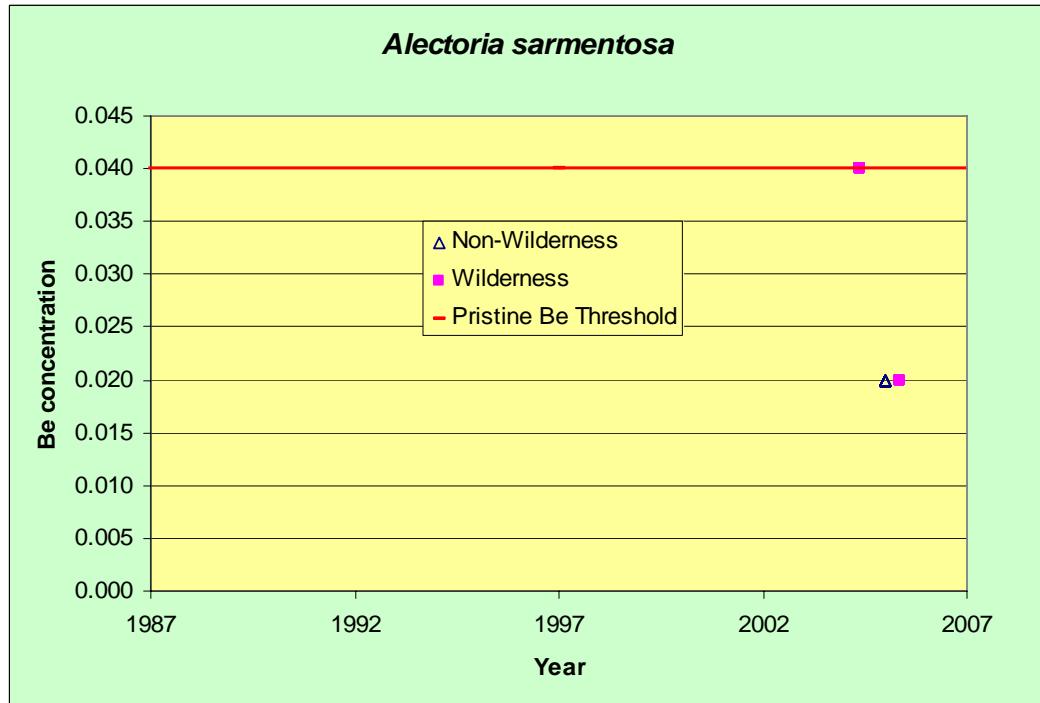


Figure X-4. Wilderness and Non-Wilderness plot means of Be ppm in *Alectoria sarmentosa* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Be ppm

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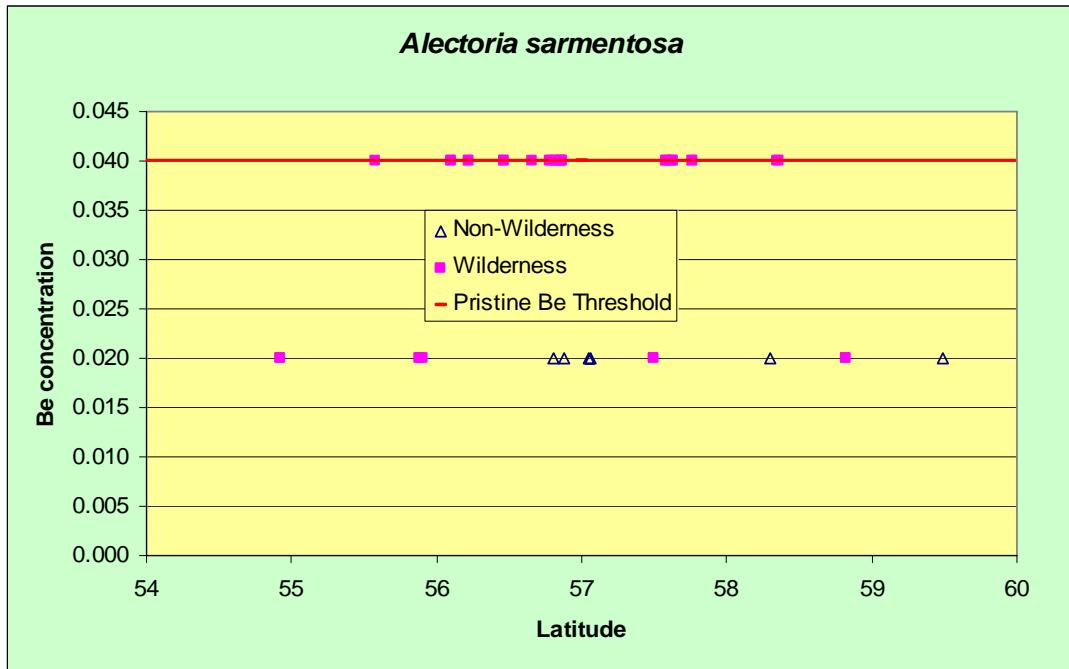


Figure X-5. Wilderness and Non-Wilderness plot means of Be ppm in *Alectoria sarmentosa* vs. plot Latitude.

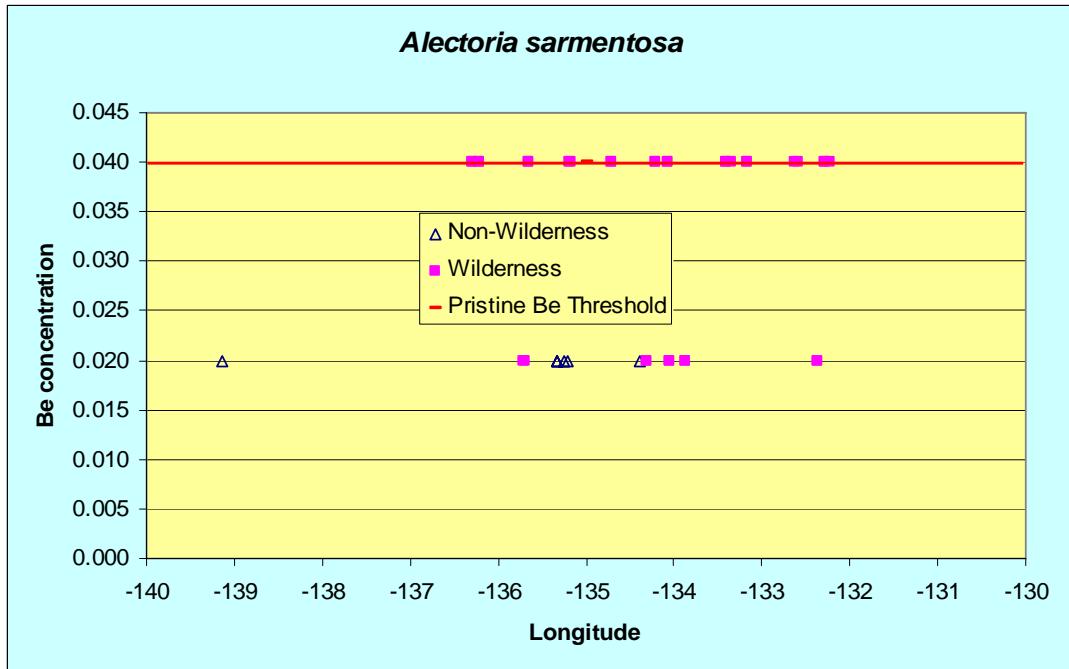


Figure X-6. Wilderness and Non-Wilderness plot means of Be ppm in *Alectoria sarmentosa* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Be ppm

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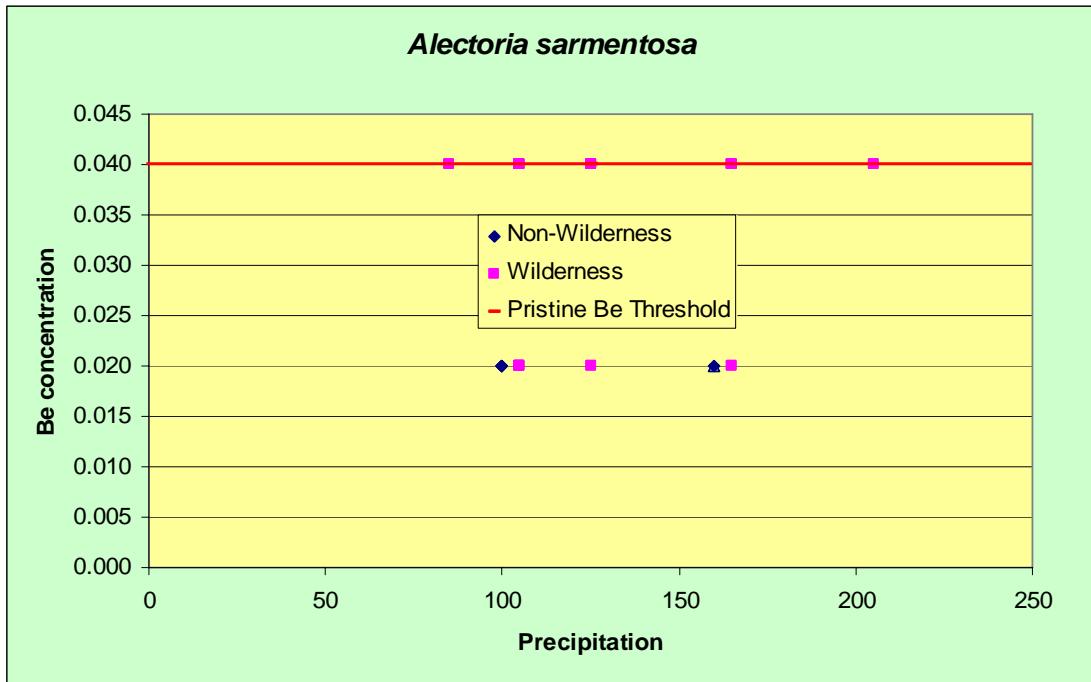


Figure X-7. Wilderness and Non-Wilderness plot means of Be ppm in *Alectoria sarmentosa* vs. plot Precipitation.

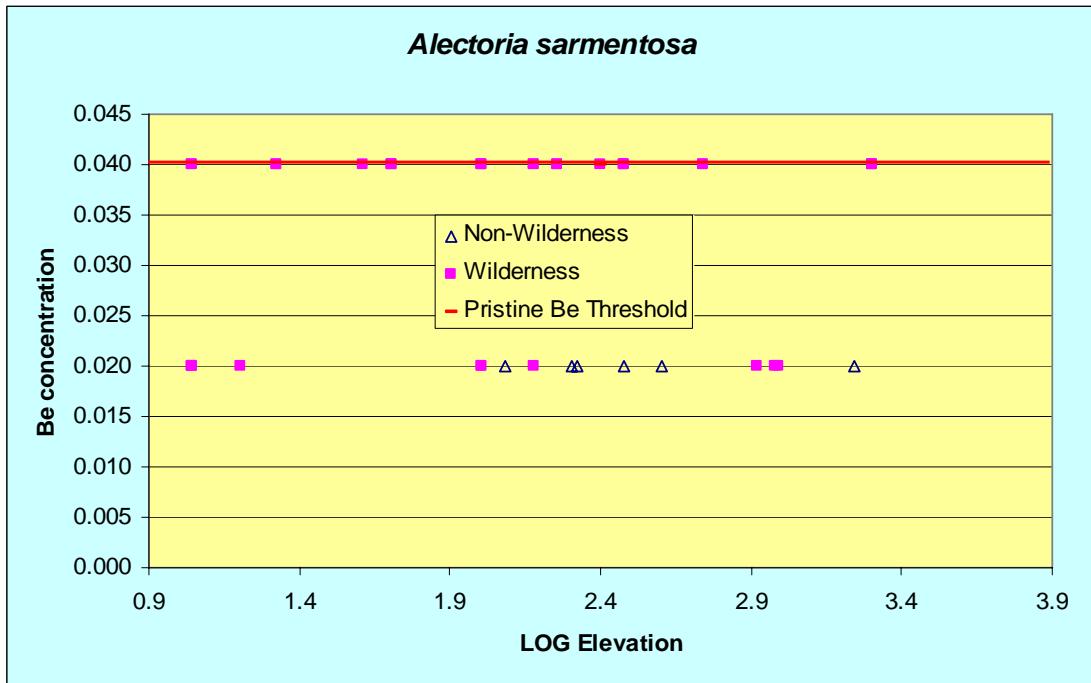


Figure X-8. Wilderness and Non-Wilderness plot means of Be ppm in *Alectoria sarmentosa* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Be ppm

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Hypogymnia species

In this series, all of the *Hypogymnia* species were included as a group.

Table X-3. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Be ppm content of *Hypogymnia species* per year.

Be ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	0.04	0.0000	0.0400	0.0400
2005	Non-Wilderness	0.02	0.0000	0.0200	0.0200
2005	Wilderness	0.02	0.0000	0.0200	0.0200

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Be ppm

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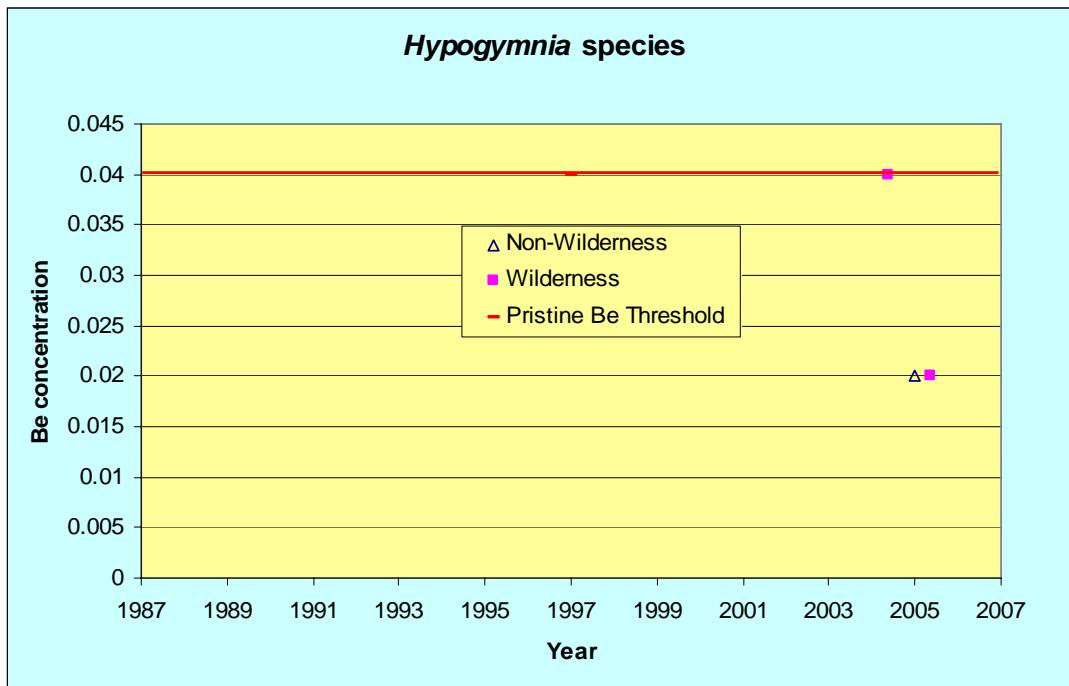


Figure X-9. Wilderness and Non-Wilderness yearly means of Be ppm in *Hypogymnia* species per year.

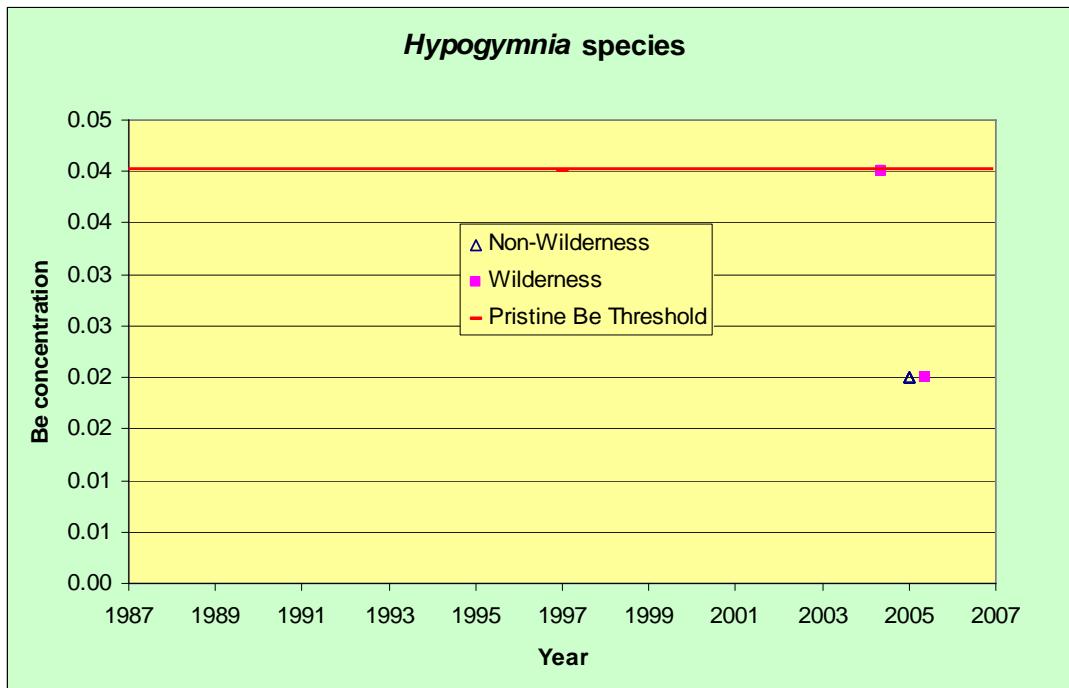


Figure X-10. Wilderness and Non-Wilderness plot means of Be ppm in *Hypogymnia* species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Be ppm

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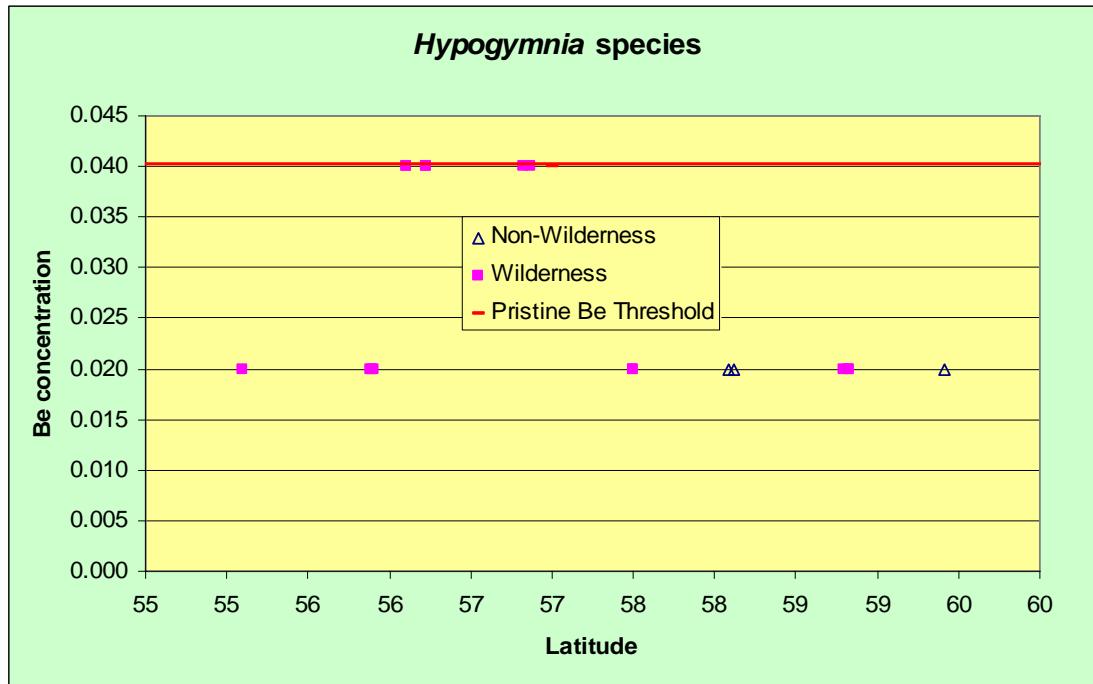


Figure X-11. Wilderness and Non-Wilderness plot means of Be ppm in *Hypogymnia* species vs. plot Latitude.

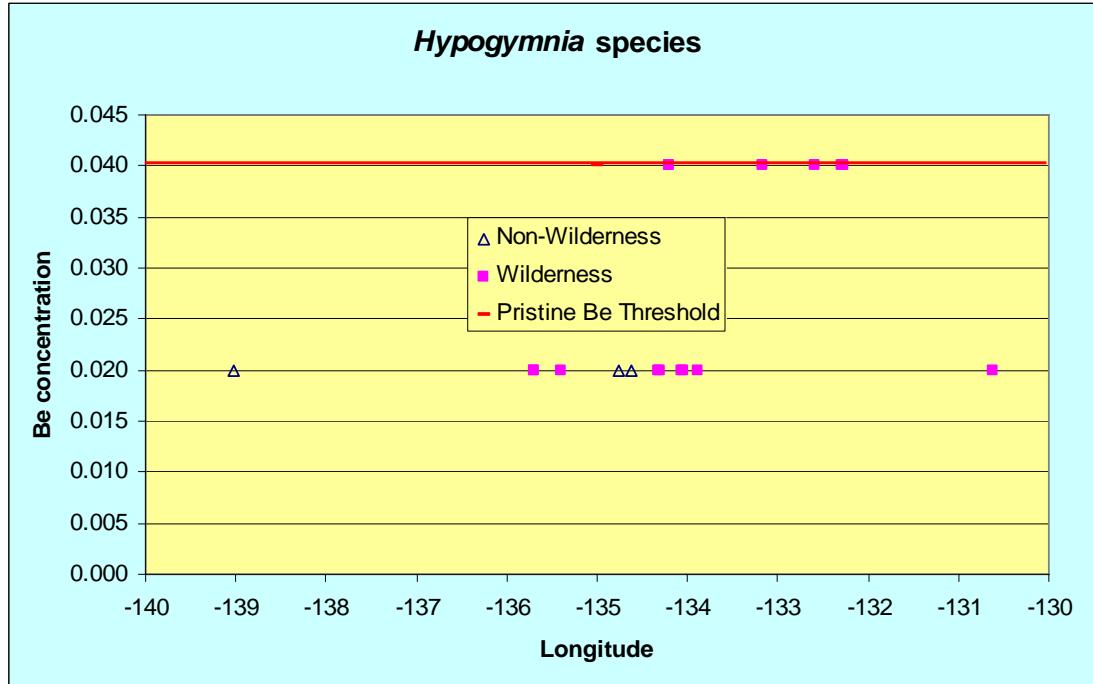


Figure X-12. Wilderness and Non-Wilderness plot means of Be ppm in *Hypogymnia* species vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Be ppm

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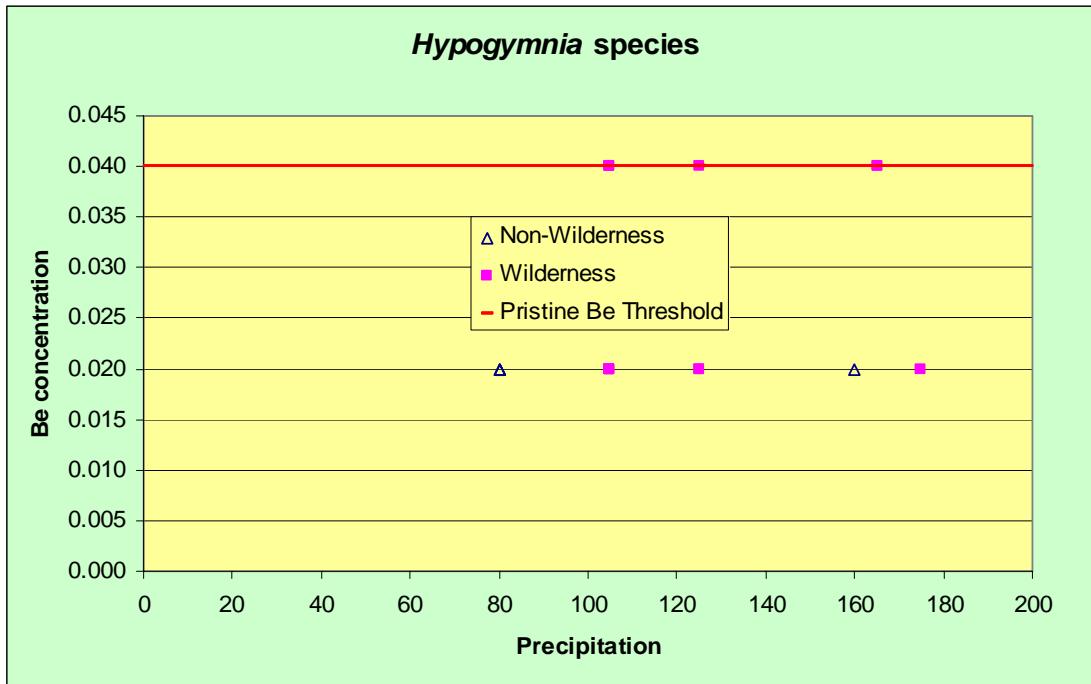


Figure X-13. Wilderness and Non-Wilderness plot means of Be ppm in *Hypogymnia species* vs. plot Precipitation.

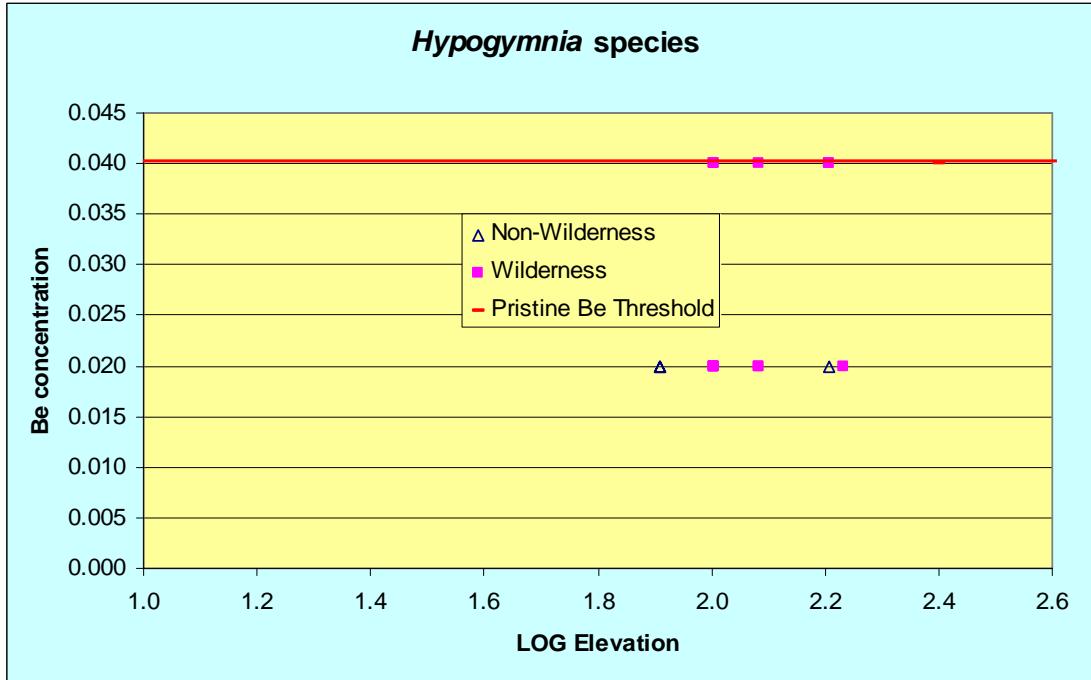


Figure X-14. Wilderness and Non-Wilderness plot means of Be ppm in *Hypogymnia species* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Be ppm

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Lobaria oregana

Table X-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Be ppm content of *Lobaria oregana* per year.

Be ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	0.04	0.0000	0.0400	0.0400
2005	Non-Wilderness	0.02	na	na	na
2005	Wilderness	0.02	0.0000	0.0200	0.0200

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Be ppm

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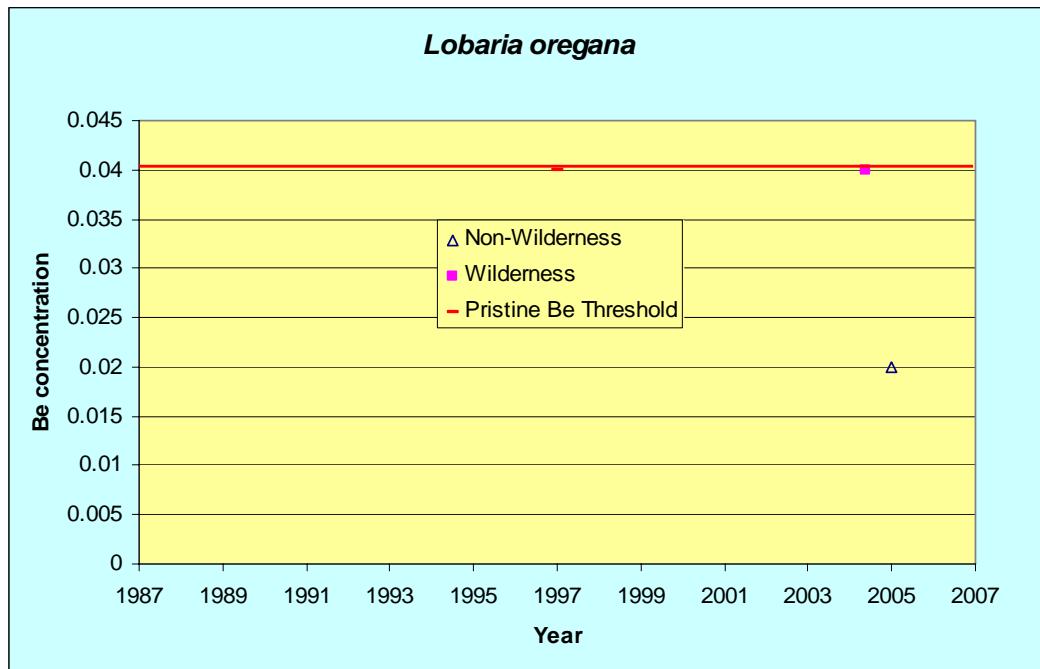


Figure X-15. Wilderness and Non-Wilderness yearly means of Be ppm in *Lobaria oregana* per year.

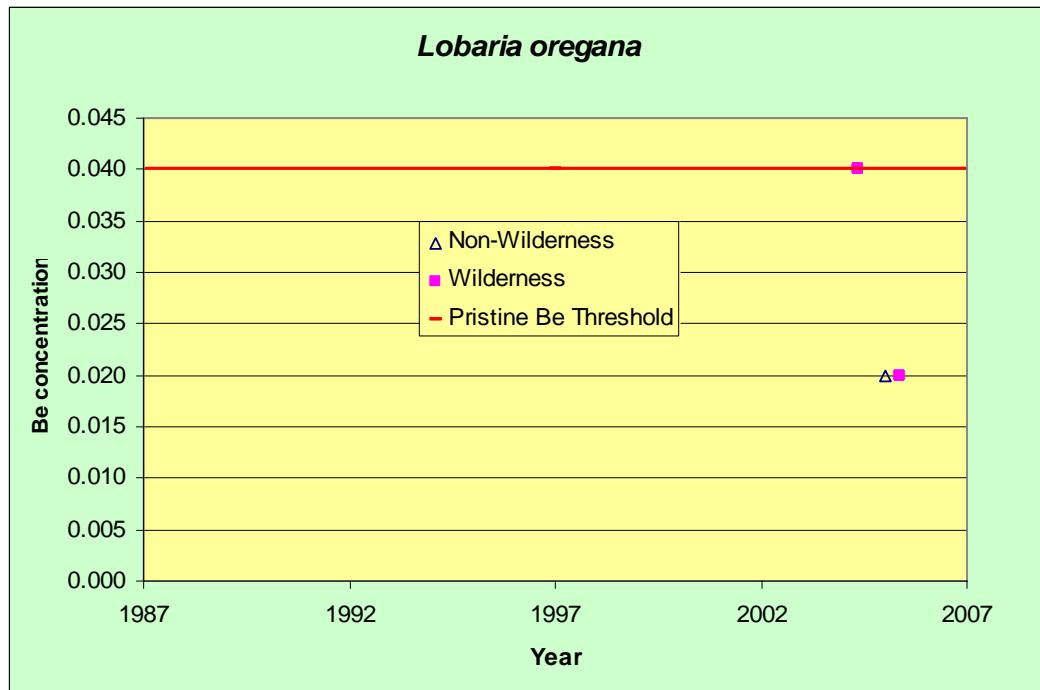


Figure X-16. Wilderness and Non-Wilderness plot means of Be ppm in *Lobaria oregana* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Be ppm

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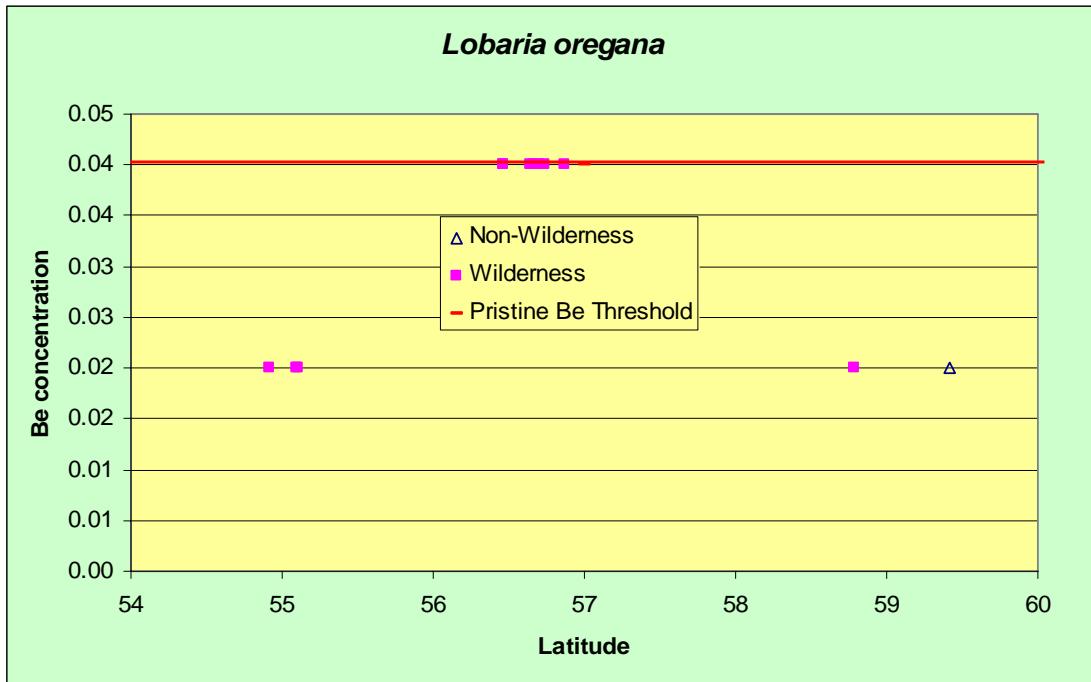


Figure X-17. Wilderness and Non-Wilderness plot means of Be ppm in *Lobaria oregana* vs. plot Latitude.

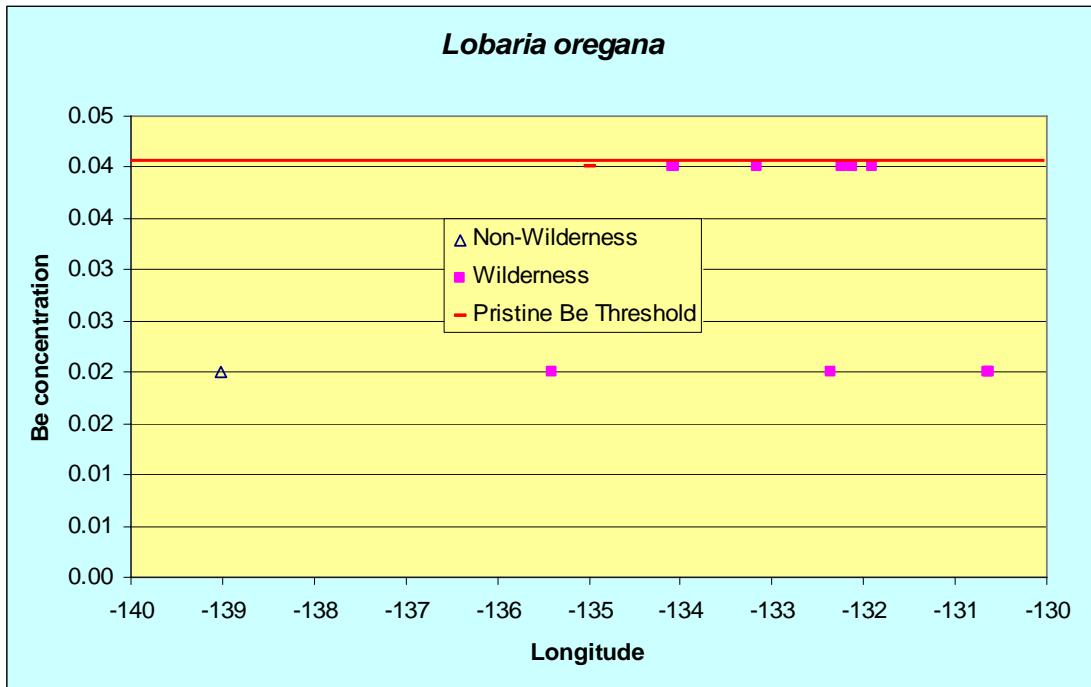


Figure X-18. Wilderness and Non-Wilderness plot means of Be ppm in *Lobaria oregana* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Be ppm

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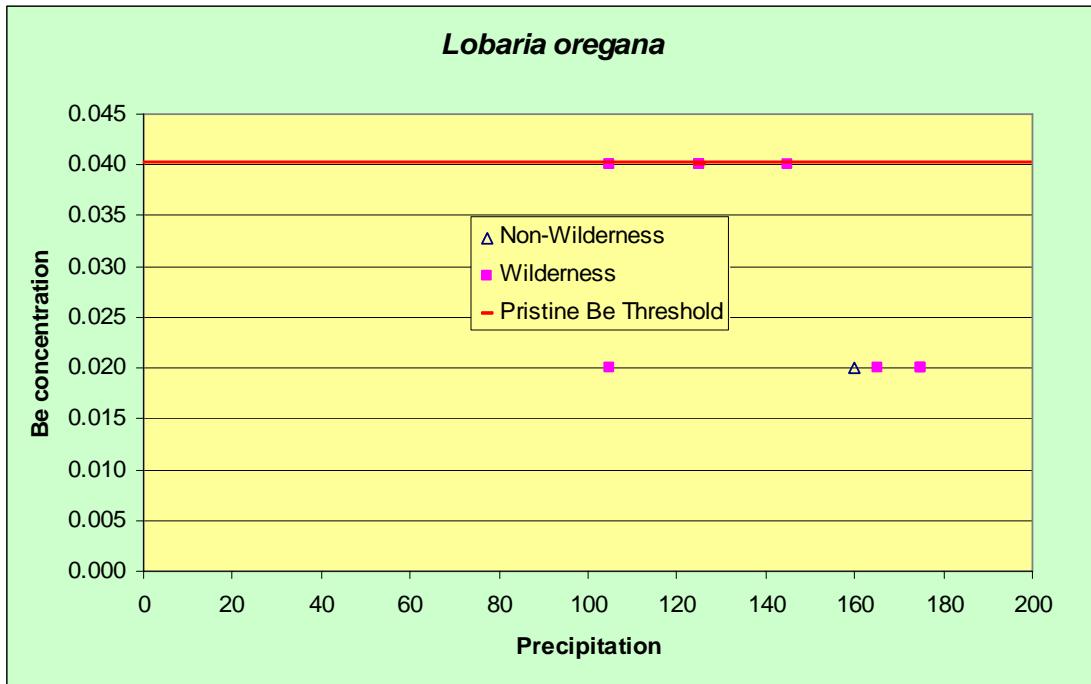


Figure X-19. Wilderness and Non-Wilderness plot means of Be ppm in *Lobaria oregana* vs. plot Precipitation.

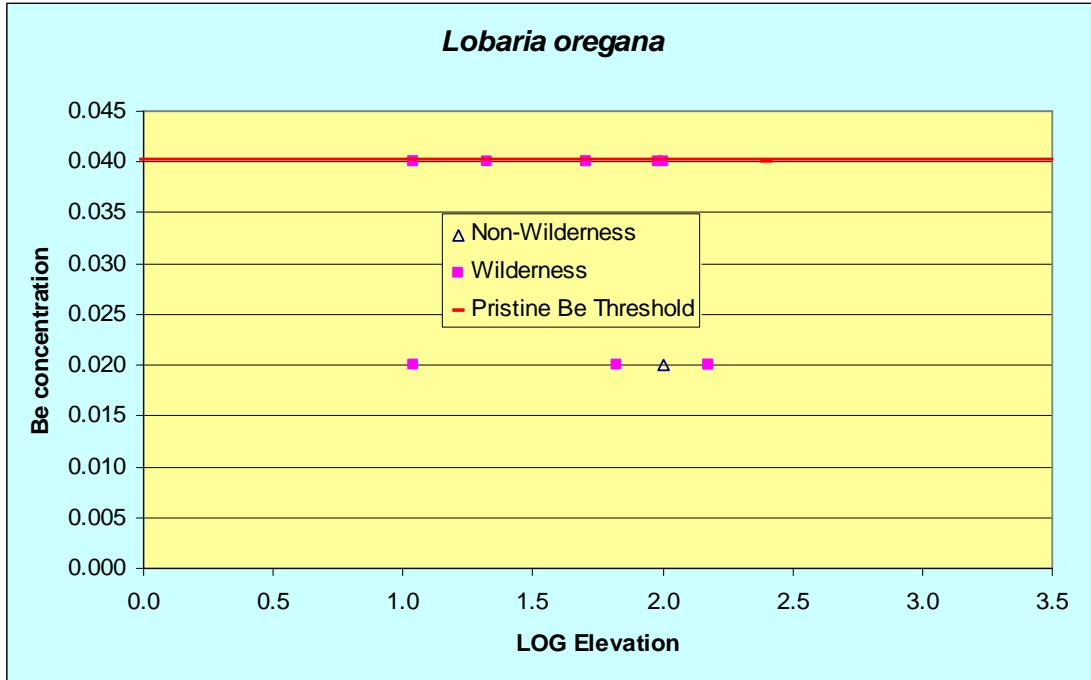


Figure X-20. Wilderness and Non-Wilderness plot means of Be ppm in *Lobaria oregana* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Be ppm

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Platismatia glauca

Table X-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Be ppm content of *Platismatia glauca* per year.

Be ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	0.04	0.0000	0.0400	0.0400
2005	Non-Wilderness	0.02	0.0000	0.0200	0.0200
2005	Wilderness	0.02	0.0000	0.0200	0.0200

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Be ppm

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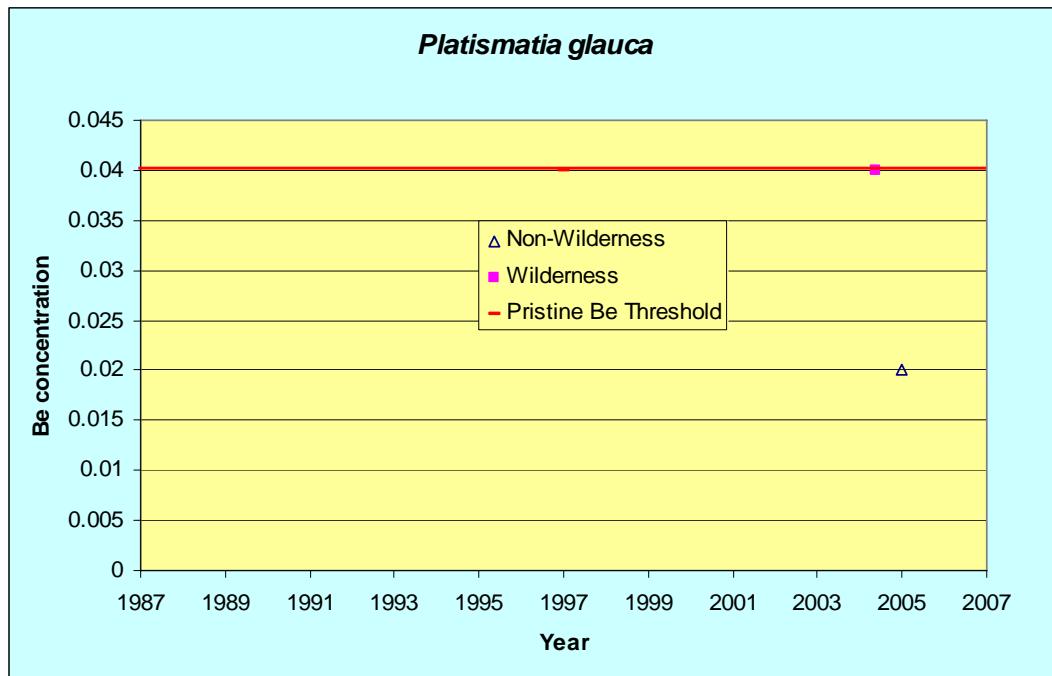


Figure X-21. Wilderness and Non-Wilderness yearly means of Be ppm
in *Platismatia glauca* per year.

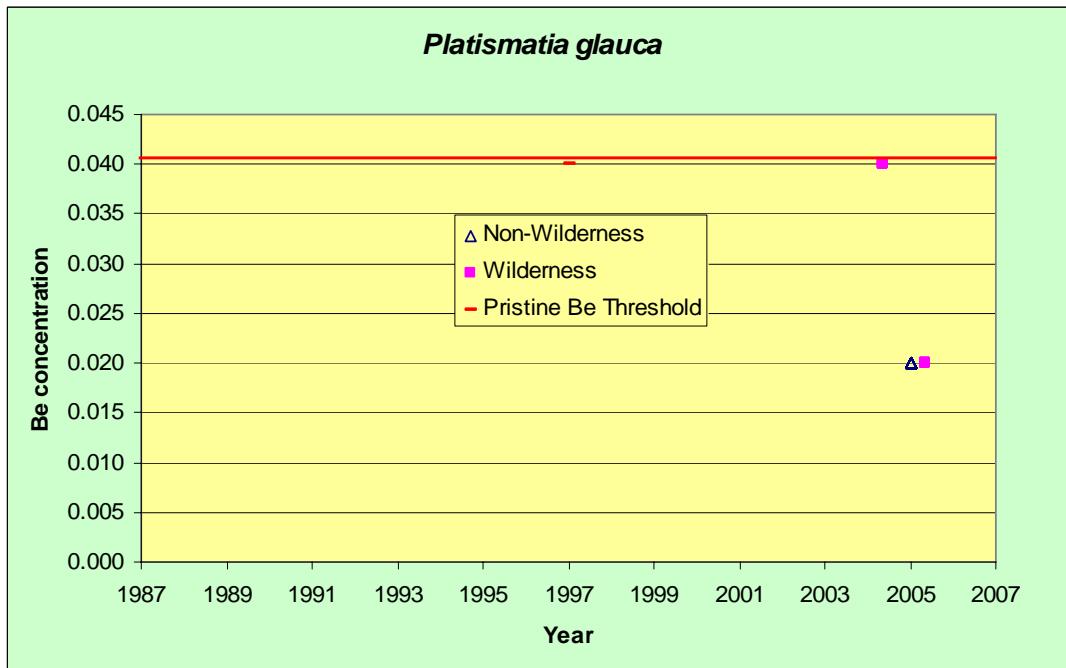


Figure X-22. Wilderness and Non-Wilderness plot means of Be ppm
in *Platismatia glauca* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Be ppm

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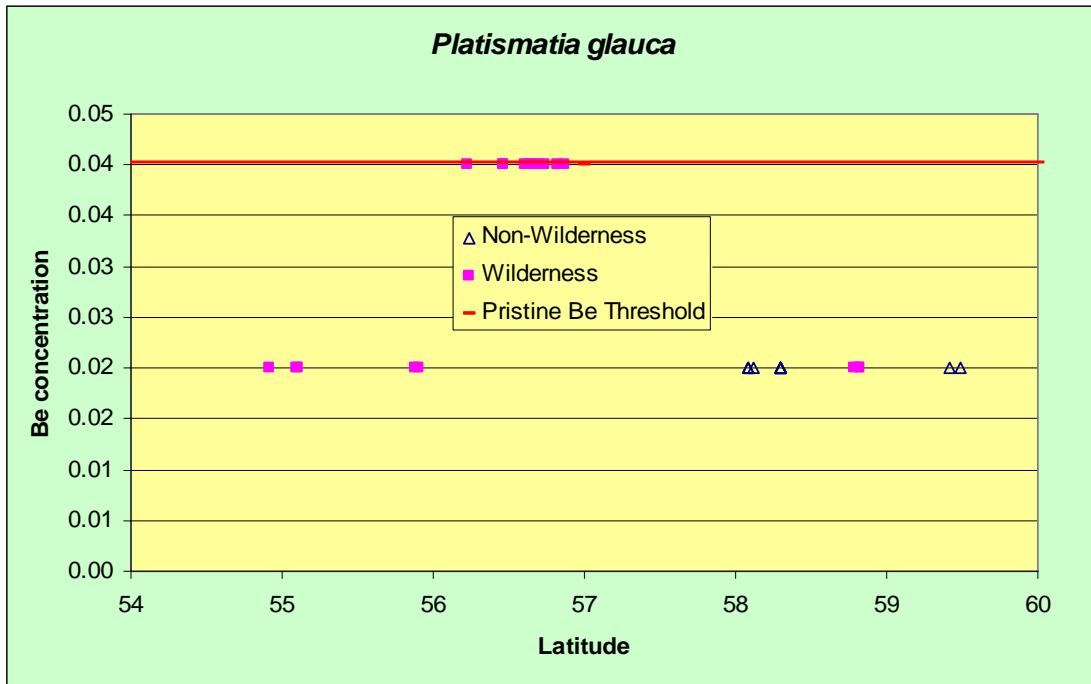


Figure X-23. Wilderness and Non-Wilderness plot means of Be ppm in *Platismatia glauca* vs. plot Latitude.

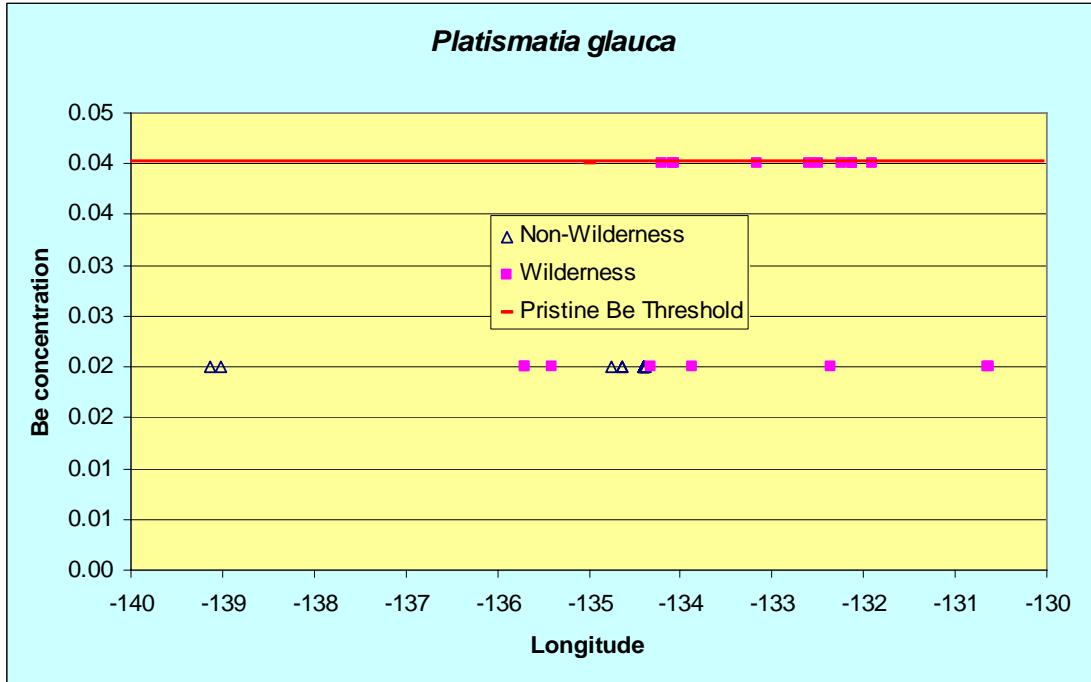


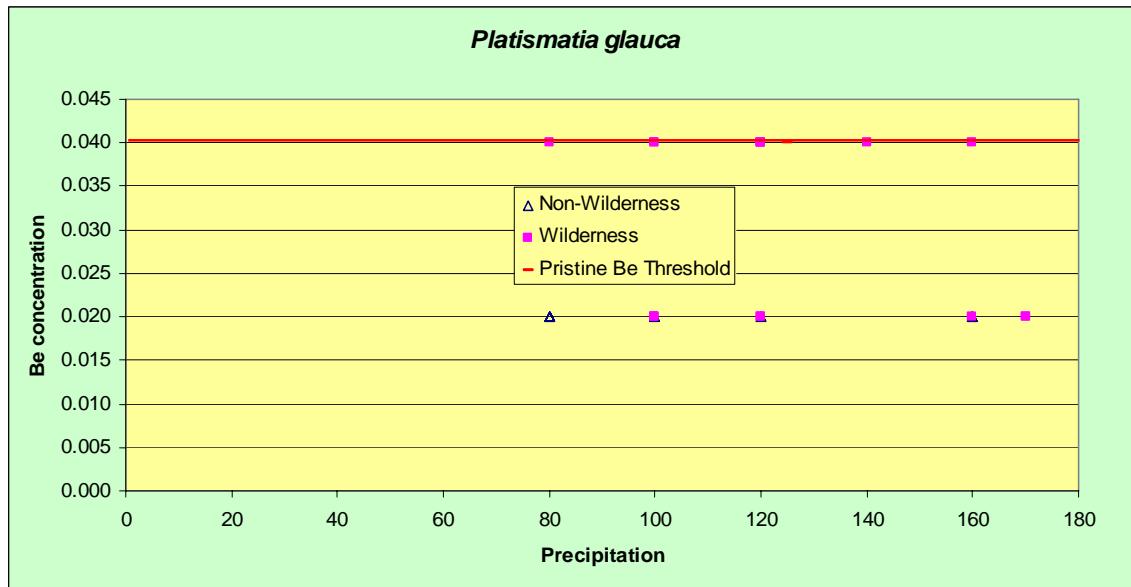
Figure X-24. Wilderness and Non-Wilderness plot means of Be ppm in *Platismatia glauca* vs. plot Longitude.

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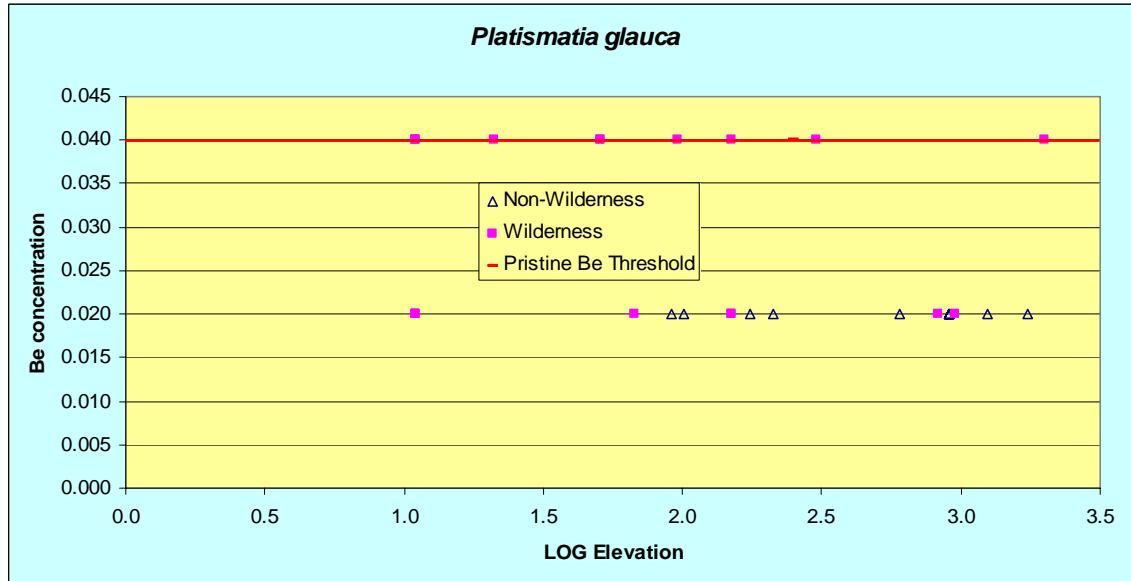
ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Be ppm

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**Figure X-25. Wilderness and Non-Wilderness plot means of Be ppm
in *Platismatia glauca* vs. plot Precipitation.**



**Figure X-26. Wilderness and Non-Wilderness plot means of Be ppm
in *Platismatia glauca* vs. plot Log-Elevation.**

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ca ppm

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XI. SUMMARY OF Ca PPM DATA ANALYSIS

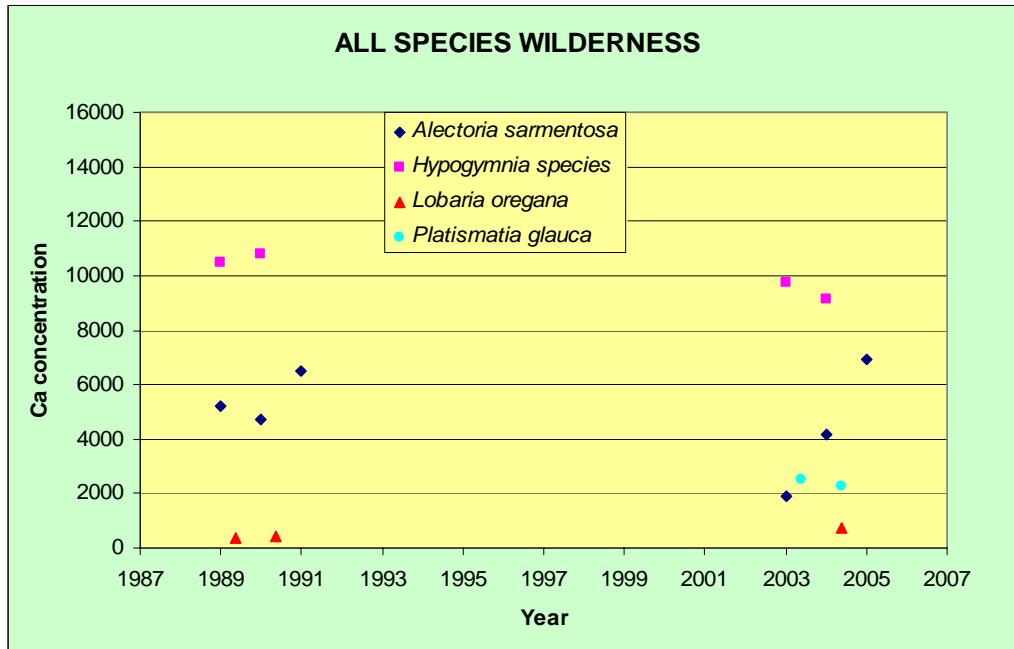


Figure XI-27. Wilderness plot means of Ca ppm
in All Species per year.

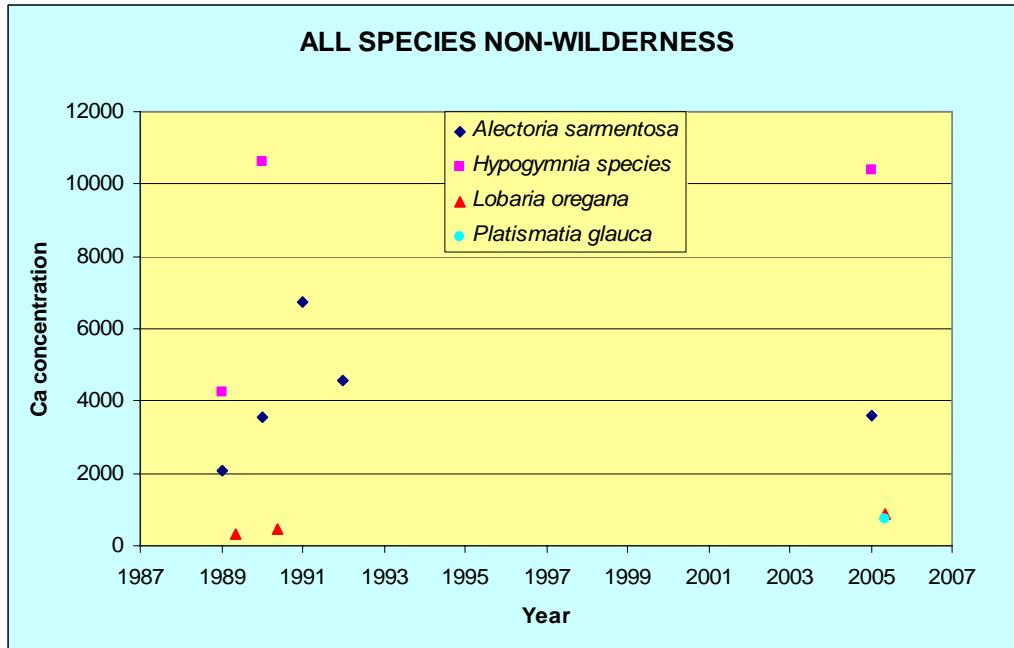


Figure XI-28. Non-Wilderness plot means of Ca ppm
in All Species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ca ppm

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Alectoria sarmentosa

Summary Statistics:

Table XI-2. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Ca ppm content of *Alectoria sarmentosa* per year.

Ca ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	2081.72	529.9073	610.4615	3552.9785
1989	Wilderness	5234.99	954.3677	2781.7141	7688.2748
1990	Non-Wilderness	3567.36	560.4786	2415.2845	4719.4451
1990	Wilderness	4729.97	1012.8840	2251.5300	7208.4080
1991	Non-Wilderness	6727.52	1359.4200	3871.4850	9583.5570
1991	Wilderness	6504.13	1181.7710	3223.0110	9785.2540
1992	Non-Wilderness	4556.83	NA	2775.5152	6338.1427
2003	Wilderness	1889.64	776.6950	7979.2070	11758.4840
2004	Wilderness	4146.98	373.4374	3374.4615	4919.4896
2005	Non-Wilderness	3604.71	463.4197	2413.4502	4795.9665
2005	Wilderness	6938.53	604.0697	5572.0295	8305.0305

Summary of Statistical Tests:

$$t = 1.5029, df = 8, p\text{-value} = 0.1713$$

There is no evidence of a difference in Ca ppm content in *Alectoria sarmentosa* from pre-2000 and post 2000 samples (p-value = 0.1713).

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ca ppm

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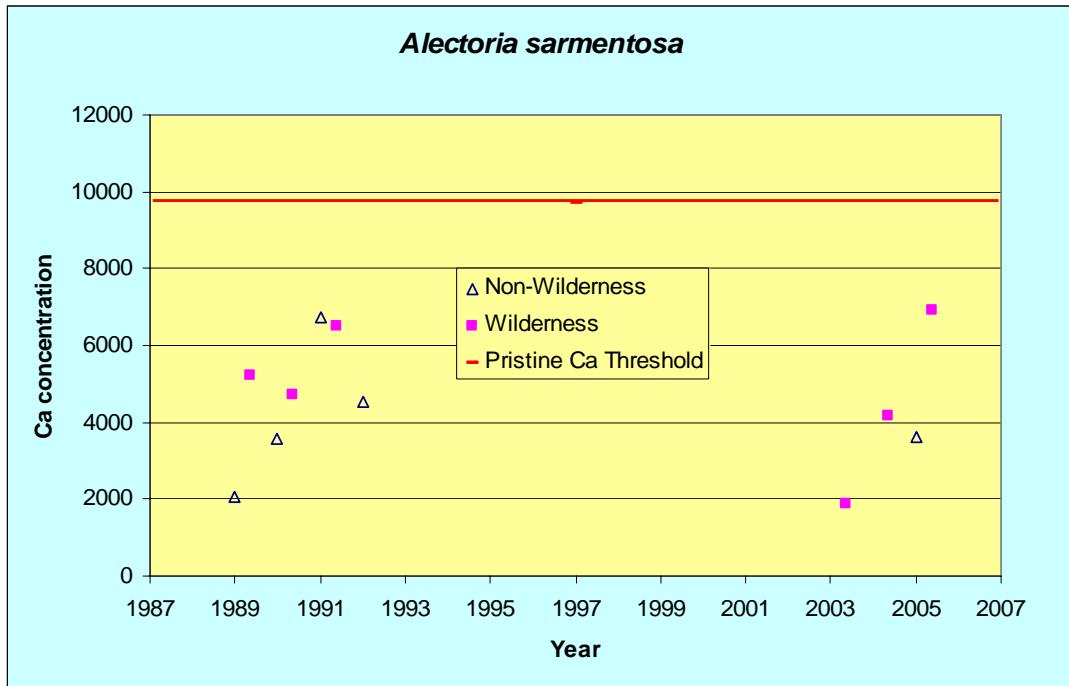


Figure XI-3. Wilderness and Non-Wilderness yearly means of Ca ppm in *Alectoria sarmentosa* per year.

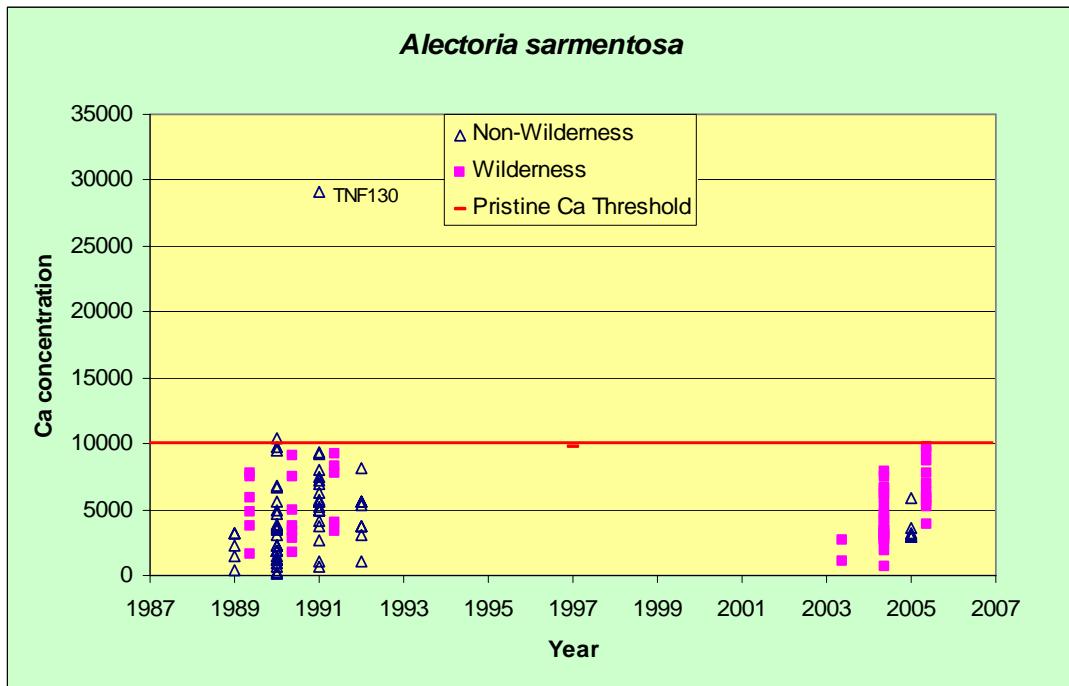


Figure XI-4. Wilderness and Non-Wilderness plot means of Ca ppm in *Alectoria sarmentosa* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ca ppm

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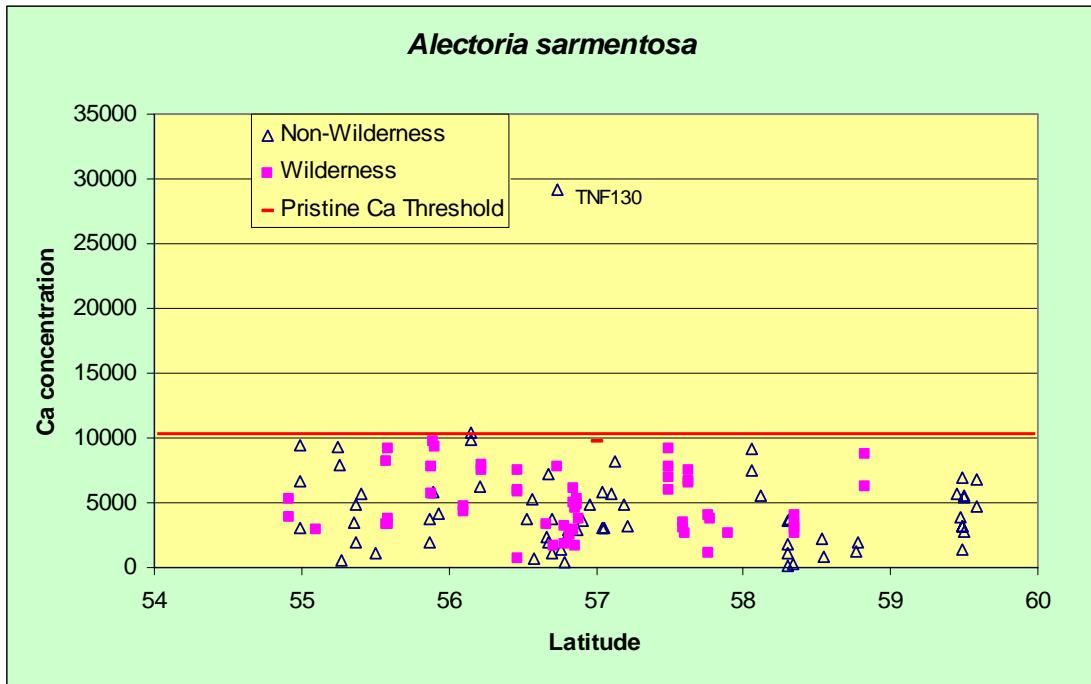


Figure XI-5. Wilderness and Non-Wilderness plot means of Ca ppm in *Alectoria sarmentosa* vs. plot Latitude.

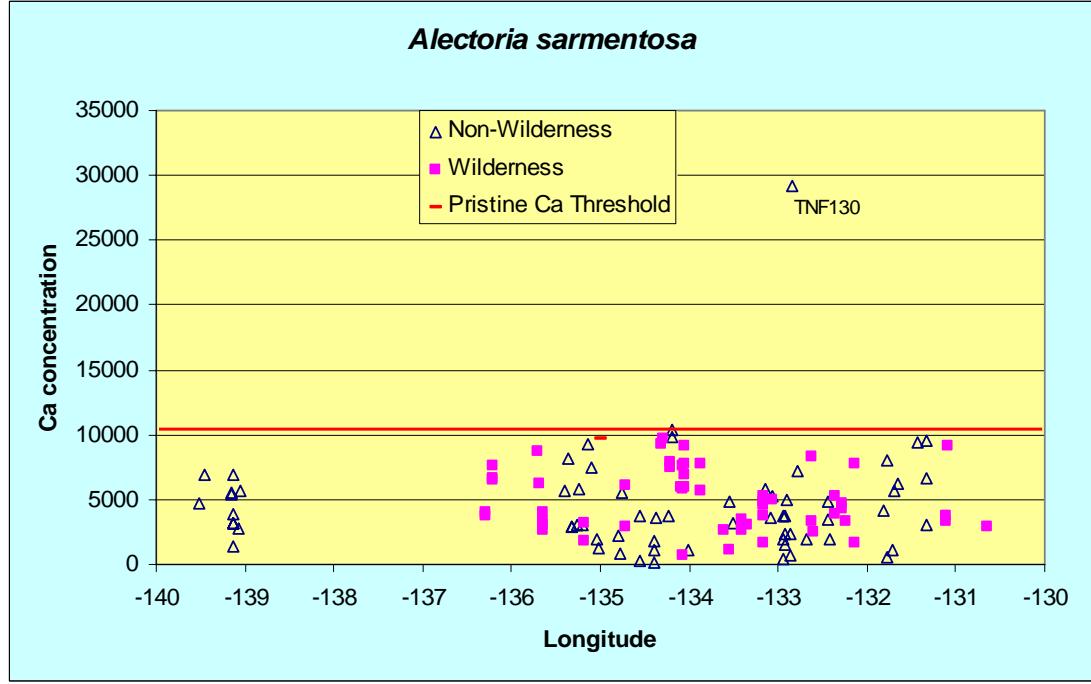


Figure XI-6. Wilderness and Non-Wilderness plot means of Ca ppm in *Alectoria sarmentosa* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ca ppm

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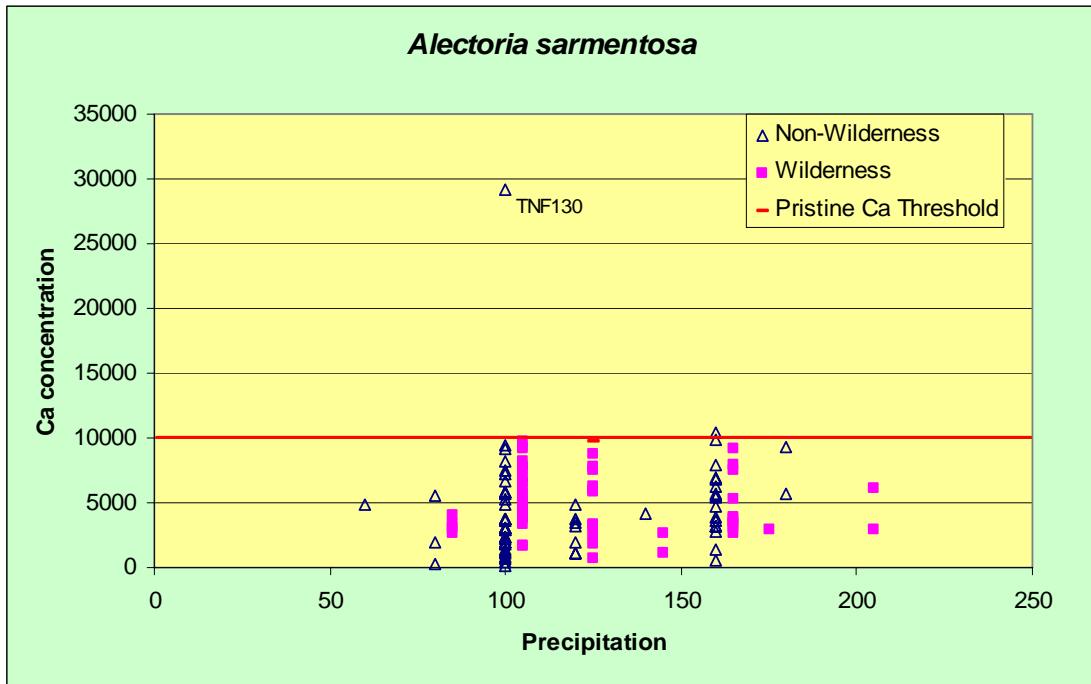


Figure XI-7. Wilderness and Non-Wilderness plot means of Ca ppm in *Alectoria sarmentosa* vs. plot Precipitation.

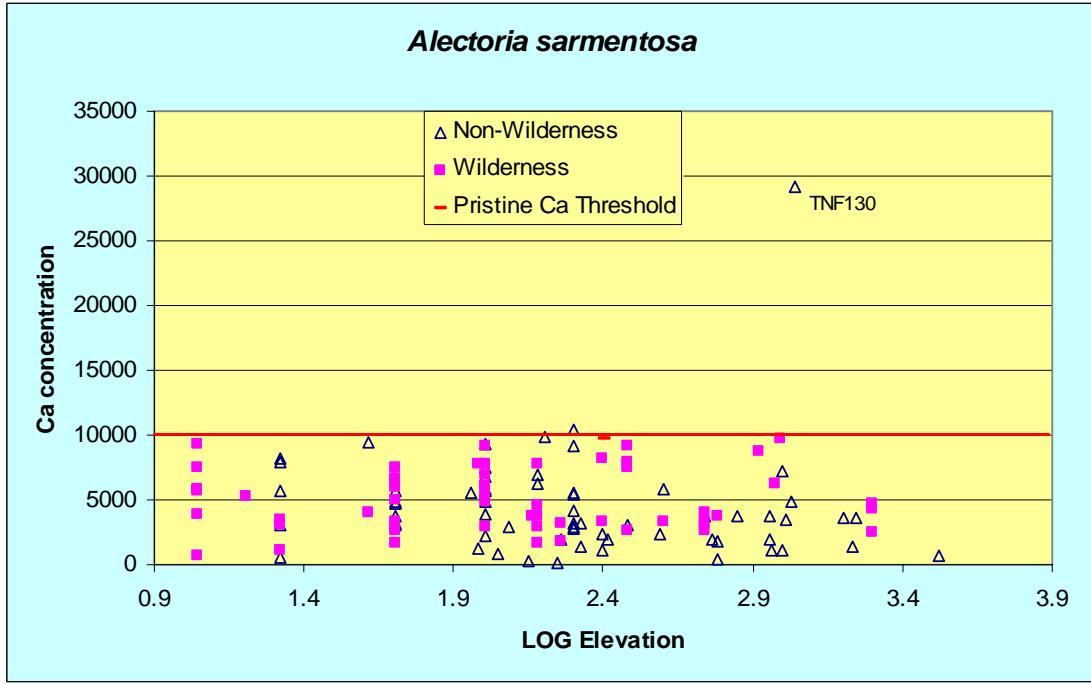


Figure XI-8. Wilderness and Non-Wilderness plot means of Ca ppm in *Alectoria sarmentosa* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ca ppm

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Hypogymnia species

In this series, all of the *Hypogymnia* species were included as a group.

Table XI-3. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Ca ppm content of *Hypogymnia species* per year.

Ca ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	4245.50	1452.5000	14210.2600	22701.2600
1989	Wilderness	10509.67	2082.5800	4727.4980	16291.8350
1990	Non-Wilderness	10596.47	1541.7000	7357.4740	13835.4560
1990	Wilderness	10759.10	2303.8300	5121.8270	16396.3630
2003	Wilderness	9740.80	NA	NA	NA
2004	Wilderness	9139.63	1222.0490	5998.2480	12281.0040
2005	Non-Wilderness	10365.47	1652.7150	3254.4090	17476.5250
2005	Wilderness	14090.39	1292.1380	11110.7120	17070.0650

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ca ppm

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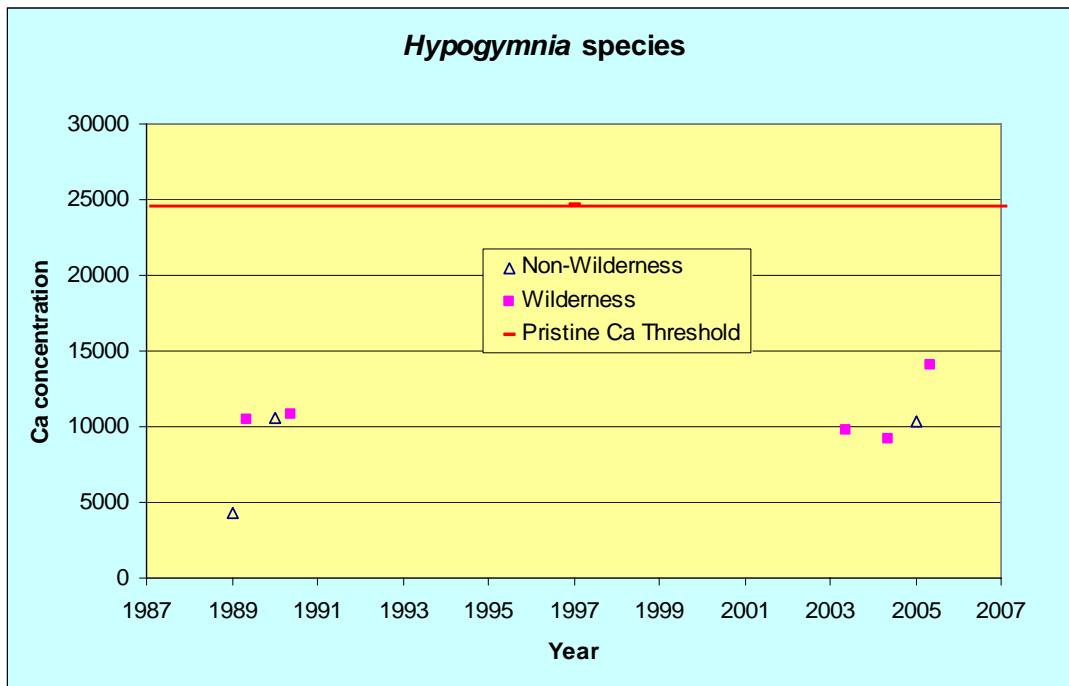


Figure XI-9. Wilderness and Non-Wilderness yearly means of Ca ppm in *Hypogymnia* species per year.

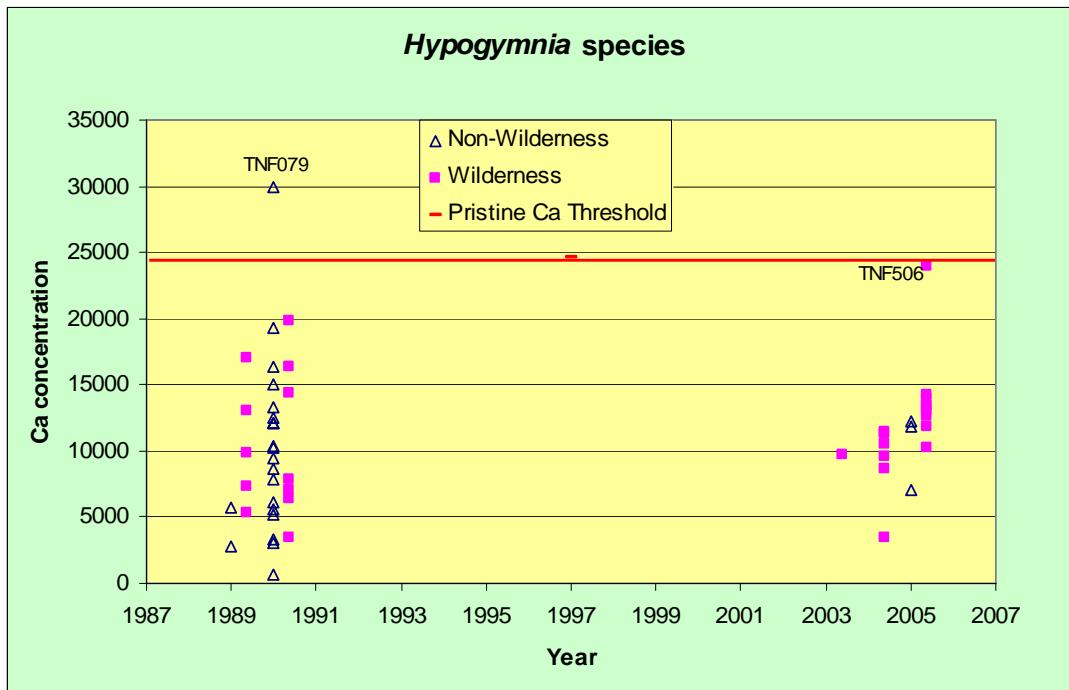


Figure XI-10. Wilderness and Non-Wilderness plot means of Ca ppm in *Hypogymnia* species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ca ppm

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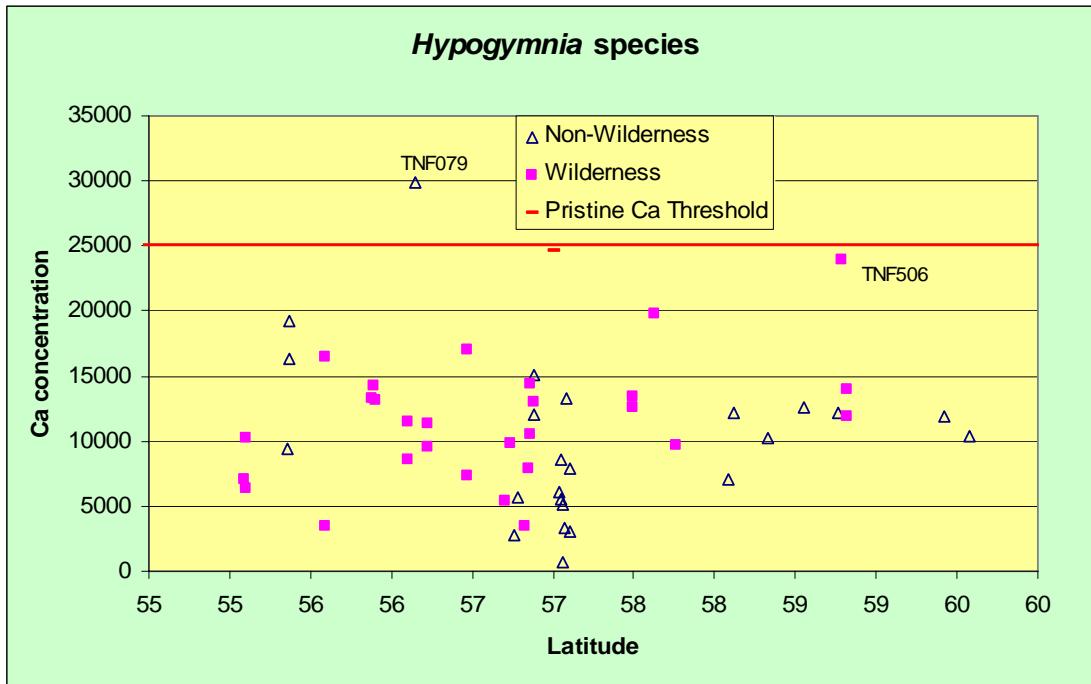


Figure XI-11. Wilderness and Non-Wilderness plot means of Ca ppm in *Hypogymnia* species vs. plot Latitude.

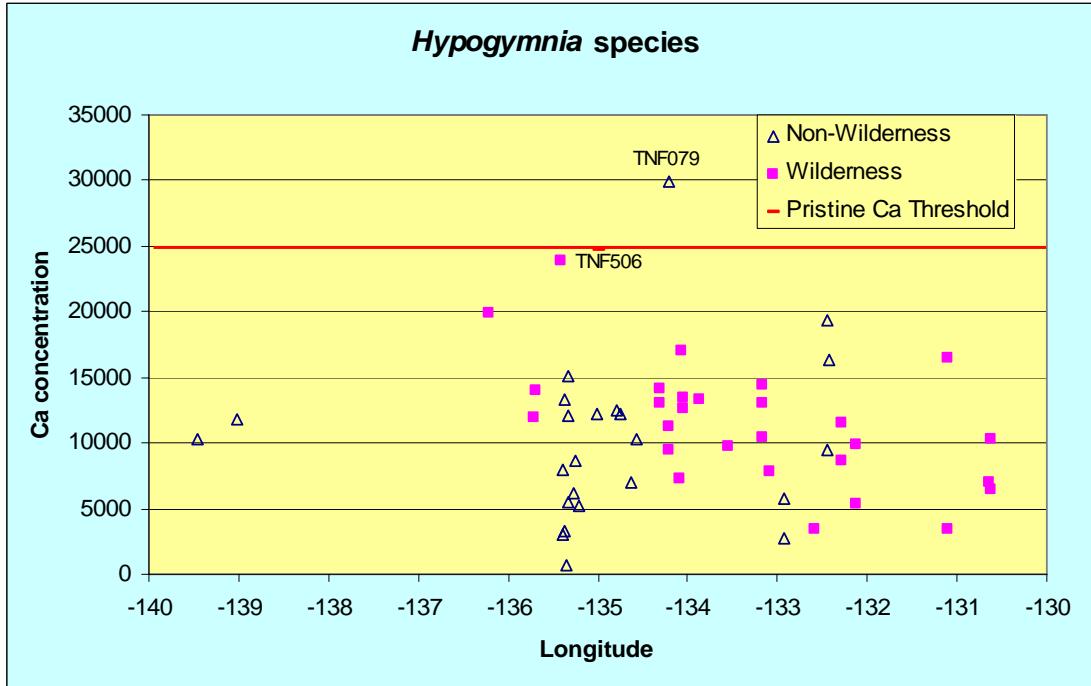


Figure XI-12. Wilderness and Non-Wilderness plot means of Ca ppm in *Hypogymnia* species vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ca ppm

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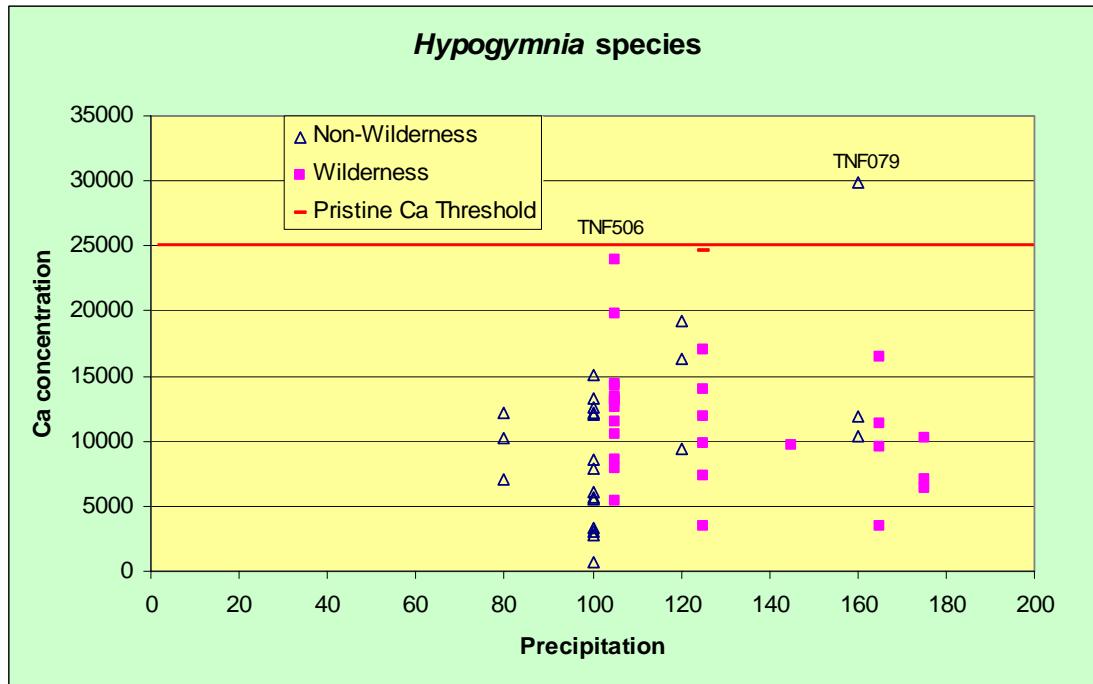


Figure XI-13. Wilderness and Non-Wilderness plot means of Ca ppm in *Hypogymnia* species vs. plot Precipitation.

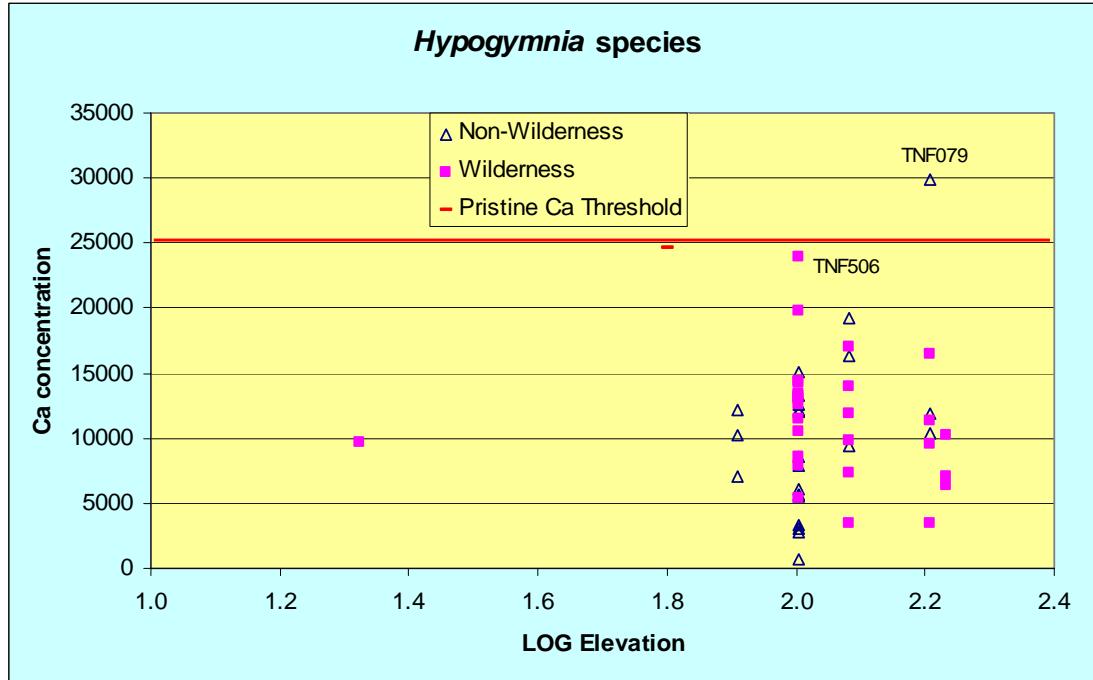


Figure XI-14. Wilderness and Non-Wilderness plot means of Ca ppm in *Hypogymnia* species vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ca ppm

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Lobaria oregana

Table XI-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Ca ppm content of *Lobaria oregana* per year.

Ca ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	334.17	19.7224	271.4013	396.9321
1989	Wilderness	390.24	35.9300	290.4857	490.0010
1990	Non-Wilderness	467.88	27.8034	407.3061	528.4631
1990	Wilderness	418.34	28.4251	345.2751	491.4133
2004	Wilderness	739.66	76.1875	553.2329	926.0812
2005	Non-Wilderness	877.24	NA	NA	NA
2005	Wilderness	698.11	262.3059	NA	1532.8808

Summary of Statistical Tests:

$$t = -1.4706, \text{ df} = 4, \text{ p-value} = 0.2153$$

There is no evidence of a difference in Ca ppm content in *Lobaria oregana* from pre-2000 and post 2000 samples (p-value = 0.2153).

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ca ppm

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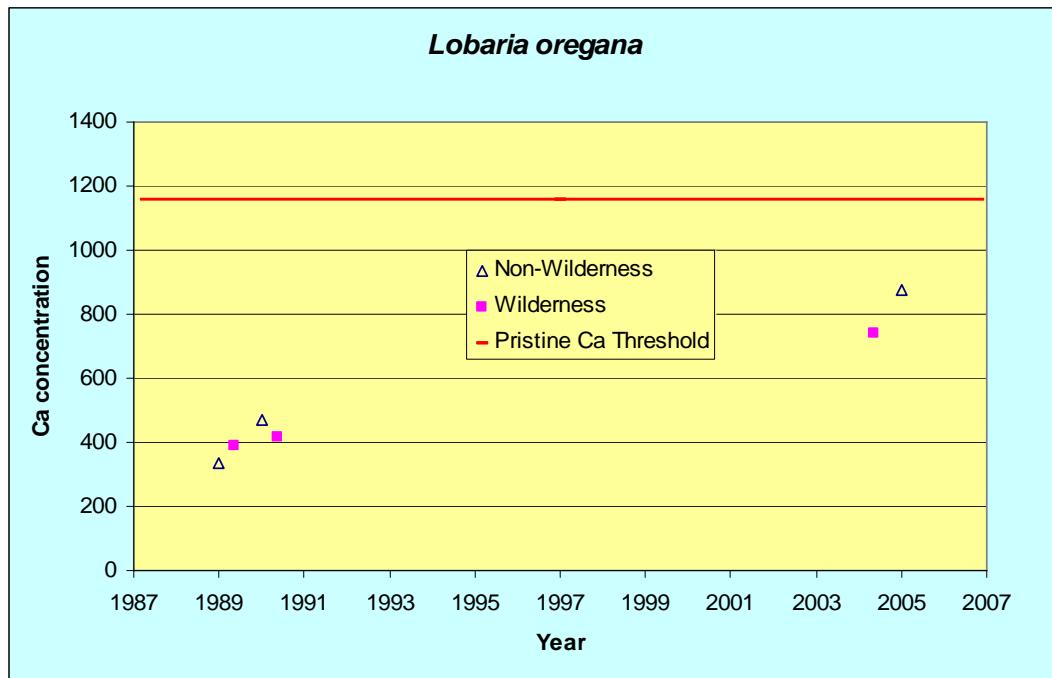


Figure XI-15. Wilderness and Non-Wilderness yearly means of Ca ppm in *Lobaria oregana* per year.

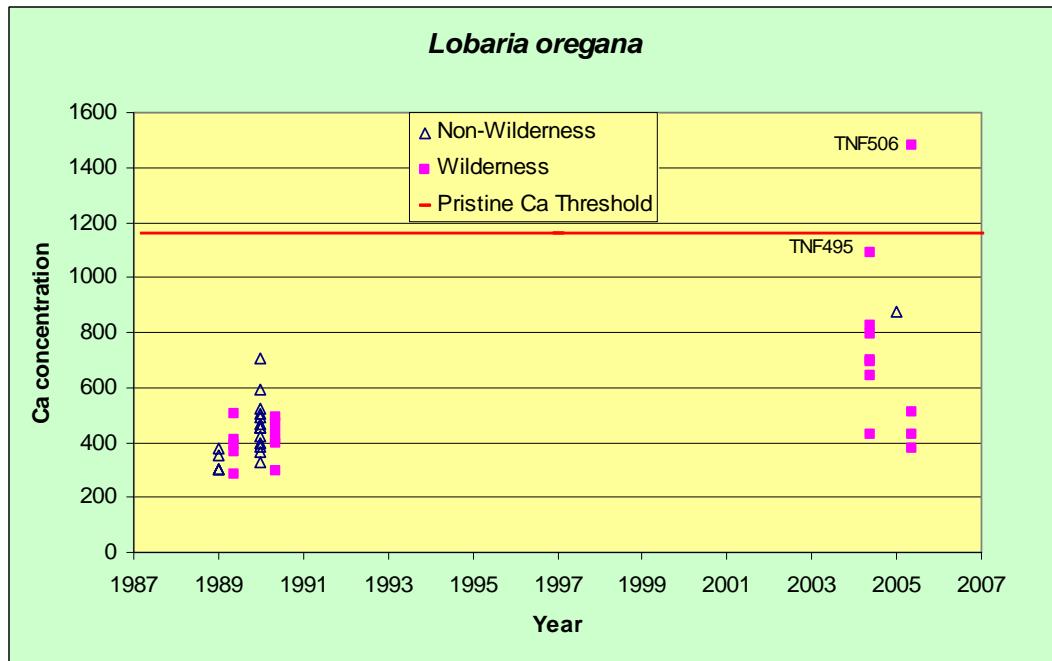


Figure XI-16. Wilderness and Non-Wilderness plot means of Ca ppm in *Lobaria oregana* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ca ppm

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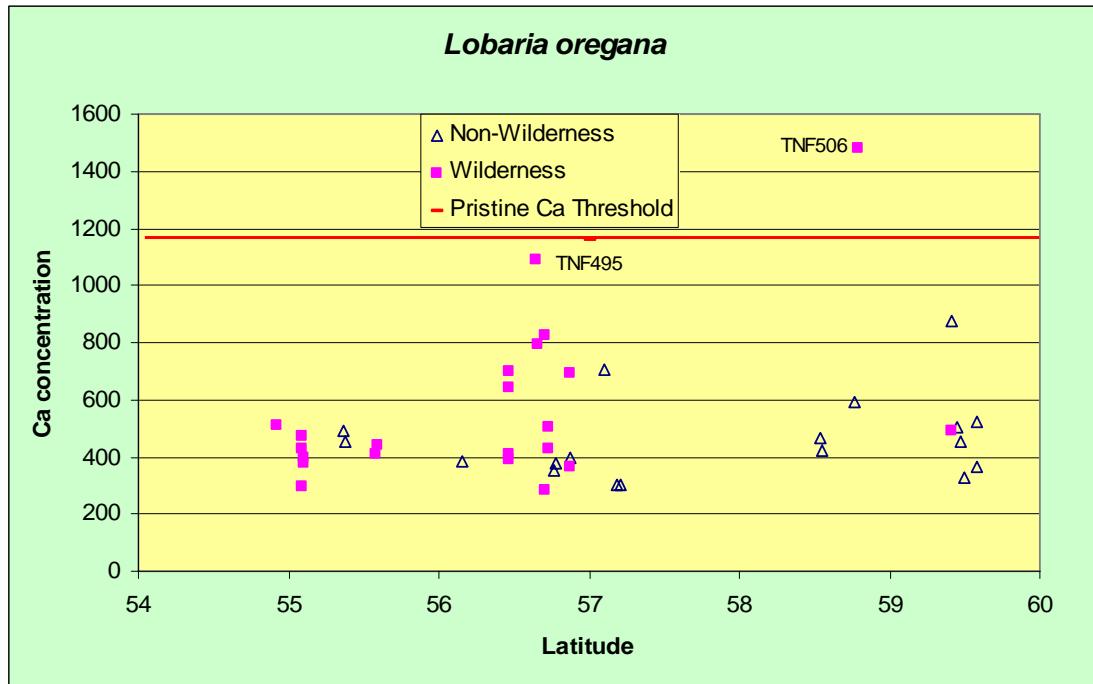


Figure XI-17. Wilderness and Non-Wilderness plot means of Ca ppm in *Lobaria oregana* vs. plot Latitude.

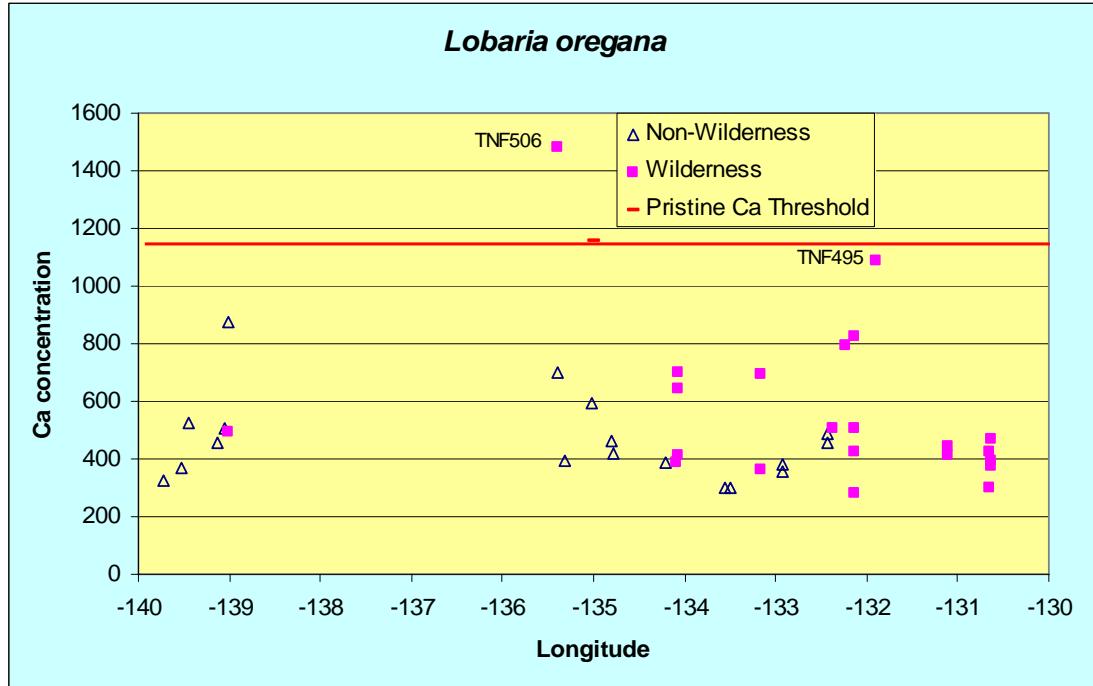


Figure XI-18. Wilderness and Non-Wilderness plot means of Ca ppm in *Lobaria oregana* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ca ppm

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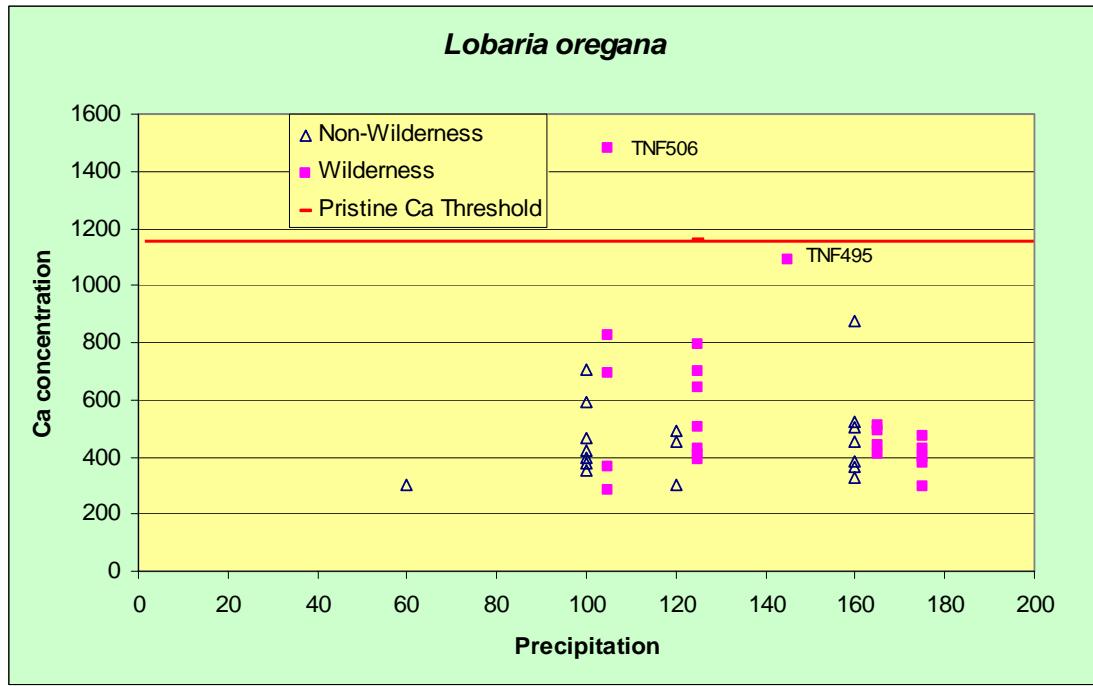


Figure XI-19. Wilderness and Non-Wilderness plot means of Ca ppm in *Lobaria oregana* vs. plot Precipitation.

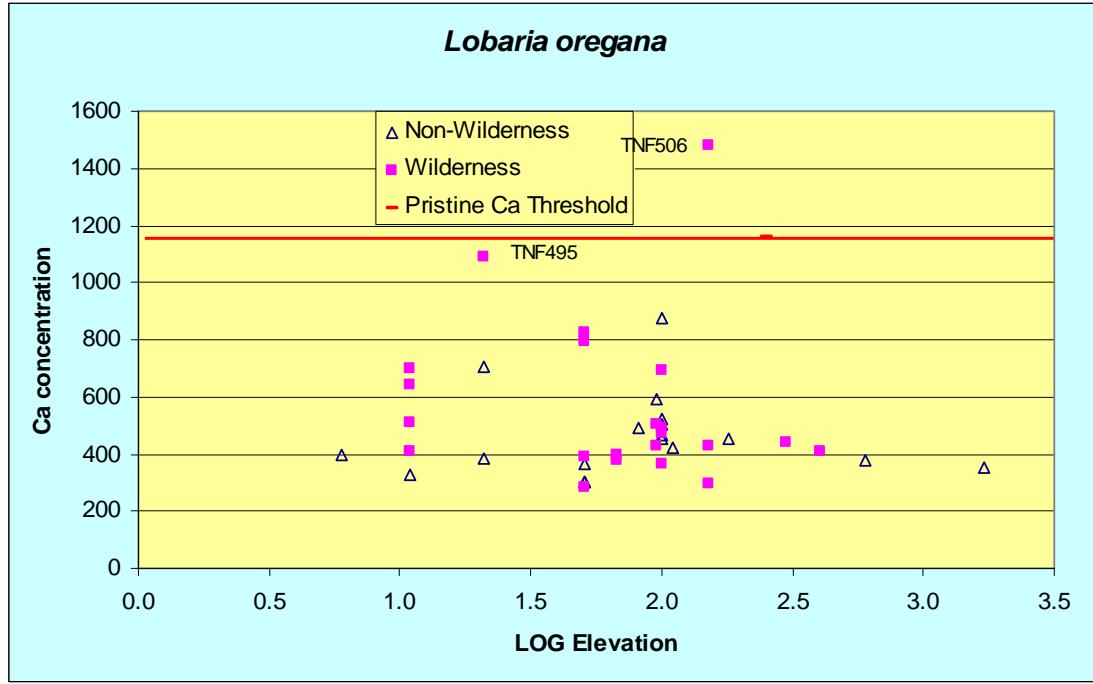


Figure XI-20. Wilderness and Non-Wilderness plot means of Ca ppm in *Lobaria oregana* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ca ppm

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Platismatia glauca

Table XI-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Ca ppm content of *Platismatia glauca* per year.

Ca ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2003	Wilderness	2505.97	NA	NA	NA
2004	Wilderness	2294.39	219.3717	1798.1345	2790.6412
2005	Non-Wilderness	2523.86	235.6644	1990.7517	3056.9716
2005	Wilderness	2860.64	380.3439	1961.2671	3760.0079

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ca ppm

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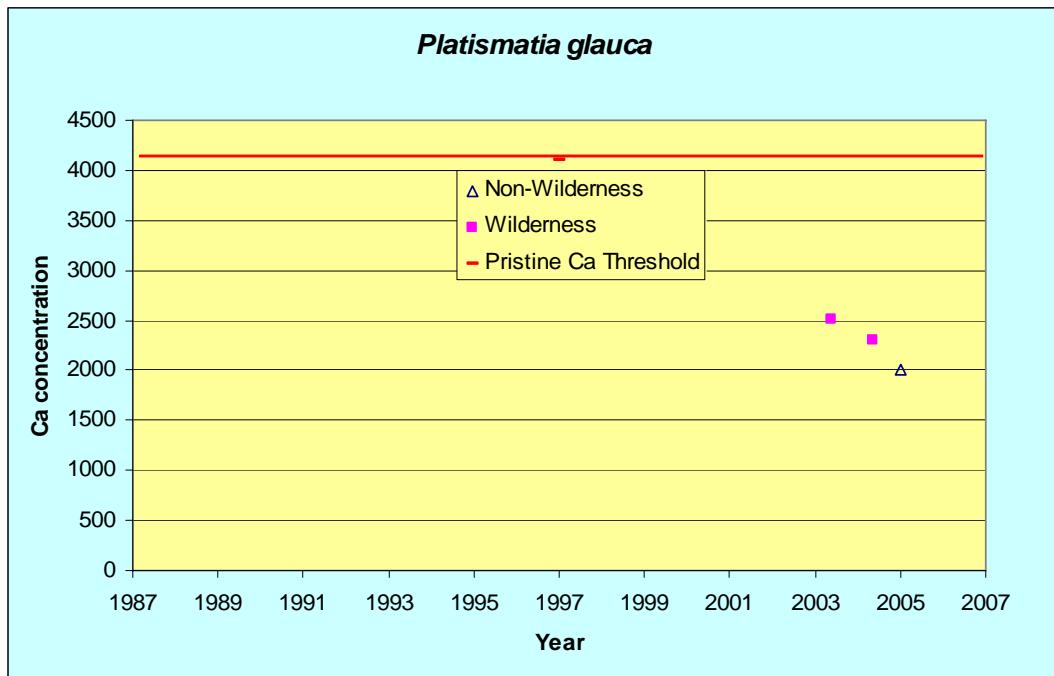


Figure XI-21. Wilderness and Non-Wilderness yearly means of Ca ppm in *Platismatia glauca* per year.

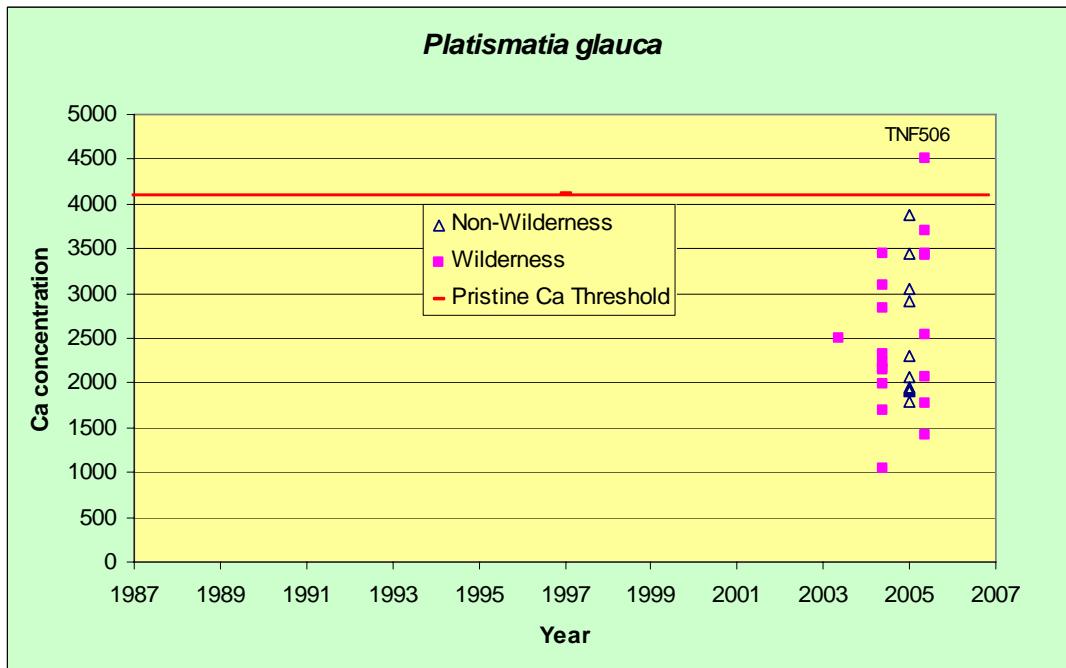


Figure XI-22. Wilderness and Non-Wilderness plot means of Ca ppm in *Platismatia glauca* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ca ppm

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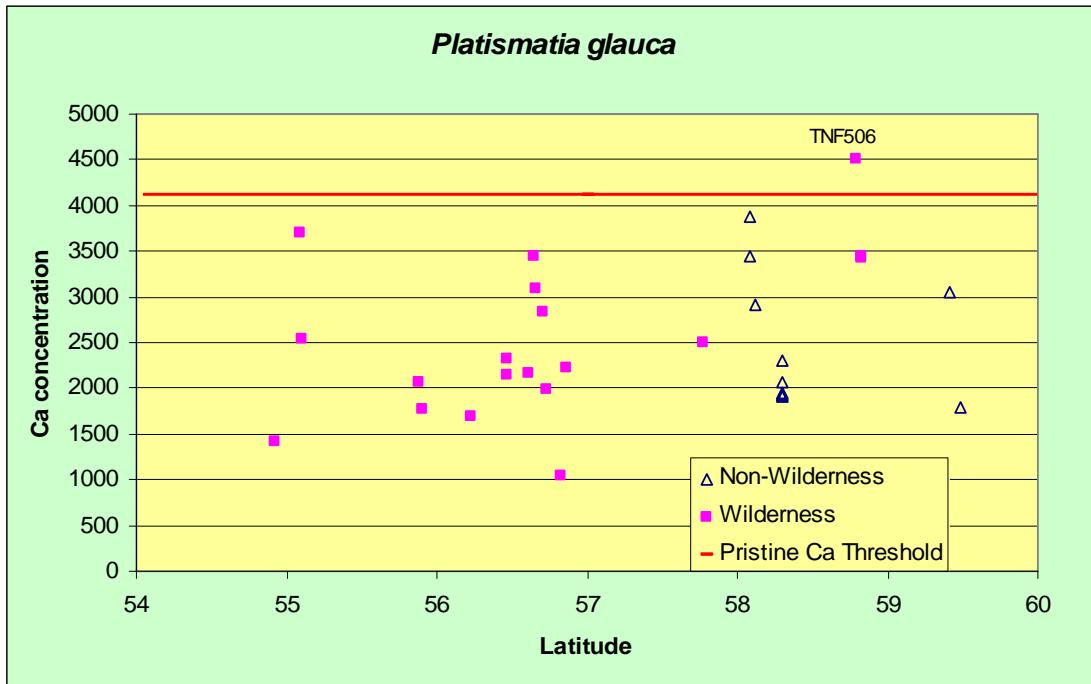


Figure XI-23. Wilderness and Non-Wilderness plot means of Ca ppm in *Platismatia glauca* vs. plot Latitude.

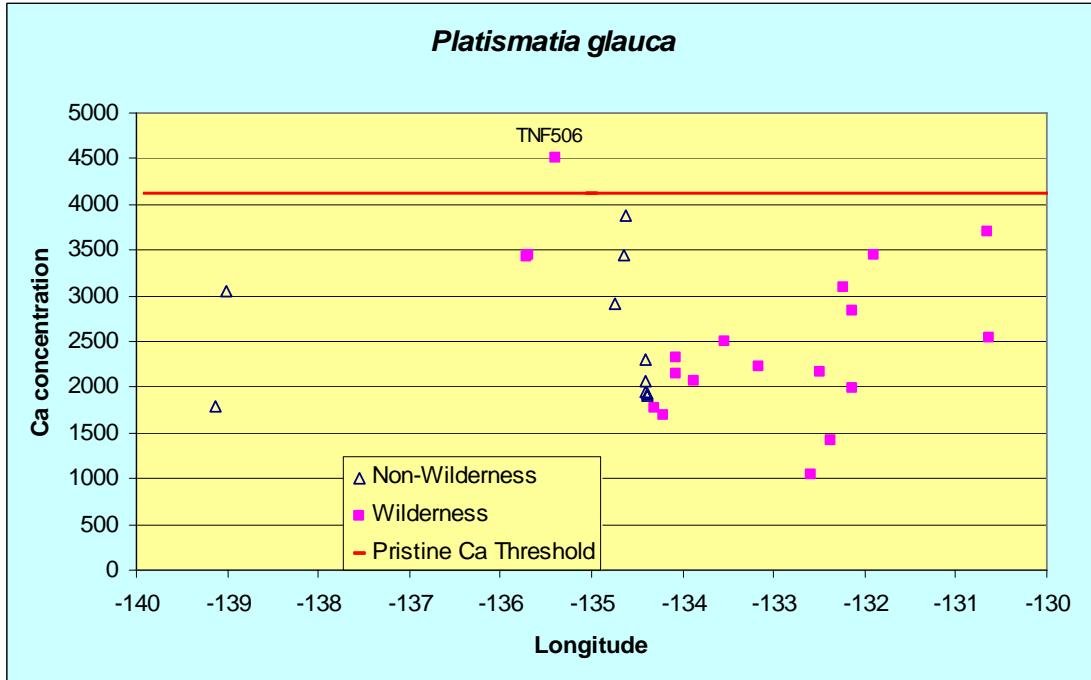


Figure XI-24. Wilderness and Non-Wilderness plot means of Ca ppm in *Platismatia glauca* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ca ppm

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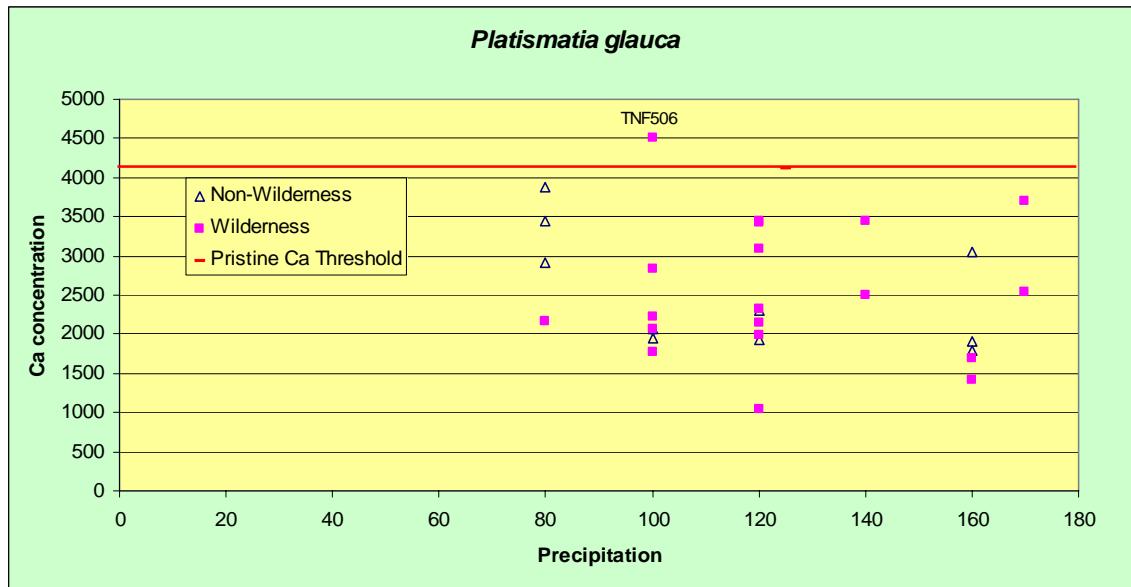


Figure XI-25. Wilderness and Non-Wilderness plot means of Ca ppm
in *Platismatia glauca* vs. plot Precipitation.

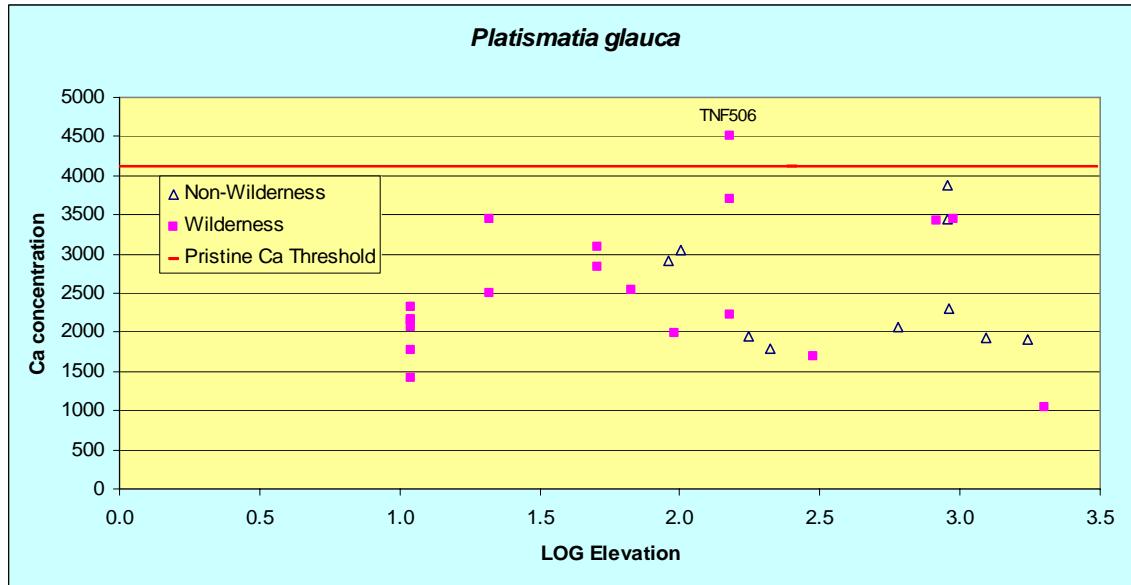


Figure XI-26. Wilderness and Non-Wilderness plot means of Ca ppm
in *Platismatia glauca* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cd ppm

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XII. SUMMARY OF Cd PPM DATA ANALYSIS

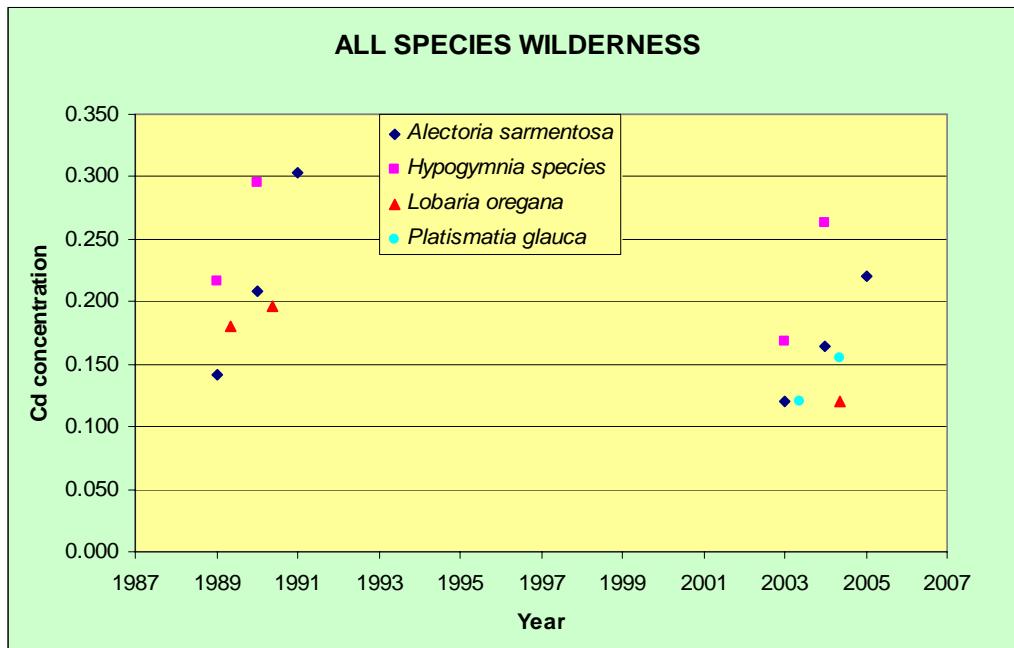


Figure XII-27. Wilderness plot means of Cd ppm in All Species per year.

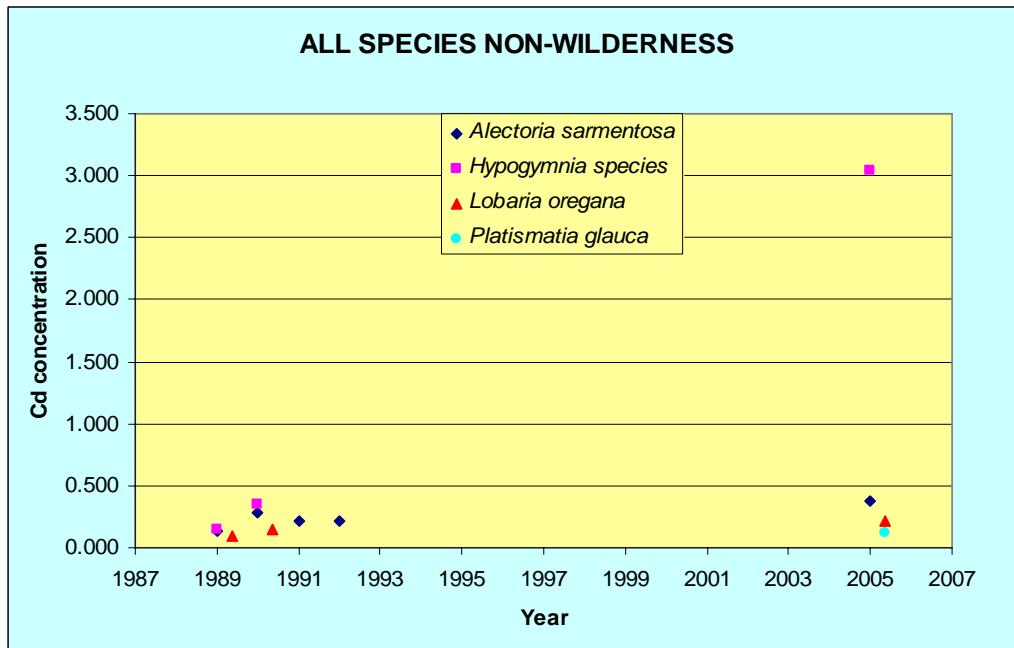


Figure XII-28. Non-Wilderness plot means of Cd ppm in All Species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cd ppm

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Alectoria sarmentosa

Summary Statistics:

Table XII-2. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Cd ppm content of *Alectoria sarmentosa* per year.

Cd ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	0.13	0.0087	0.1068	0.1552
1989	Wilderness	0.14	0.0327	0.0576	0.2257
1990	Non-Wilderness	0.29	0.0527	0.1768	0.3936
1990	Wilderness	0.21	0.0315	0.1320	0.2861
1991	Non-Wilderness	0.2189	0.0205	0.1757	0.2620
1991	Wilderness	0.30	0.0474	0.1722	0.4355
1992	Non-Wilderness	0.21	0.0657	0.0533	0.3642
2003	Wilderness	0.12	0.0000	0.1200	0.1200
2004	Wilderness	0.16	0.0125	0.1383	0.1902
2005	Non-Wilderness	0.37	0.1416	0.0072	0.7353
2005	Wilderness	0.22	0.0004	0.2197	0.2215

Summary of Statistical Tests:

$$t = 0.957, \text{ df} = 8, \text{ p-value} = 0.3666$$

There is no evidence of a difference in Cd ppm content in *Alectoria sarmentosa* from pre-2000 and post 2000 samples (p-value = 0.3666).

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cd ppm

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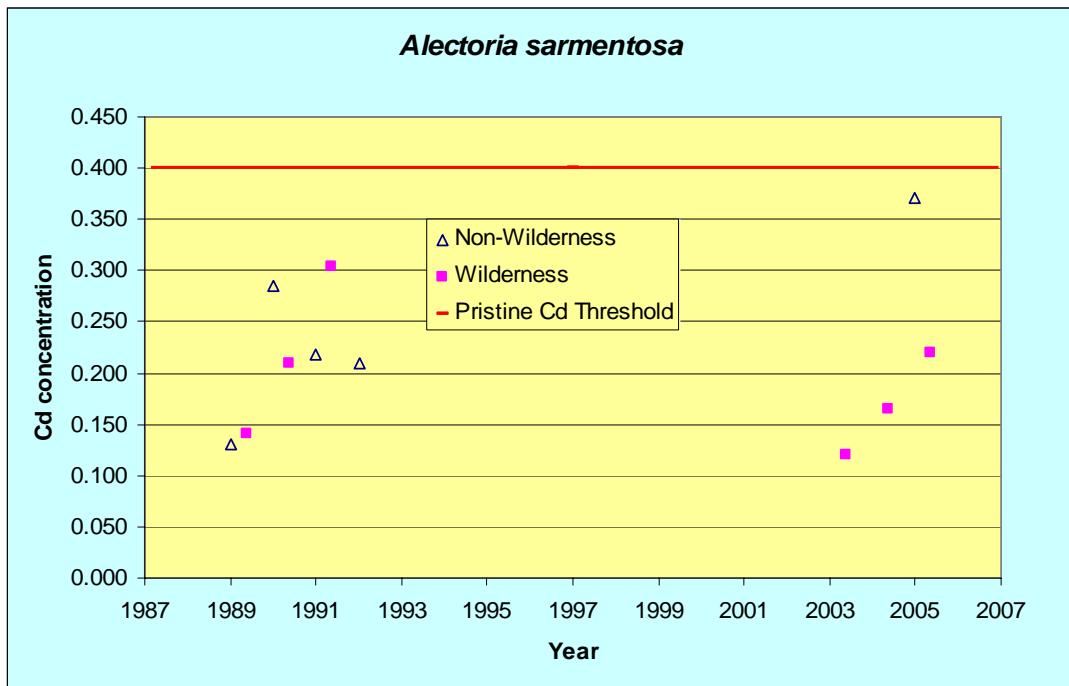


Figure XII-3. Wilderness and Non-Wilderness yearly means of Cd ppm in *Alectoria sarmentosa* per year.

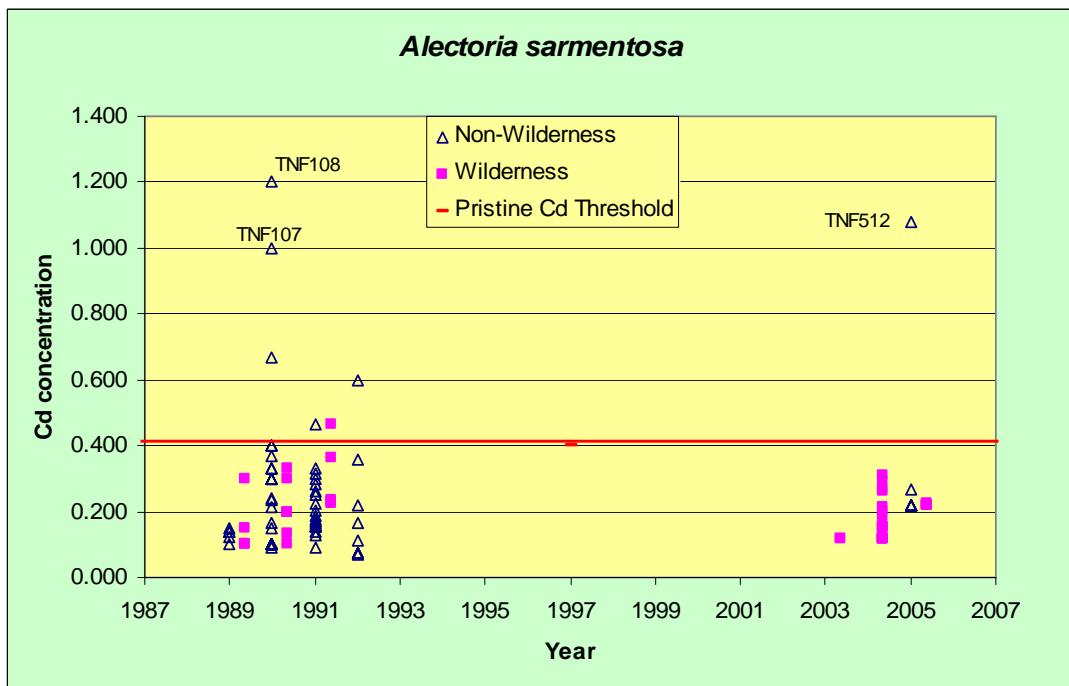


Figure XII-4. Wilderness and Non-Wilderness plot means of Cd ppm in *Alectoria sarmentosa* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cd ppm

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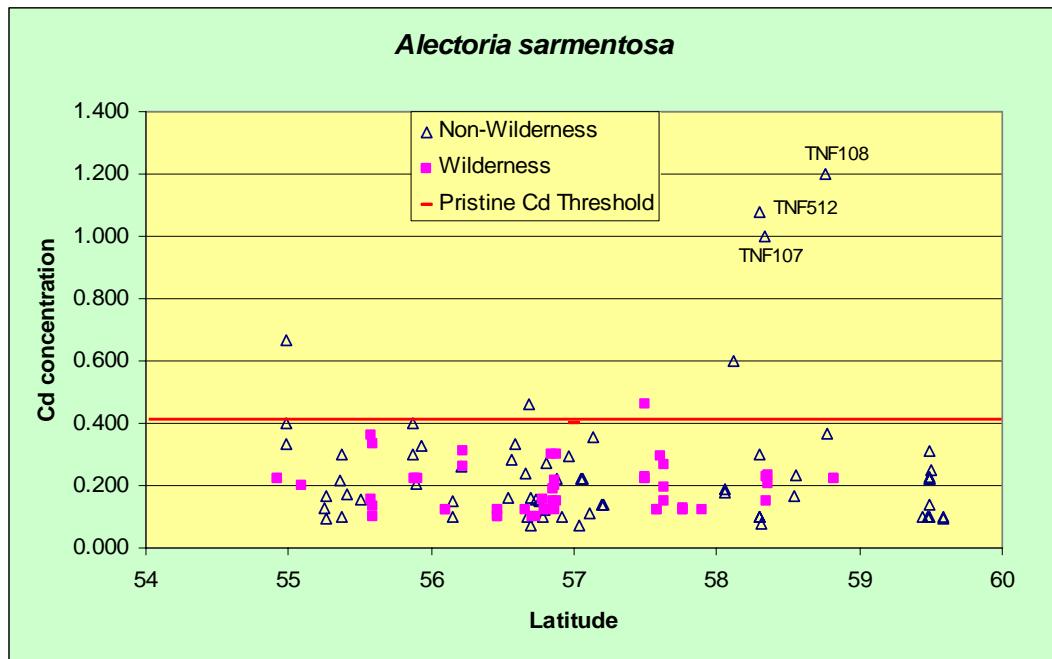


Figure XII-5. Wilderness and Non-Wilderness plot means of Cd ppm in *Alectoria sarmentosa* vs. plot Latitude.

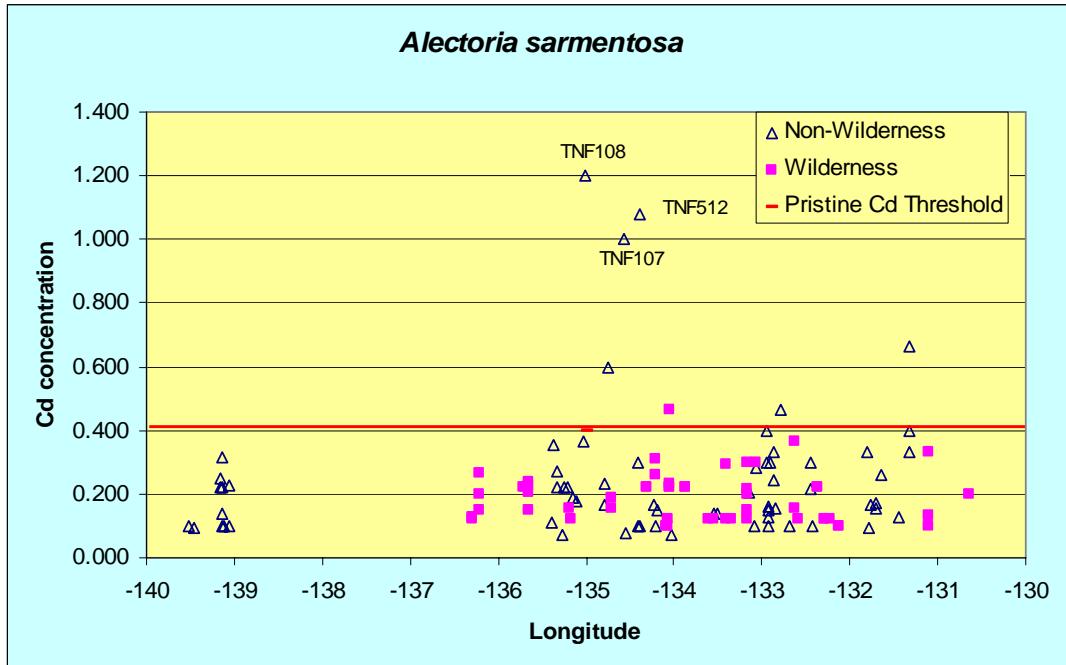


Figure XII-6. Wilderness and Non-Wilderness plot means of Cd ppm in *Alectoria sarmentosa* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cd ppm

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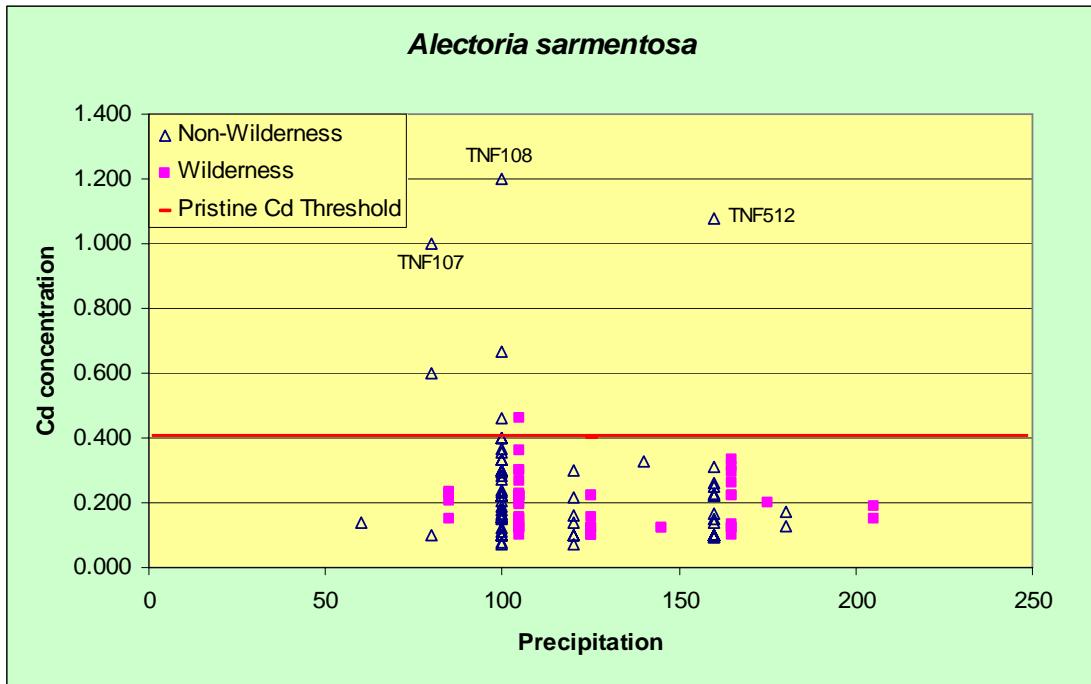


Figure XII-7. Wilderness and Non-Wilderness plot means of Cd ppm in *Alectoria sarmentosa* vs. plot Precipitation.

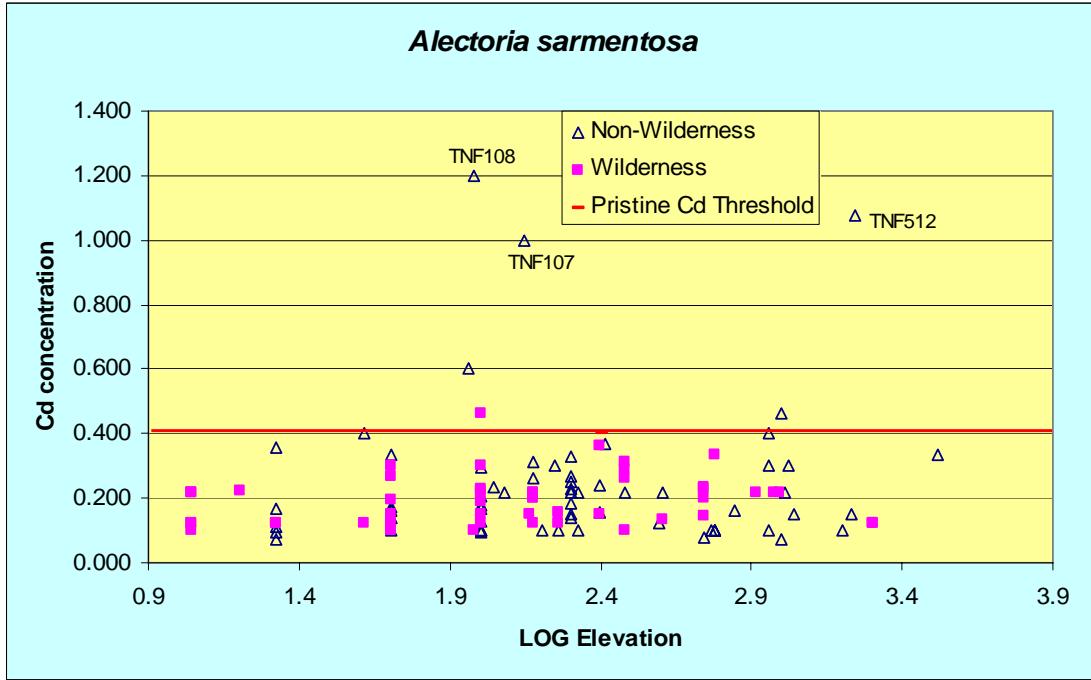


Figure XII-8. Wilderness and Non-Wilderness plot means of Cd ppm in *Alectoria sarmentosa* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cd ppm

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Hypogymnia species

In this series, all of the *Hypogymnia* species were included as a group.

Table XII-3. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Cd ppm content of *Hypogymnia species* per year.

Cd ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	0.15	0.0500	0.4853	0.7853
1989	Wilderness	0.22	0.0726	0.0150	0.4184
1990	Non-Wilderness	0.35	0.0623	0.2235	0.4853
1990	Wilderness	0.30	0.0570	0.1557	0.4347
2003	Wilderness	0.17	NA	NA	NA
2004	Wilderness	0.26	0.0711	0.0809	0.4466
2005	Non-Wilderness	3.04	1.4535	3.2093	9.2986
2005	Wilderness	0.31	0.0576	0.1775	0.4432

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cd ppm

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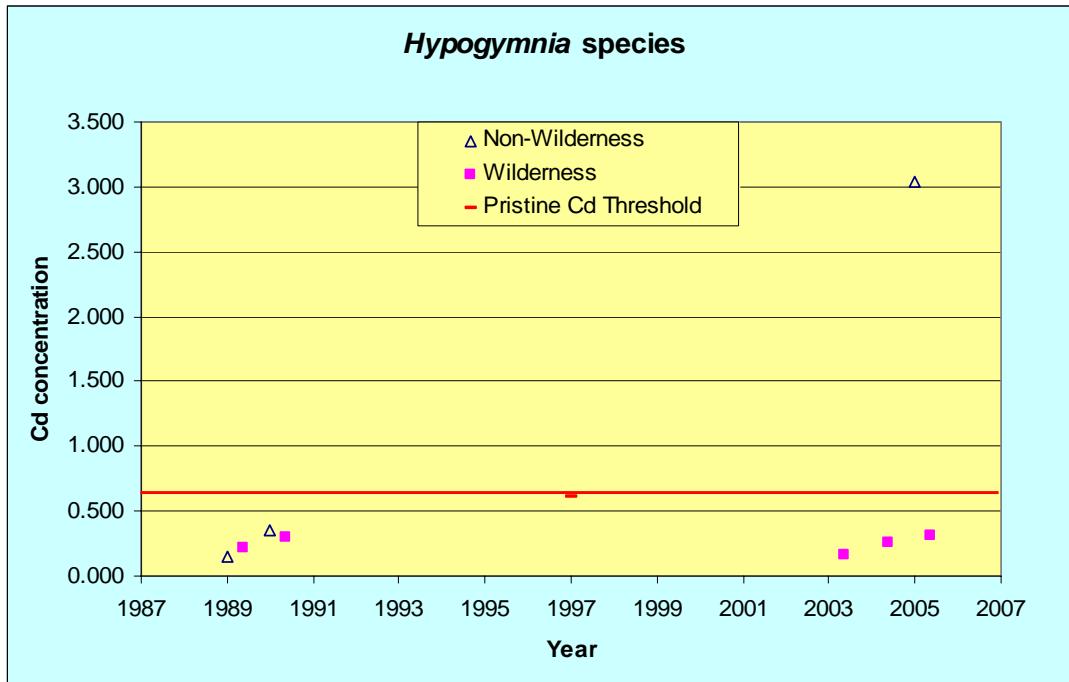


Figure XII-9. Wilderness and Non-Wilderness yearly means of Cd ppm in *Hypogymnia* species per year.

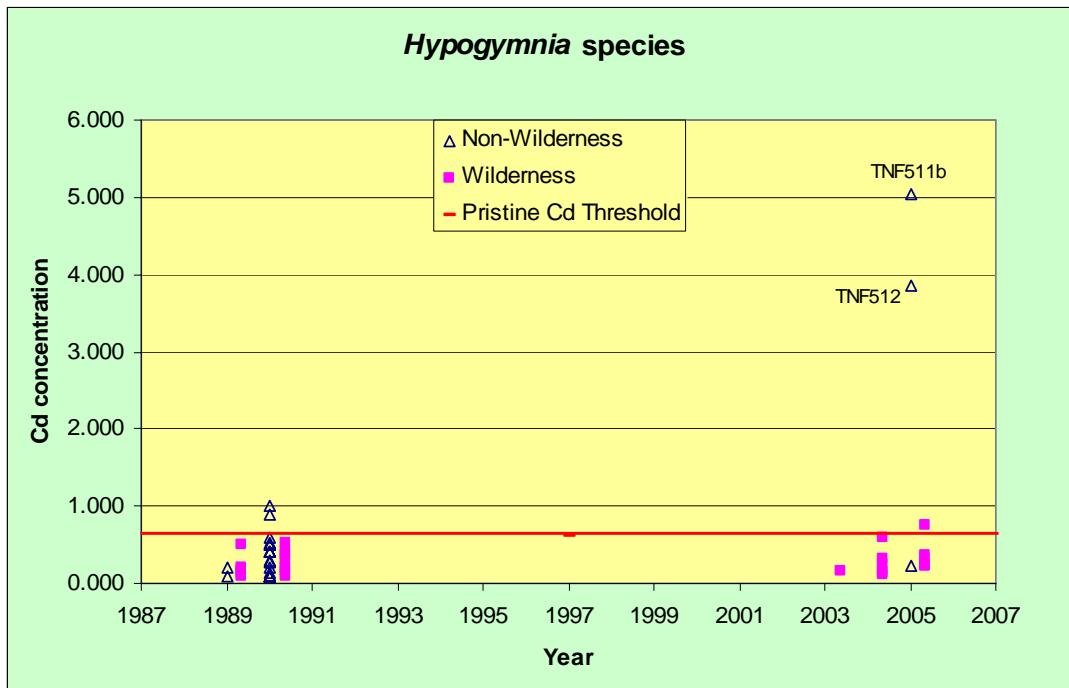


Figure XII-10. Wilderness and Non-Wilderness plot means of Cd ppm in *Hypogymnia* species per year.

ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cd ppm

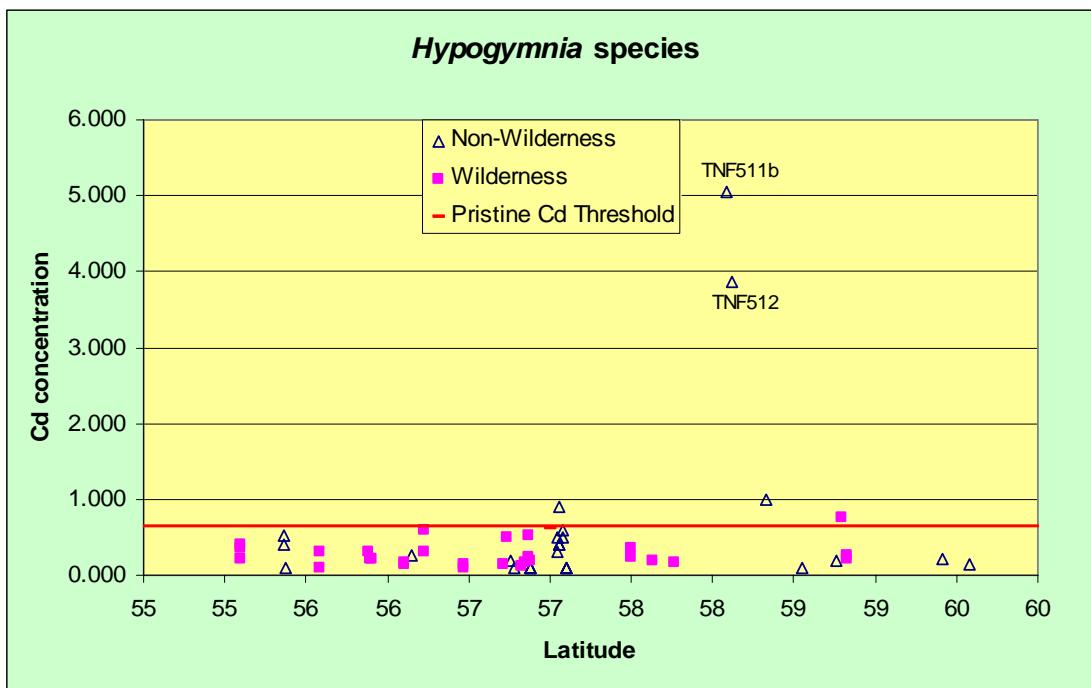


Figure XII-11. Wilderness and Non-Wilderness plot means of Cd ppm in *Hypogymnia* species vs. plot Latitude.

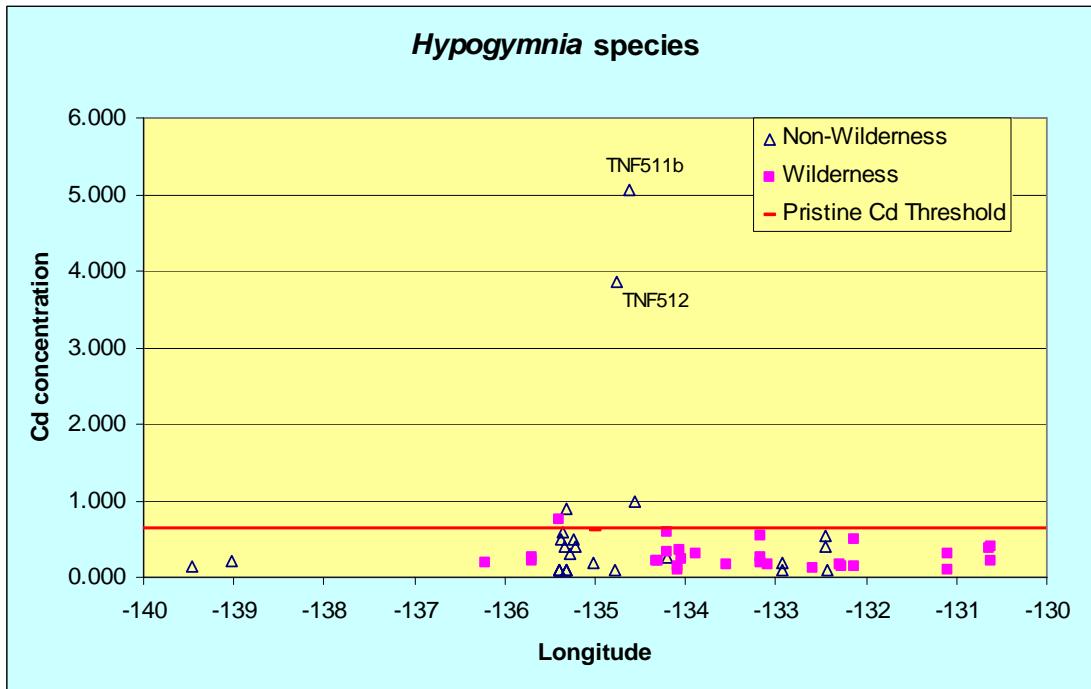


Figure XII-12. Wilderness and Non-Wilderness plot means of Cd ppm in *Hypogymnia* species vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cd ppm

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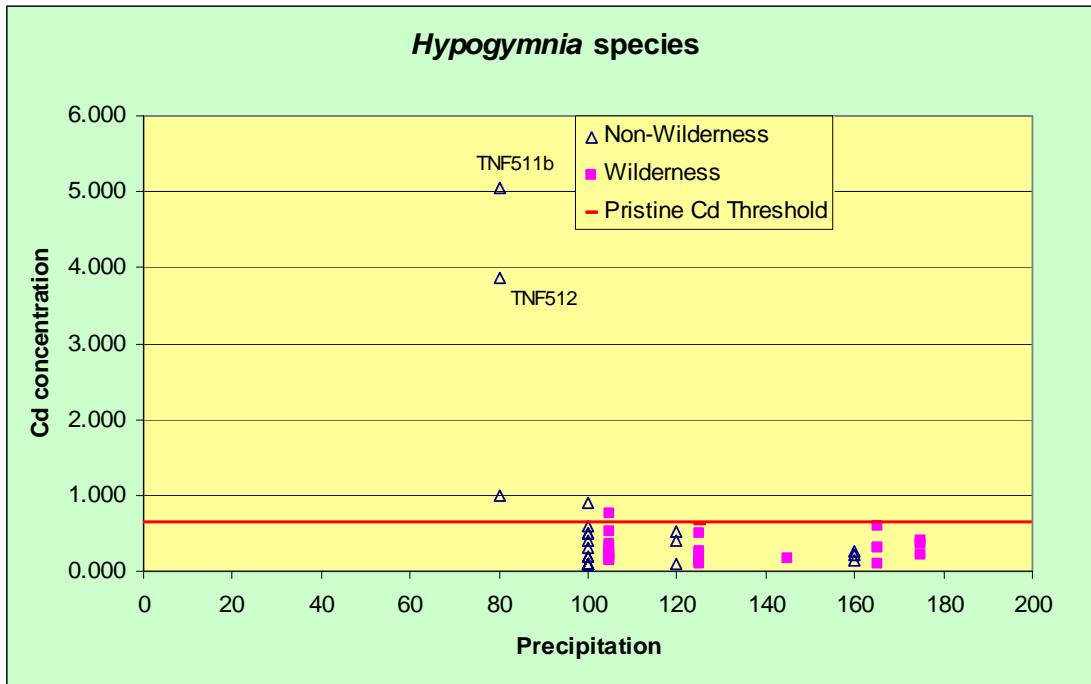


Figure XII-13. Wilderness and Non-Wilderness plot means of Cd ppm in *Hypogymnia* species vs. plot Precipitation.

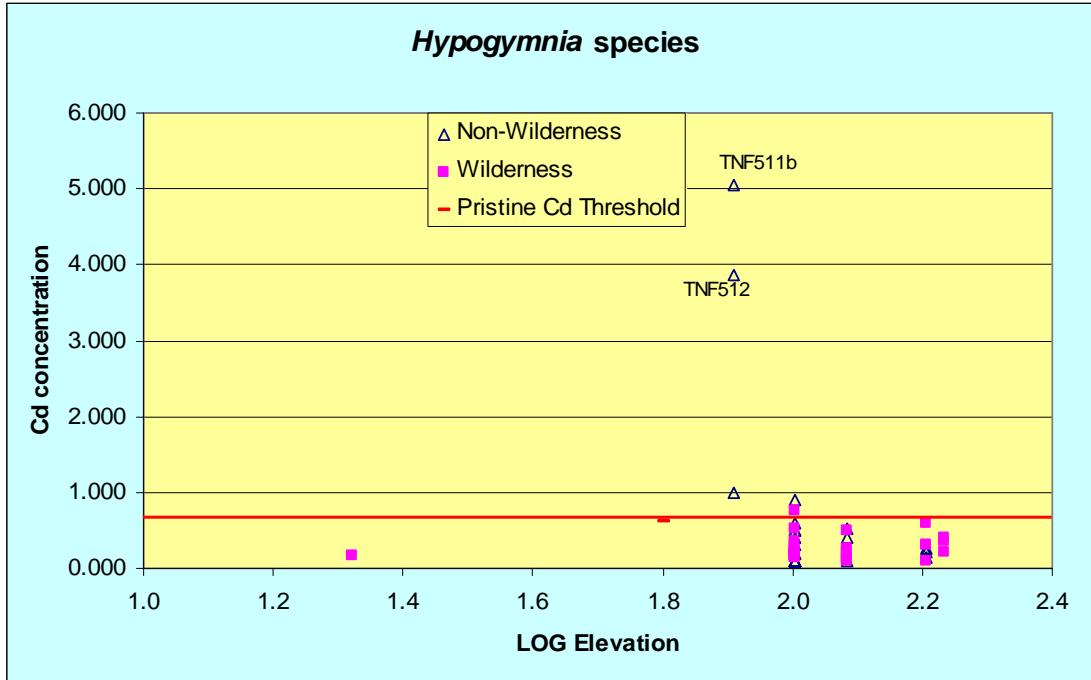


Figure XII-14. Wilderness and Non-Wilderness plot means of Cd ppm in *Hypogymnia* species vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cd ppm

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Lobaria oregana

Table XII-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Cd ppm content of *Lobaria oregana* per year.

Cd ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	0.10	0.0000	0.1000	0.1000
1989	Wilderness	0.18	0.0800	-0.0421	0.4021
1990	Non-Wilderness	0.15	0.0519	0.0388	0.2651
1990	Wilderness	0.20	0.0664	0.0261	0.3673
2004	Wilderness	0.12	0.0000	0.1200	0.1200
2005	Non-Wilderness	0.22	NA	NA	NA
2005	Wilderness	0.22	0.0000	0.2200	0.2200

Summary of Statistical Tests:

$$t = -2.5145, \text{ df} = 4, \text{ p-value} = 0.0657$$

There is suggestive evidence of a difference in Cd ppm content in *Lobaria oregana* from pre-2000 and post 2000 samples (p-value = 0.0657).

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cd ppm

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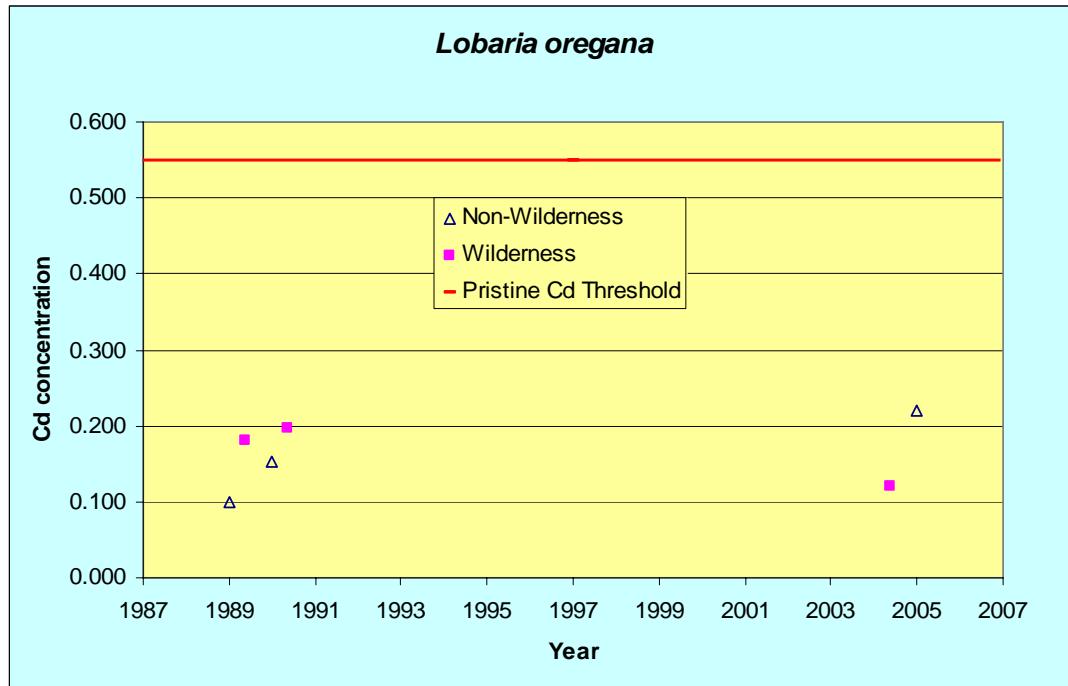


Figure XII-15. Wilderness and Non-Wilderness yearly means of Cd ppm in *Lobaria oregana* per year.

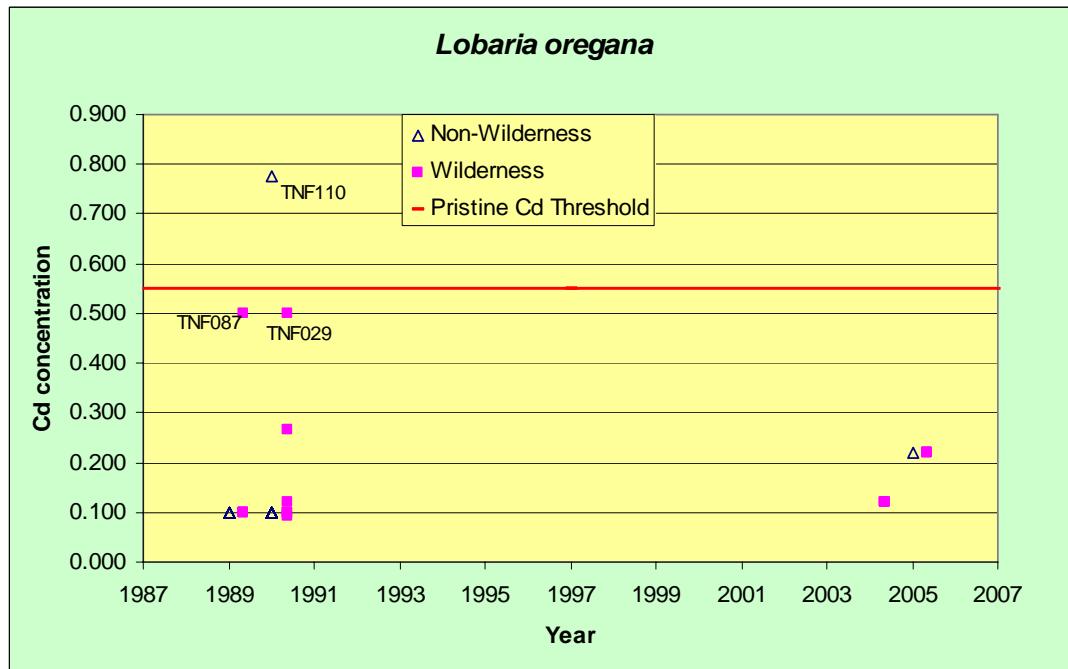


Figure XII-16. Wilderness and Non-Wilderness plot means of Cd ppm in *Lobaria oregana* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cd ppm

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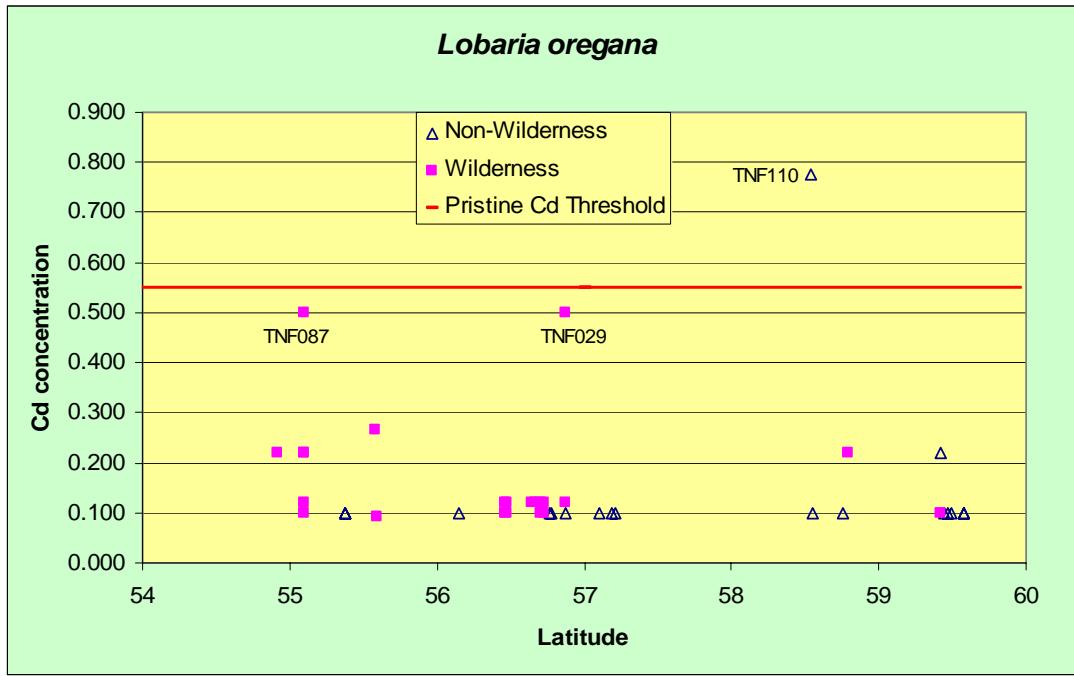


Figure XII-17. Wilderness and Non-Wilderness plot means of Cd ppm in *Lobaria oregana* vs. plot Latitude.

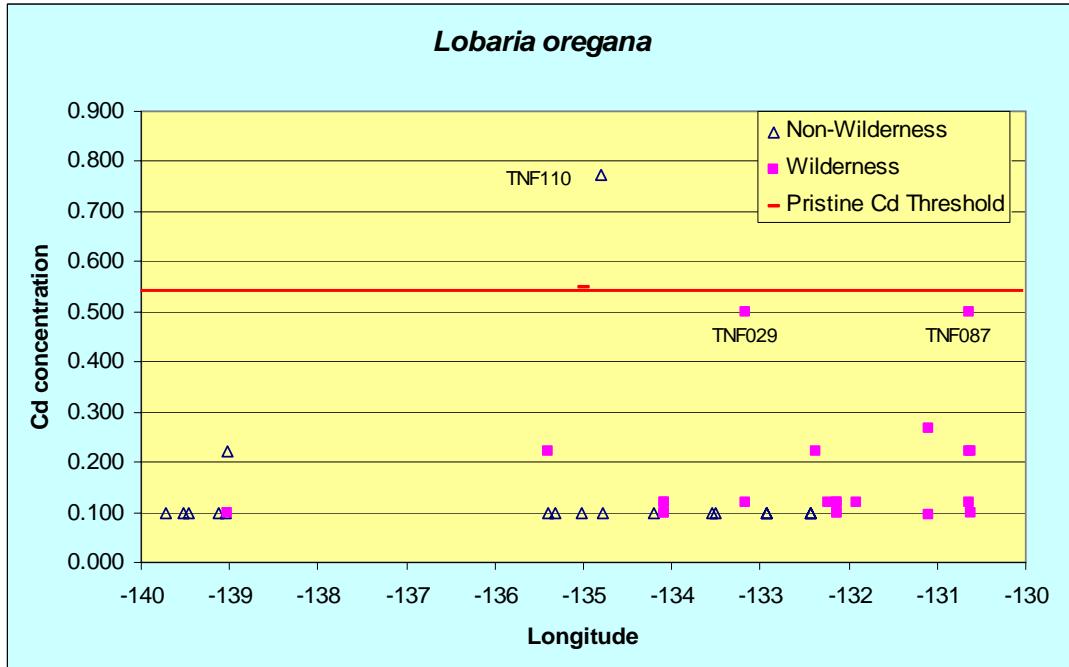


Figure XII-18. Wilderness and Non-Wilderness plot means of Cd ppm in *Lobaria oregana* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cd ppm

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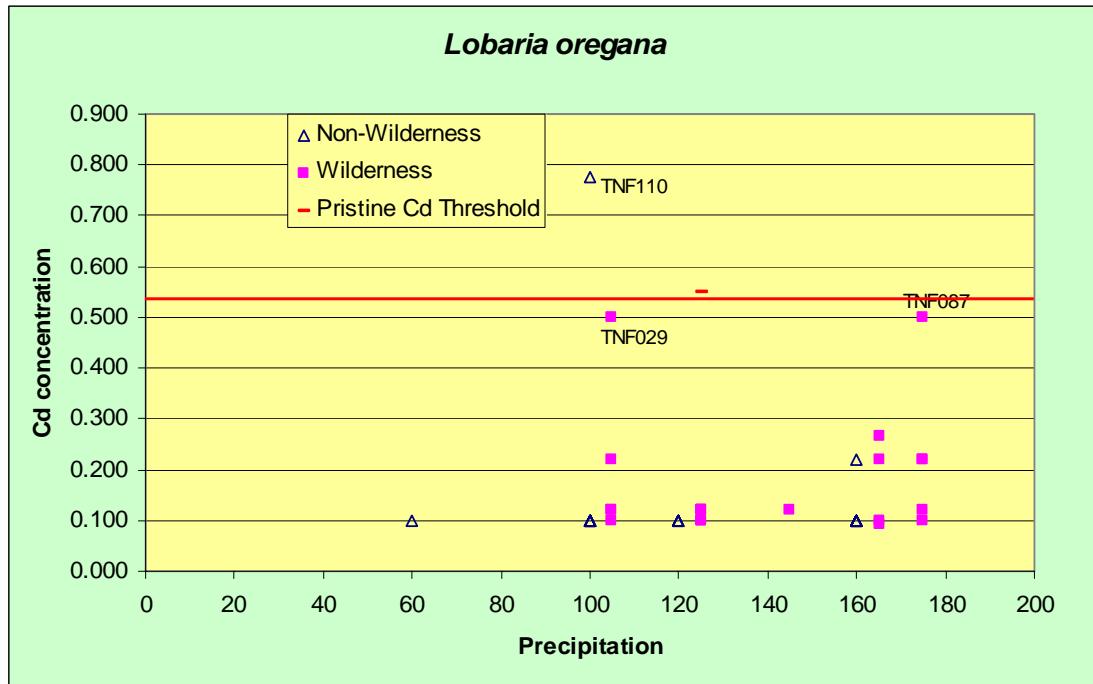


Figure XII-19. Wilderness and Non-Wilderness plot means of Cd ppm in *Lobaria oregana* vs. plot Precipitation.

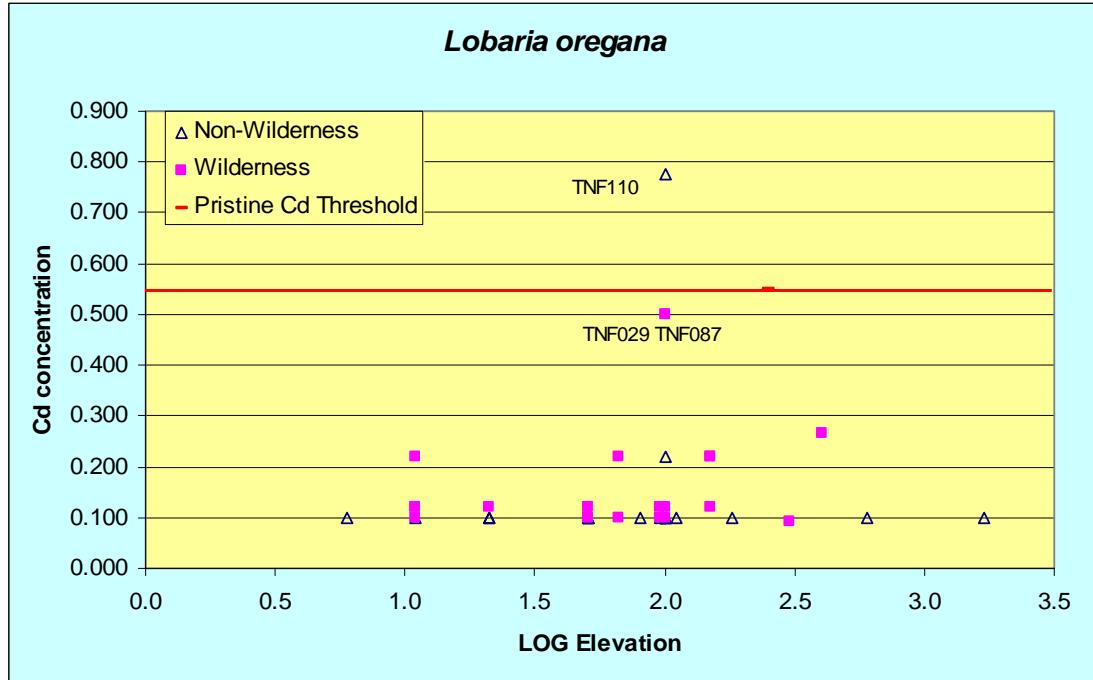


Figure XII-20. Wilderness and Non-Wilderness plot means of Cd ppm in *Lobaria oregana* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cd ppm

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Platismatia glauca

Table XII-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Cd ppm content of *Platismatia glauca* per year.

Cd ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2003	Wilderness	0.12	NA	NA	NA
2004	Wilderness	0.16	0.0298	0.0878	0.2227
2005	Non-Wilderness	1.71	0.9383	0.4089	3.8361
2005	Wilderness	0.22	0.0000	0.2200	0.2200

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cd ppm

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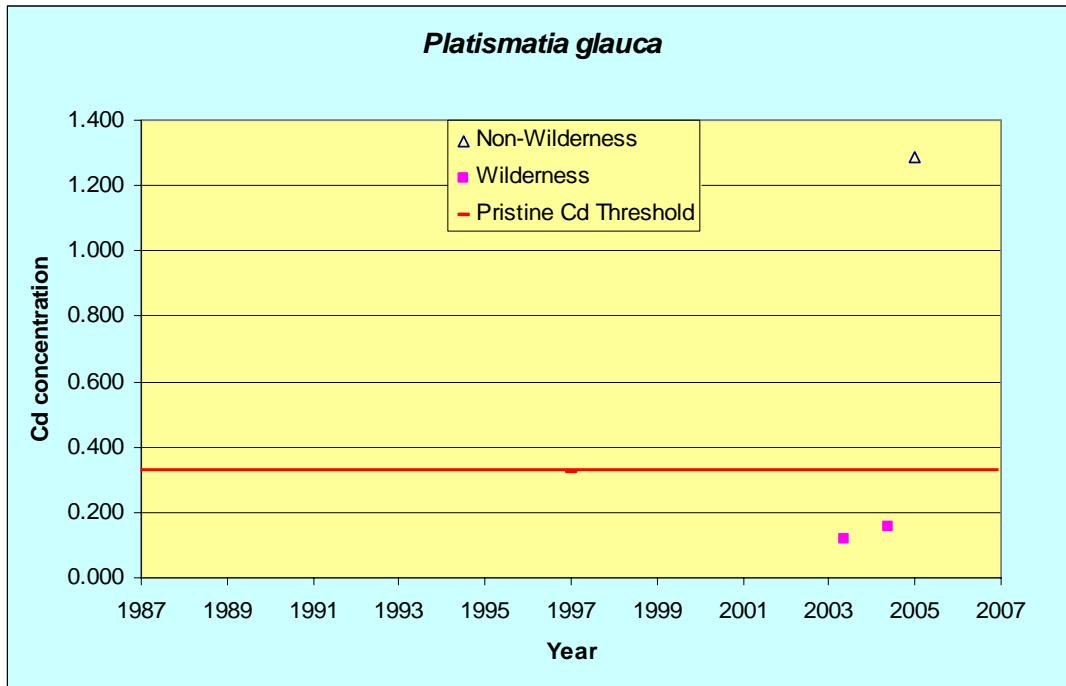


Figure XII-21. Wilderness and Non-Wilderness yearly means of Cd ppm in *Platismatia glauca* per year.

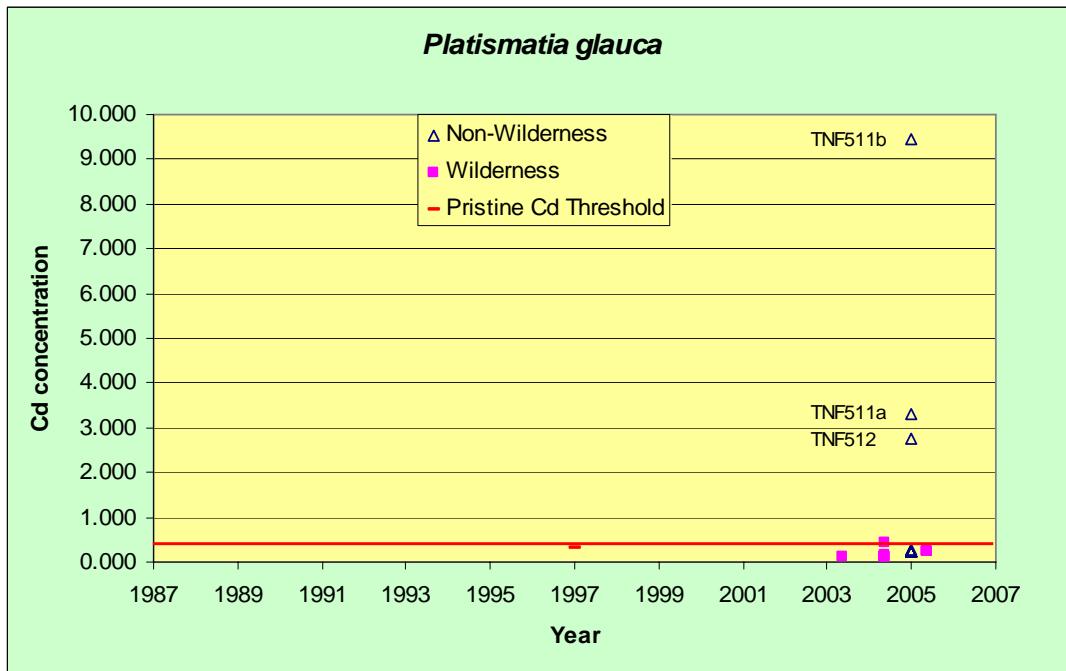


Figure XII-22. Wilderness and Non-Wilderness plot means of Cd ppm in *Platismatia glauca* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cd ppm

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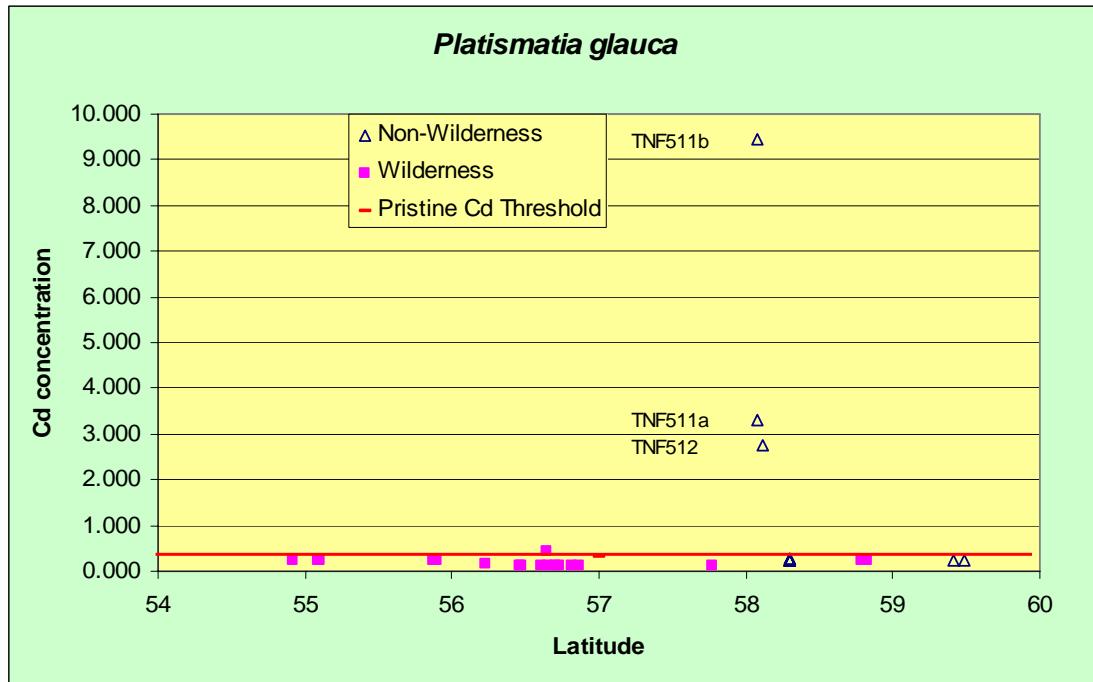


Figure XII-23. Wilderness and Non-Wilderness plot means of Cd ppm in *Platismatia glauca* vs. plot Latitude.

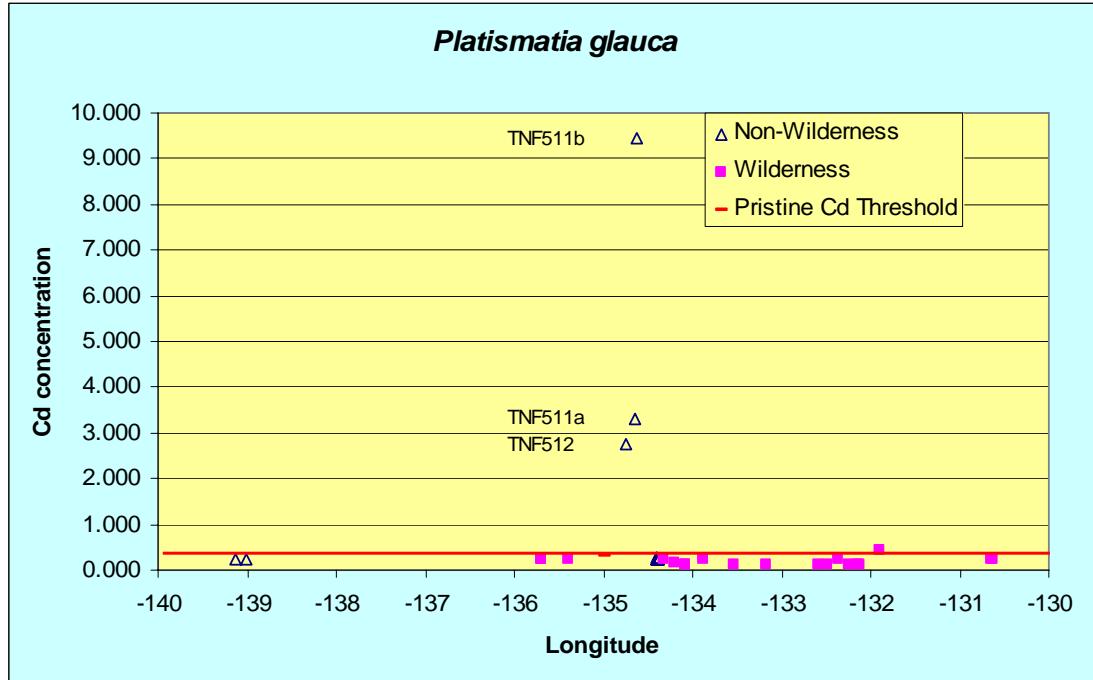


Figure XII-24. Wilderness and Non-Wilderness plot means of Cd ppm in *Platismatia glauca* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cd ppm

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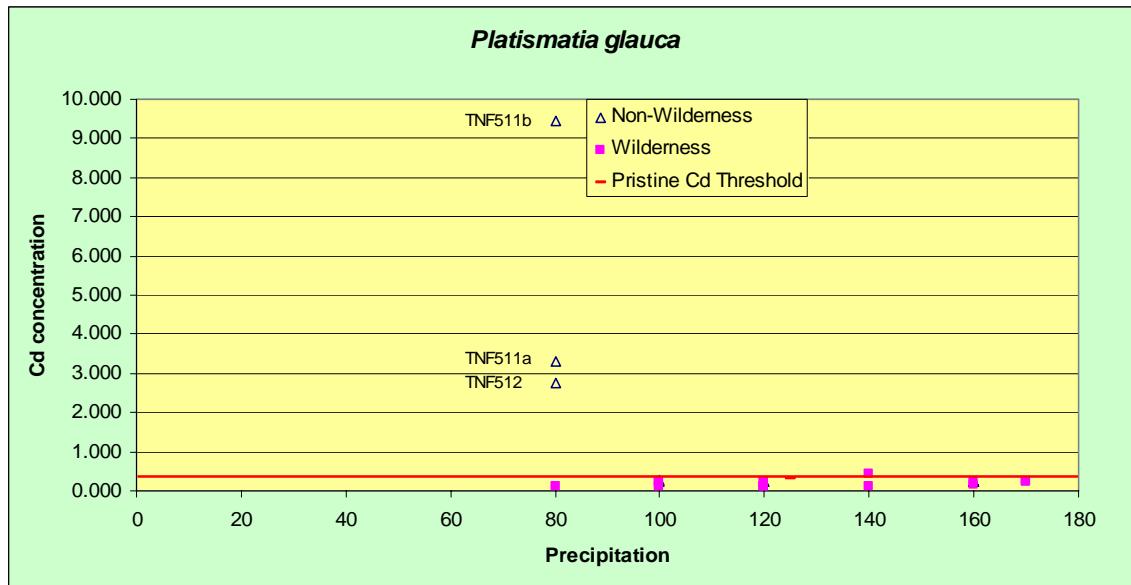


Figure XII-25. Wilderness and Non-Wilderness plot means of Cd ppm in *Platismatia glauca* vs. plot Precipitation.

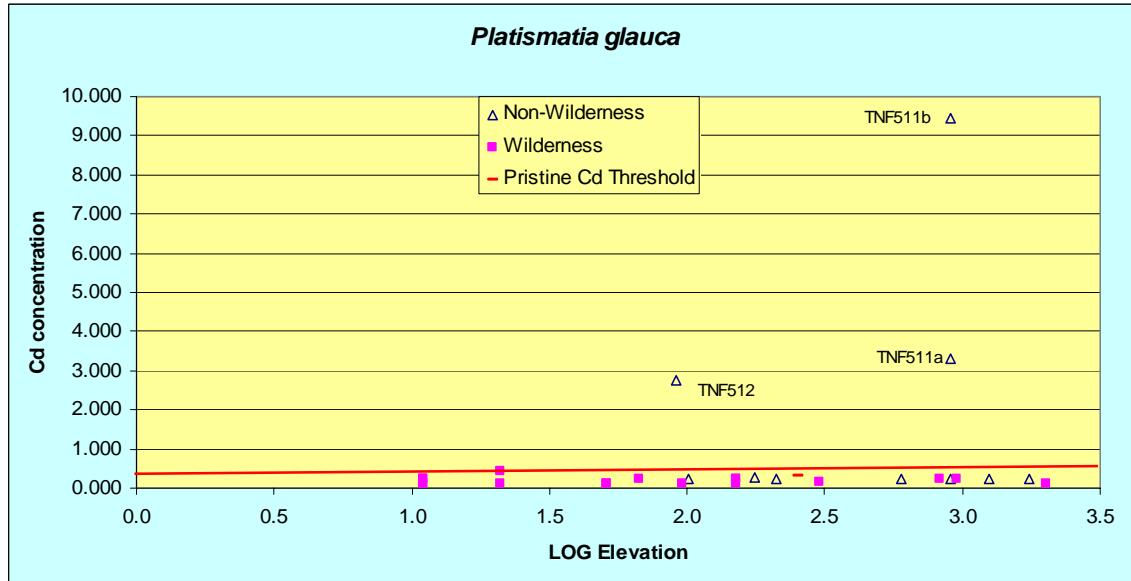


Figure XII-26. Wilderness and Non-Wilderness plot means of Cd ppm in *Platismatia glauca* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Co ppm

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XIII. SUMMARY OF Co PPM DATA ANALYSIS

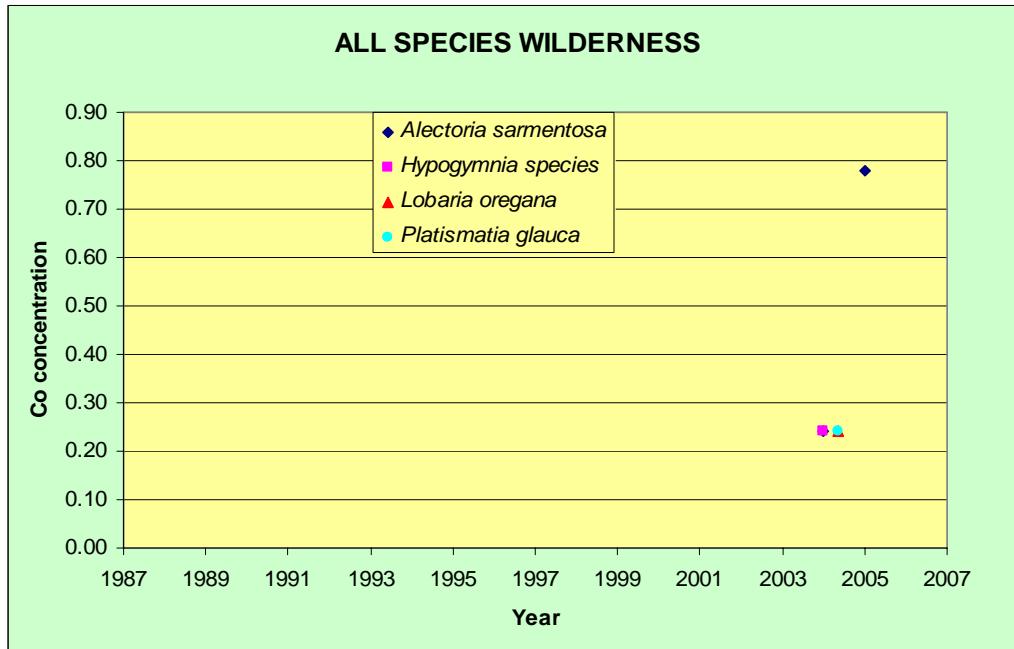


Figure XIII-27. Wilderness plot means of Co ppm
in All Species per year.

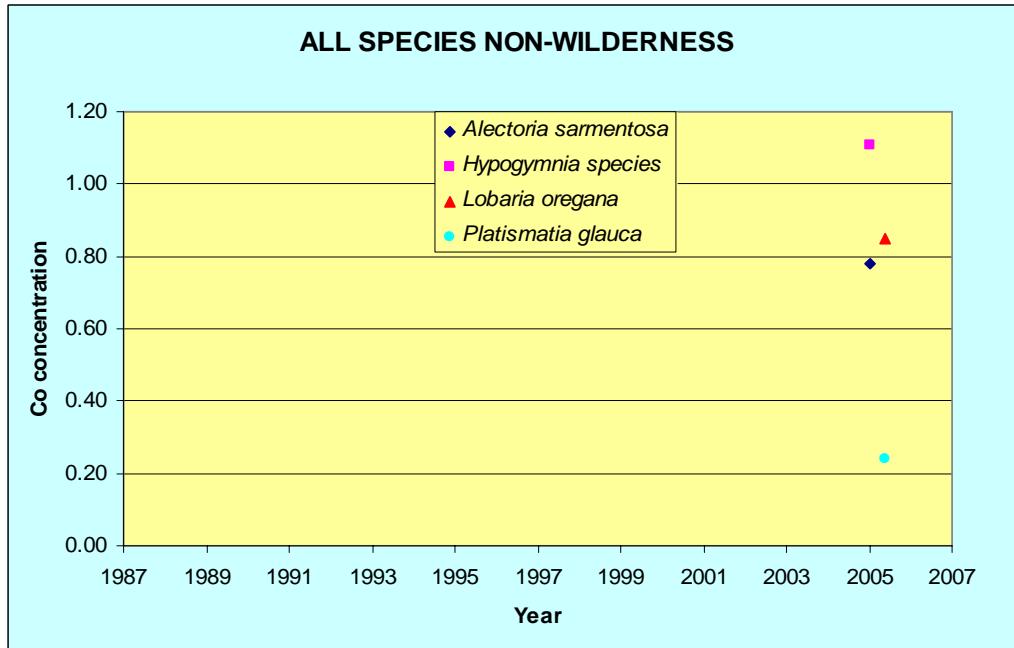


Figure XIII-28. Non-Wilderness plot means of Co ppm
in All Species per year.

ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Co ppm

Alectoria sarmentosa

Summary Statistics:

Table XIII-2. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Co ppm content of *Alectoria sarmentosa* per year.

Co				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	0.24	0.0000	0.2400	0.2400
2005	Non-Wilderness	0.78	0.0000	0.7800	0.7800
2005	Wilderness	0.78	0.0000	0.7800	0.7800

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Co ppm

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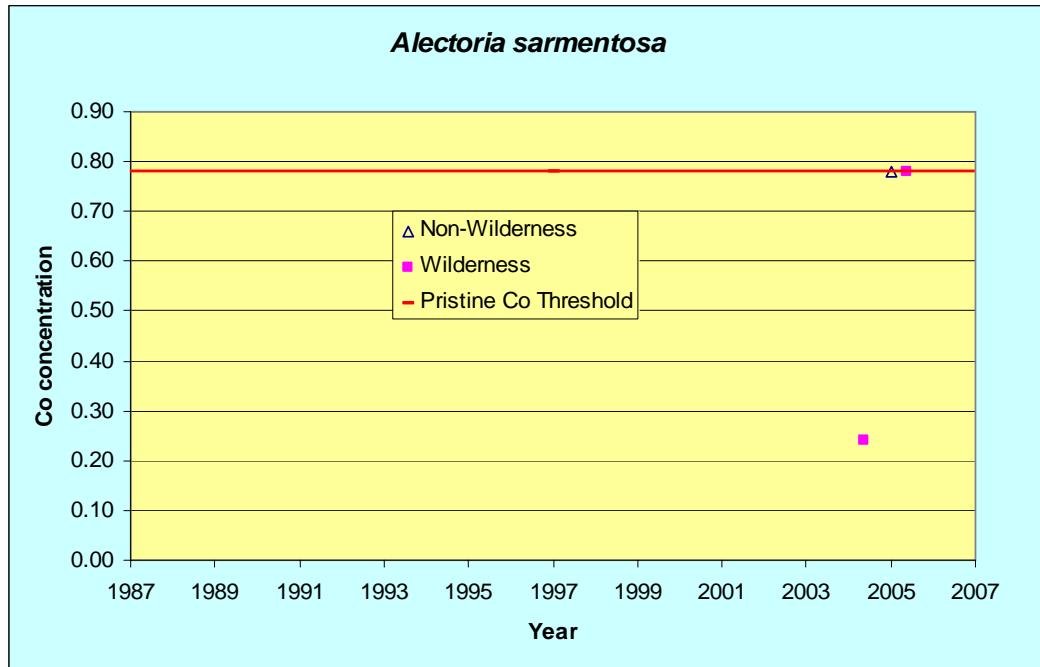


Figure XIII-3. Wilderness and Non-Wilderness yearly means of Co ppm in *Alectoria sarmentosa* per year.

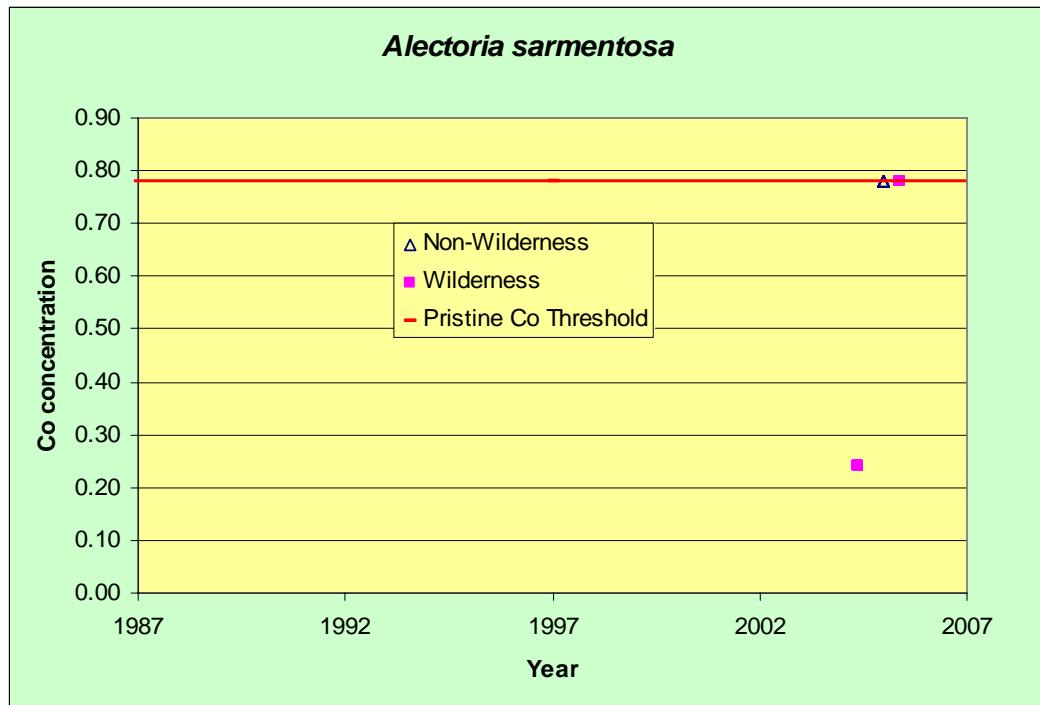


Figure XIII-4. Wilderness and Non-Wilderness plot means of Co ppm in *Alectoria sarmentosa* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Co ppm

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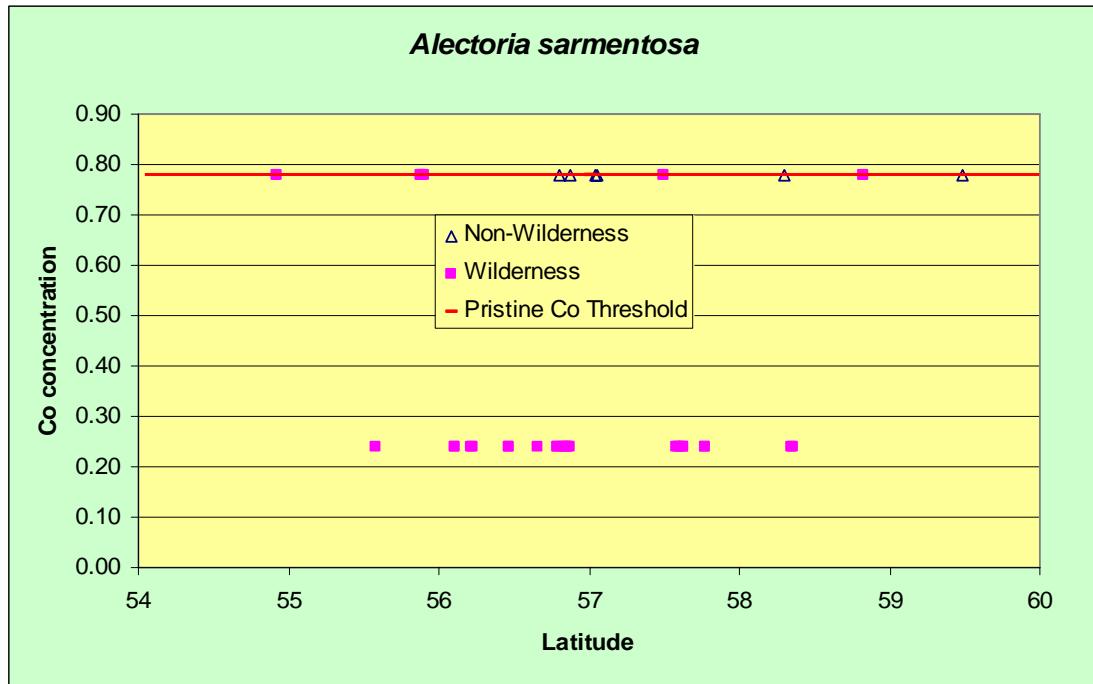


Figure XIII-5. Wilderness and Non-Wilderness plot means of Co ppm in *Alectoria sarmentosa* vs. plot Latitude.

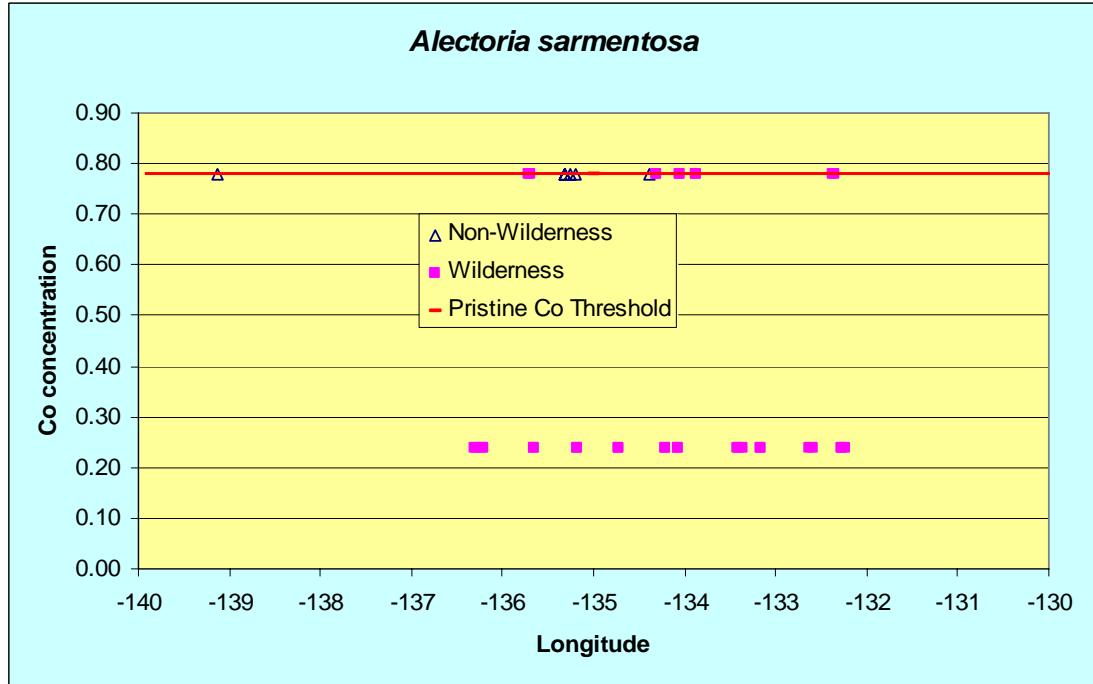


Figure XIII-6. Wilderness and Non-Wilderness plot means of Co ppm in *Alectoria sarmentosa* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Co ppm

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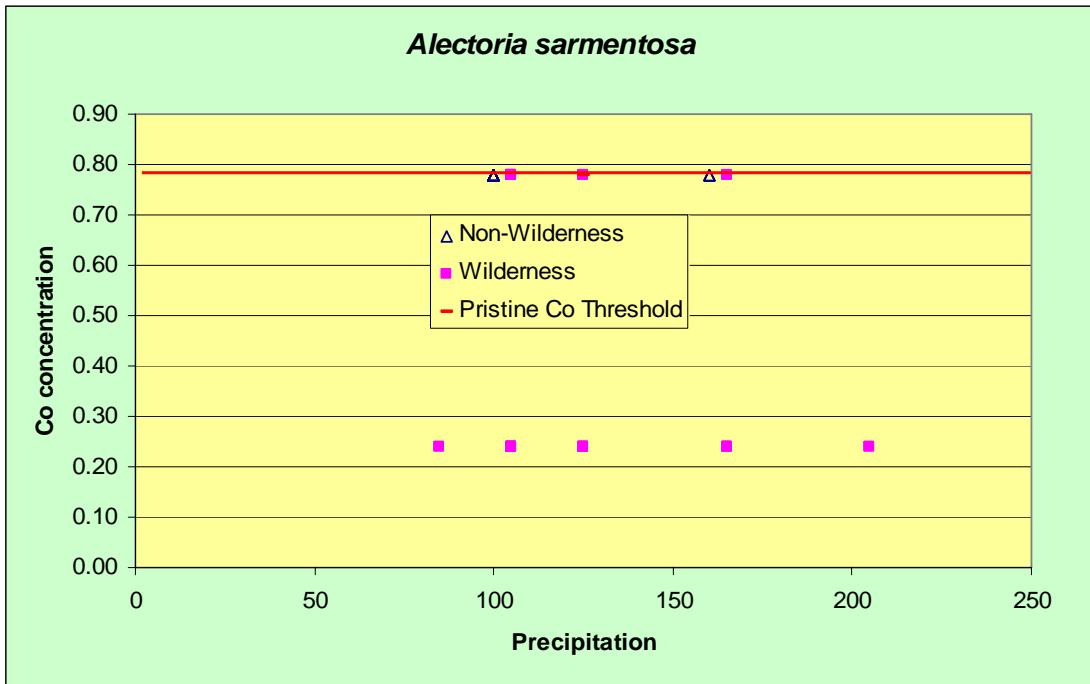


Figure XIII-7. Wilderness and Non-Wilderness plot means of Co ppm in *Alectoria sarmentosa* vs. plot Precipitation.

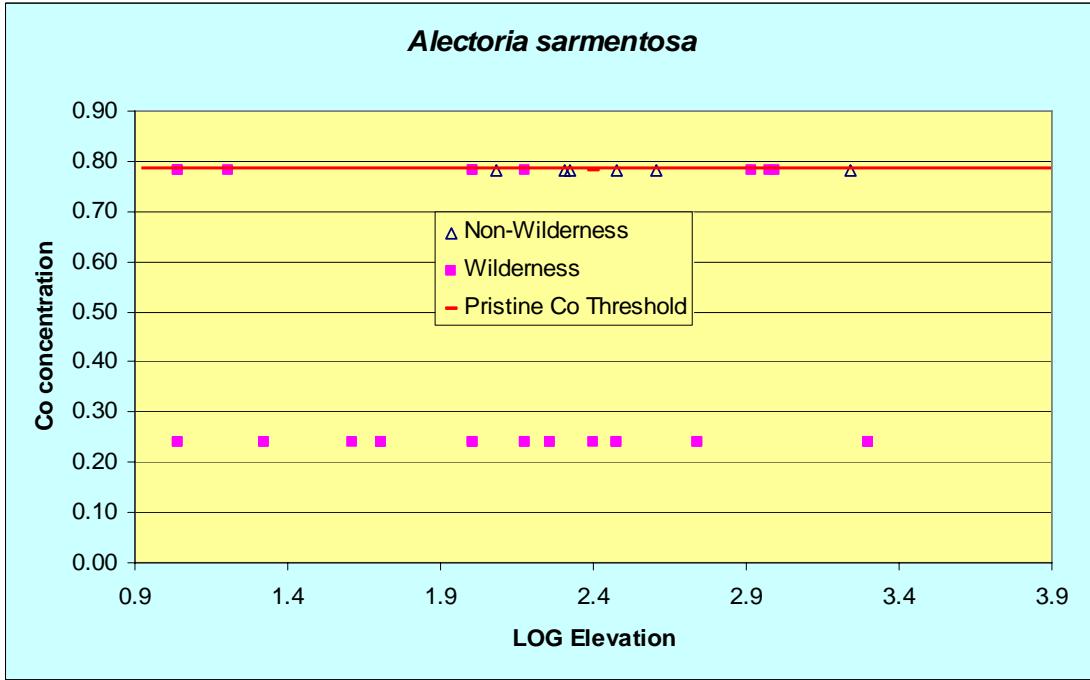


Figure XIII-8. Wilderness and Non-Wilderness plot means of Co ppm in *Alectoria sarmentosa* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Co ppm

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Hypogymnia species

In this series, all of the *Hypogymnia* species were included as a group.

Table XIII-3. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Co ppm content of *Hypogymnia species* per year.

Co ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	0.24	0.0000	0.2400	0.2400
2005	Non-Wilderness	1.11	0.1754	0.3530	1.8626
2005	Wilderness	0.84	0.0579	0.7044	0.9714

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Co ppm

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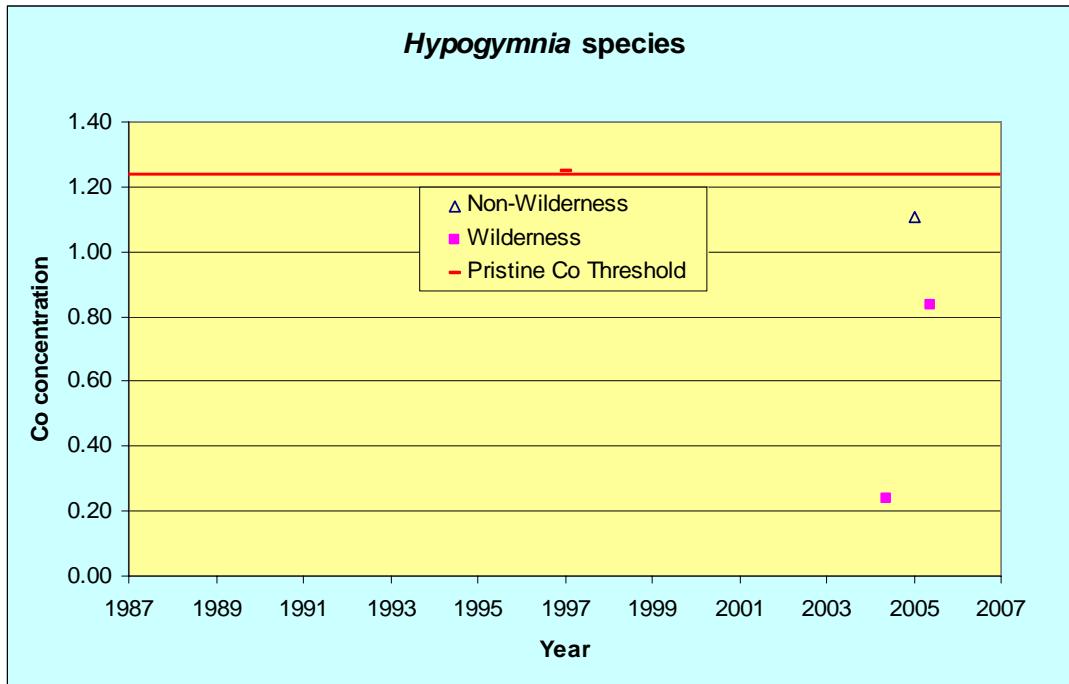


Figure XIII-9. Wilderness and Non-Wilderness yearly means of Co ppm in *Hypogymnia* species per year.

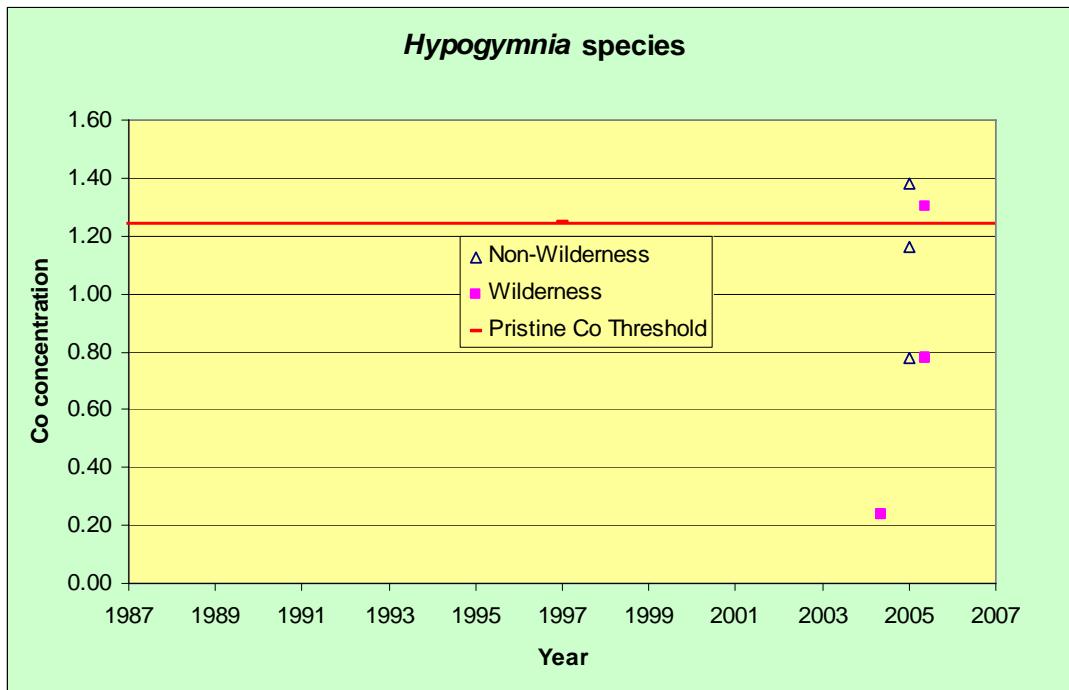


Figure XIII-10. Wilderness and Non-Wilderness plot means of Co ppm in *Hypogymnia* species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Co ppm

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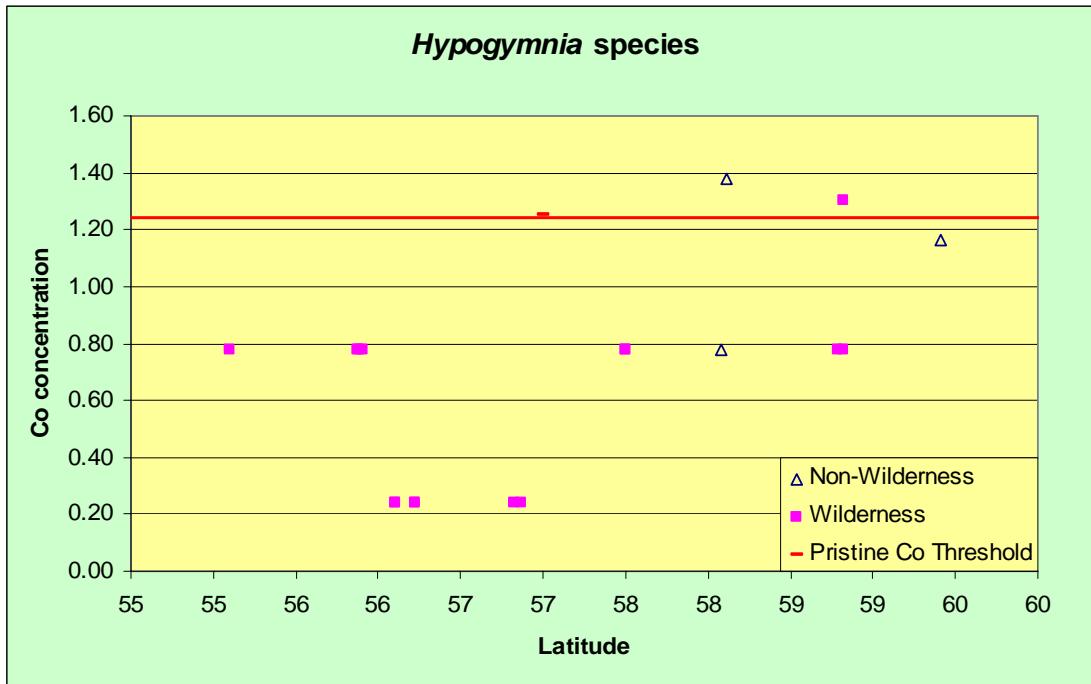


Figure XIII-11. Wilderness and Non-Wilderness plot means of Co ppm in *Hypogymnia species* vs. plot Latitude.

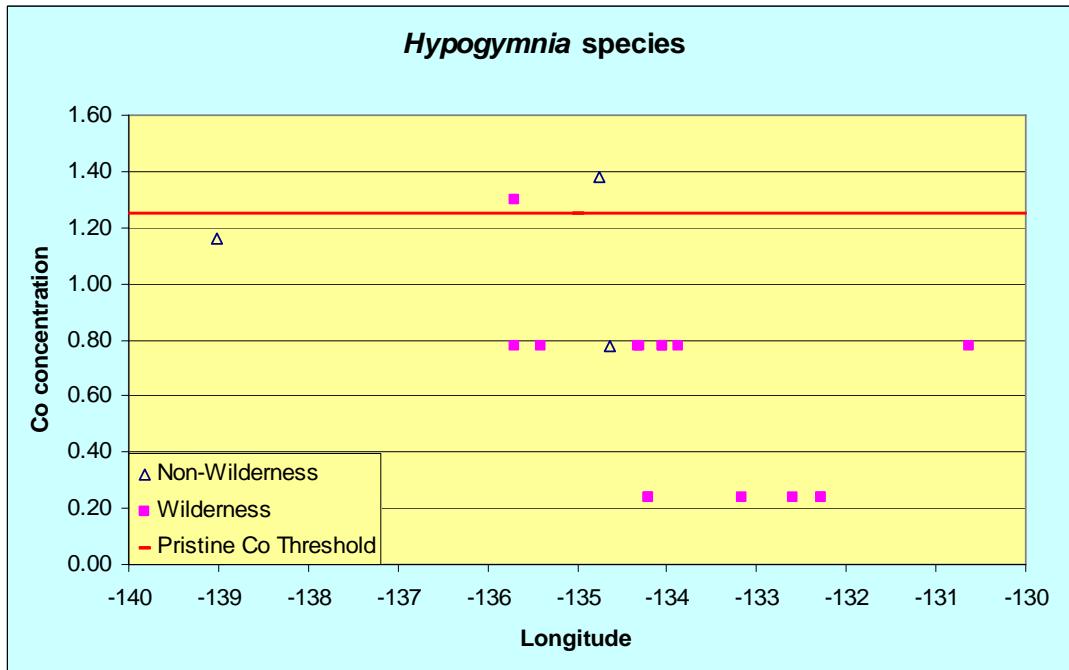


Figure XIII-12. Wilderness and Non-Wilderness plot means of Co ppm in *Hypogymnia species* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Co ppm

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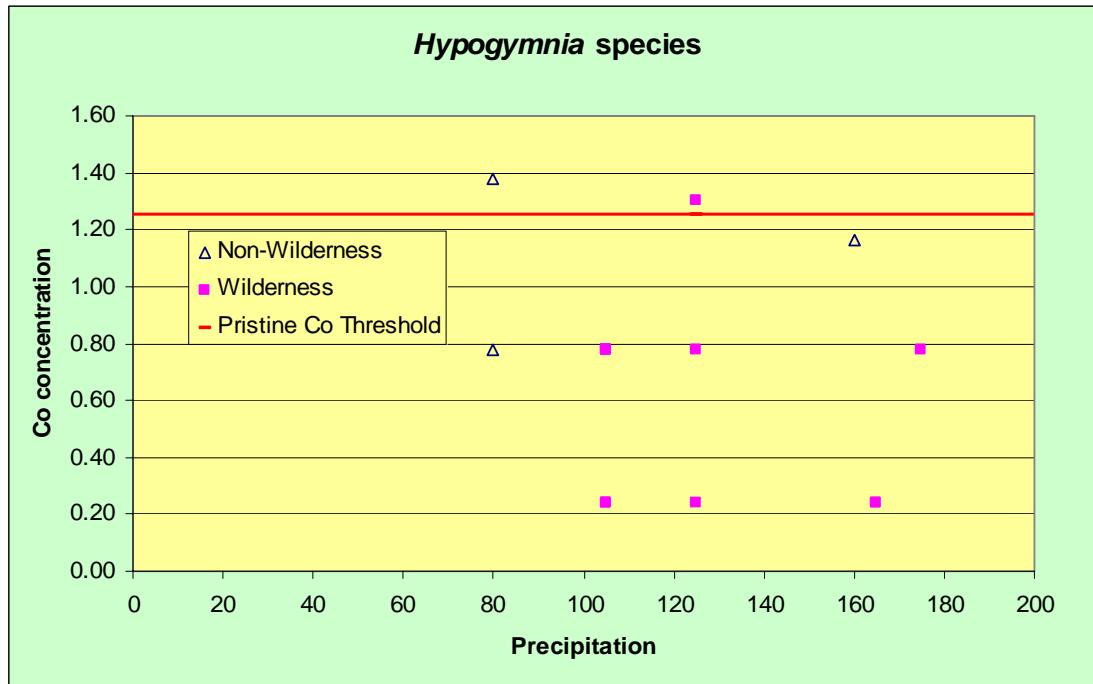


Figure XIII-13. Wilderness and Non-Wilderness plot means of Co ppm in *Hypogymnia* species vs. plot Precipitation.

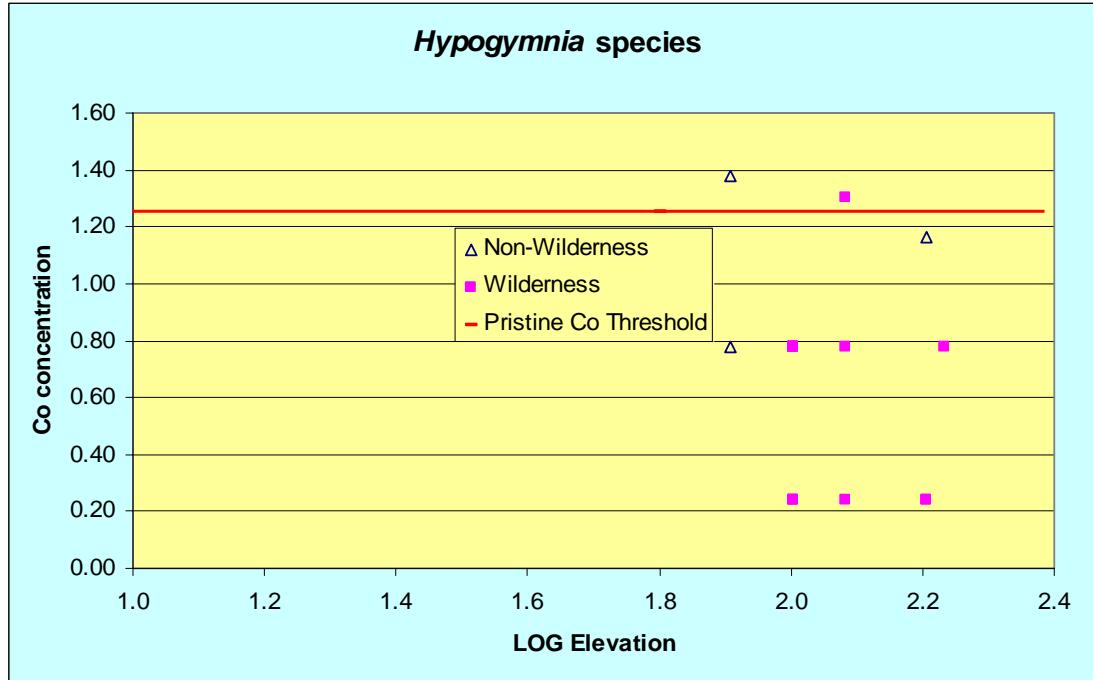


Figure XIII-14. Wilderness and Non-Wilderness plot means of Co ppm in *Hypogymnia* species vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Co ppm

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Lobaria oregana

Table XIII-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Co ppm content of *Lobaria oregana* per year.

Co ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	0.24	0.0000	0.2400	0.2400
2005	Non-Wilderness	0.85	NA	NA	NA
2005	Wilderness	0.78	0.0000	0.7800	0.7800

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Co ppm

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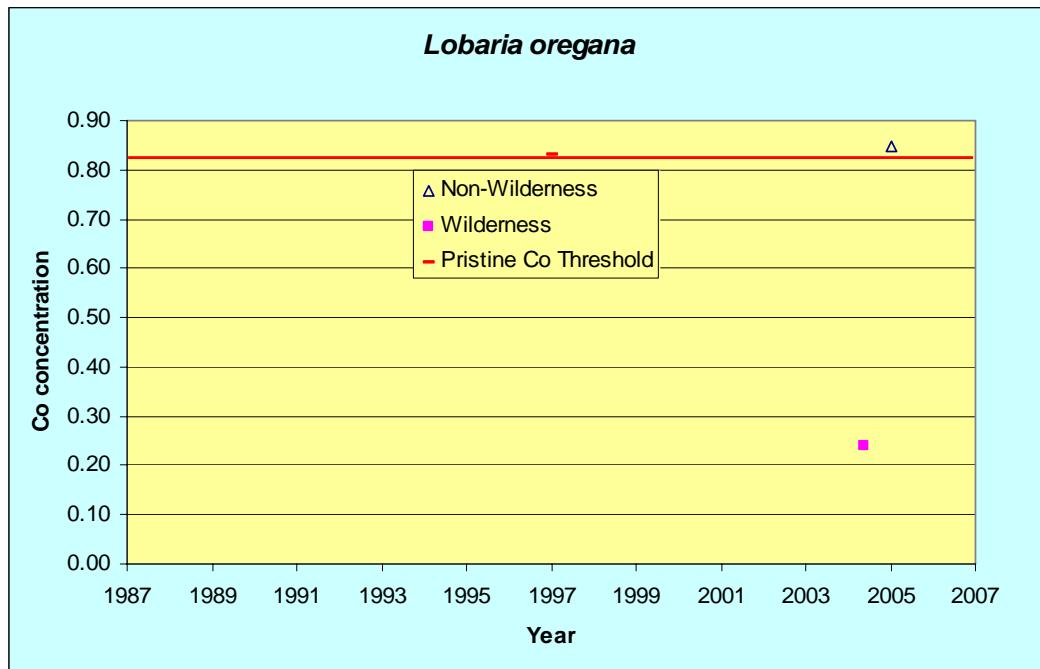


Figure XIII-15. Wilderness and Non-Wilderness yearly means of Co ppm in *Lobaria oregana* per year.

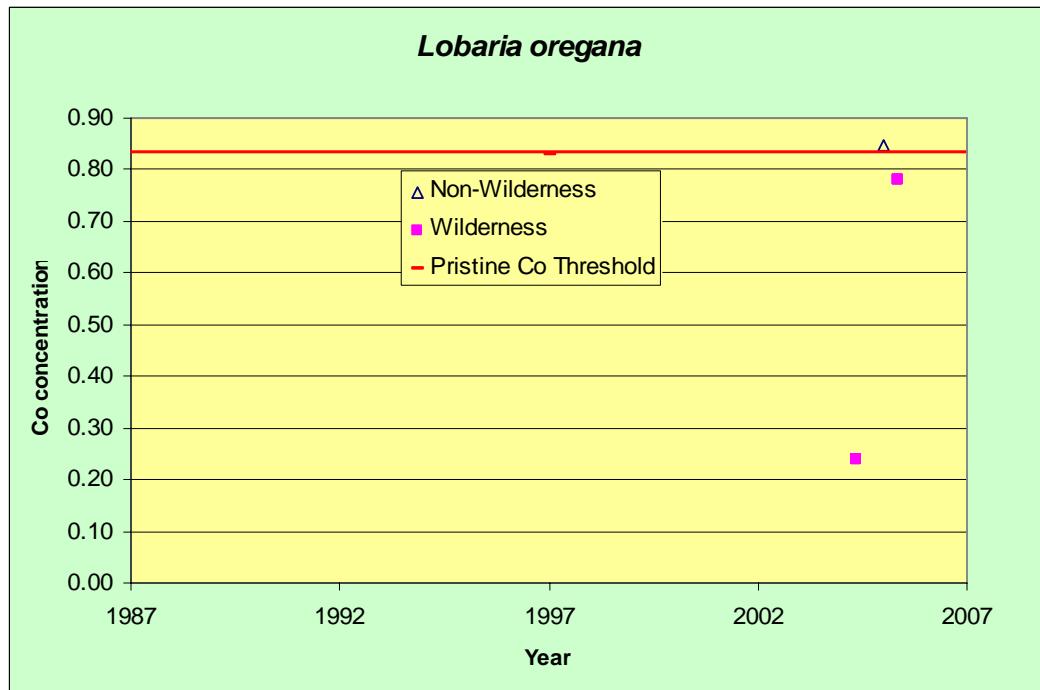


Figure XIII-16. Wilderness and Non-Wilderness plot means of Co ppm in *Lobaria oregana* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Co ppm

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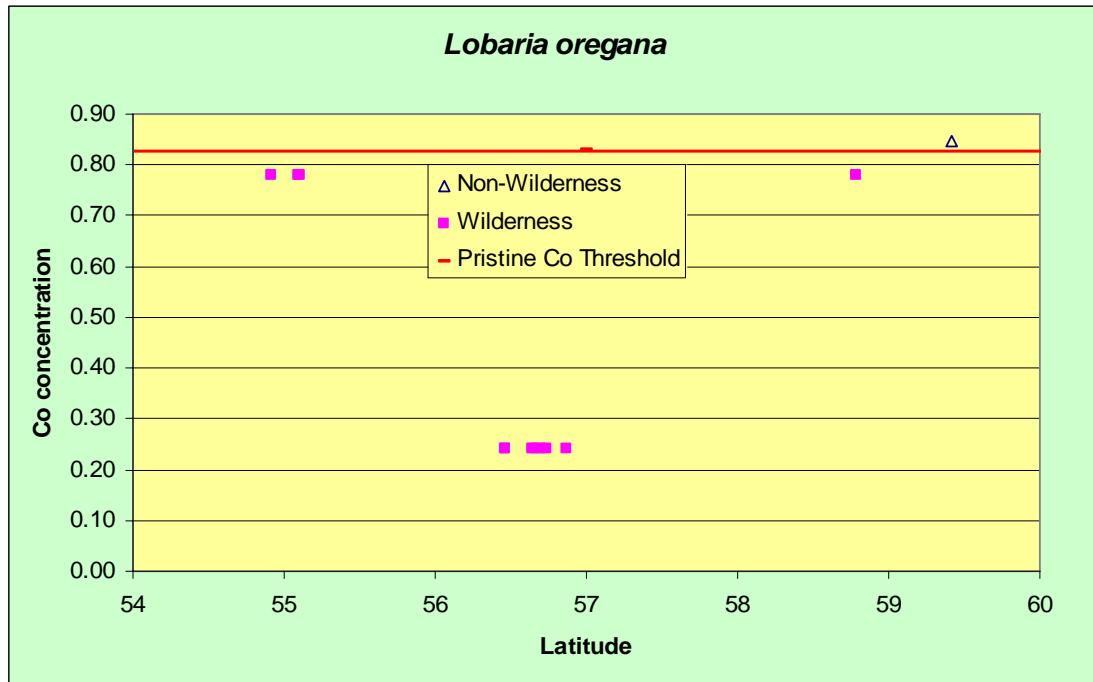


Figure XIII-17. Wilderness and Non-Wilderness plot means of Co ppm in *Lobaria oregana* vs. plot Latitude.

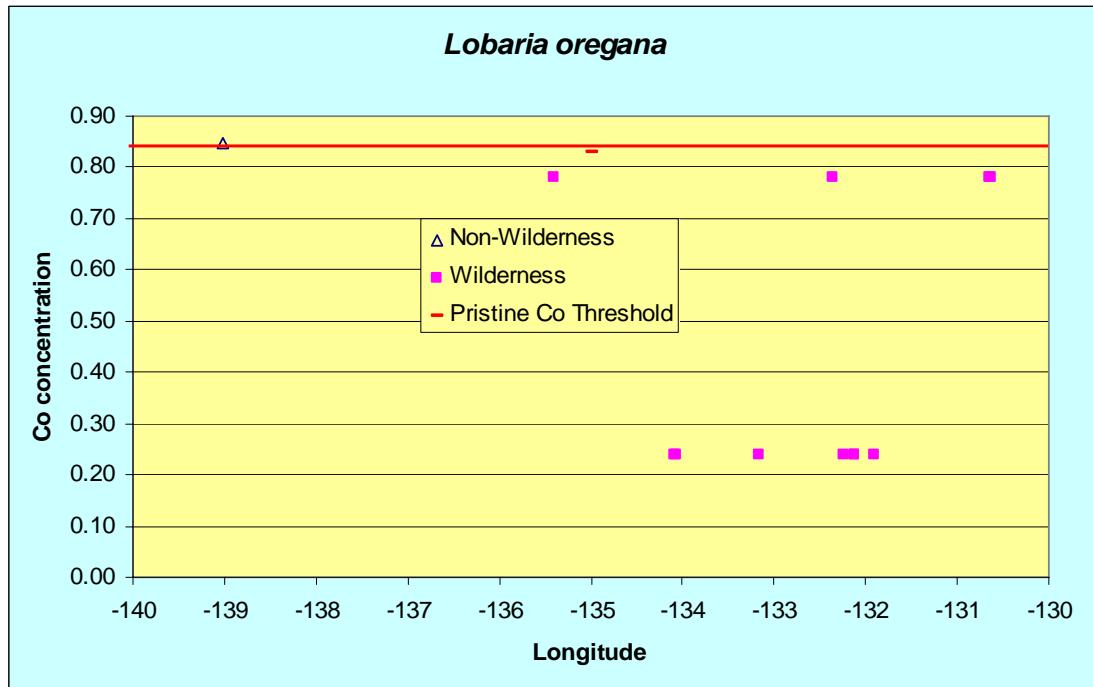


Figure XIII-18. Wilderness and Non-Wilderness plot means of Co ppm in *Lobaria oregana* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Co ppm

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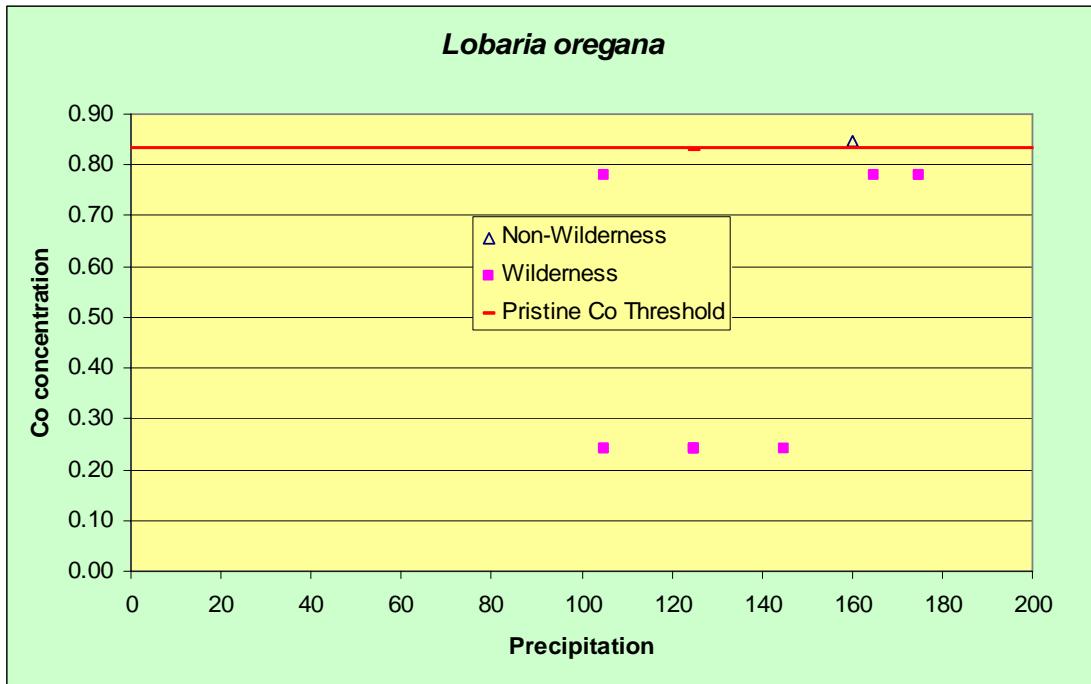


Figure XIII-19. Wilderness and Non-Wilderness plot means of Co ppm in *Lobaria oregana* vs. plot Precipitation.

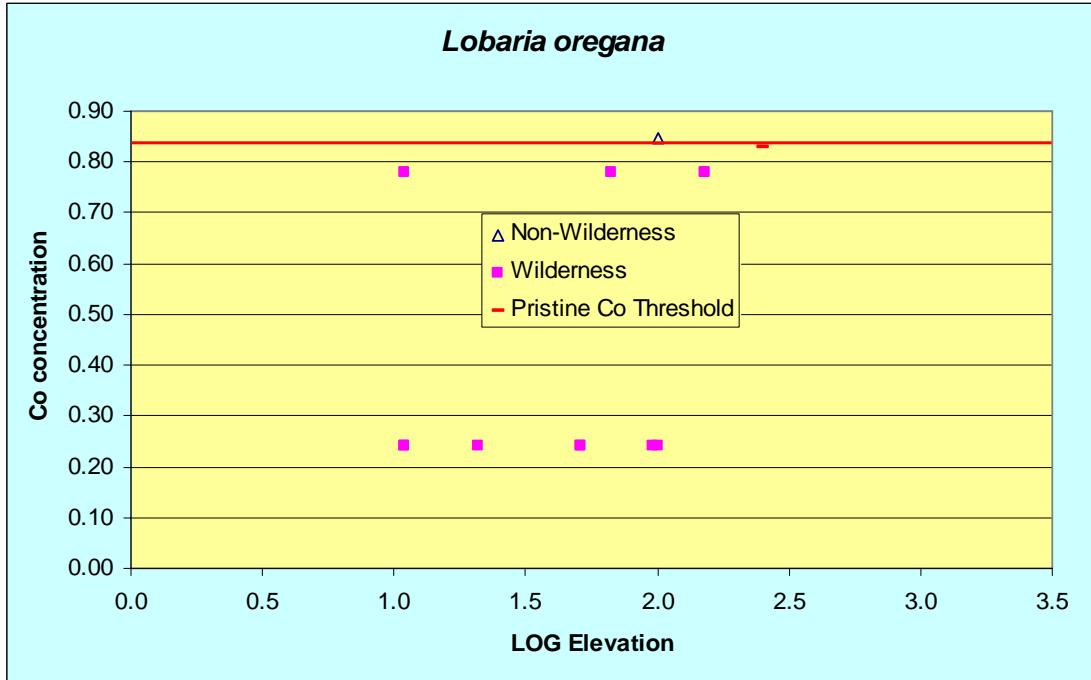


Figure XIII-20. Wilderness and Non-Wilderness plot means of Co ppm in *Lobaria oregana* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Co ppm

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Platismatia glauca

Table XIII-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Co ppm content of *Platismatia glauca* per year.

Co ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	0.24	0.0000	0.2400	0.2400
2005	Non-Wilderness	0.86	0.0611	0.7240	1.0006
2005	Wilderness	0.87	0.0592	0.7304	1.0101

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Co ppm

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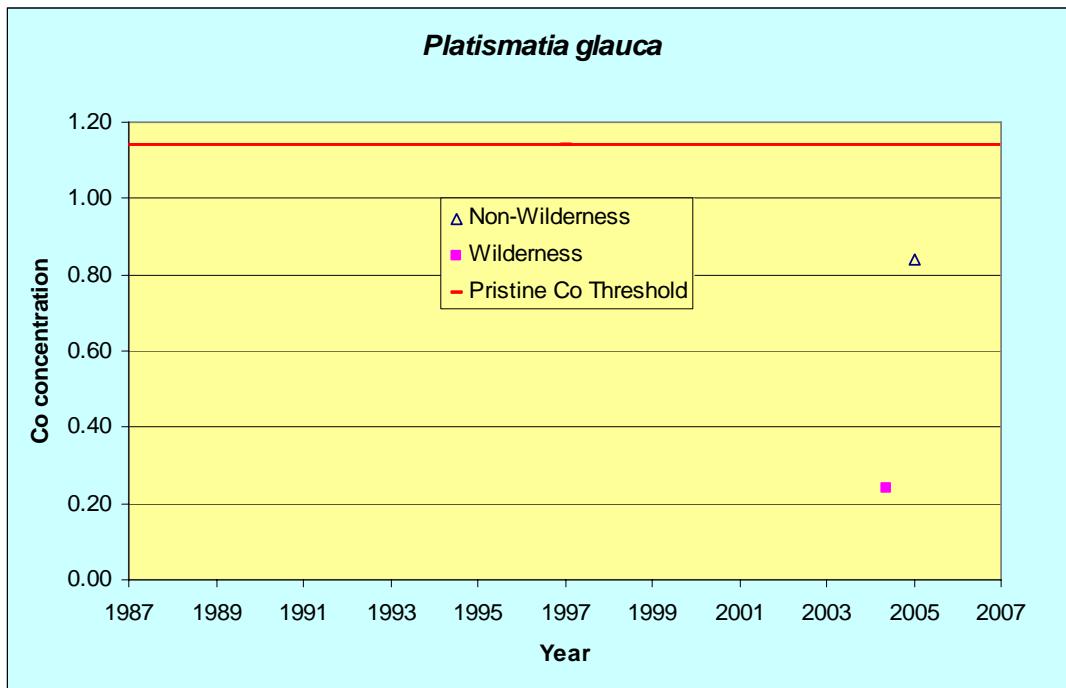


Figure XIII-21. Wilderness and Non-Wilderness yearly means of Co ppm in *Platismatia glauca* per year.

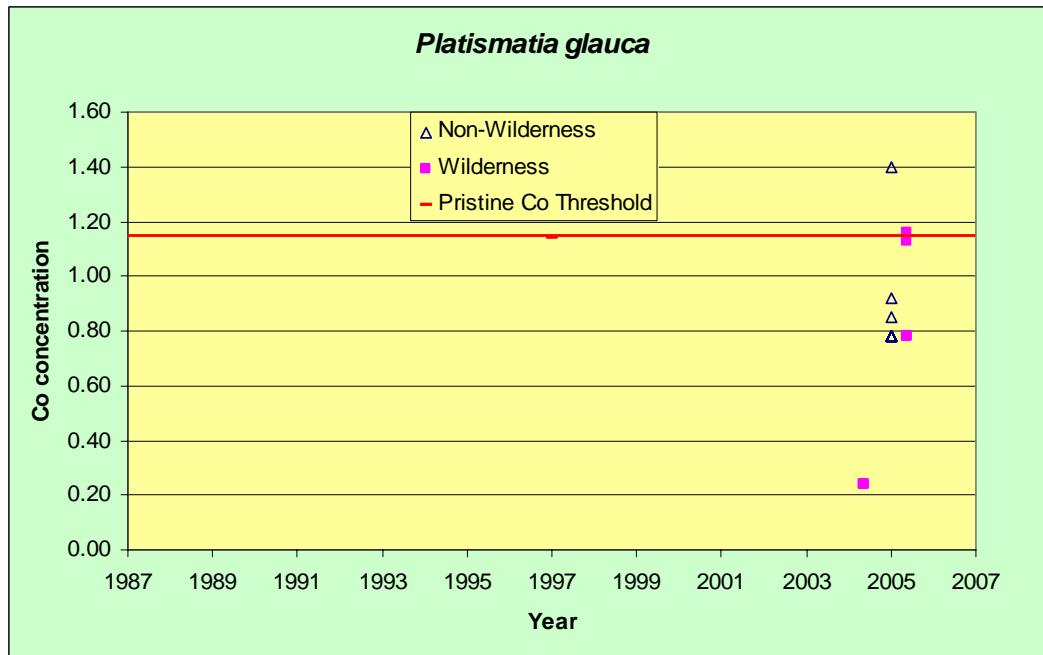


Figure XIII-22. Wilderness and Non-Wilderness plot means of Co ppm in *Platismatia glauca* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Co ppm

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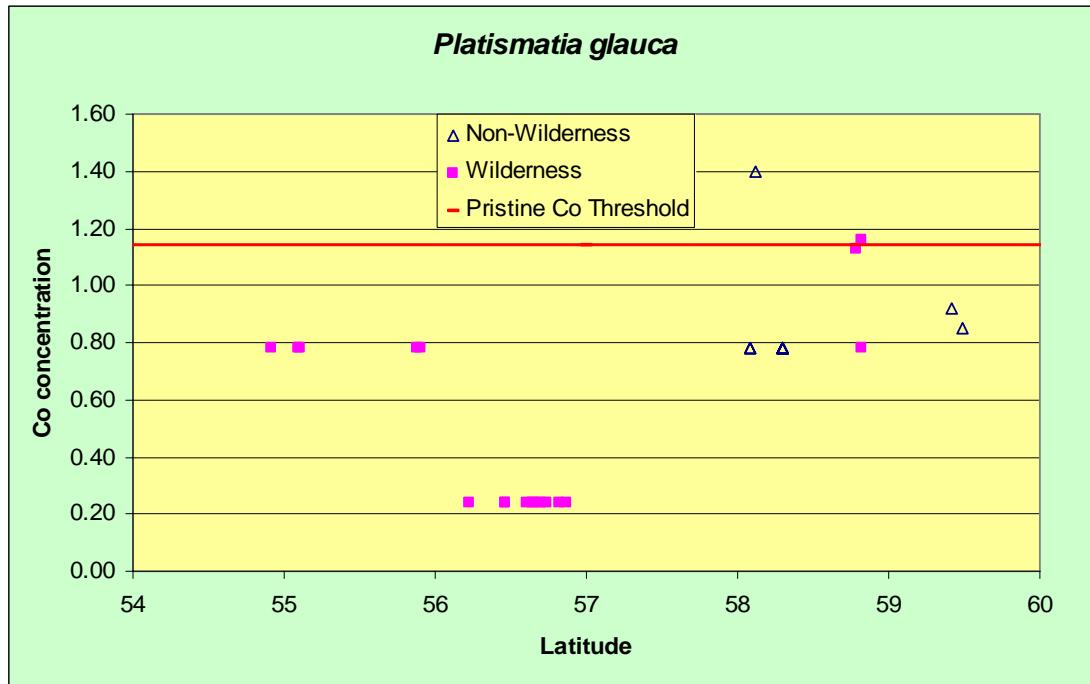


Figure XIII-23. Wilderness and Non-Wilderness plot means of Co ppm in *Platismatia glauca* vs. plot Latitude.

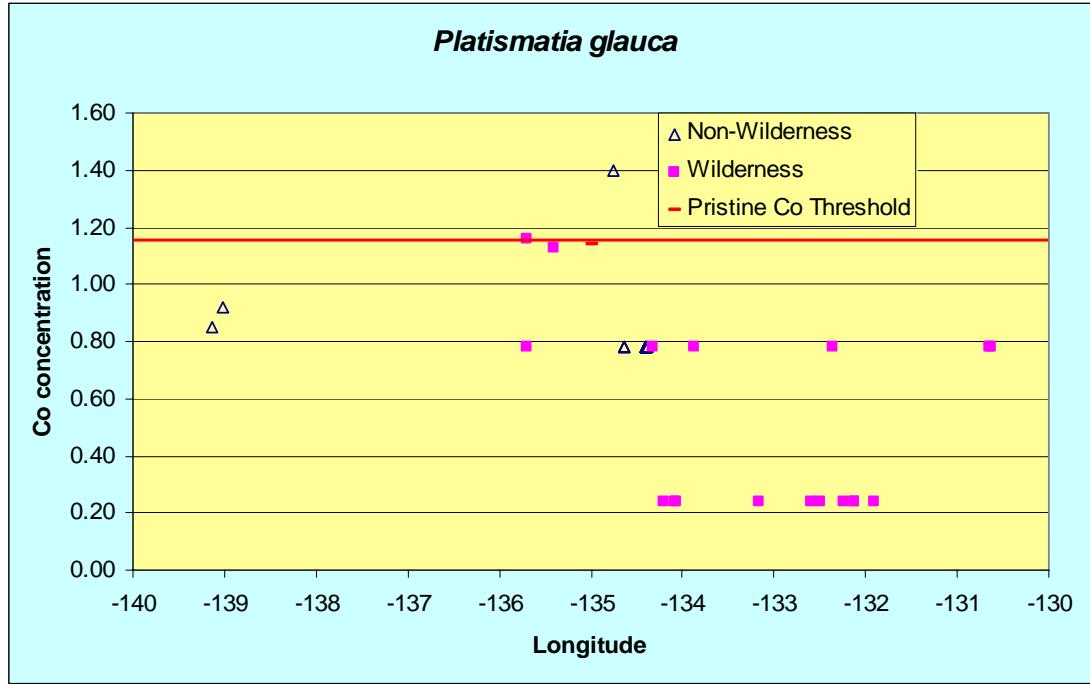


Figure XIII-24. Wilderness and Non-Wilderness plot means of Co ppm in *Platismatia glauca* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Co ppm

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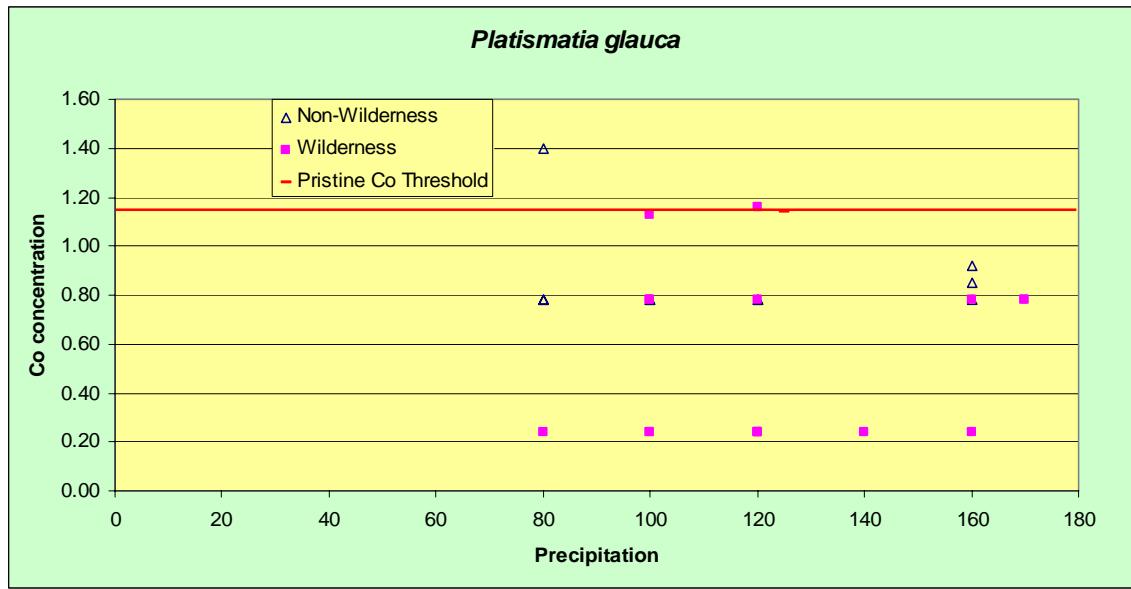


Figure XIII-25. Wilderness and Non-Wilderness plot means of Co ppm in *Platismatia glauca* vs. plot Precipitation.

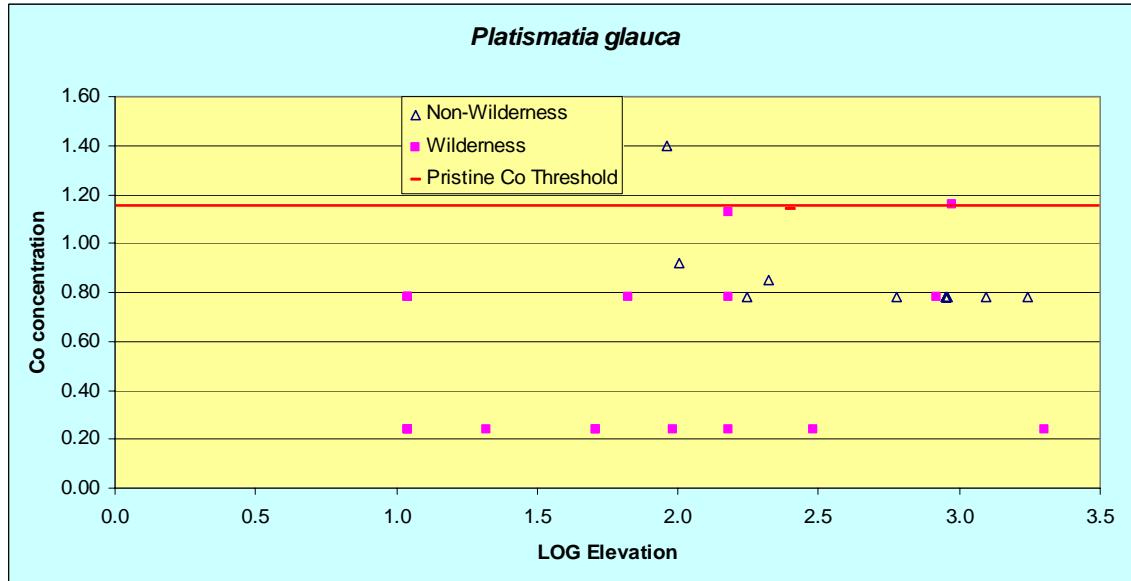


Figure XIII-26. Wilderness and Non-Wilderness plot means of Co ppm in *Platismatia glauca* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cr ppm

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XIV. SUMMARY OF Cr PPM DATA ANALYSIS

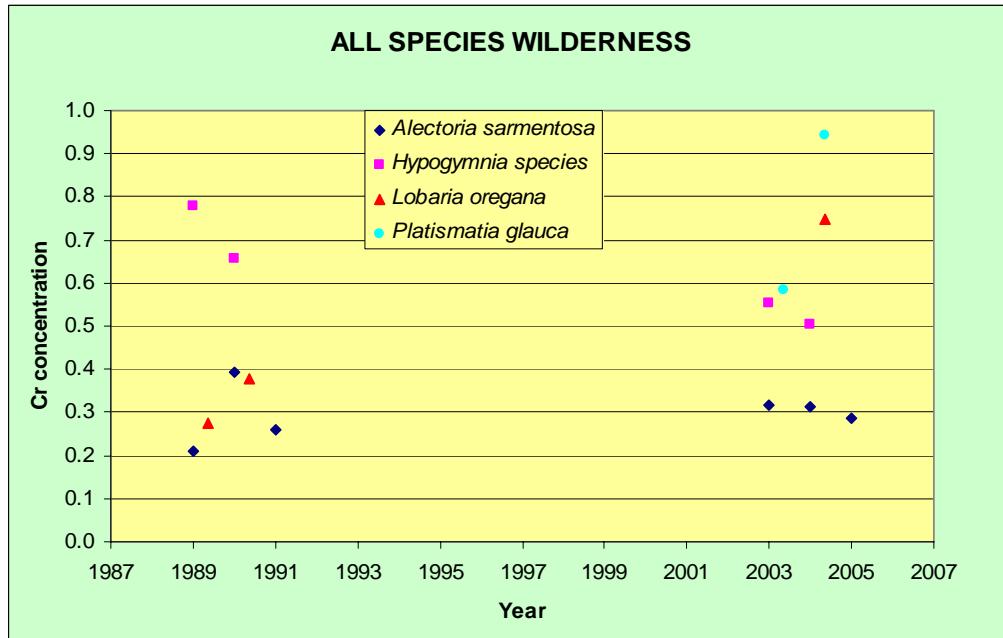


Figure XIV-27. Wilderness plot means of Cr ppm in *All Species* per year.

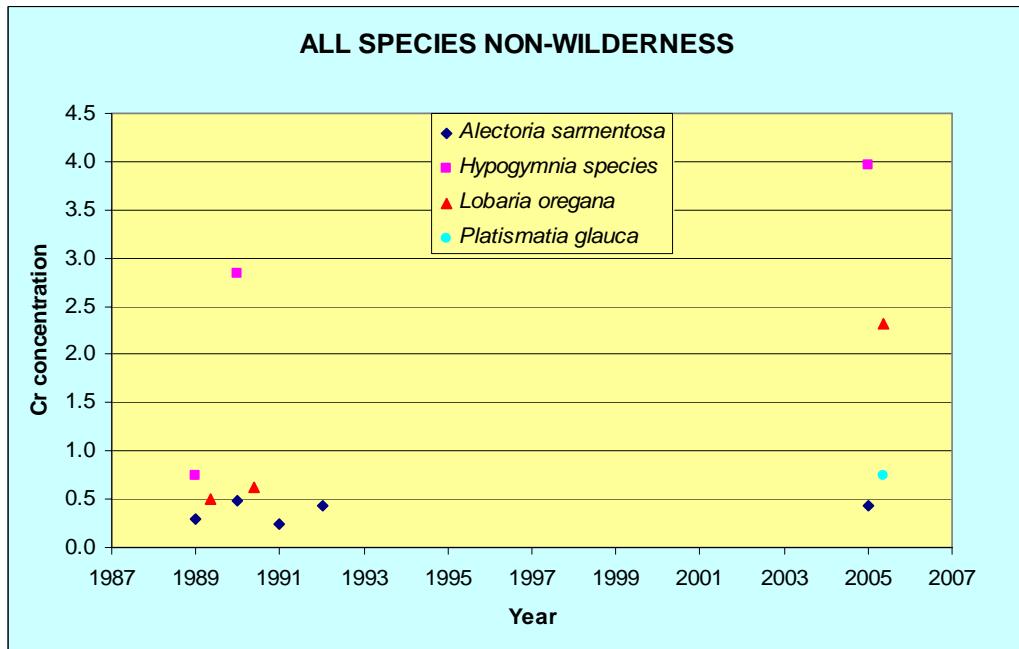


Figure XIV-28. Non-Wilderness plot means of Cr ppm in *All Species* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cr ppm

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Alectoria sarmentosa

Summary Statistics:

Table XIV-2. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Cr ppm content of *Alectoria sarmentosa* per year.

Cr ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	0.30	0.0422	0.1807	0.4153
1989	Wilderness	0.21	0.0712	0.0253	0.3914
1990	Non-Wilderness	0.49	0.0650	0.3587	0.6261
1990	Wilderness	0.39	0.0969	0.1573	0.6317
1991	Non-Wilderness	0.2420	0.0176	0.2050	0.2790
1991	Wilderness	0.26	0.0547	0.1063	0.4098
1992	Non-Wilderness	0.43	0.0633	0.2809	0.5801
2003	Wilderness	0.32	0.0148	0.1270	0.5040
2004	Wilderness	0.31	0.0214	0.2669	0.3556
2005	Non-Wilderness	0.44	0.0869	0.2152	0.6622
2005	Wilderness	0.29	0.0034	0.2783	0.2936

Summary of Statistical Tests:

$$t = -0.3201, df = 8, p\text{-value} = 0.7571$$

There is no evidence of a difference in Cr ppm content in *Alectoria sarmentosa* from pre-2000 and post 2000 samples (p-value = 0.7571).

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## ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cr ppm

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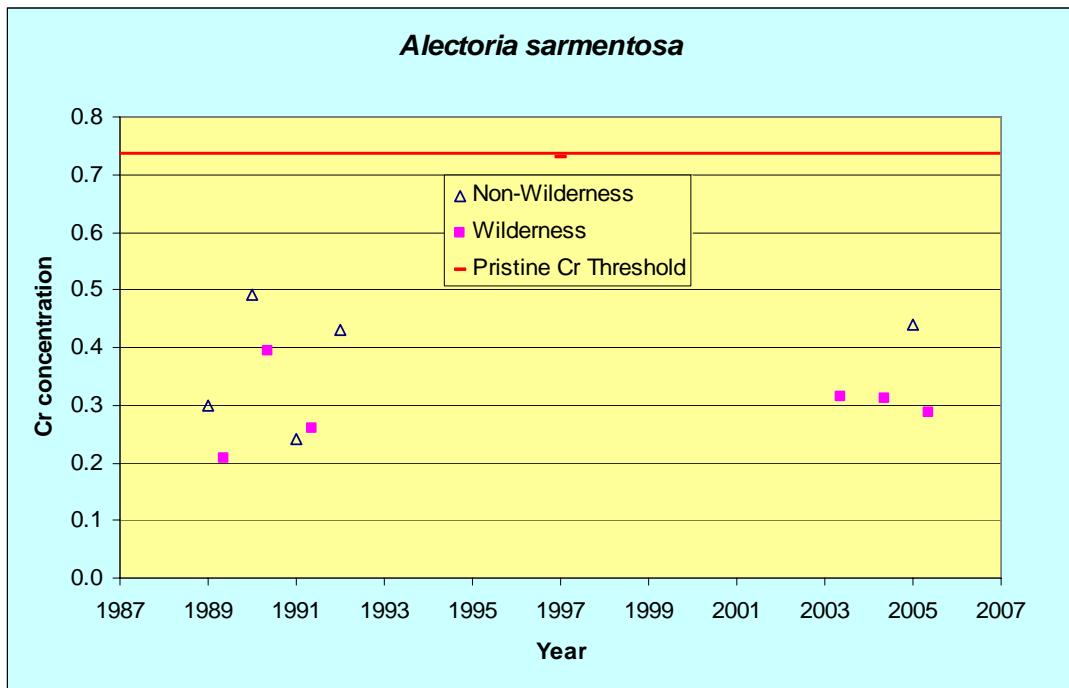


Figure XIV-3. Wilderness and Non-Wilderness yearly means of Cr ppm in *Alectoria sarmentosa* per year.

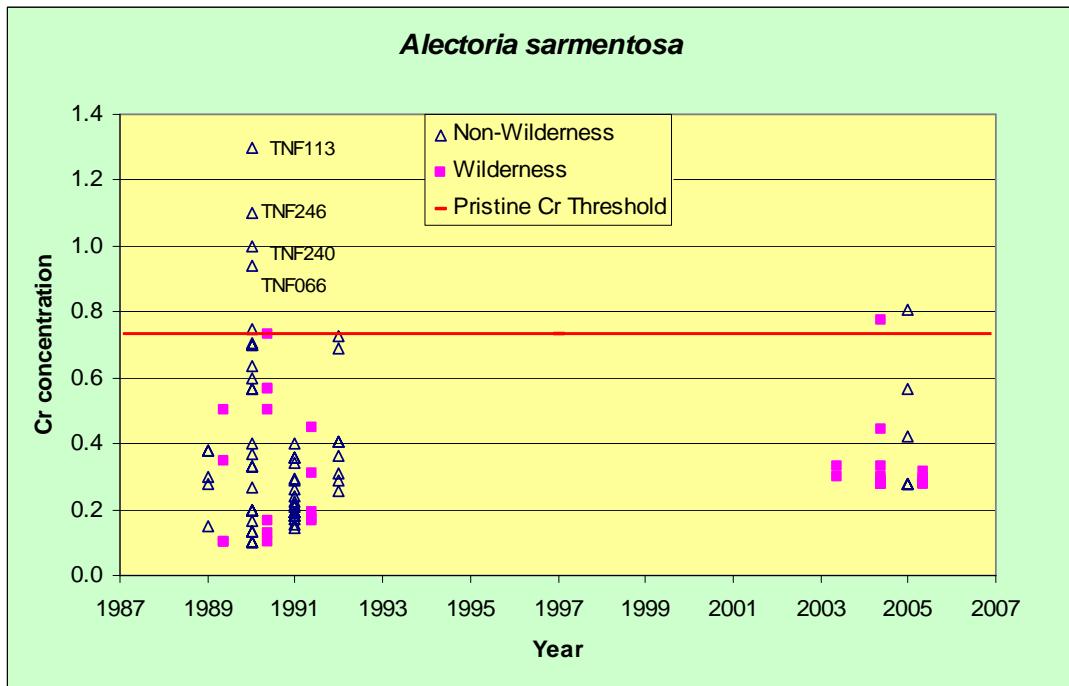


Figure XIV-4. Wilderness and Non-Wilderness plot means of Cr ppm in *Alectoria sarmentosa* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cr ppm

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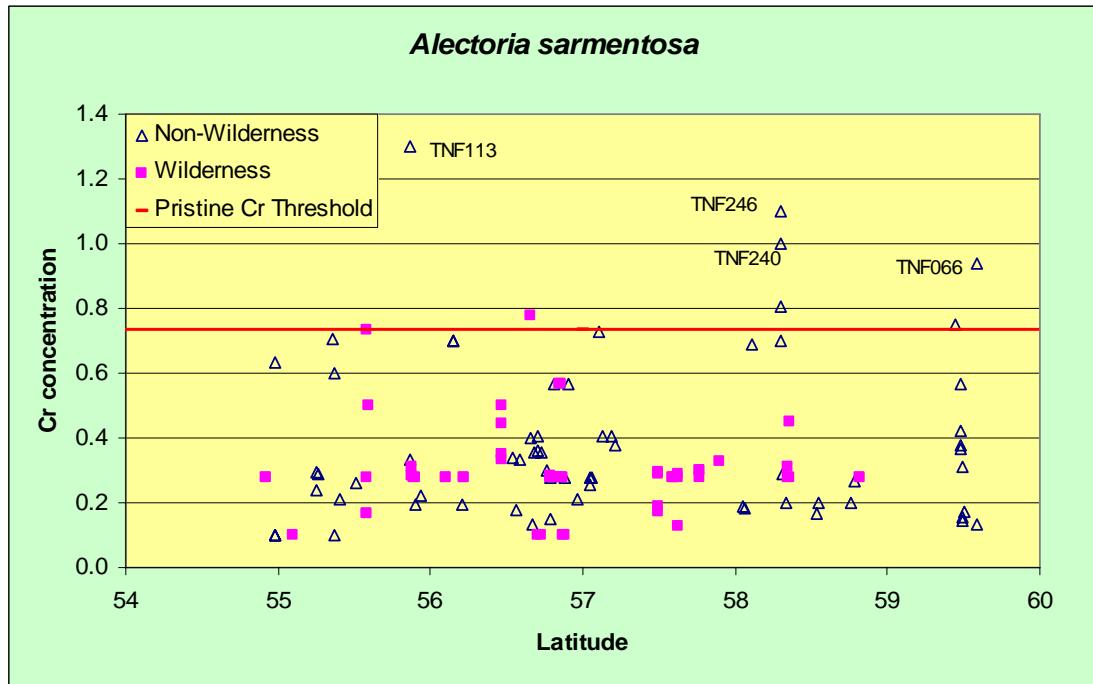


Figure XIV-5. Wilderness and Non-Wilderness plot means of Cr ppm in *Alectoria sarmentosa* vs. plot Latitude.

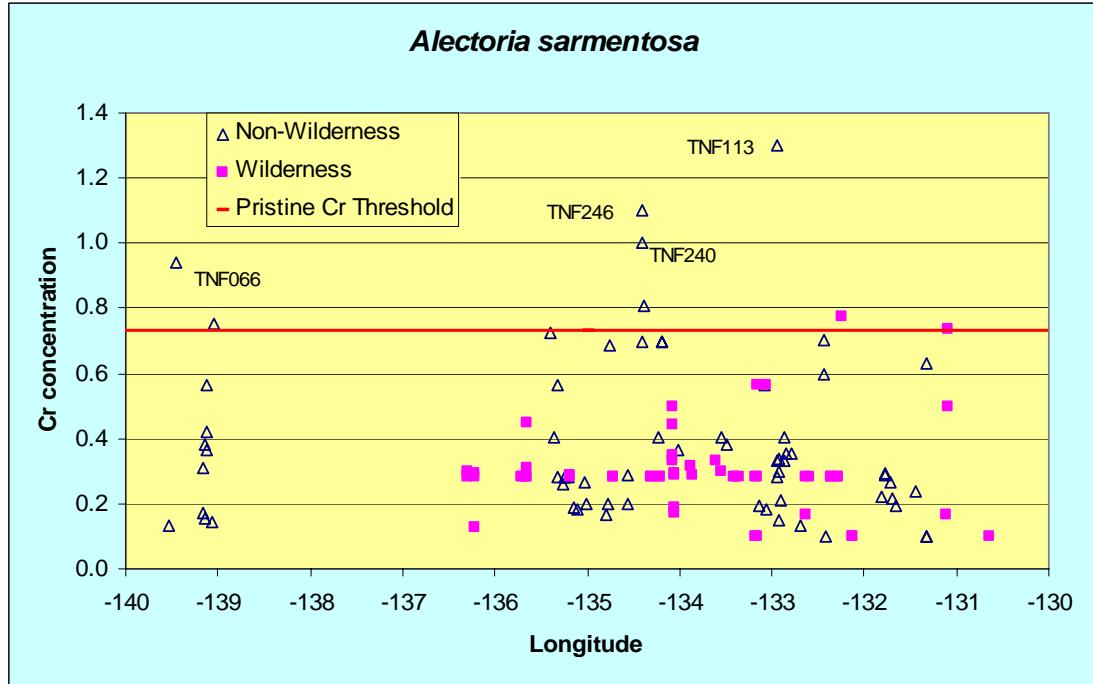


Figure XIV-6. Wilderness and Non-Wilderness plot means of Cr ppm in *Alectoria sarmentosa* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cr ppm

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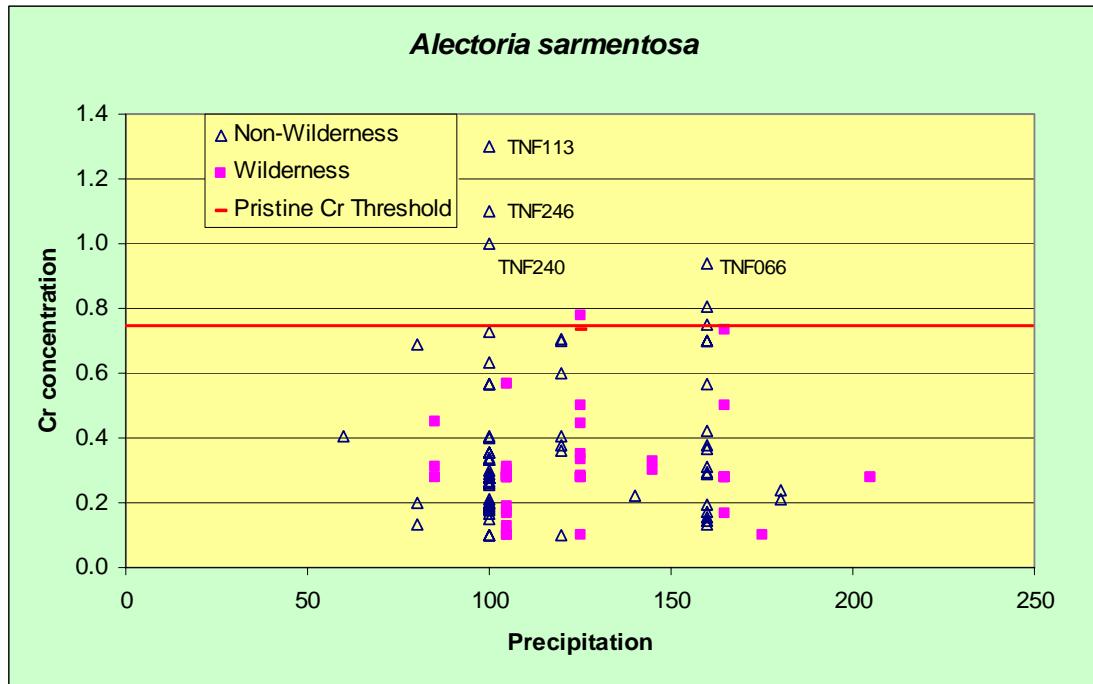


Figure XIV-7. Wilderness and Non-Wilderness plot means of Cr ppm in *Alectoria sarmentosa* vs. plot Precipitation.

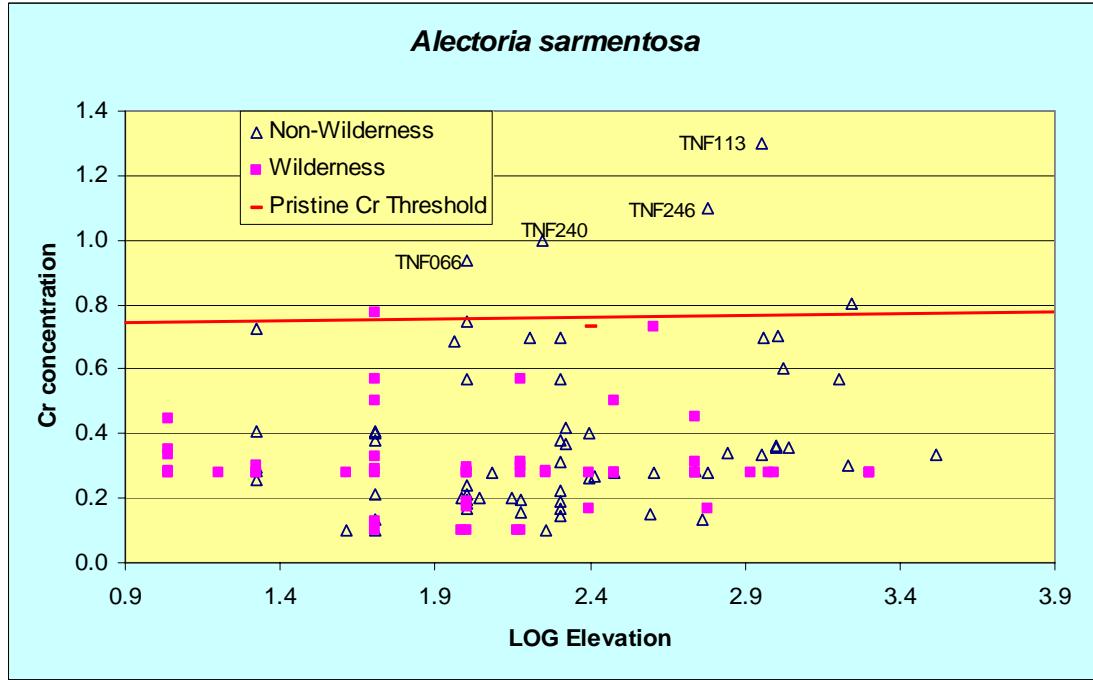


Figure XIV-8. Wilderness and Non-Wilderness plot means of Cr ppm in *Alectoria sarmentosa* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cr ppm

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Hypogymnia species

In this series, all of the *Hypogymnia* species were included as a group.

Table XIV-3. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Cr ppm content of *Hypogymnia species* per year.

Cr ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	0.75	0.4500	4.9678	6.4678
1989	Wilderness	0.78	0.2223	0.1629	1.3971
1990	Non-Wilderness	2.84	0.6270	1.5275	4.1620
1990	Wilderness	0.66	0.1472	0.2969	1.0174
2003	Wilderness	0.55	NA	NA	NA
2004	Wilderness	0.50	0.1066	0.2285	0.7766
2005	Non-Wilderness	3.97	1.1188	0.8457	8.7817
2005	Wilderness	0.90	0.2141	0.4055	1.3927

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cr ppm

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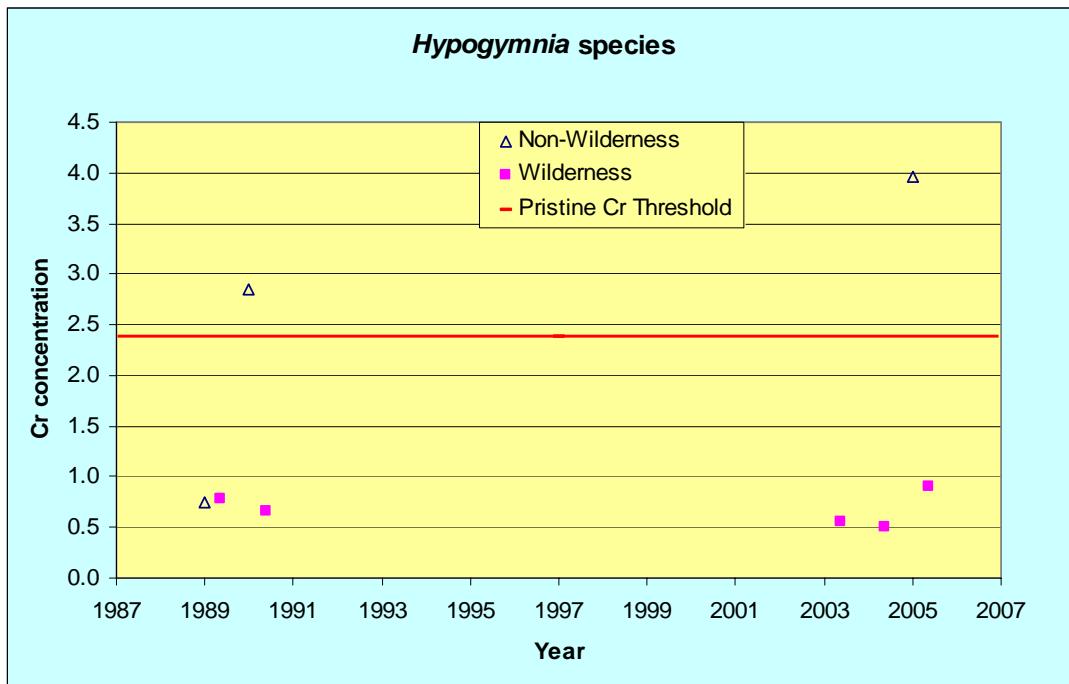


Figure XIV-9. Wilderness and Non-Wilderness yearly means of Cr ppm in *Hypogymnia* species per year.

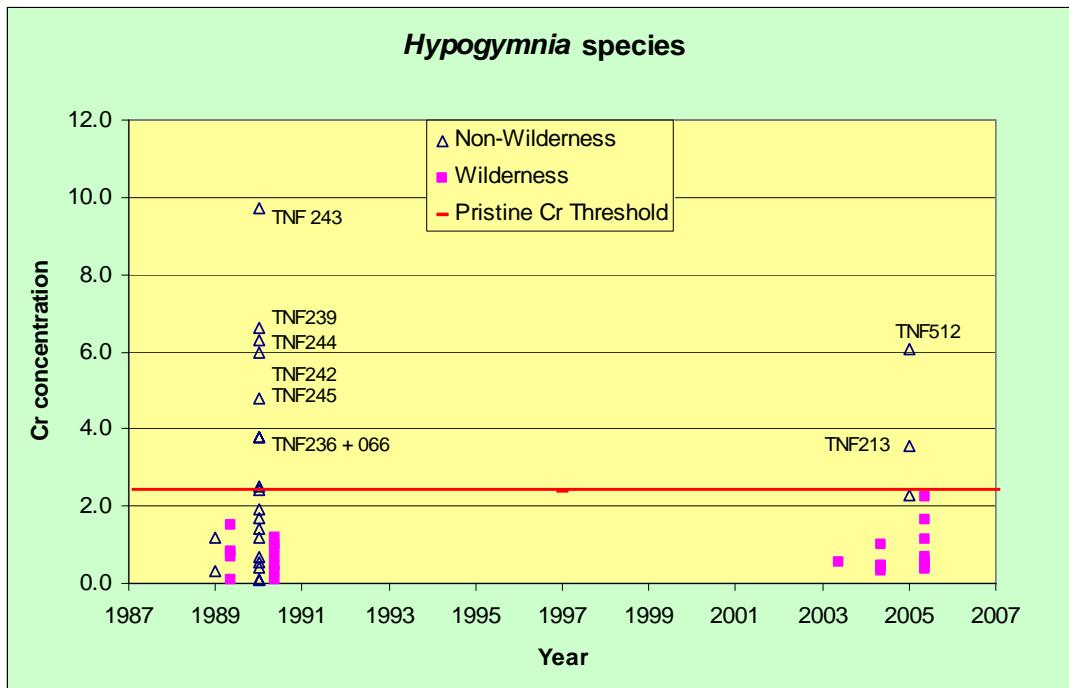


Figure XIV-10. Wilderness and Non-Wilderness plot means of Cr ppm in *Hypogymnia* species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cr ppm

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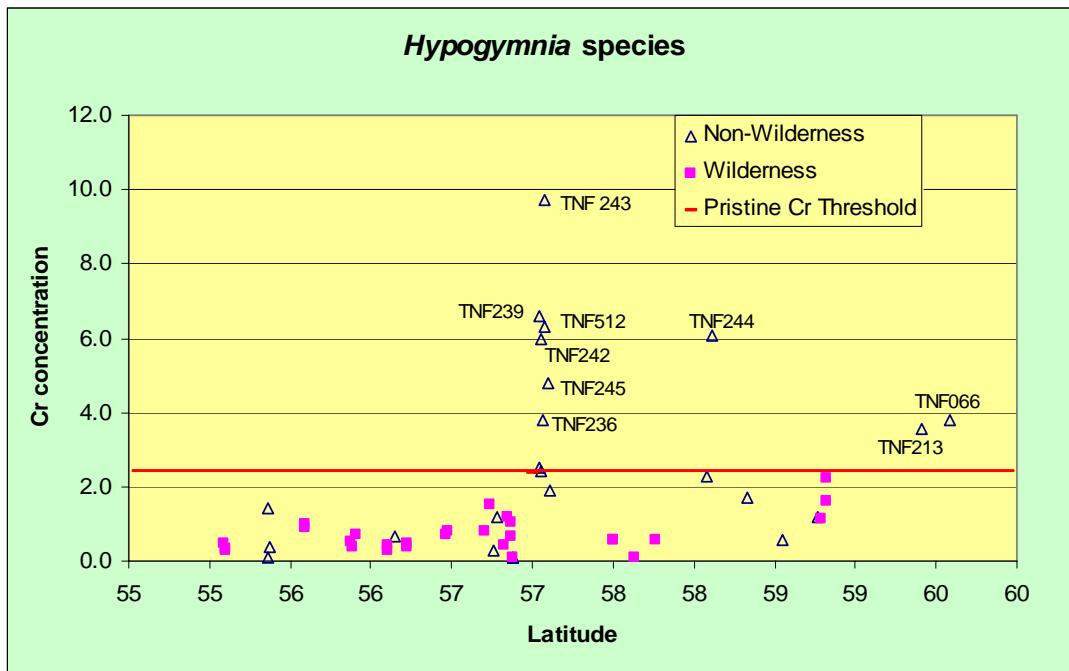


Figure XIV-11. Wilderness and Non-Wilderness plot means of Cr ppm in *Hypogymnia species* vs. plot Latitude.

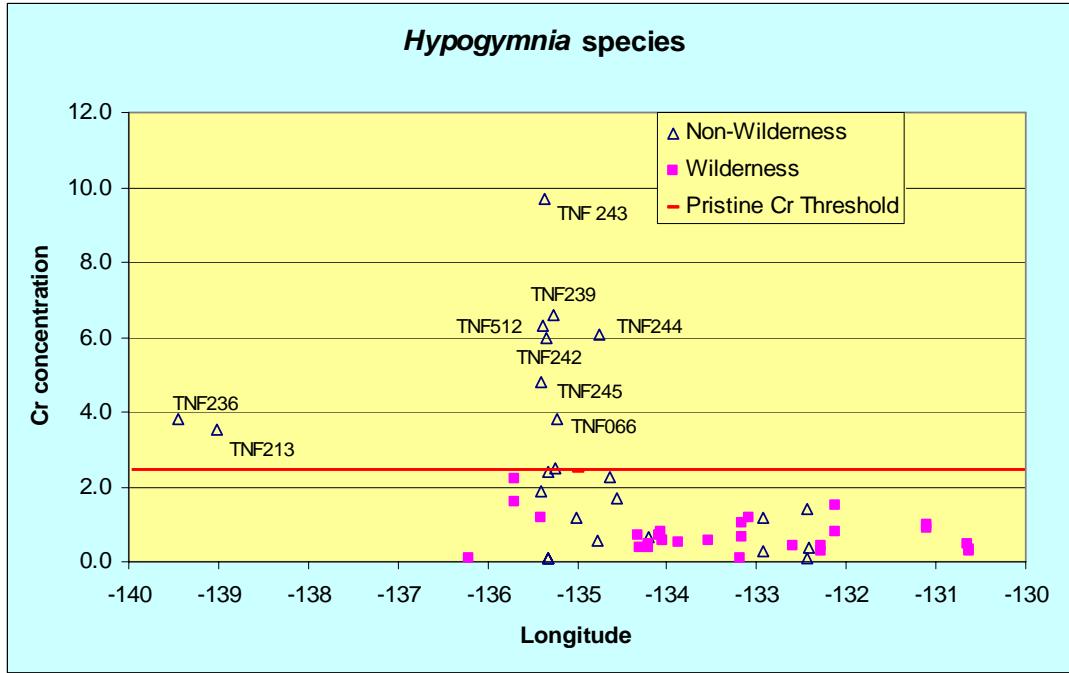


Figure XIV-12. Wilderness and Non-Wilderness plot means of Cr ppm in *Hypogymnia species* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cr ppm

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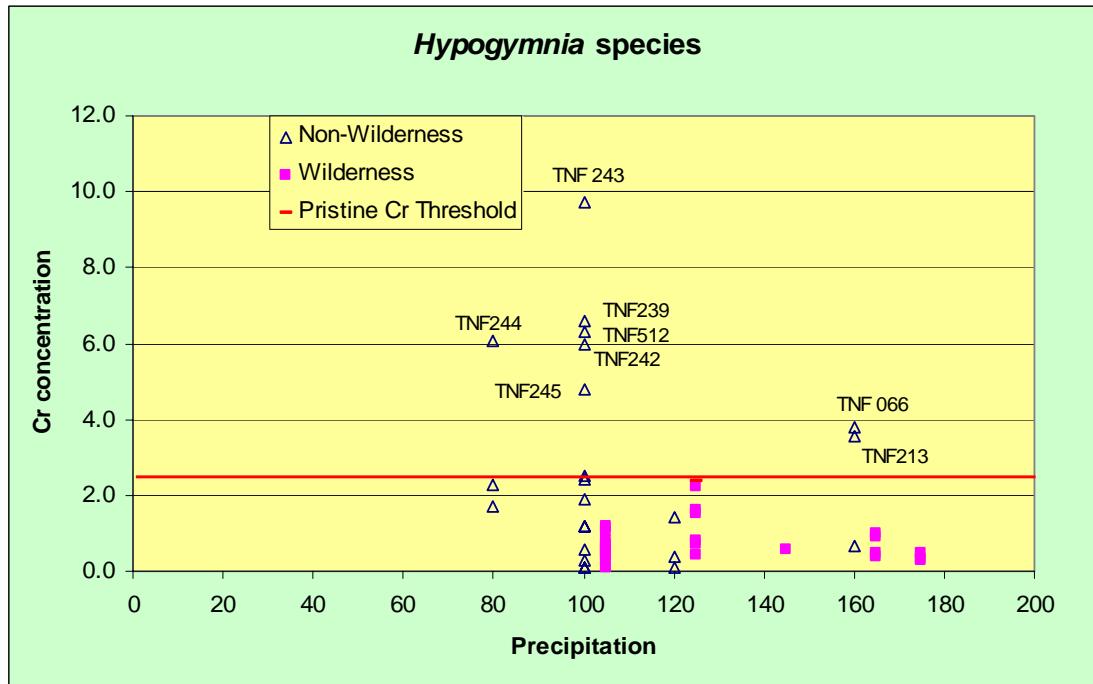


Figure XIV-13. Wilderness and Non-Wilderness plot means of Cr ppm in *Hypogymnia* species vs. plot Precipitation.

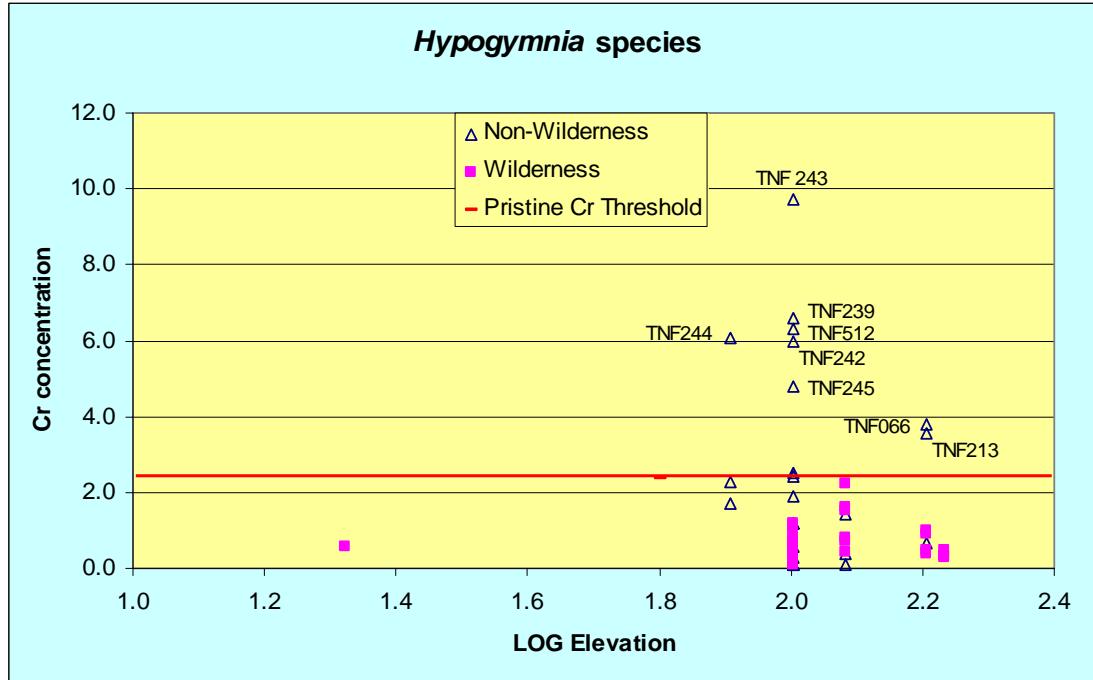


Figure XIV-14. Wilderness and Non-Wilderness plot means of Cr ppm in *Hypogymnia* species vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cr ppm

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Lobaria oregana

Table XIV-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Cr ppm content of *Lobaria oregana* per year.

Cr ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	0.51	0.0344	0.3990	0.6177
1989	Wilderness	0.28	0.1005	-0.0038	0.5545
1990	Non-Wilderness	0.62	0.1445	0.3005	0.9302
1990	Wilderness	0.38	0.1932	-0.1181	0.8753
2004	Wilderness	0.75	0.1450	0.3920	1.1017
2005	Non-Wilderness	2.32	NA	NA	NA
2005	Wilderness	0.41	0.0994	0.0943	0.7272

Summary of Statistical Tests:

$$t = -1.19, df = 4, p\text{-value} = 0.2999$$

There is no evidence of a difference in Cr ppm content in *Lobaria oregana* from pre-2000 and post 2000 samples (p-value = 0.2999).

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cr ppm

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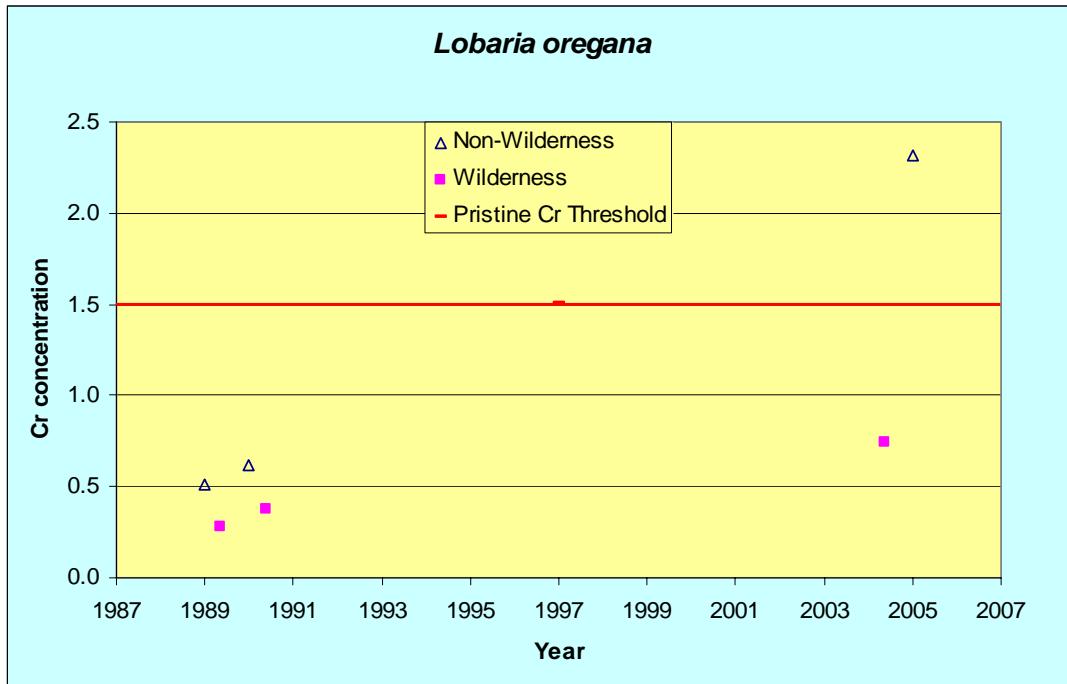


Figure XIV-15. Wilderness and Non-Wilderness yearly means of Cr ppm in *Lobaria oregana* per year.

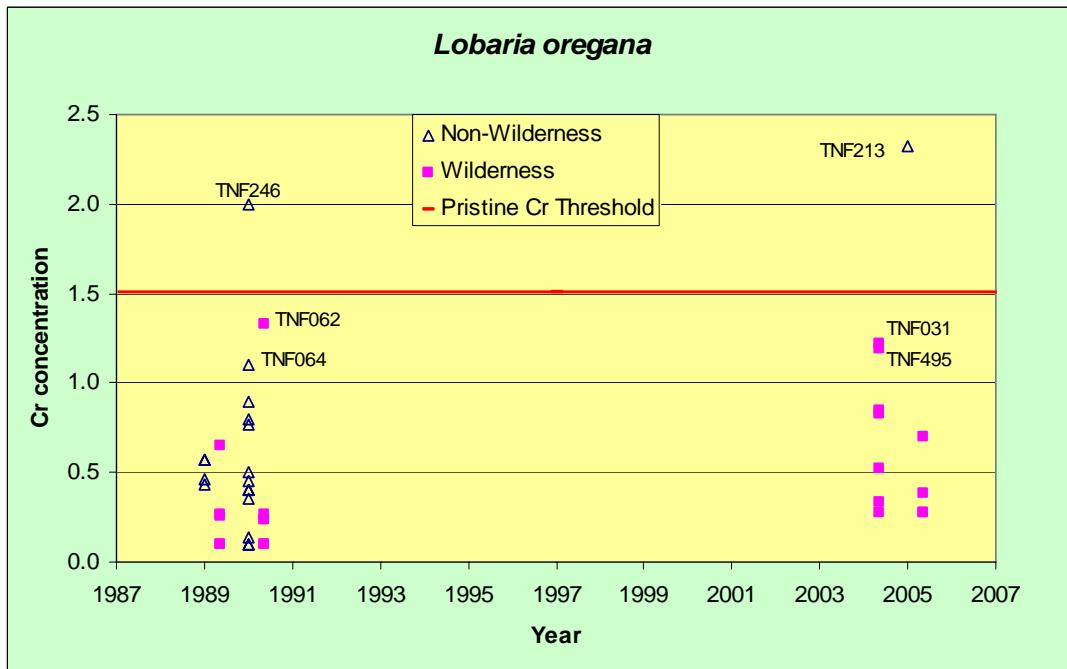


Figure XIV-16. Wilderness and Non-Wilderness plot means of Cr ppm in *Lobaria oregana* per year.

ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cr ppm

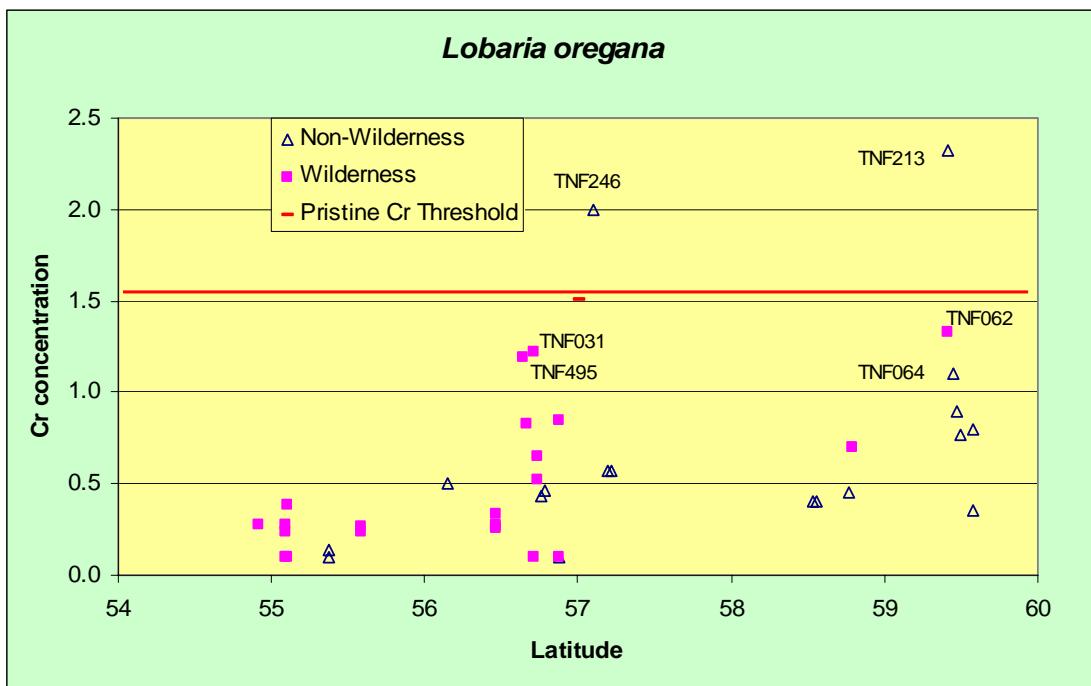


Figure XIV-17. Wilderness and Non-Wilderness plot means of Cr ppm in *Lobaria oregana* vs. plot Latitude.

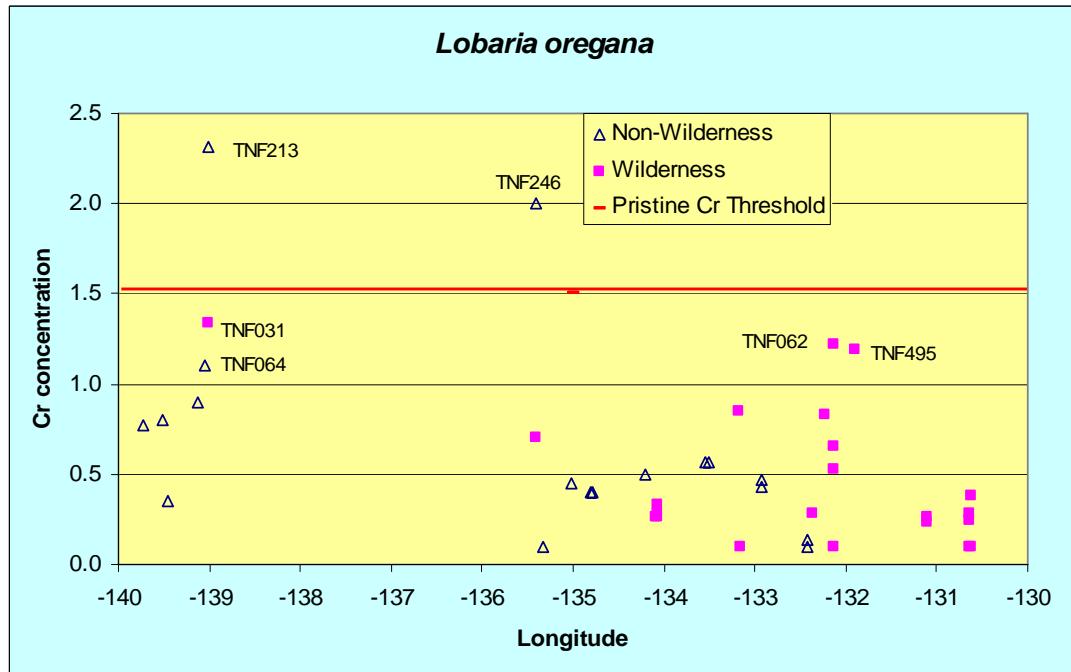


Figure XIV-18. Wilderness and Non-Wilderness plot means of Cr ppm in *Lobaria oregana* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cr ppm

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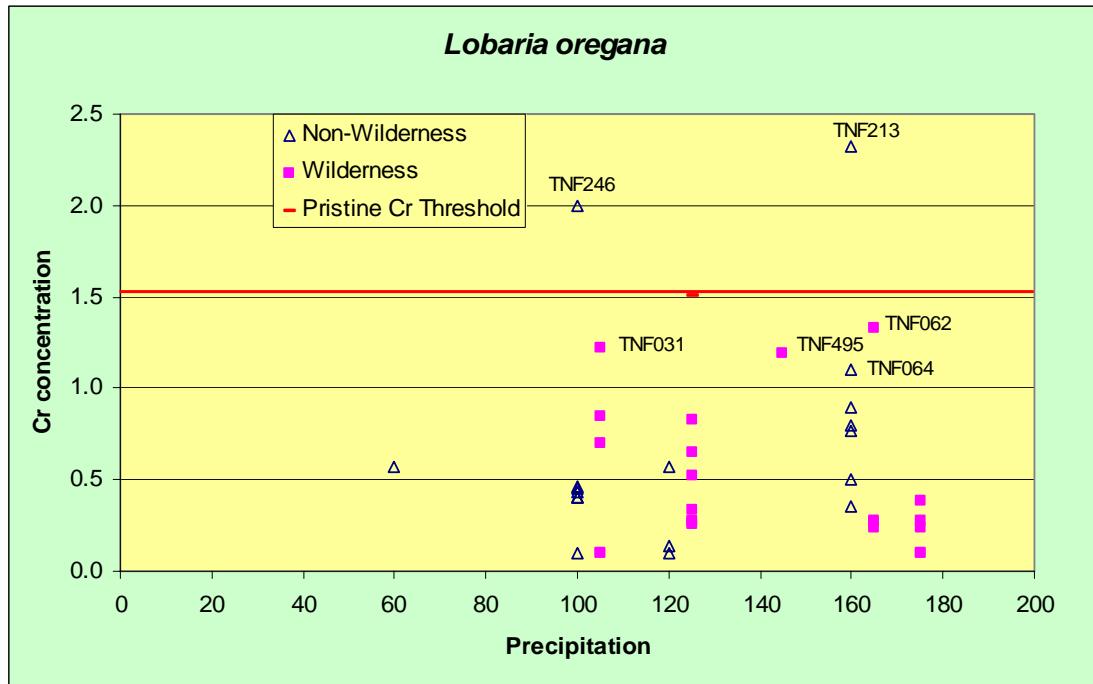


Figure XIV-19. Wilderness and Non-Wilderness plot means of Cr ppm in *Lobaria oregana* vs. plot Precipitation.

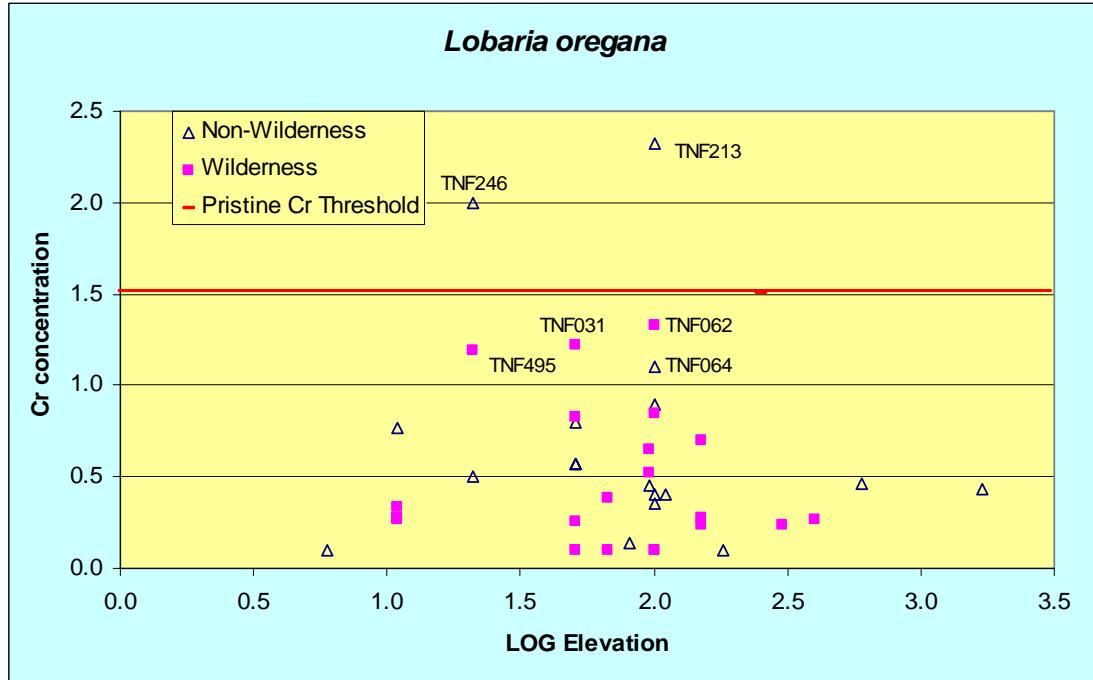


Figure XIV-20. Wilderness and Non-Wilderness plot means of Cr ppm in *Lobaria oregana* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cr ppm

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Platismatia glauca

Table XIV-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Cr ppm content of *Platismatia glauca* per year.

Cr ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2003	Wilderness	0.58	NA	NA	NA
2004	Wilderness	0.94	0.1798	0.5371	1.3504
2005	Non-Wilderness	3.02	0.5248	1.8331	4.2077
2005	Wilderness	1.17	0.3019	0.4538	1.8817

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cr ppm

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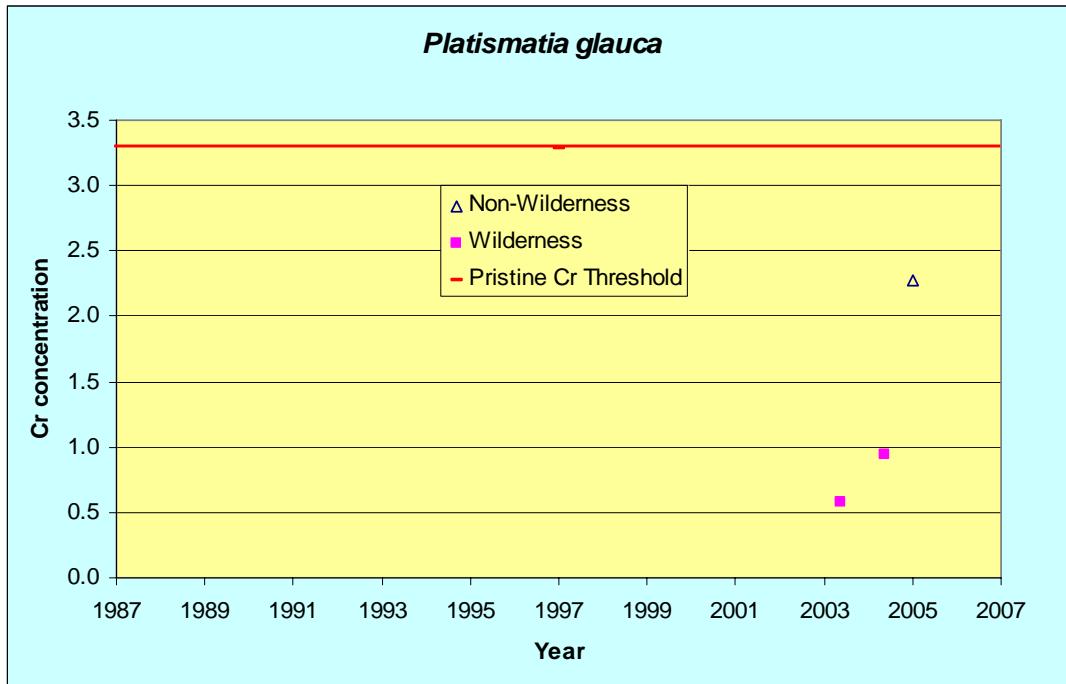


Figure XIV-21. Wilderness and Non-Wilderness yearly means of Cr ppm in *Platismatia glauca* per year.

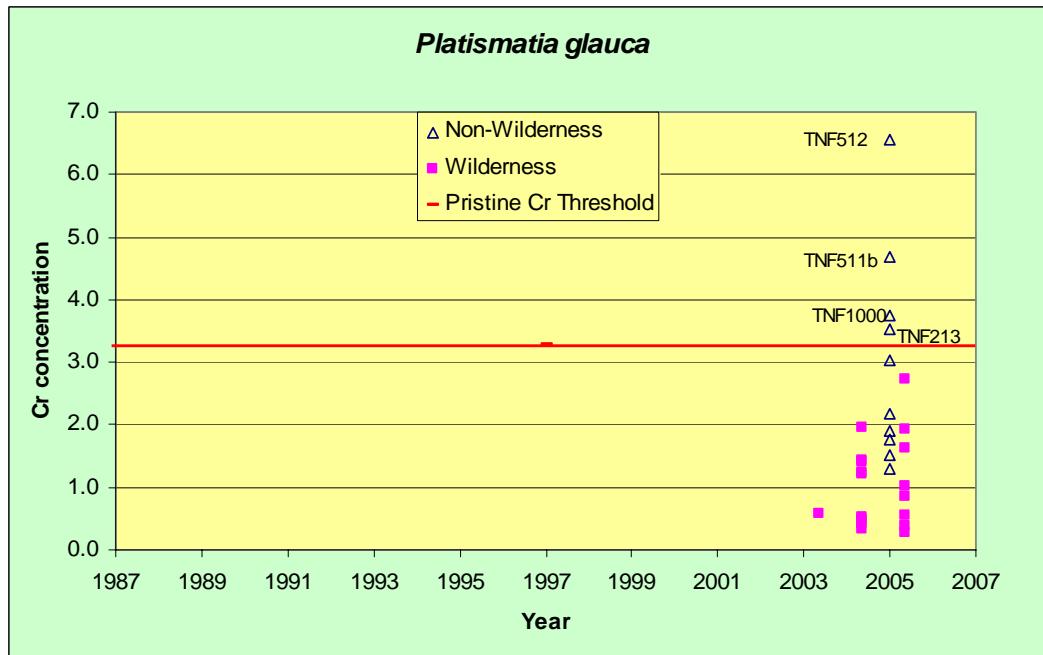


Figure XIV-22. Wilderness and Non-Wilderness plot means of Cr ppm in *Platismatia glauca* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cr ppm

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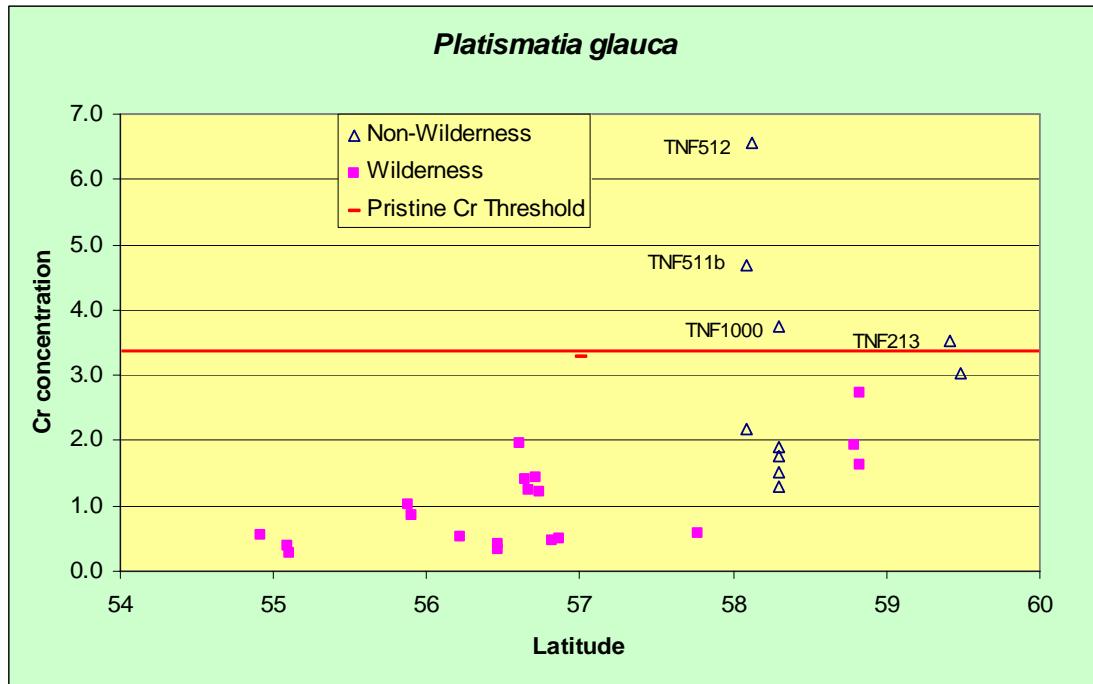


Figure XIV-23. Wilderness and Non-Wilderness plot means of Cr ppm in *Platismatia glauca* vs. plot Latitude.

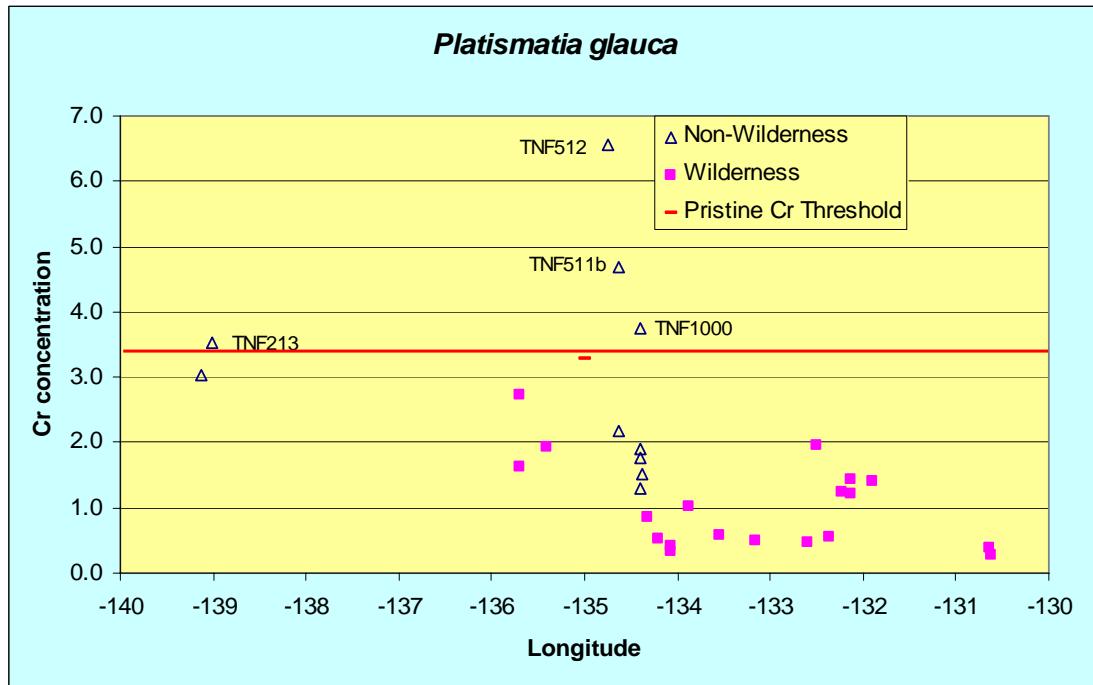


Figure XIV-24. Wilderness and Non-Wilderness plot means of Cr ppm in *Platismatia glauca* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cr ppm

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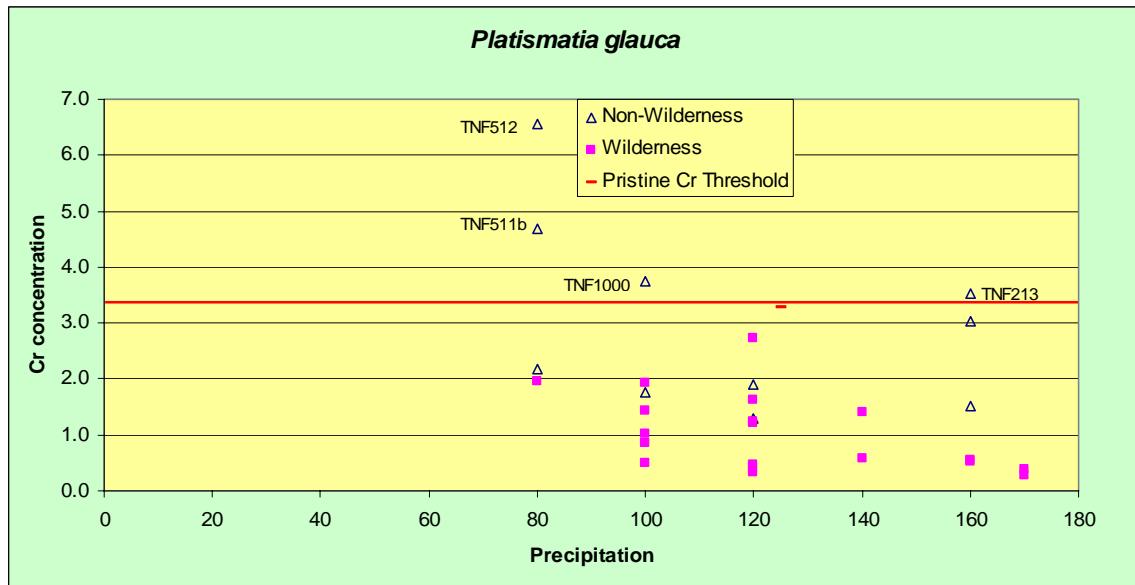


Figure XIV-25. Wilderness and Non-Wilderness plot means of Cr ppm in *Platismatia glauca* vs. plot Precipitation.

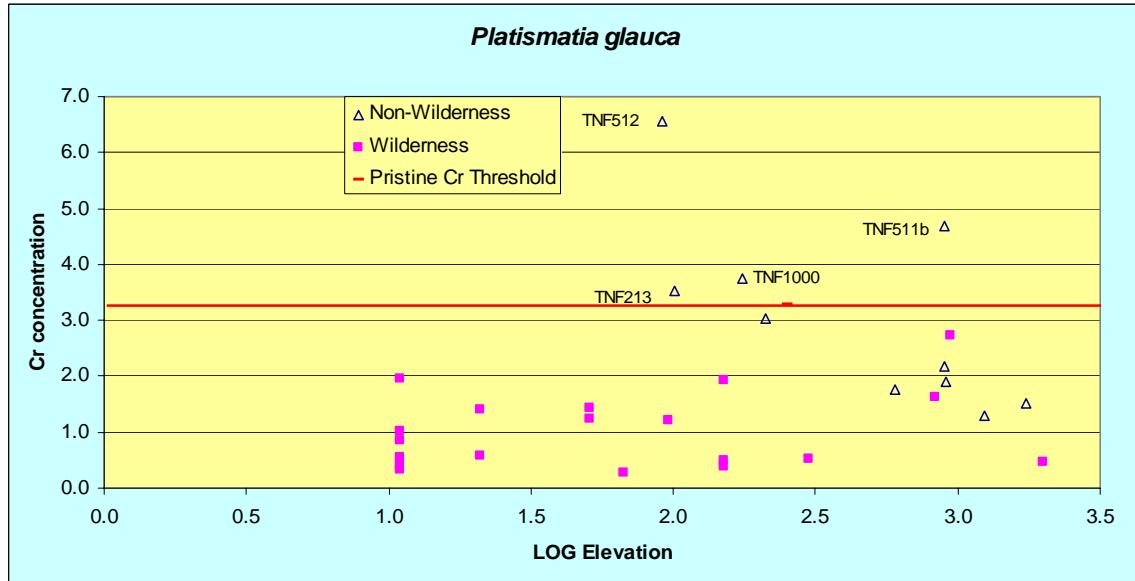


Figure XIV-26. Wilderness and Non-Wilderness plot means of Cr ppm in *Platismatia glauca* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cu ppm

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XV. SUMMARY OF Cu PPM DATA ANALYSIS

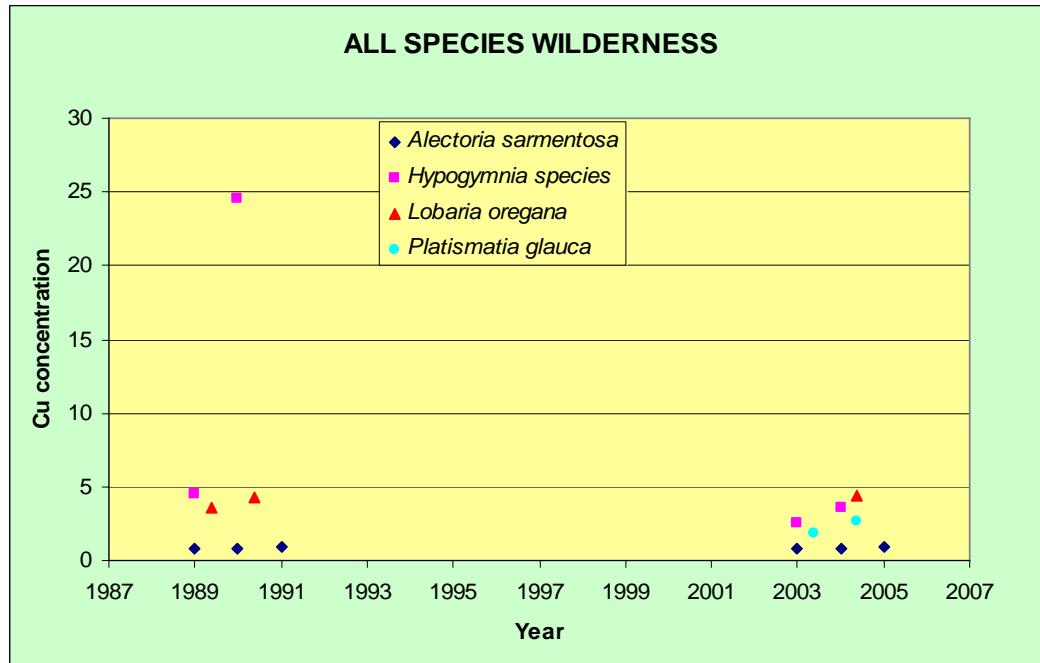


Figure XV-27. Wilderness plot means of Cu ppm in All Species per year.

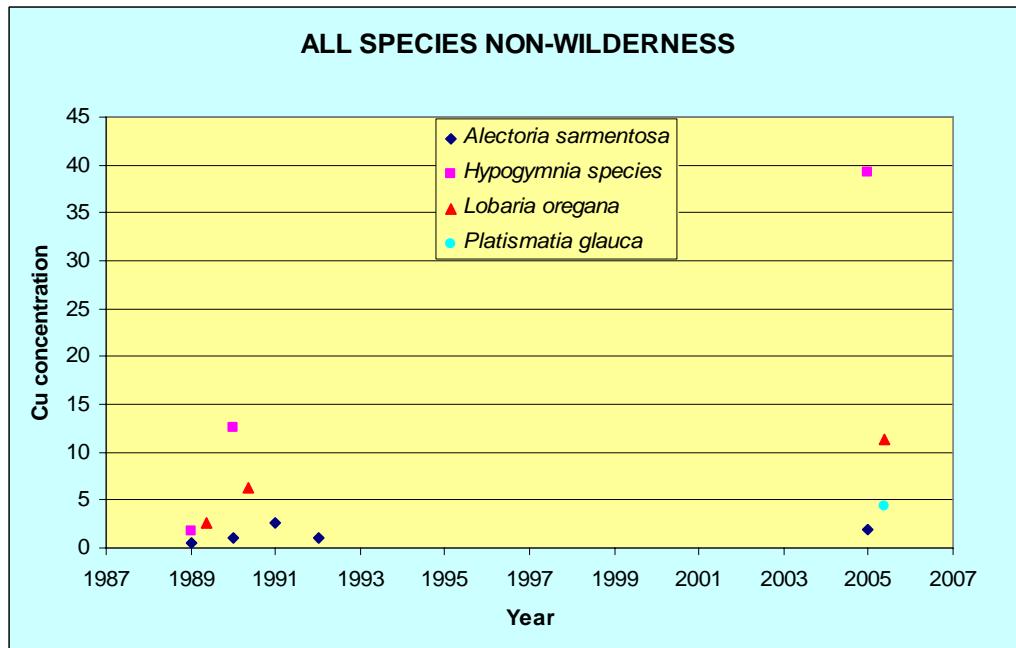


Figure XV-28. Non-Wilderness plot means of Cu ppm in All Species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cu ppm

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Alectoria sarmentosa

Summary Statistics:

Table XV-2. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Cu ppm content of *Alectoria sarmentosa* per year.

Cu ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	0.57	0.0882	0.3278	0.8178
1989	Wilderness	0.82	0.1500	0.4340	1.2053
1990	Non-Wilderness	1.13	0.1382	0.8430	1.4111
1990	Wilderness	0.81	0.1116	0.5357	1.0819
1991	Non-Wilderness	2.6288	1.6673	0.8741	6.1316
1991	Wilderness	0.98	0.0606	0.8124	1.1487
1992	Non-Wilderness	1.09	0.0759	0.9061	1.2649
2003	Wilderness	0.80	0.2785	2.7402	4.3372
2004	Wilderness	0.86	0.0944	0.6616	1.0522
2005	Non-Wilderness	1.88	0.4529	0.7204	3.0487
2005	Wilderness	0.96	0.1280	0.6719	1.2511

Summary of Statistical Tests:

$$t = -0.4902, df = 8, p\text{-value} = 0.6371$$

There is no evidence of a difference in Cu ppm content in *Alectoria sarmentosa* from pre-2000 and post 2000 samples (p-value = 0.6371).

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cu ppm

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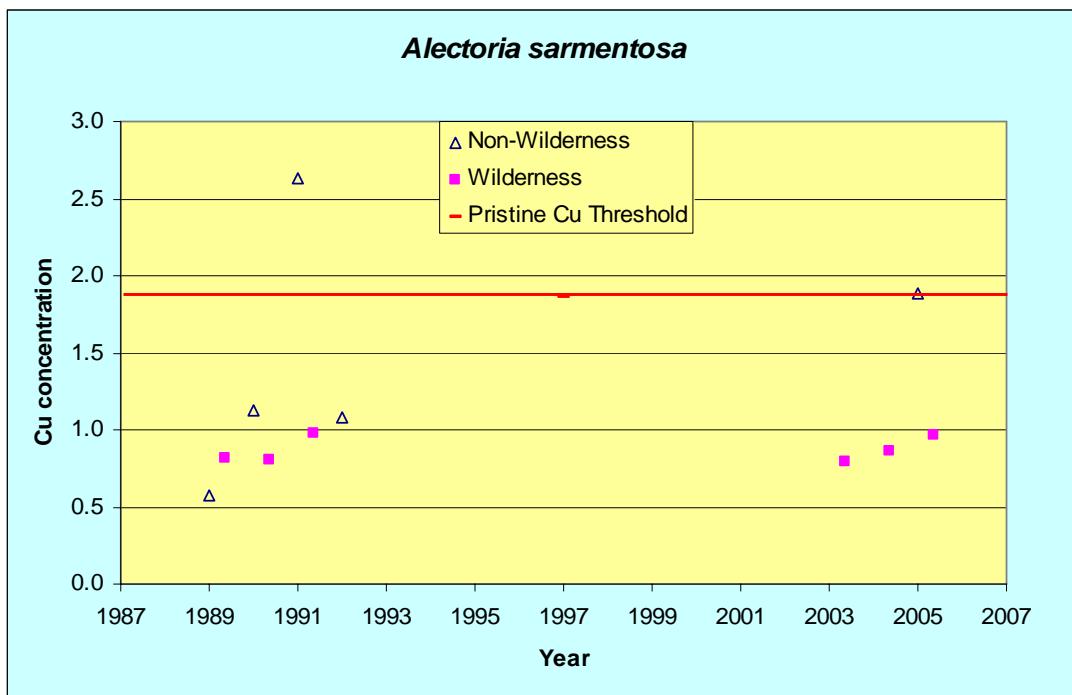


Figure XV-3. Wilderness and Non-Wilderness yearly means of Cu ppm in *Alectoria sarmentosa* per year.

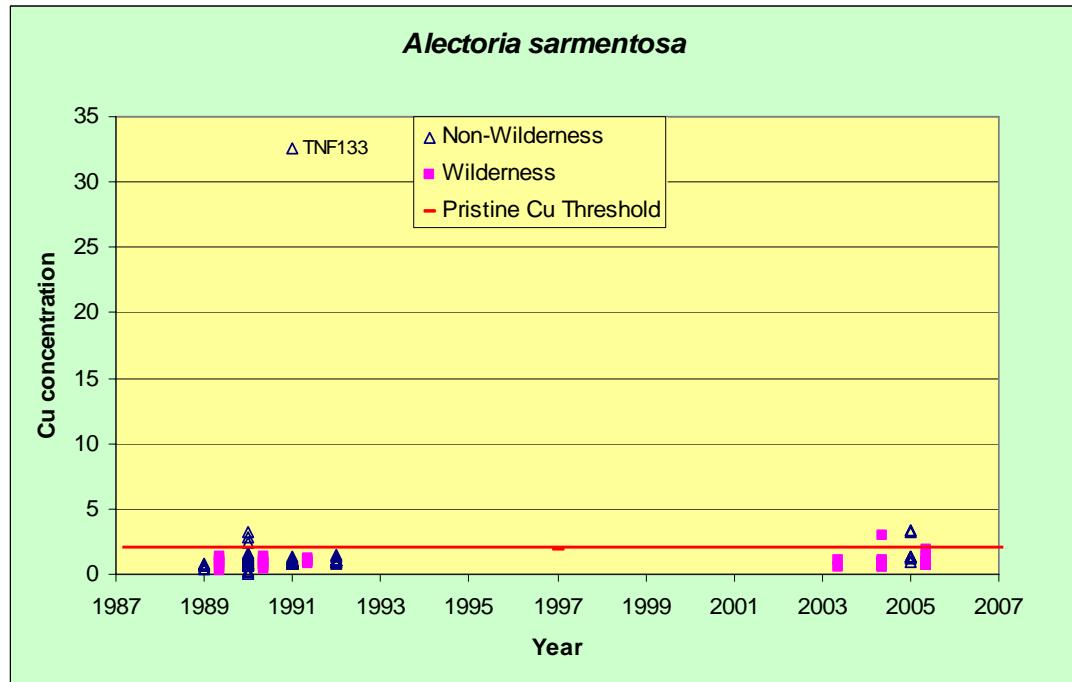


Figure XV-4. Wilderness and Non-Wilderness plot means of Cu ppm in *Alectoria sarmentosa* per year.

ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cu ppm

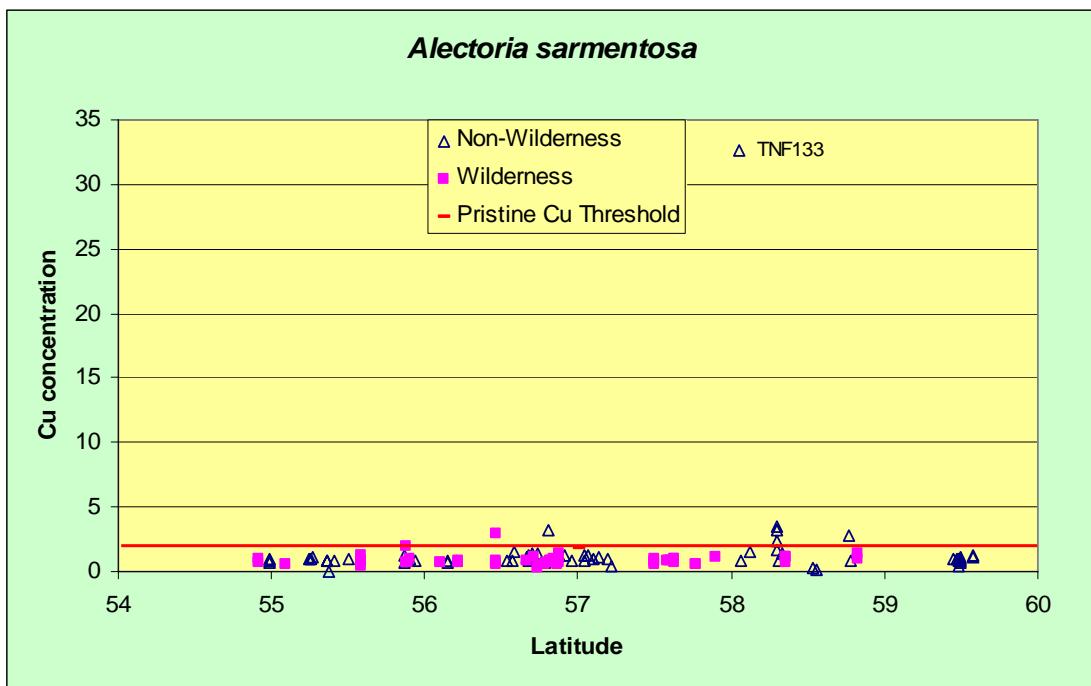


Figure XV-5. Wilderness and Non-Wilderness plot means of Cu ppm in *Alectoria sarmentosa* vs. plot Latitude.

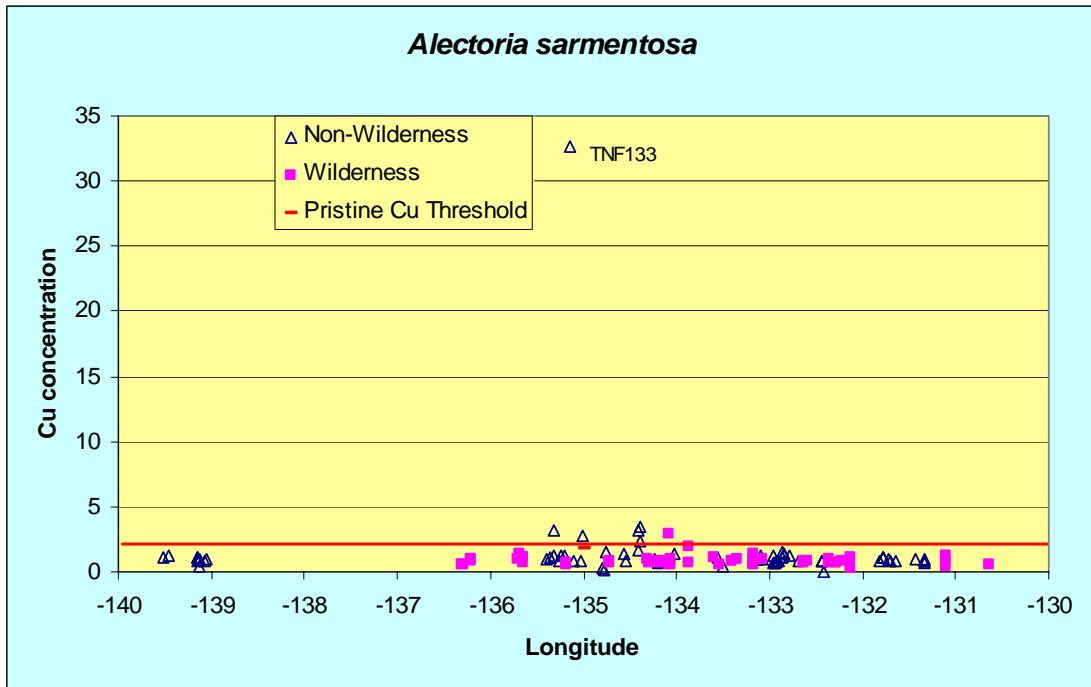


Figure XV-6. Wilderness and Non-Wilderness plot means of Cu ppm in *Alectoria sarmentosa* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cu ppm

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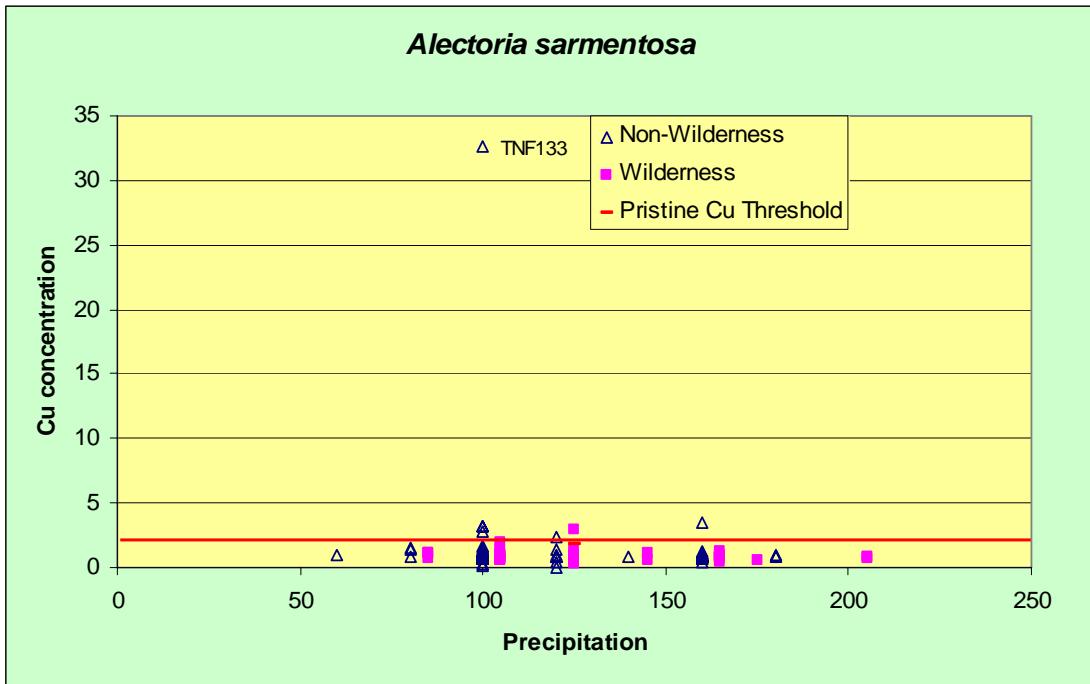


Figure XV-7. Wilderness and Non-Wilderness plot means of Cu ppm in *Alectoria sarmentosa* vs. plot Precipitation.

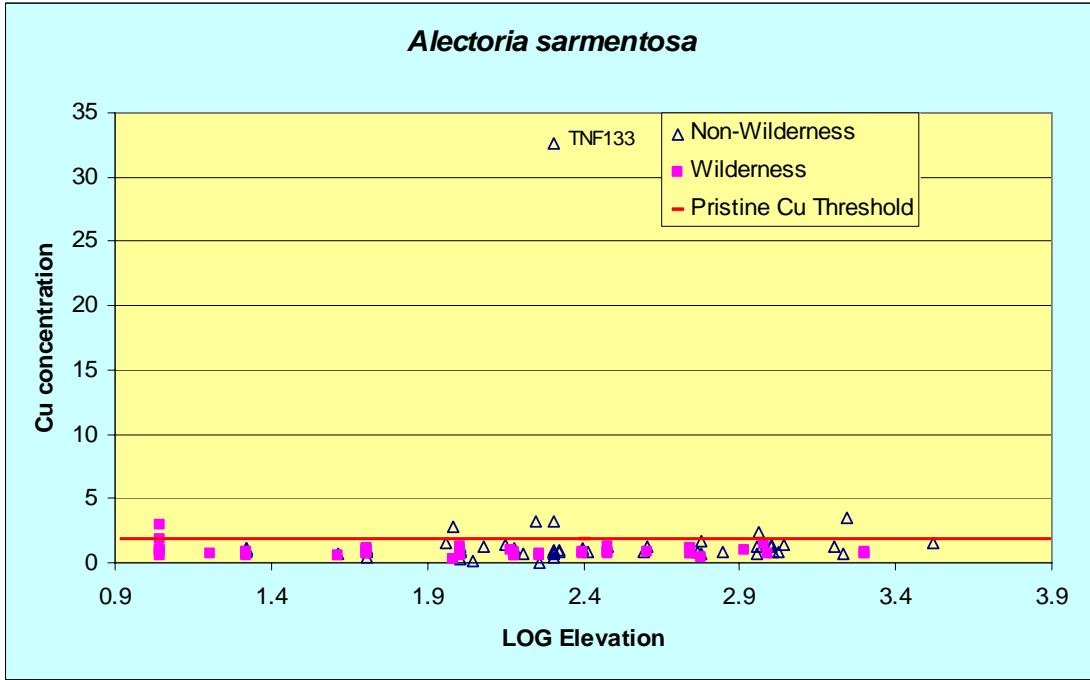


Figure XV-8. Wilderness and Non-Wilderness plot means of Cu ppm in *Alectoria sarmentosa* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cu ppm

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Hypogymnia species

In this series, all of the *Hypogymnia* species were included as a group.

Table XV-3. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Cu ppm content of *Hypogymnia species* per year.

Cu ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	1.81	1.1650	12.9977	16.6077
1989	Wilderness	4.48	0.7630	2.3619	6.5988
1990	Non-Wilderness	12.63	4.8302	2.4776	22.7735
1990	Wilderness	24.51	21.0863	27.0854	76.1073
2003	Wilderness	2.55	NA	NA	NA
2004	Wilderness	3.57	0.2028	3.0491	4.0920
2005	Non-Wilderness	39.17	12.5573	14.8553	93.2039
2005	Wilderness	4.58	0.7303	2.8918	6.2601

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cu ppm

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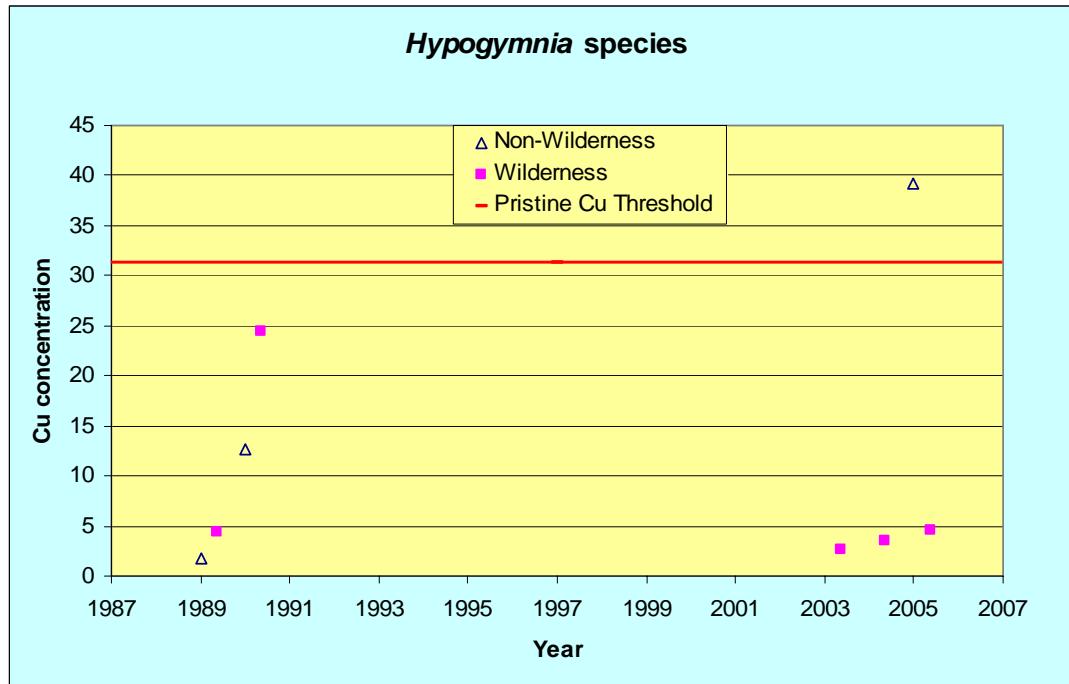


Figure XV-9. Wilderness and Non-Wilderness yearly means of Cu ppm in *Hypogymnia* species per year.

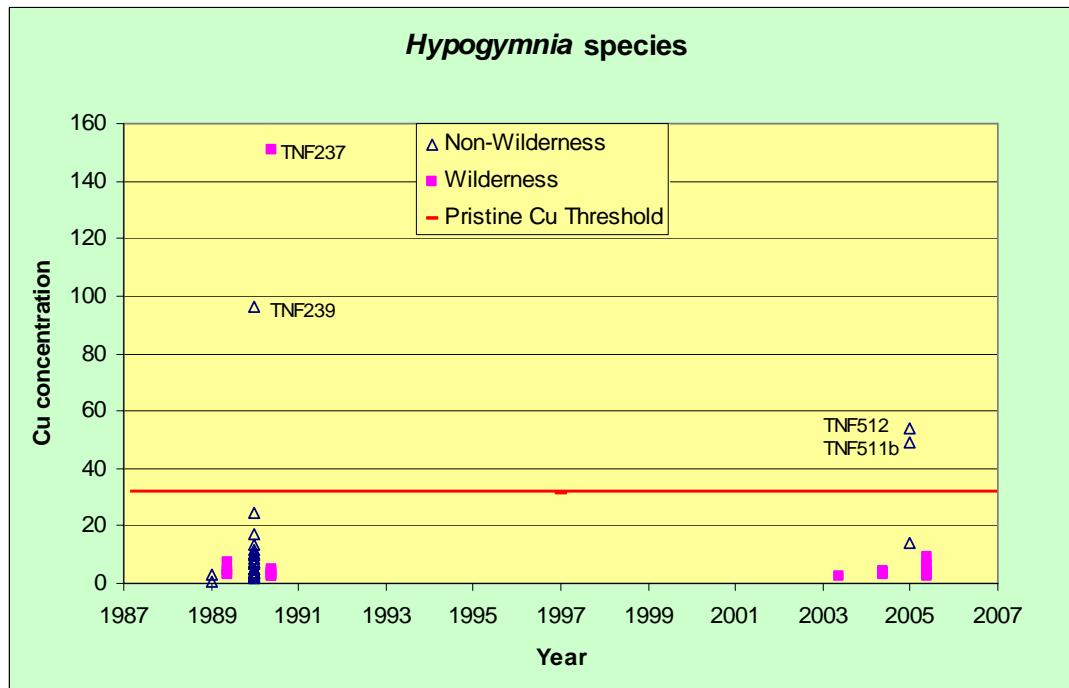


Figure XV-10. Wilderness and Non-Wilderness plot means of Cu ppm in *Hypogymnia* species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cu ppm

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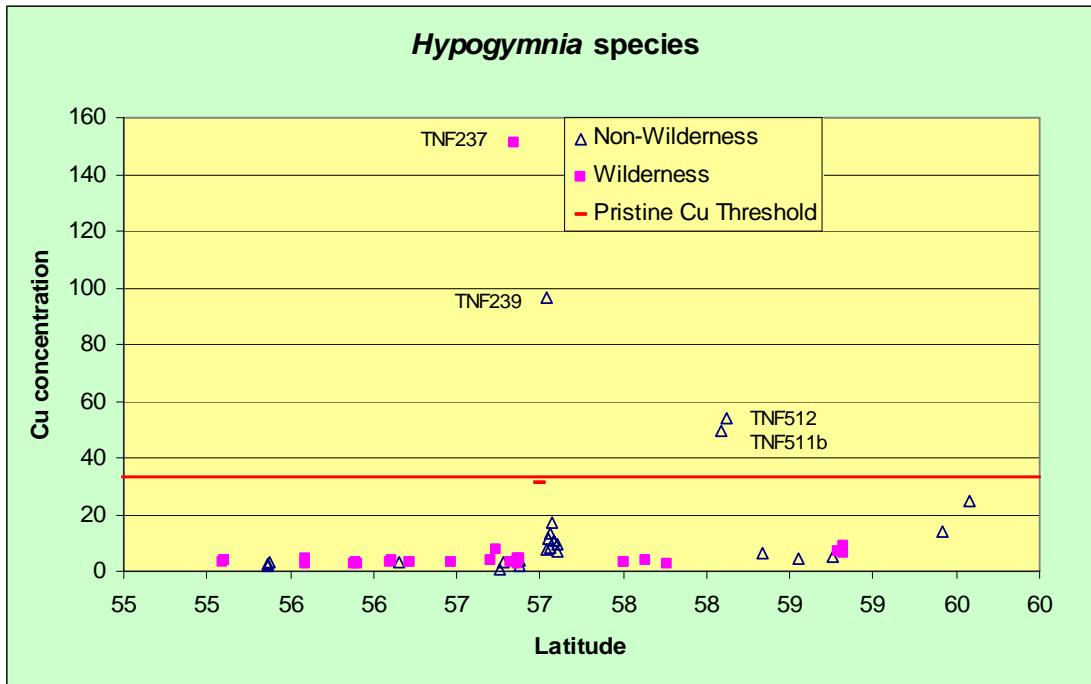


Figure XV-11. Wilderness and Non-Wilderness plot means of Cu ppm in *Hypogymnia* species vs. plot Latitude.

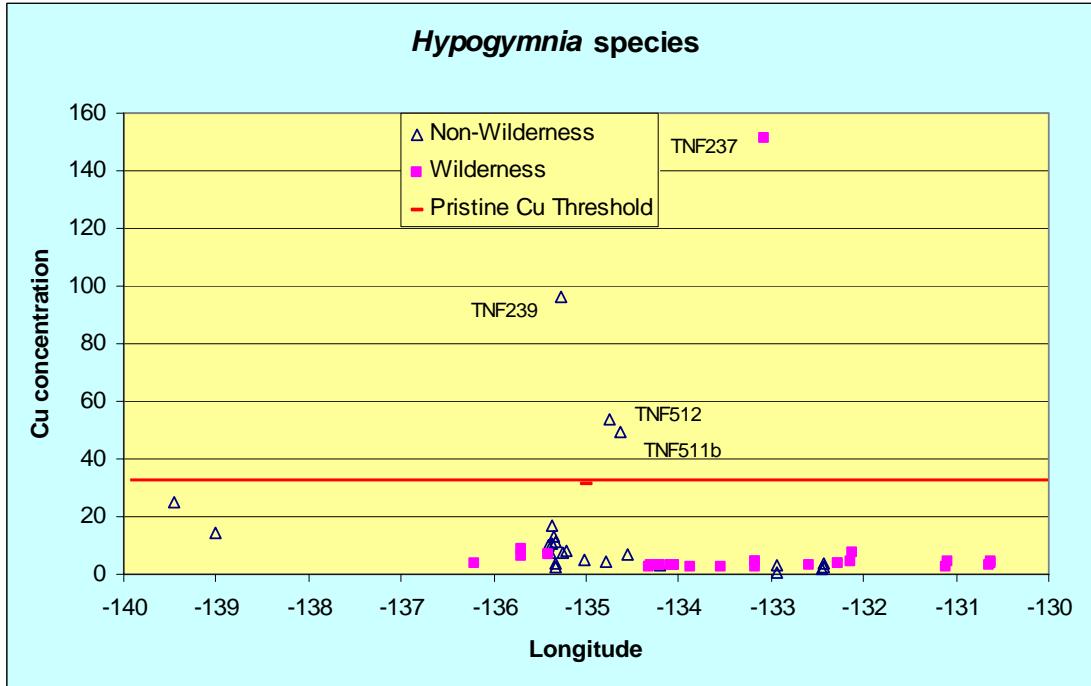


Figure XV-12. Wilderness and Non-Wilderness plot means of Cu ppm in *Hypogymnia* species vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cu ppm

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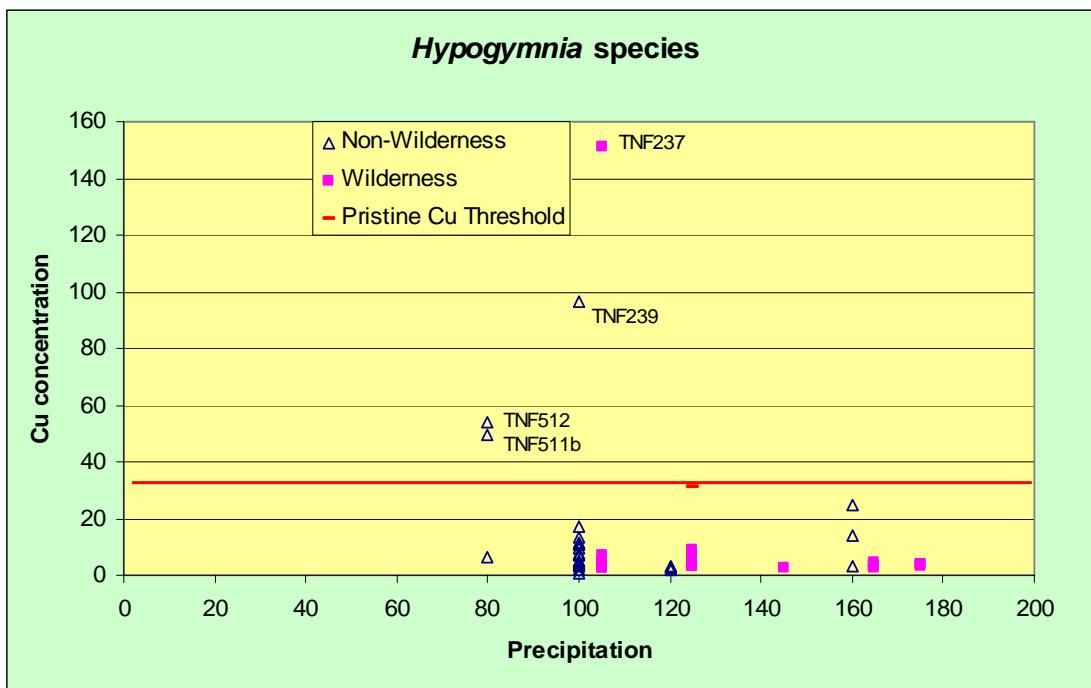


Figure XV-13. Wilderness and Non-Wilderness plot means of Cu ppm in *Hypogymnia* species vs. plot Precipitation.

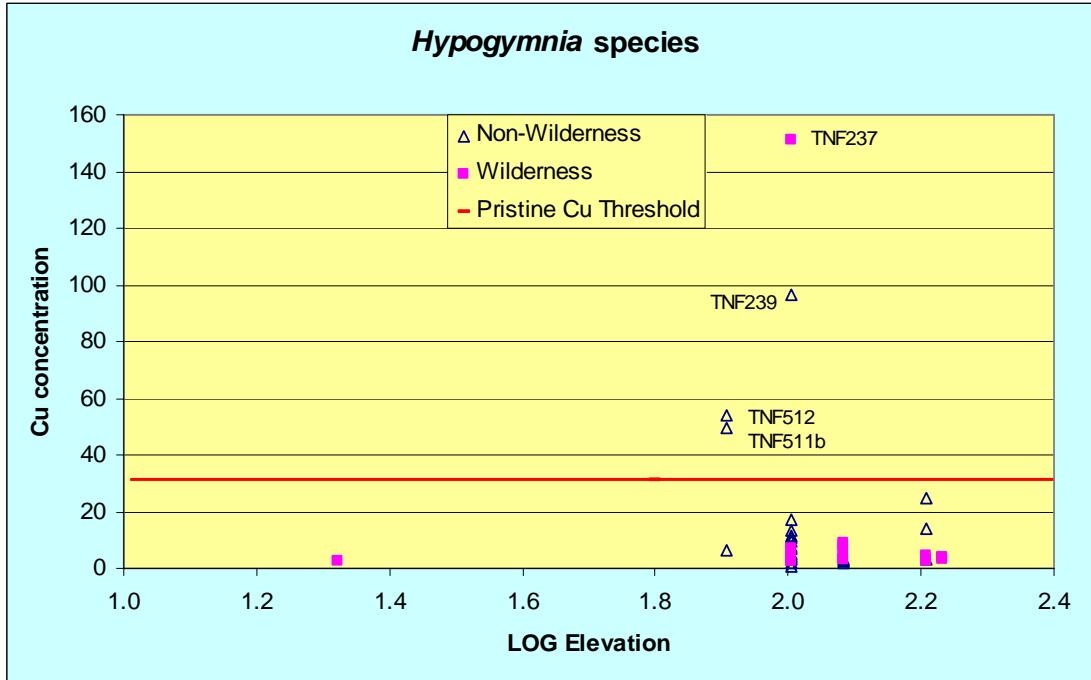


Figure XV-14. Wilderness and Non-Wilderness plot means of Cu ppm in *Hypogymnia* species vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cu ppm

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Lobaria oregana

Table XV-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Cu ppm content of *Lobaria oregana* per year.

Cu ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	2.57	0.9786	-0.5428	5.6861
1989	Wilderness	3.63	0.7151	1.6415	5.6126
1990	Non-Wilderness	6.20	0.9823	4.0605	8.3410
1990	Wilderness	4.34	1.1448	1.3957	7.2812
2004	Wilderness	4.36	0.9396	2.0595	6.6578
2005	Non-Wilderness	11.34	NA	NA	NA
2005	Wilderness	3.52	0.9518	0.4891	6.5474

Summary of Statistical Tests:

$$t = -0.438, \text{ df} = 4, \text{ p-value} = 0.684$$

There is suggestive evidence of a difference in Cu ppm content in *Lobaria oregana* from pre-2000 and post 2000 samples (p-value = 0.0684).

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cu ppm

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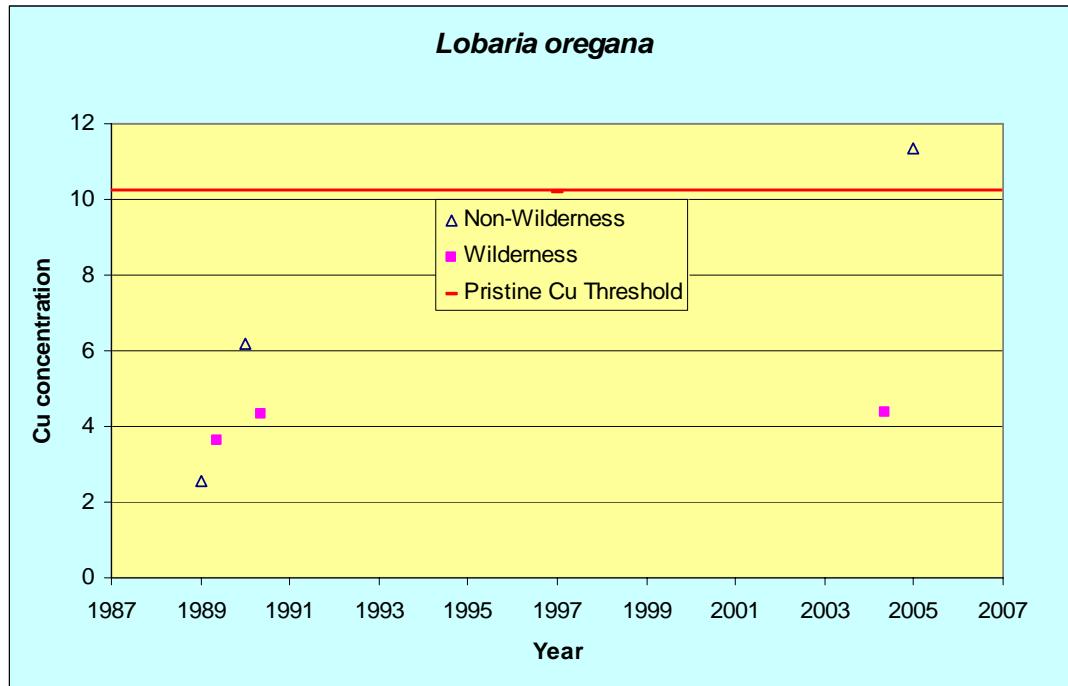


Figure XV-15. Wilderness and Non-Wilderness yearly means of Cu ppm in *Lobaria oregana* per year.

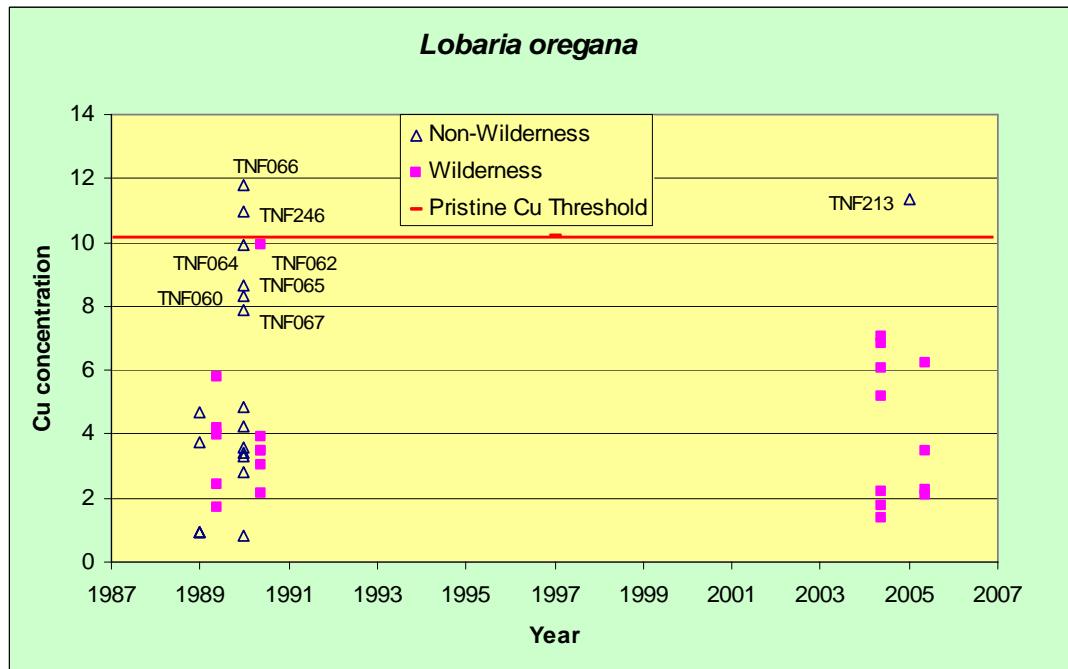


Figure XV-16. Wilderness and Non-Wilderness plot means of Cu ppm in *Lobaria oregana* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cu ppm

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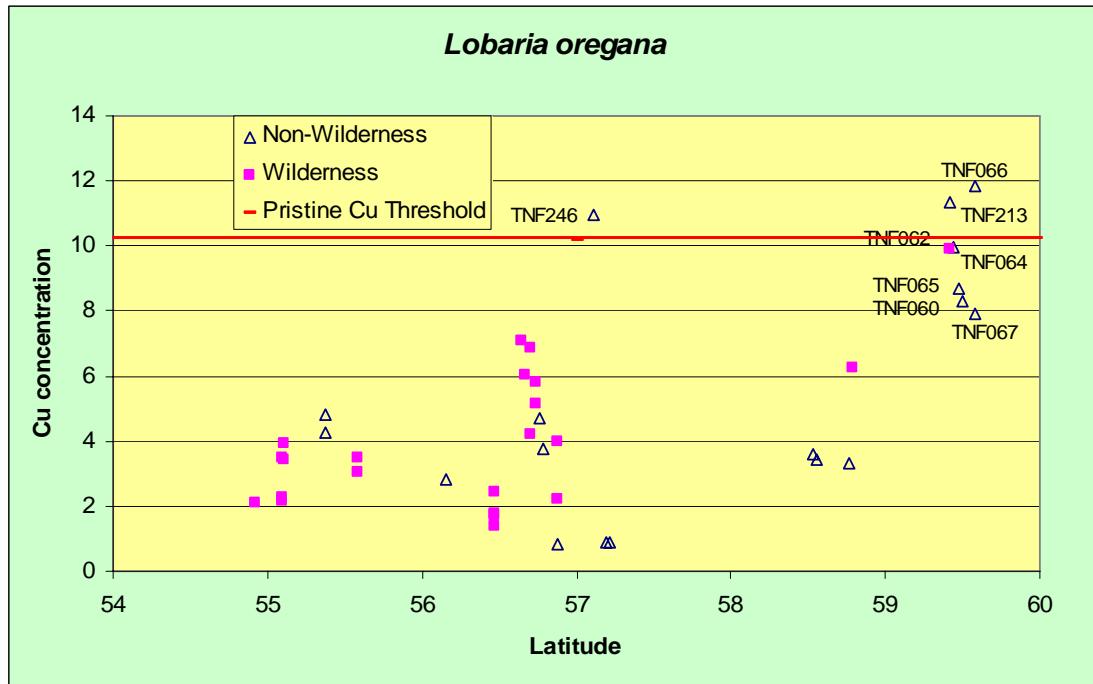


Figure XV-17. Wilderness and Non-Wilderness plot means of Cu ppm in *Lobaria oregana* vs. plot Latitude.

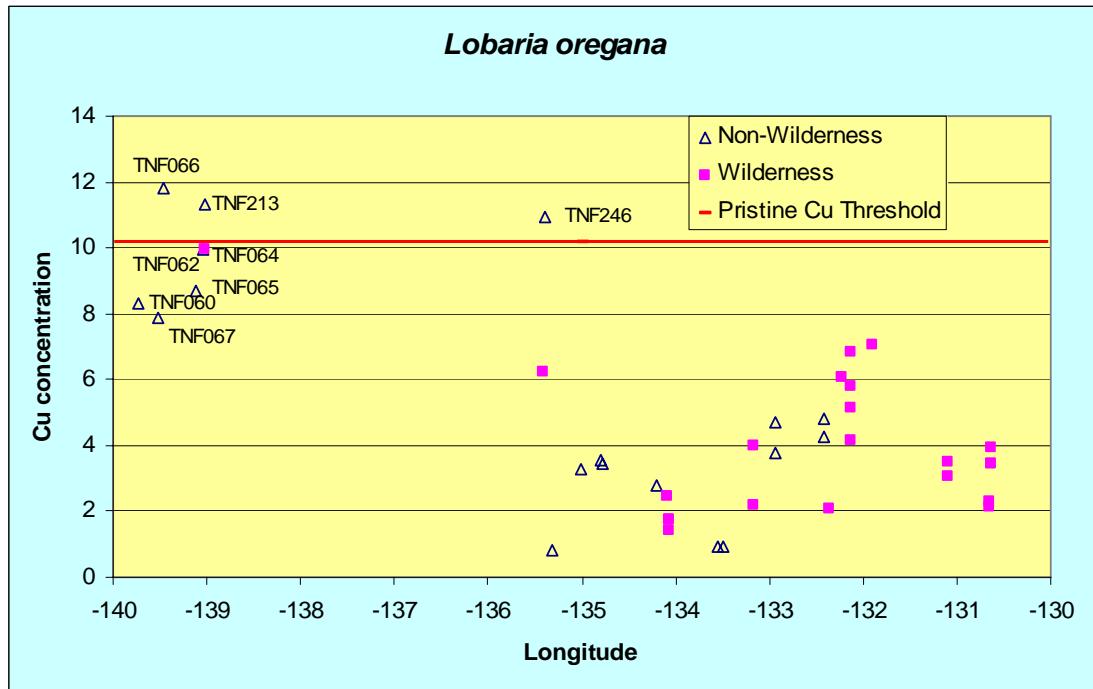


Figure XV-18. Wilderness and Non-Wilderness plot means of Cu ppm in *Lobaria oregana* vs. plot Longitude.

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## ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cu ppm

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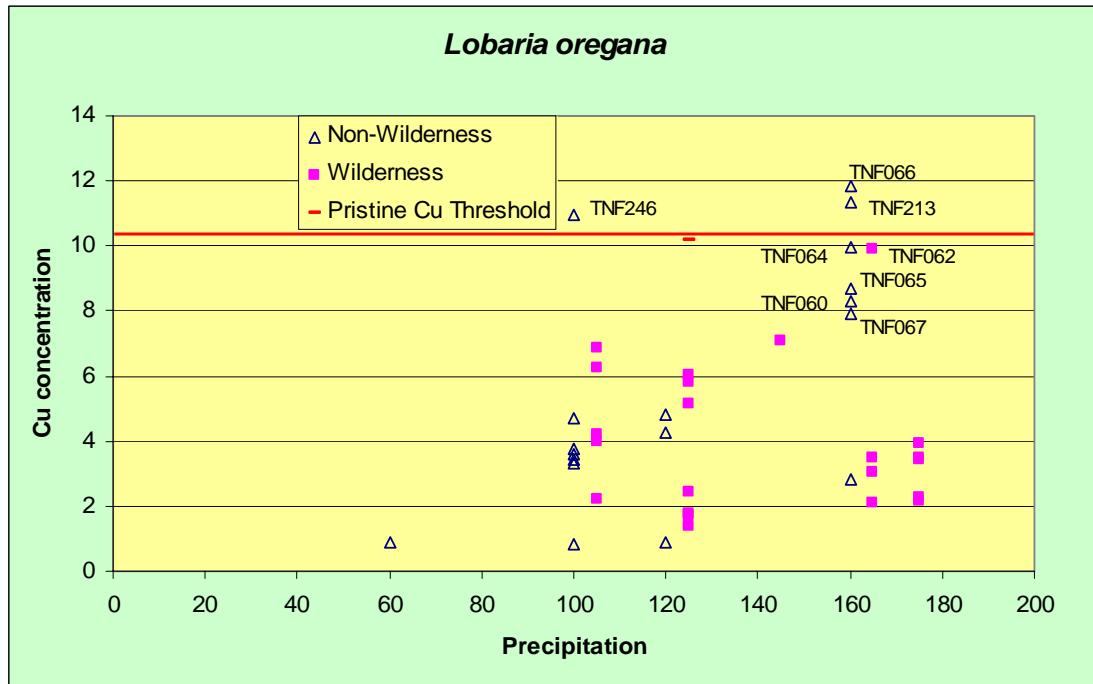


Figure XV-19. Wilderness and Non-Wilderness plot means of Cu ppm in *Lobaria oregana* vs. plot Precipitation.

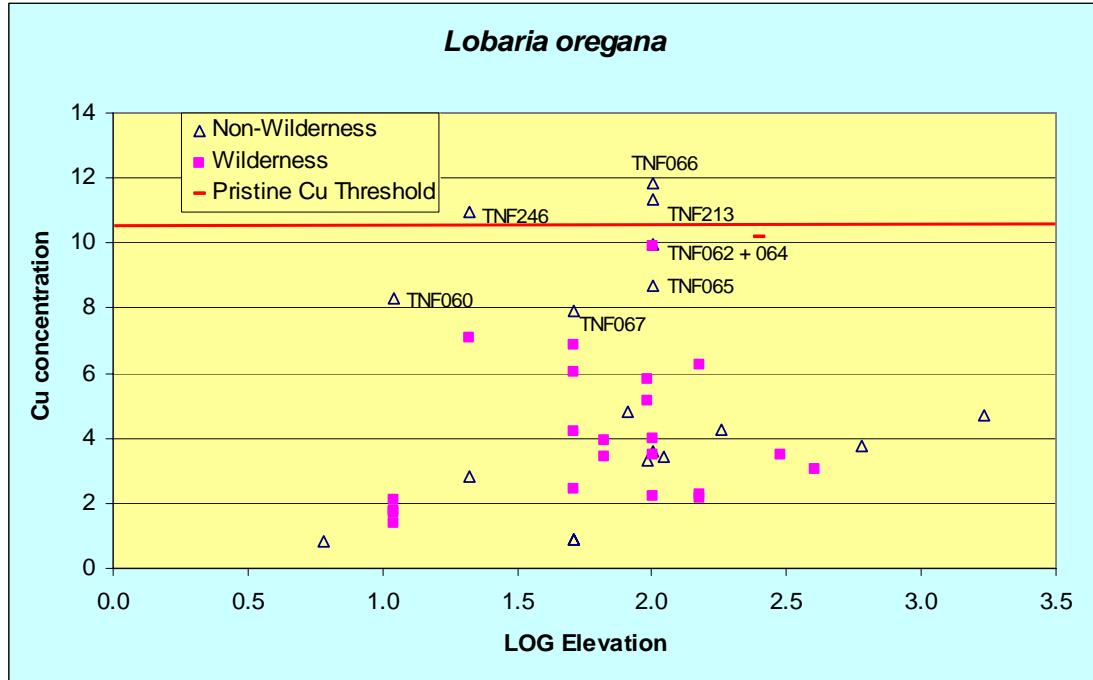


Figure XV-20. Wilderness and Non-Wilderness plot means of Cu ppm in *Lobaria oregana* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cu ppm

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Platismatia glauca

Table XV-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Cu ppm content of *Platismatia glauca* per year.

Cu ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2003	Wilderness	1.86	NA	NA	NA
2004	Wilderness	2.72	0.3458	1.9337	3.4983
2005	Non-Wilderness	21.42	9.3170	0.3387	42.4915
2005	Wilderness	3.67	0.7104	1.9930	5.3526

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cu ppm

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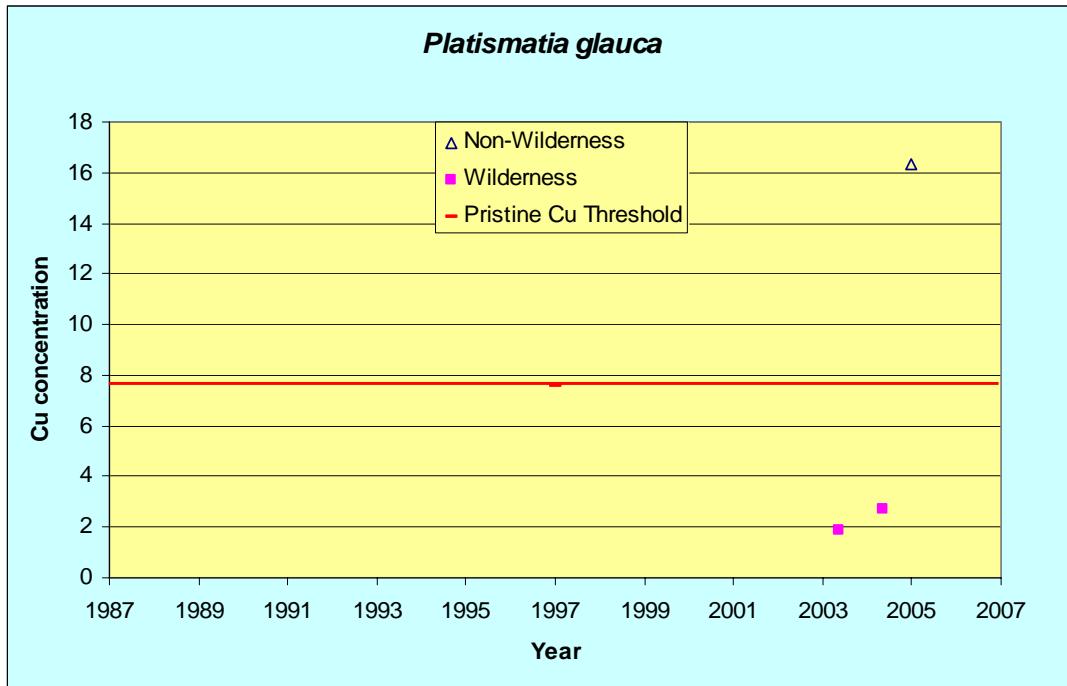


Figure XV-21. Wilderness and Non-Wilderness yearly means of Cu ppm in *Platismatia glauca* per year.

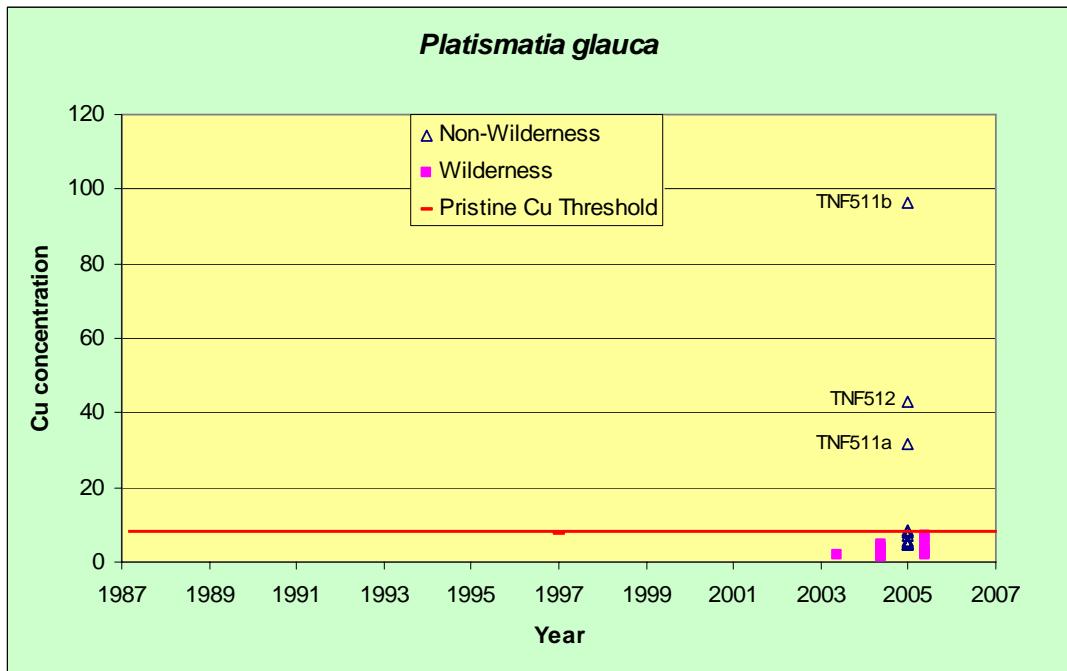


Figure XV-22. Wilderness and Non-Wilderness plot means of Cu ppm in *Platismatia glauca* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cu ppm

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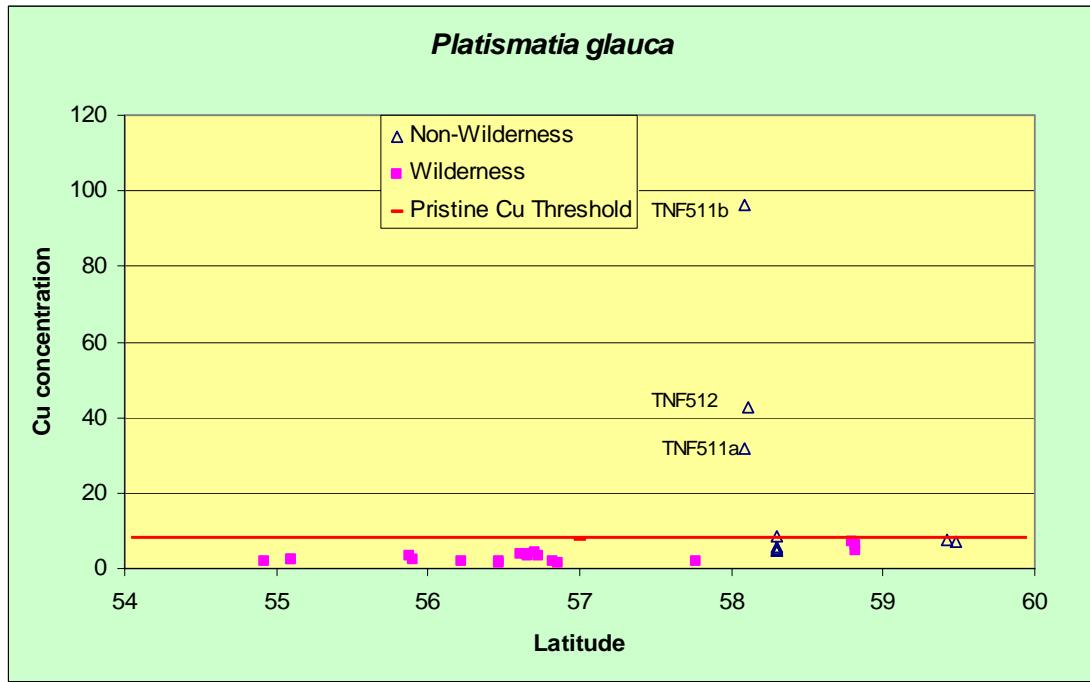


Figure XV-23. Wilderness and Non-Wilderness plot means of Cu ppm in *Platismatia glauca* vs. plot Latitude.

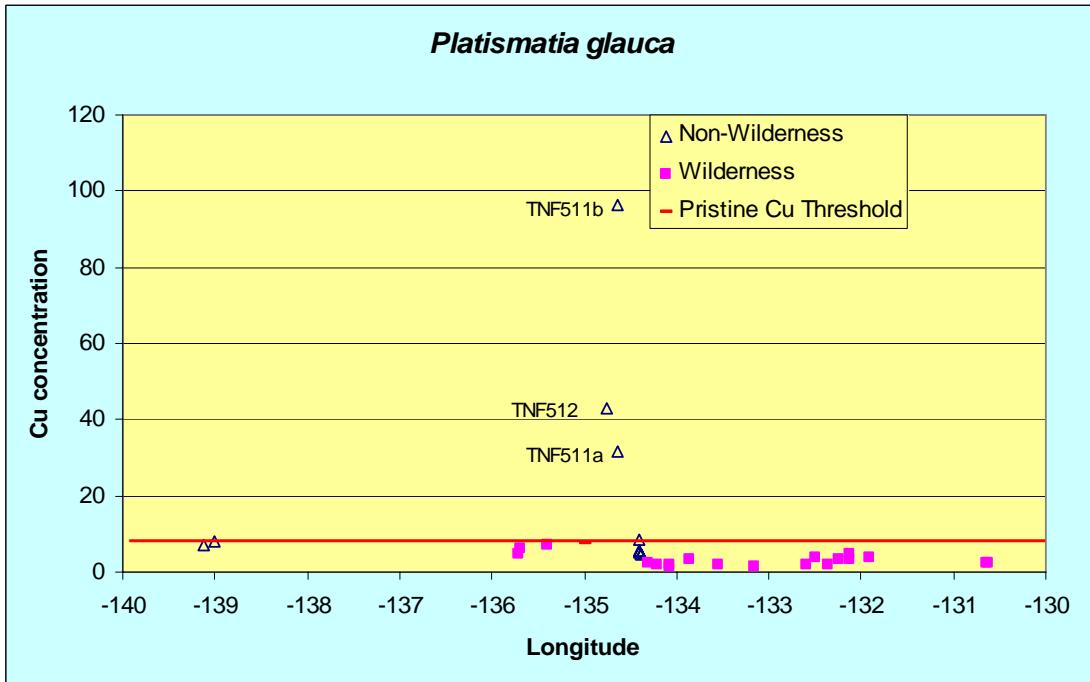


Figure XV-24. Wilderness and Non-Wilderness plot means of Cu ppm in *Platismatia glauca* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Cu ppm

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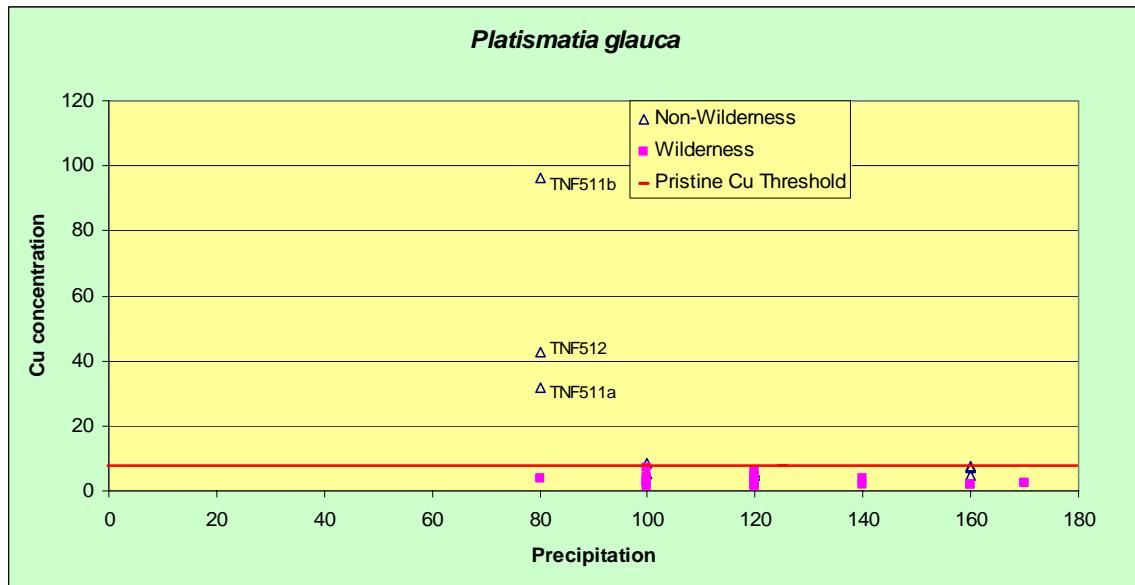


Figure XV-25. Wilderness and Non-Wilderness plot means of Cu ppm in *Platismatia glauca* vs. plot Precipitation.

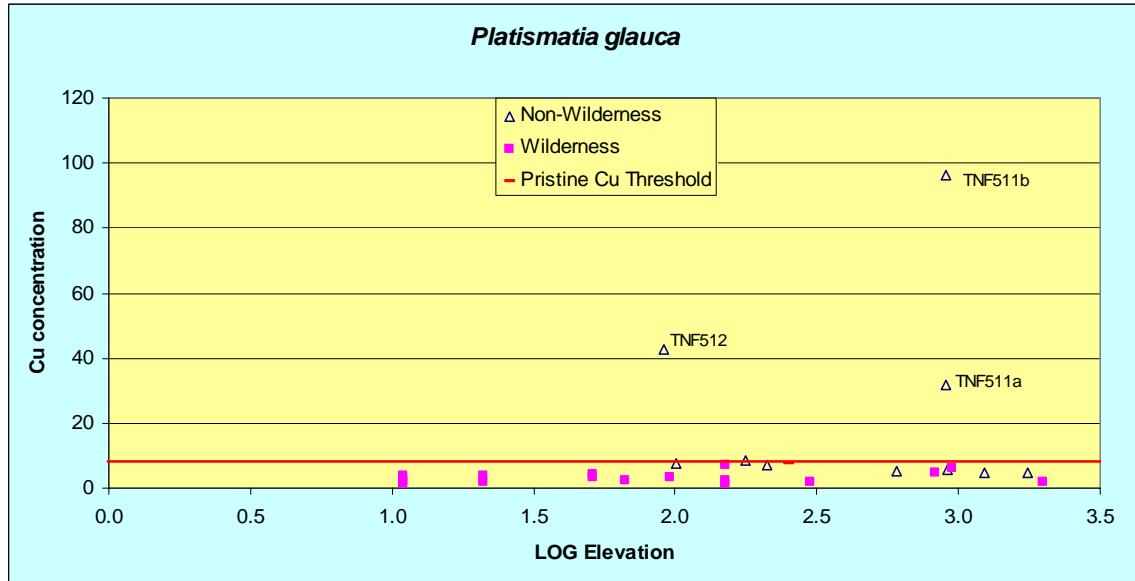


Figure XV-26. Wilderness and Non-Wilderness plot means of Cu ppm in *Platismatia glauca* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Fe ppm

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XVI. SUMMARY OF Fe PPM DATA ANALYSIS

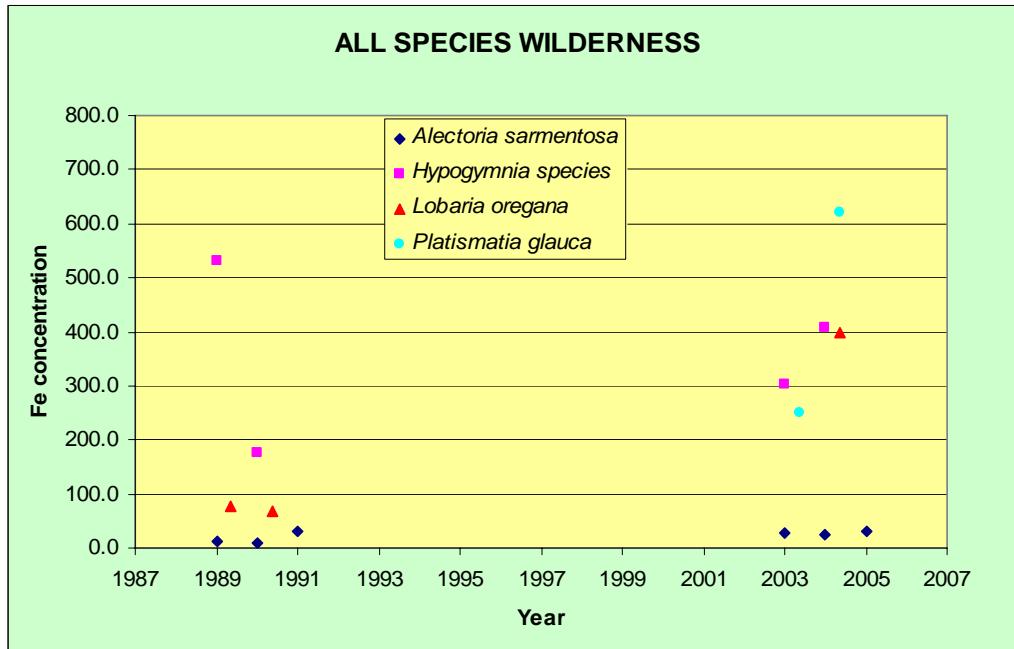


Figure XVI-27. Wilderness plot means of Fe ppm
in All Species per year.

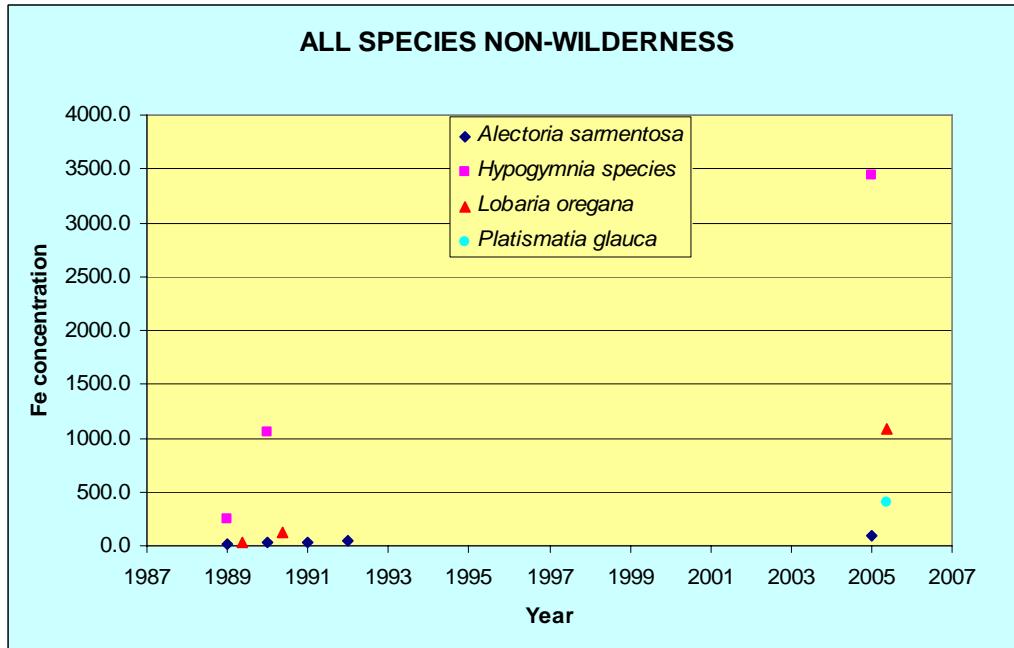


Figure XVI-28. Non-Wilderness plot means of Fe ppm
in All Species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Fe ppm

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Alectoria sarmentosa

Summary Statistics:

Table XVI-2. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Fe ppm content of *Alectoria sarmentosa* per year.

Fe ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	9.02	2.3762	2.4226	15.6174
1989	Wilderness	11.76	1.3771	8.2156	15.2955
1990	Non-Wilderness	36.82	6.8413	22.7529	50.8779
1990	Wilderness	10.75	2.4898	4.6564	16.8408
1991	Non-Wilderness	27.4185	3.2779	20.5320	34.3050
1991	Wilderness	29.94	8.6782	5.8489	54.0382
1992	Non-Wilderness	50.66	13.2521	19.3265	81.9989
2003	Wilderness	27.34	11.2036	115.0199	169.6901
2004	Wilderness	24.86	2.4647	19.7637	29.9611
2005	Non-Wilderness	85.57	33.1719	0.3037	170.8460
2005	Wilderness	31.94	9.2438	11.0272	52.8490

Summary of Statistical Tests:

$$t = -0.4902, df = 8, p\text{-value} = 0.6371$$

There is no evidence of a difference in Fe ppm content in *Alectoria sarmentosa* from pre-2000 and post 2000 samples (p-value = 0.6371).

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Fe ppm

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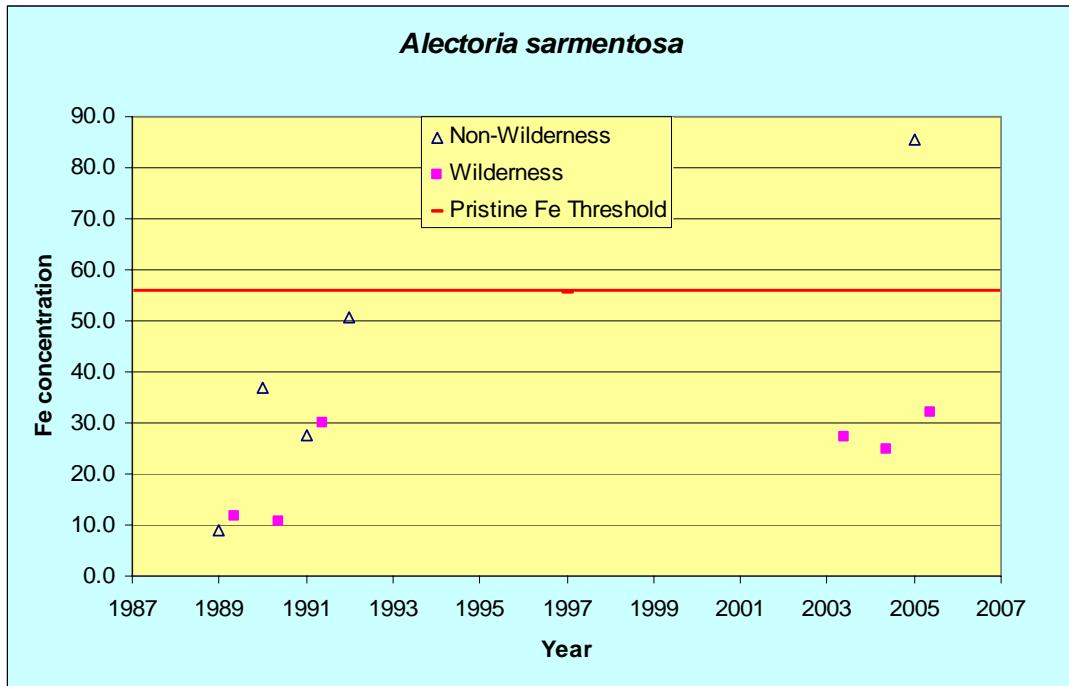


Figure XVI-3. Wilderness and Non-Wilderness yearly means of Fe ppm in *Alectoria sarmentosa* per year.

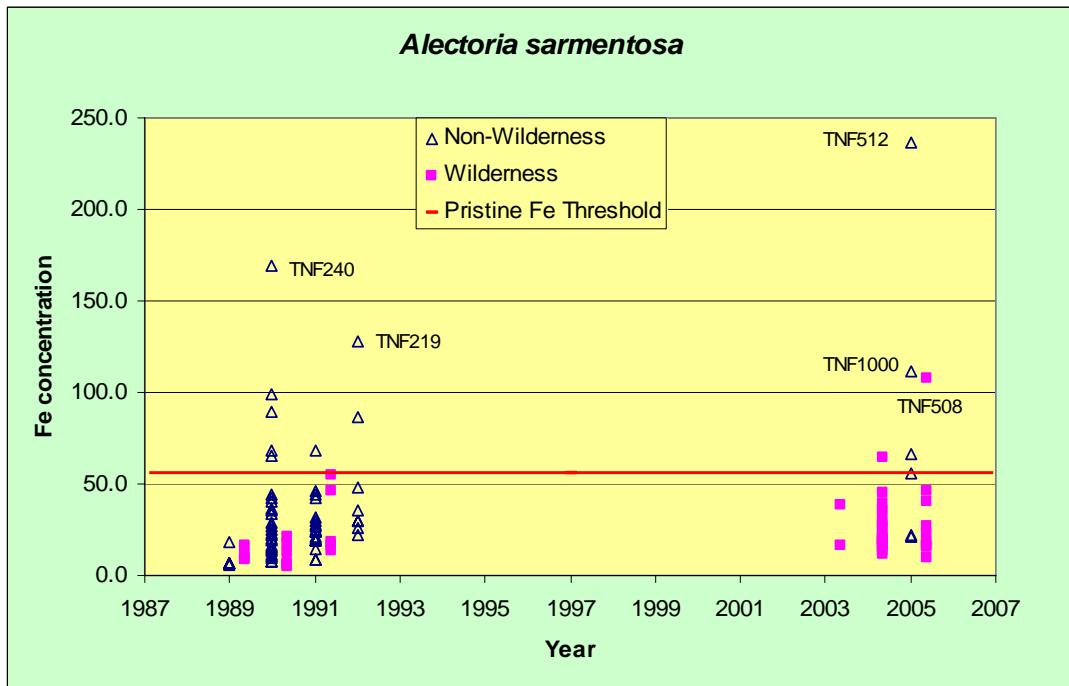


Figure XVI-4. Wilderness and Non-Wilderness plot means of Fe ppm in *Alectoria sarmentosa* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Fe ppm

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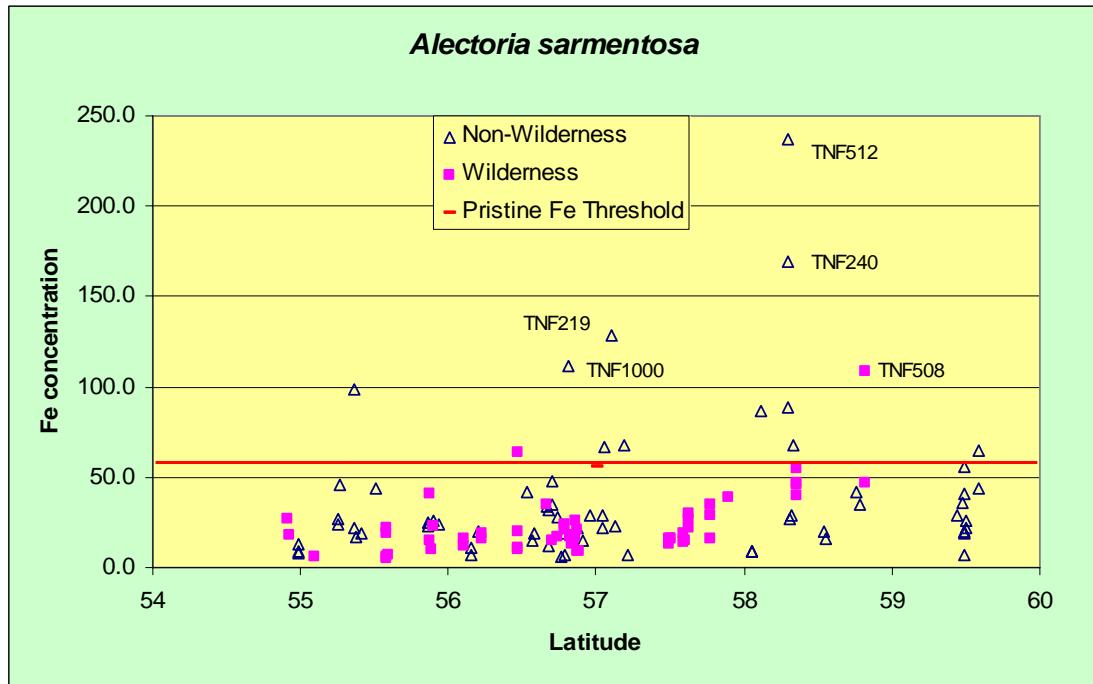


Figure XVI-5. Wilderness and Non-Wilderness plot means of Fe ppm in *Alectoria sarmentosa* vs. plot Latitude.

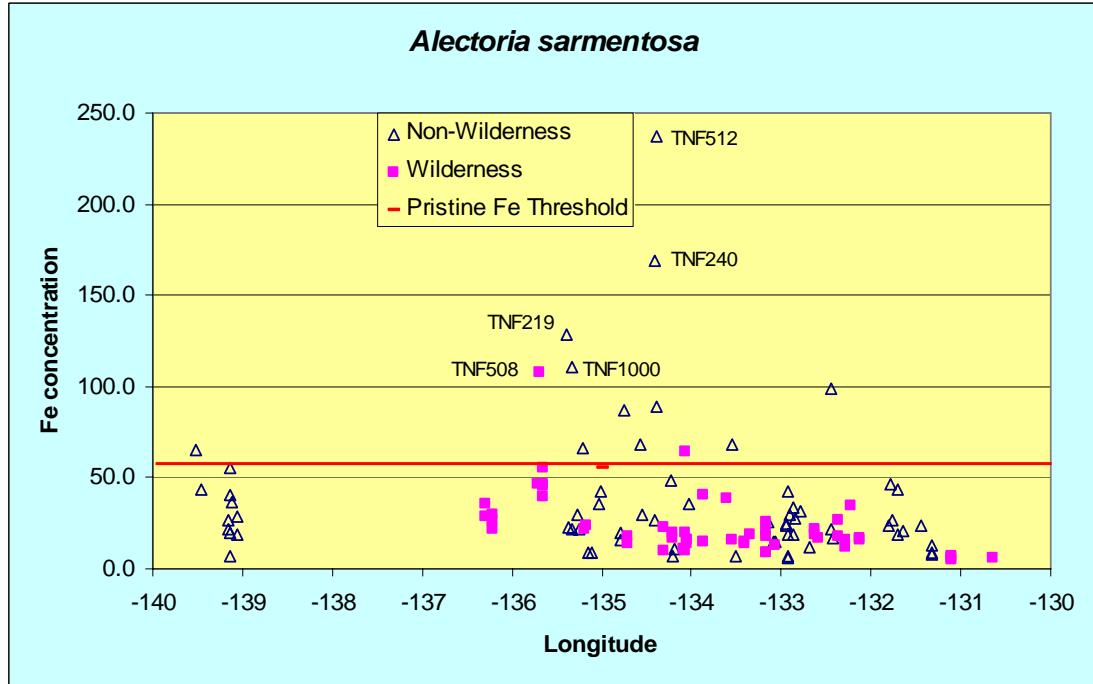


Figure XVI-6. Wilderness and Non-Wilderness plot means of Fe ppm in *Alectoria sarmentosa* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Fe ppm

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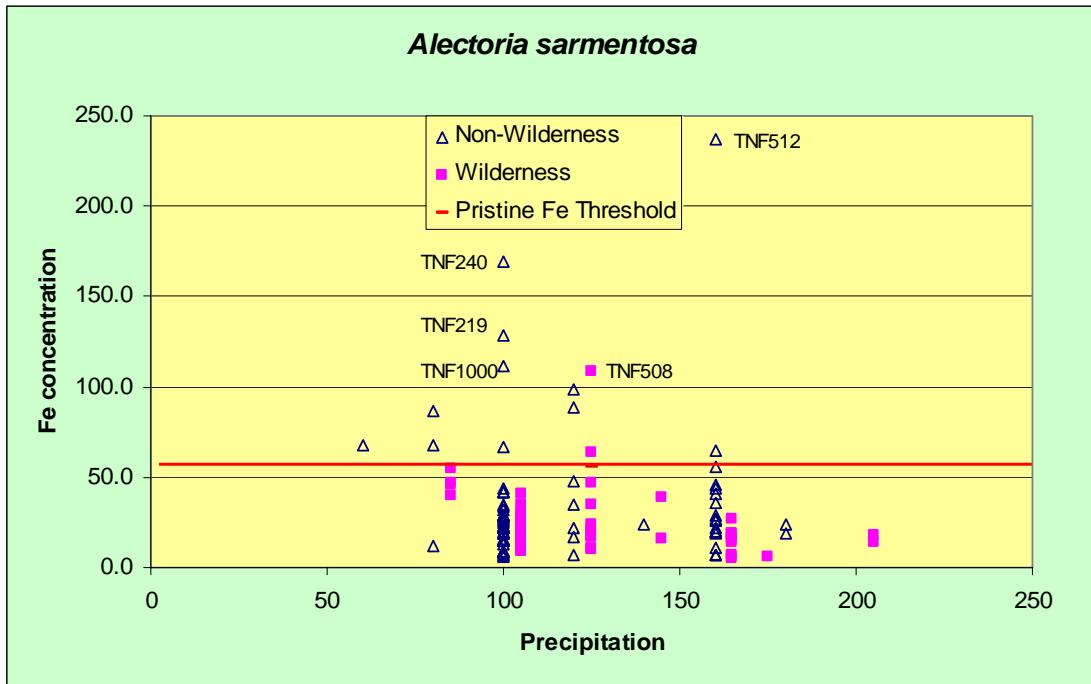


Figure XVI-7. Wilderness and Non-Wilderness plot means of Fe ppm in *Alectoria sarmentosa* vs. plot Precipitation.

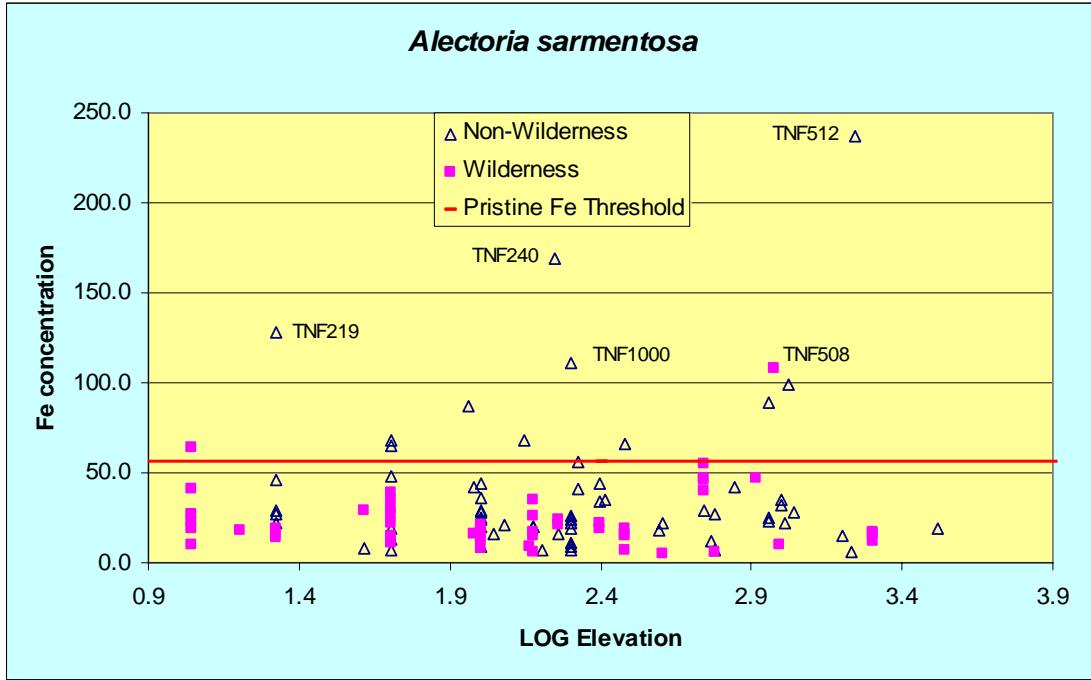


Figure XVI-8. Wilderness and Non-Wilderness plot means of Fe ppm in *Alectoria sarmentosa* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Fe ppm

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Hypogymnia species

In this series, all of the *Hypogymnia* species were included as a group.

Table XVI-3. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Fe ppm content of *Hypogymnia species* per year.

Fe ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	243.50	235.5000	2748.8110	3235.8110
1989	Wilderness	531.55	266.0219	207.0451	1270.1451
1990	Non-Wilderness	1055.45	226.9311	578.6828	1532.2120
1990	Wilderness	177.24	39.7317	80.0182	274.4580
2003	Wilderness	302.79	NA	NA	NA
2004	Wilderness	408.95	96.8329	160.0304	657.8641
2005	Non-Wilderness	3441.40	1205.8310	1746.8740	8629.6740
2005	Wilderness	691.24	228.0810	165.2831	1217.1946

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Fe ppm

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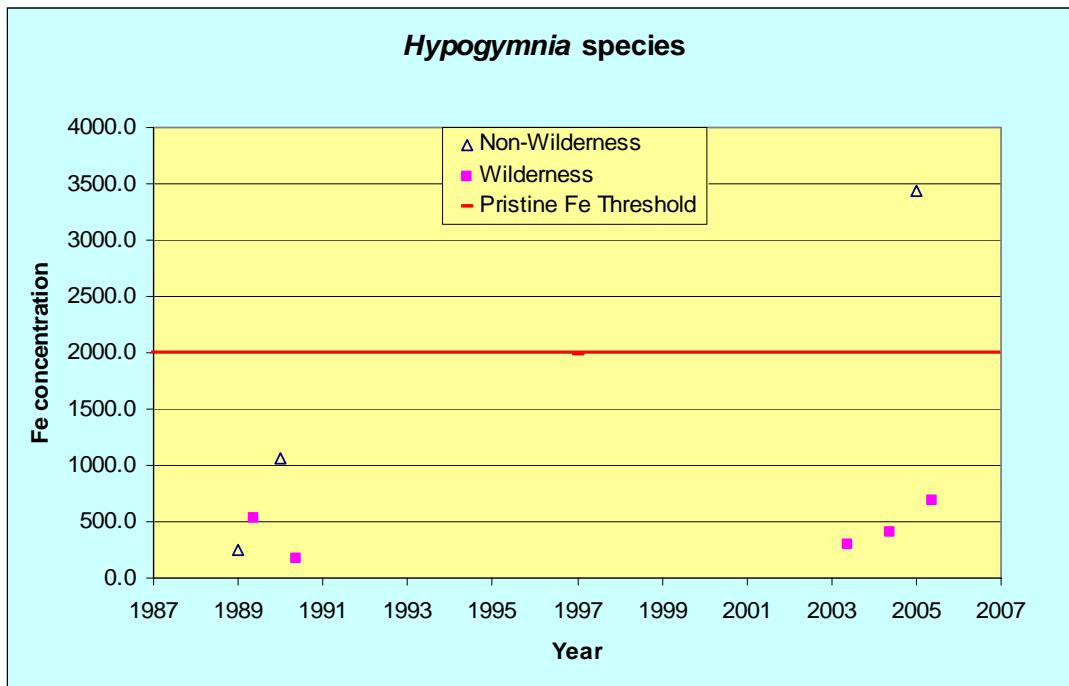


Figure XVI-9. Wilderness and Non-Wilderness yearly means of Fe ppm in *Hypogymnia* species per year.

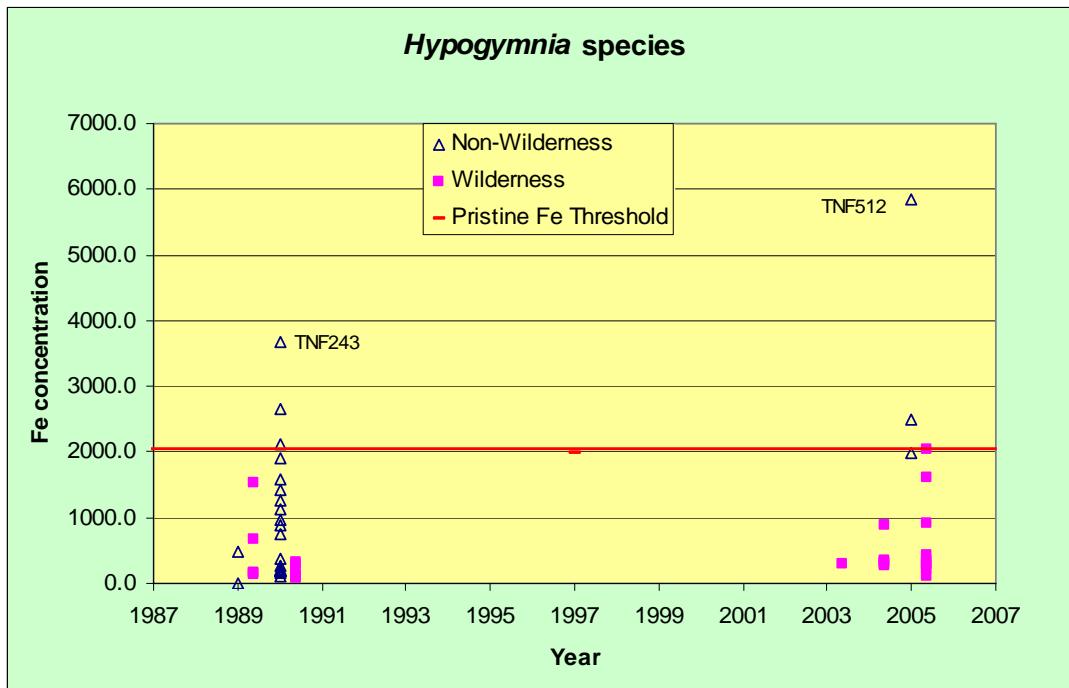


Figure XVI-10. Wilderness and Non-Wilderness plot means of Fe ppm in *Hypogymnia* species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Fe ppm

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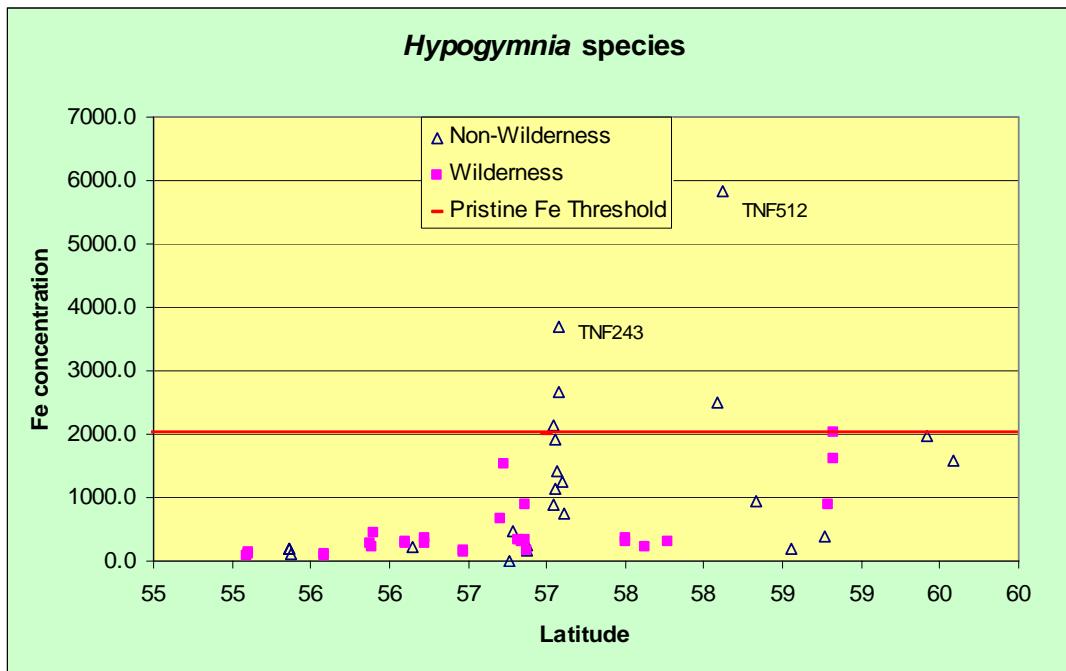


Figure XVI-11. Wilderness and Non-Wilderness plot means of Fe ppm in *Hypogymnia* species vs. plot Latitude.

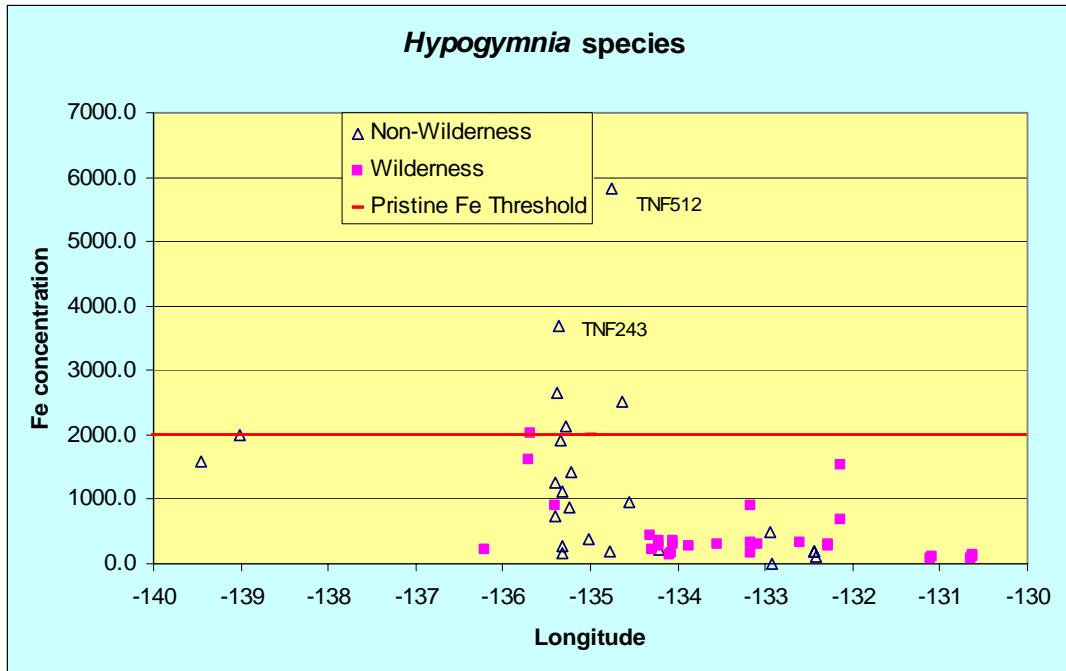


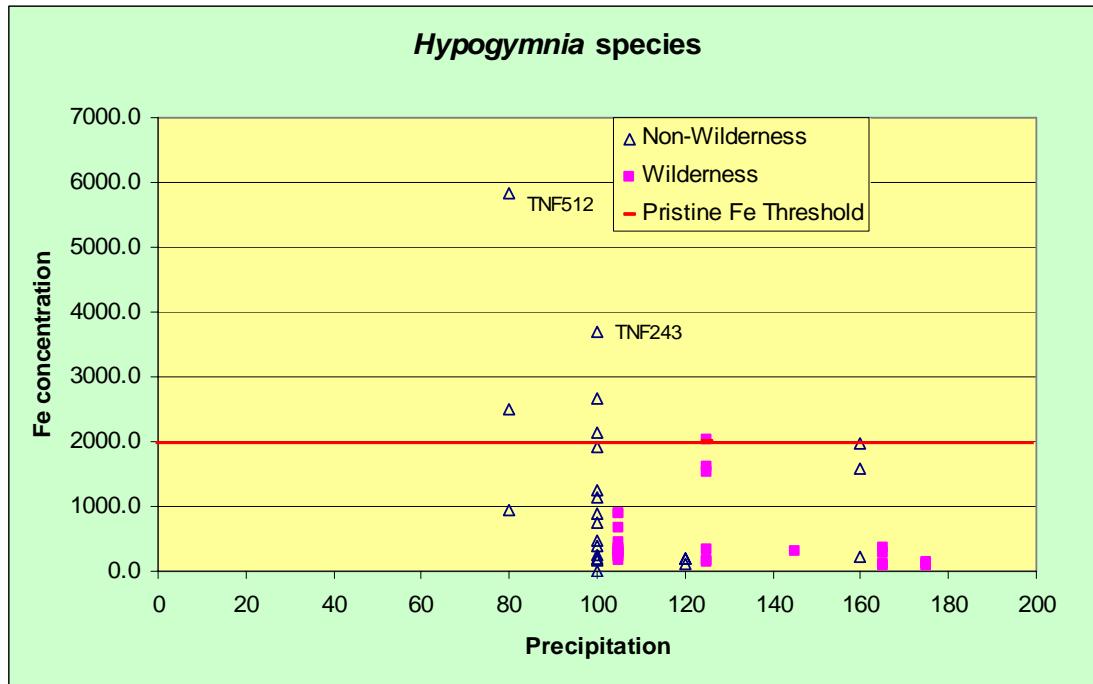
Figure XVI-12. Wilderness and Non-Wilderness plot means of Fe ppm in *Hypogymnia* species vs. plot Longitude.

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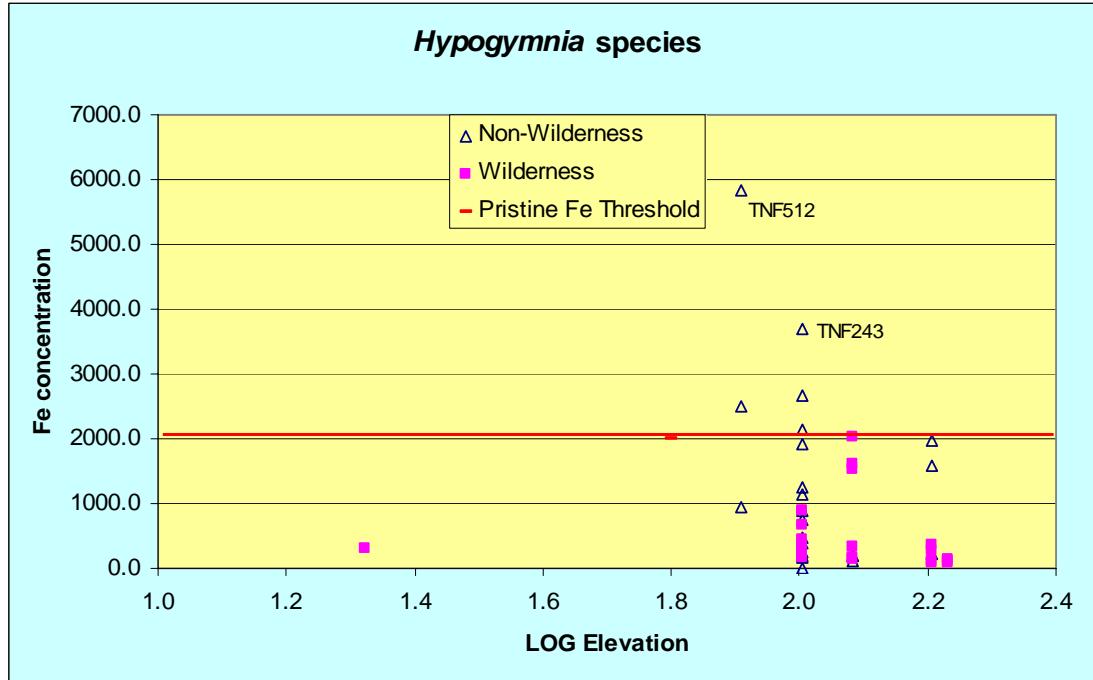
ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Fe ppm

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**Figure XVI-13. Wilderness and Non-Wilderness plot means of Fe ppm
in *Hypogymnia* species vs. plot Precipitation.**



**Figure XVI-14. Wilderness and Non-Wilderness plot means of Fe ppm
in *Hypogymnia* species vs. plot Log-Elevation.**

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Fe ppm

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Lobaria oregana

Table XVI-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Fe ppm content of *Lobaria oregana* per year.

Fe ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	37.50	10.4292	4.3096	70.6904
1989	Wilderness	77.84	29.7676	-4.8049	160.4915
1990	Non-Wilderness	120.93	31.1713	53.0132	188.8458
1990	Wilderness	67.70	45.0773	NA	183.5724
2004	Wilderness	399.92	138.4878	61.0566	738.7914
2005	Non-Wilderness	1086.01	NA	NA	NA
2005	Wilderness	156.50	104.4616	NA	488.9397

Summary of Statistical Tests:

$$t = -1.3283, \text{ df} = 4, \text{ p-value} = 0.2548$$

There is no evidence of a difference in Fe ppm content in *Lobaria oregana* from pre-2000 and post 2000 samples (p-value = 0.2548).

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Fe ppm

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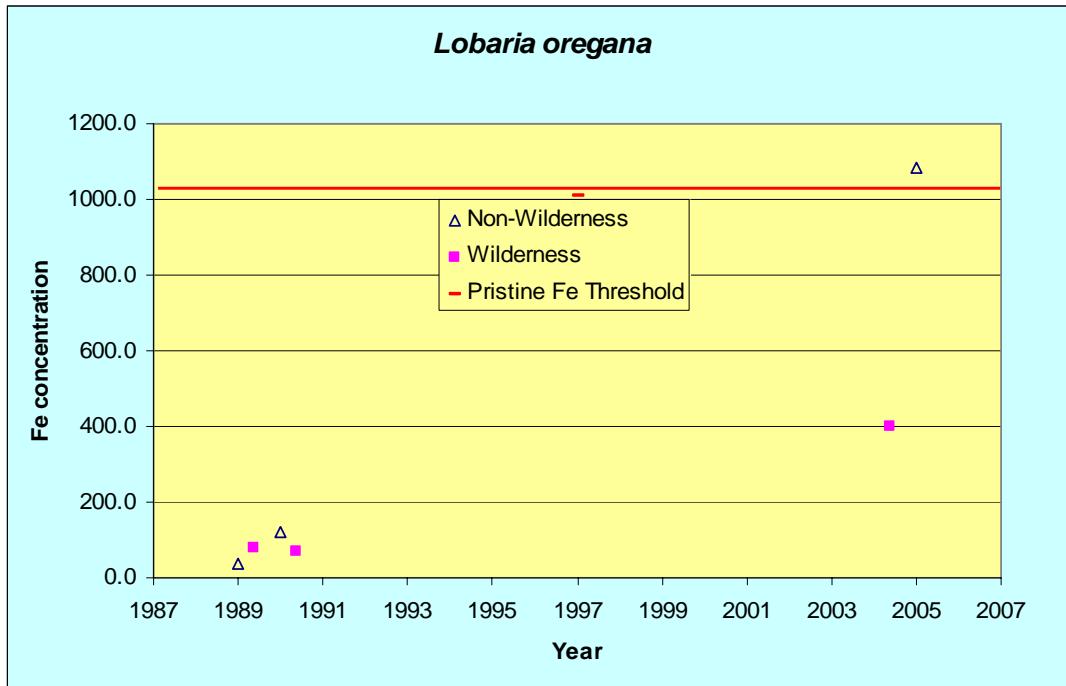


Figure XVI-15. Wilderness and Non-Wilderness yearly means of Fe ppm in *Lobaria oregana* per year.

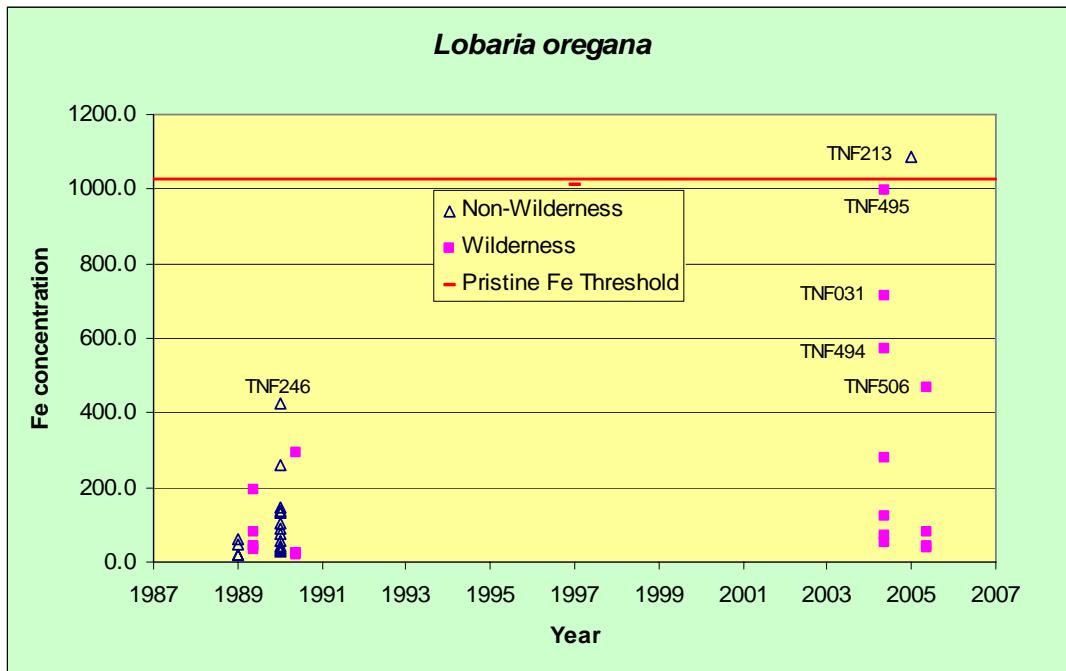


Figure XVI-16. Wilderness and Non-Wilderness plot means of Fe ppm in *Lobaria oregana* per year.

ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Fe ppm

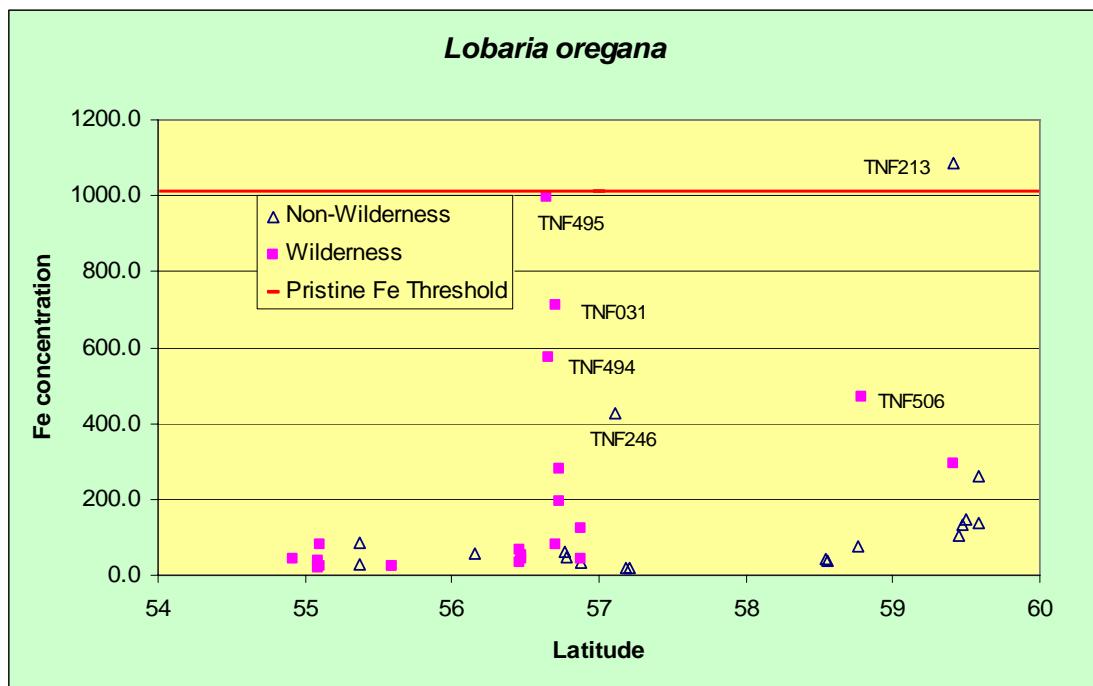


Figure XVI-17. Wilderness and Non-Wilderness plot means of Fe ppm in *Lobaria oregana* vs. plot Latitude.

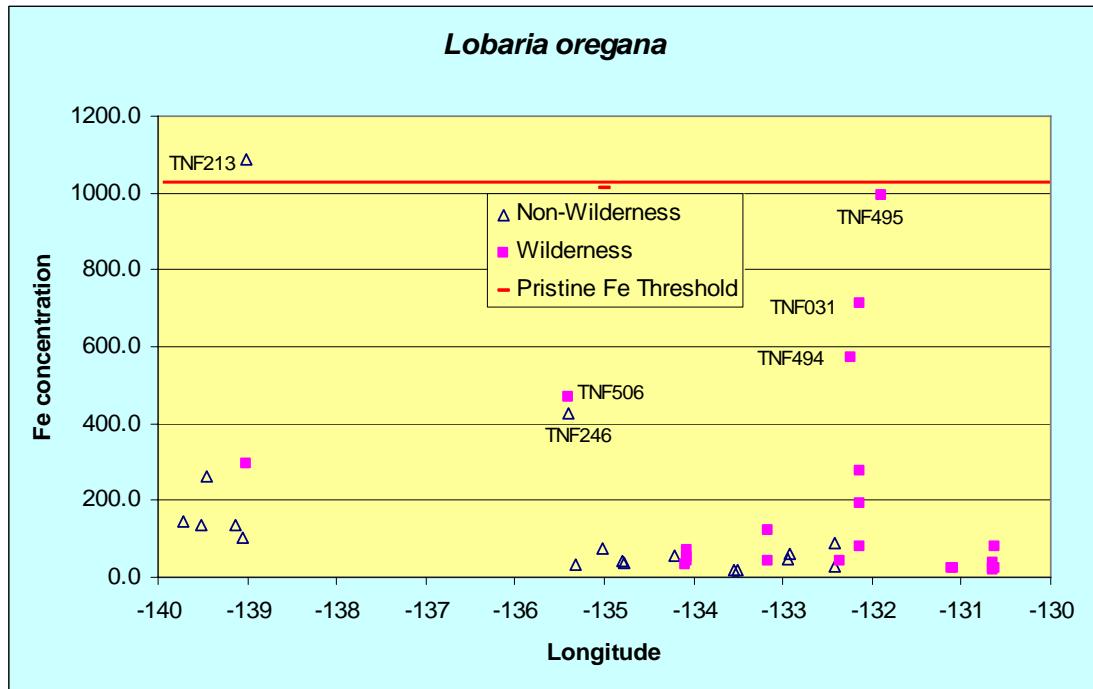


Figure XVI-18. Wilderness and Non-Wilderness plot means of Fe ppm in *Lobaria oregana* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Fe ppm

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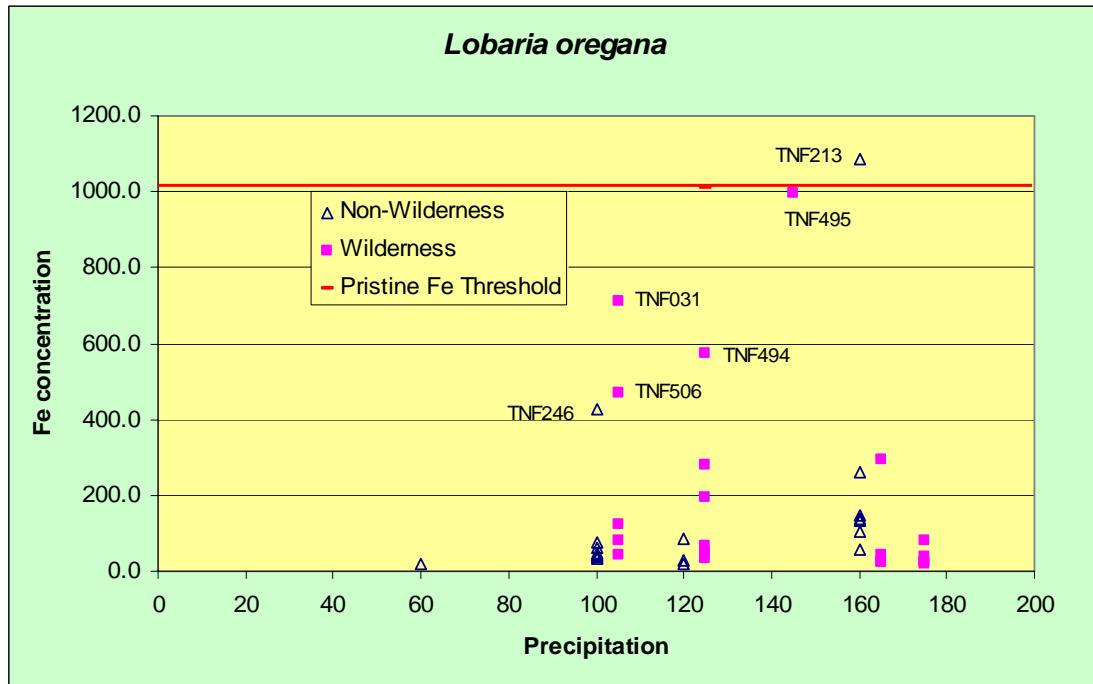


Figure XVI-19. Wilderness and Non-Wilderness plot means of Fe ppm in *Lobaria oregana* vs. plot Precipitation.

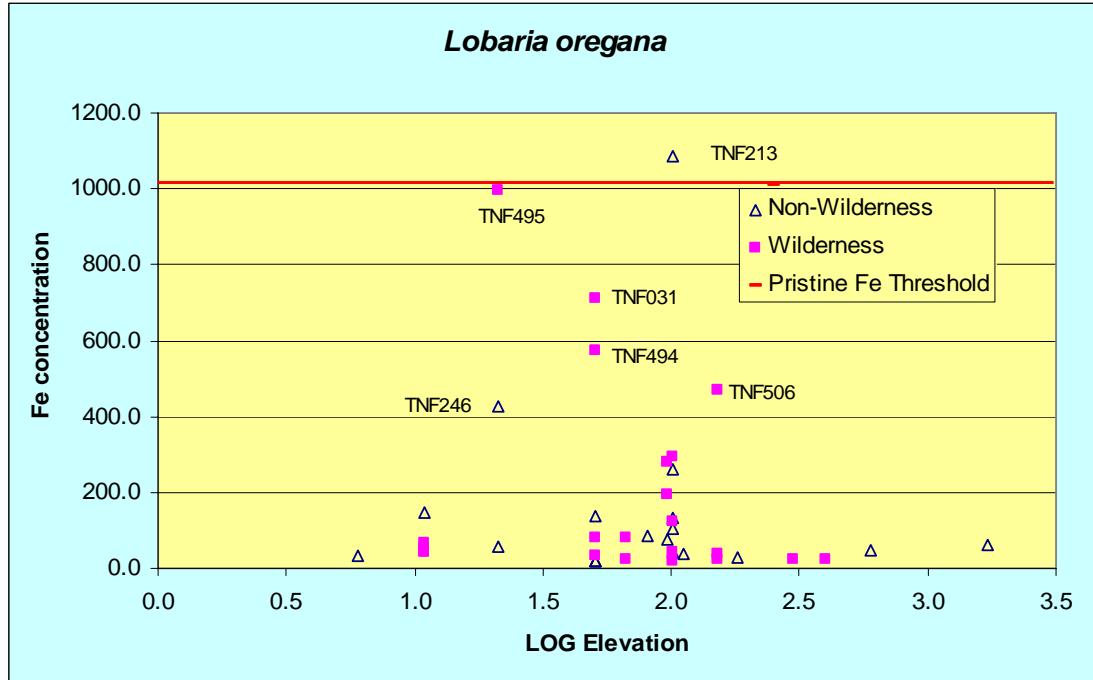


Figure XVI-20. Wilderness and Non-Wilderness plot means of Fe ppm in *Lobaria oregana* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Fe ppm

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Platismatia glauca

Table XVI-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Fe ppm content of *Platismatia glauca* per year.

Fe ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2003	Wilderness	248.94	NA	NA	NA
2004	Wilderness	620.58	152.9757	274.5240	966.6342
2005	Non-Wilderness	1937.93	542.1553	711.4864	3164.3673
2005	Wilderness	764.37	251.0329	170.7707	1357.9677

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Fe ppm

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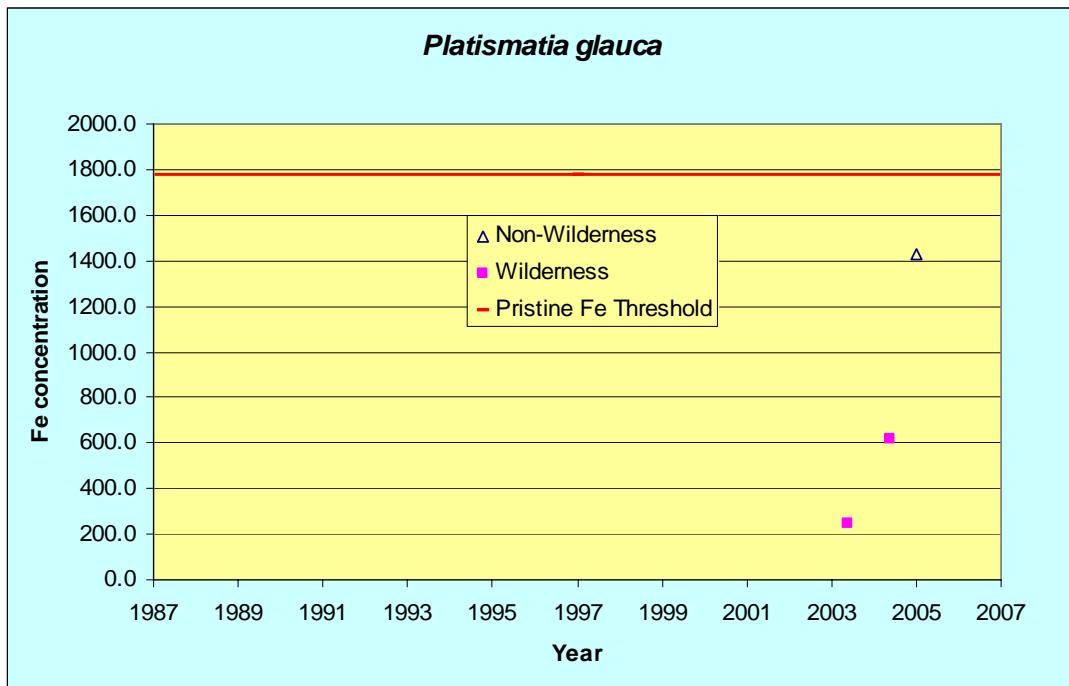


Figure XVI-21. Wilderness and Non-Wilderness yearly means of Fe ppm in *Platismatia glauca* per year.

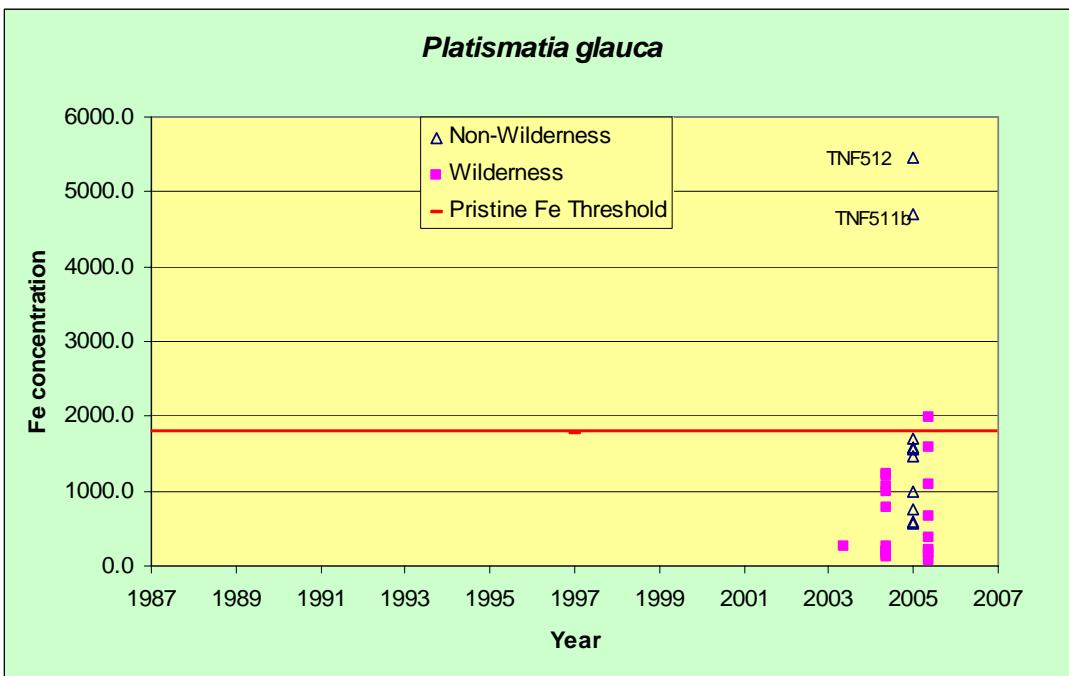


Figure XVI-22. Wilderness and Non-Wilderness plot means of Fe ppm in *Platismatia glauca* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Fe ppm

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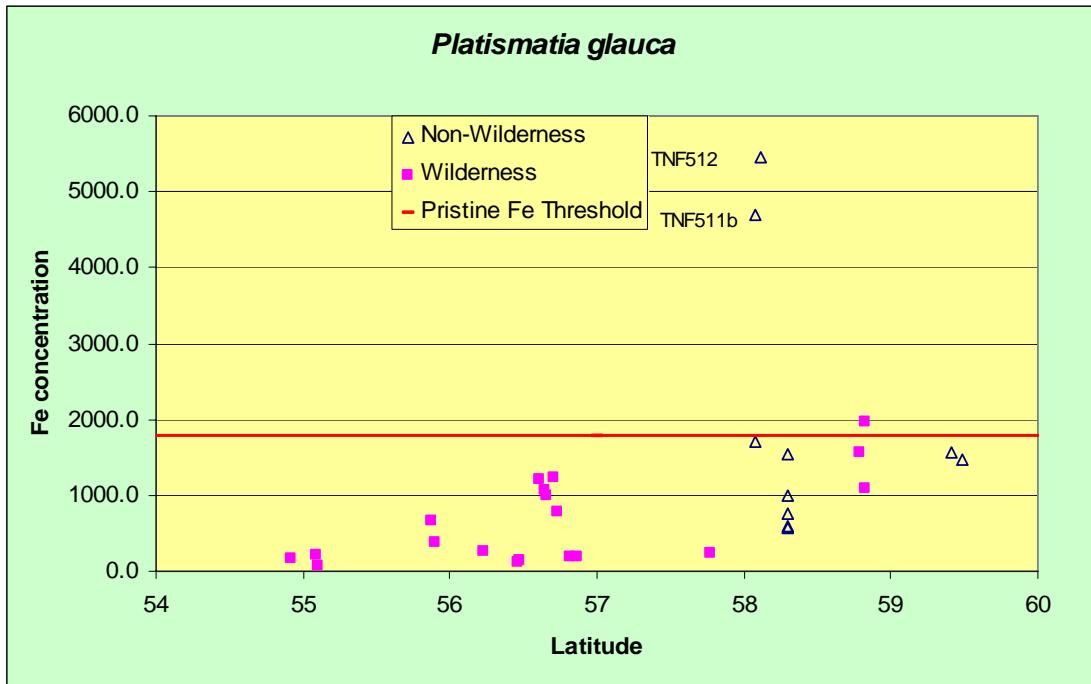


Figure XVI-23. Wilderness and Non-Wilderness plot means of Fe ppm in *Platismatia glauca* vs. plot Latitude.

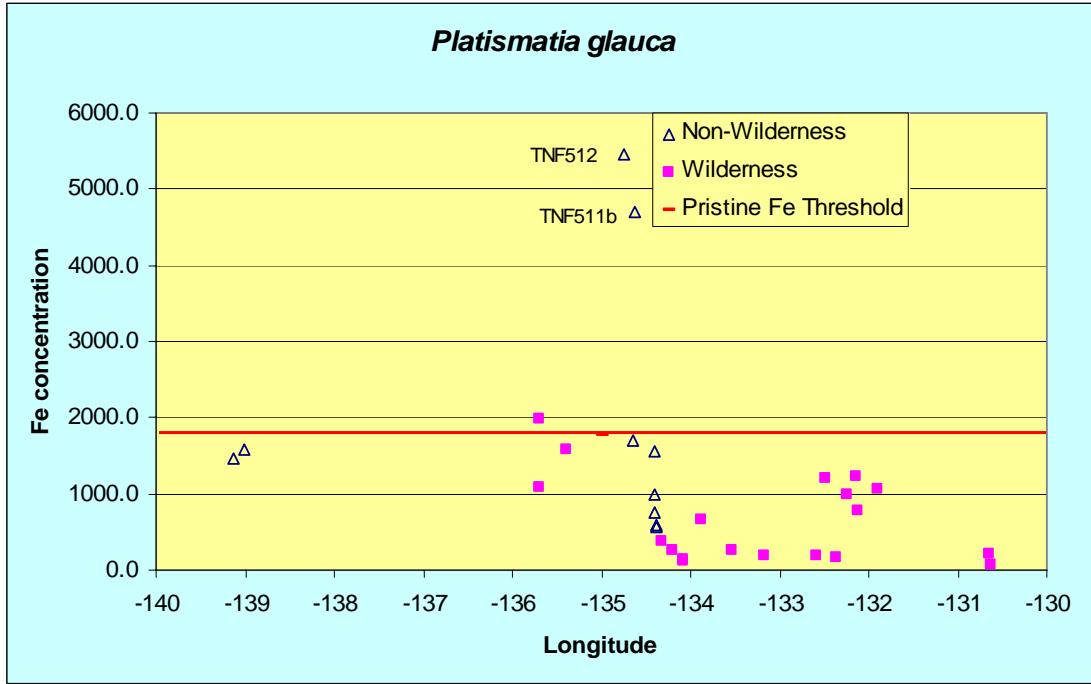


Figure XVI-24. Wilderness and Non-Wilderness plot means of Fe ppm in *Platismatia glauca* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Fe ppm

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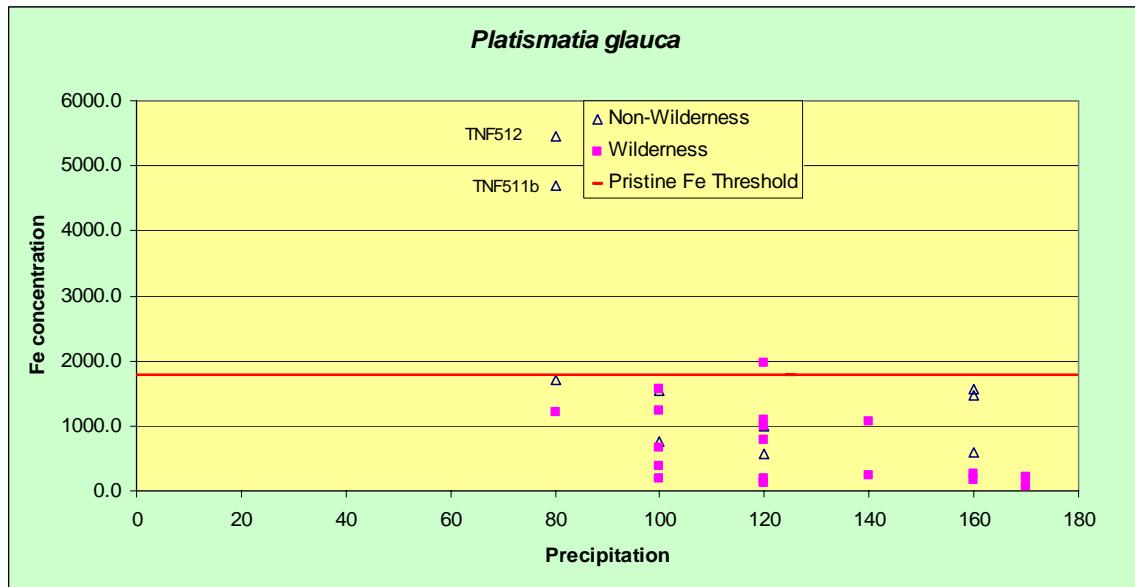


Figure XVI-25. Wilderness and Non-Wilderness plot means of Fe ppm in *Platismatia glauca* vs. plot Precipitation.

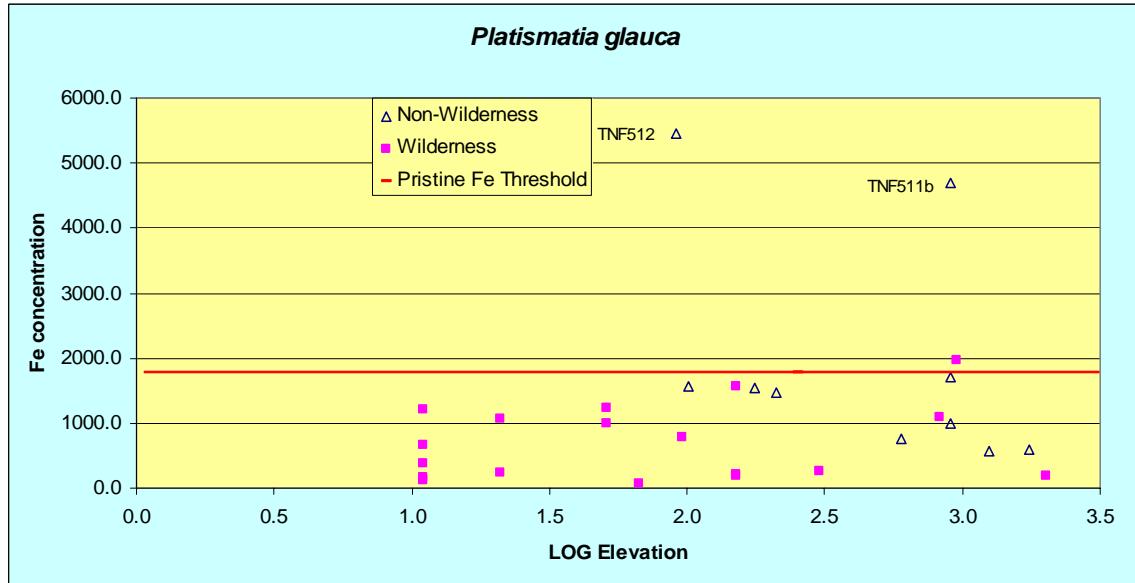


Figure XVI-26. Wilderness and Non-Wilderness plot means of Fe ppm in *Platismatia glauca* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

K ppm

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XVII. SUMMARY OF K PPM DATA ANALYSIS

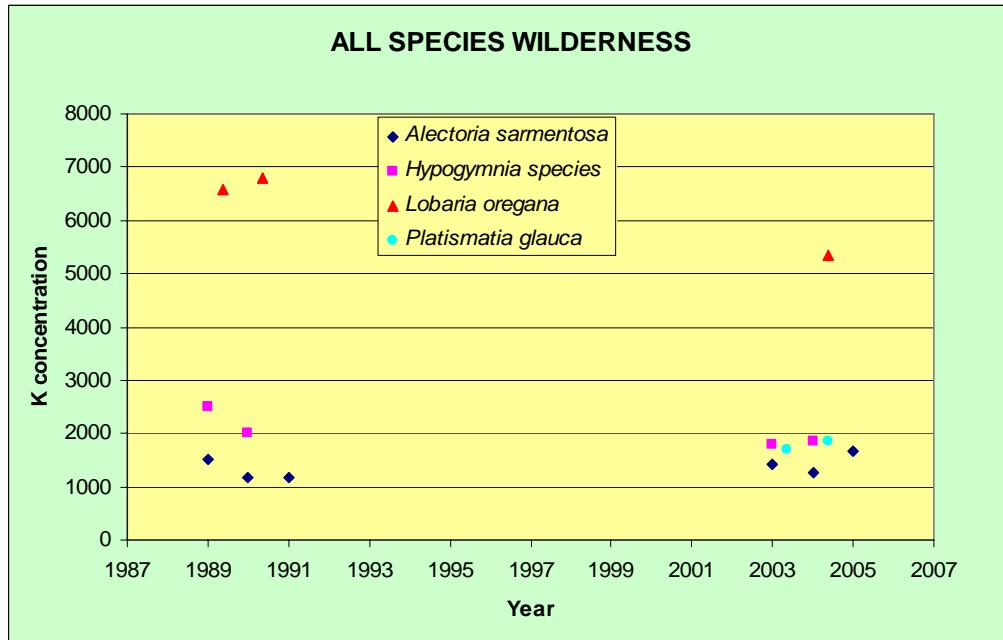


Figure XVII-27. Wilderness plot means of K ppm
in *All Species* per year.

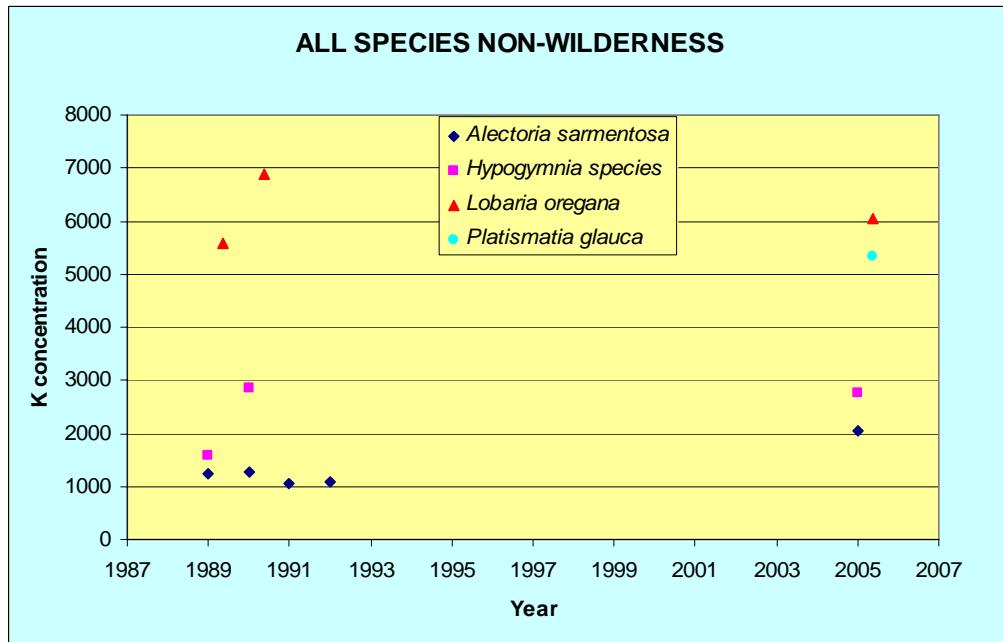


Figure XVII-28. Non-Wilderness plot means of K ppm
in *All Species* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

K ppm

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Alectoria sarmentosa

Summary Statistics:

Table XVII-2. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the K ppm content of *Alectoria sarmentosa* per year.

K ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	1255.68	65.1090	1074.9084	1436.4516
1989	Wilderness	1511.59	73.2470	1323.3010	1699.8760
1990	Non-Wilderness	1270.42	92.2713	1080.7533	1460.0862
1990	Wilderness	1171.00	131.7895	848.5190	1493.4734
1991	Non-Wilderness	1062.9554	21.8562	1017.0372	1108.8737
1991	Wilderness	1176.68	47.3177	1045.3063	1308.0564
1992	Non-Wilderness	1087.78	53.8311	960.4870	1215.0678
2003	Wilderness	1414.02	315.6833	2597.1204	5425.1537
2004	Wilderness	1278.47	216.0594	831.5146	1725.4203
2005	Non-Wilderness	2033.56	256.7456	1373.5769	2693.5481
2005	Wilderness	1683.25	173.8661	1289.9370	2076.5620

Summary of Statistical Tests:

$$t = -0.9586, df = 8, p\text{-value} = 0.3658$$

There is no evidence of a difference in K ppm content in *Alectoria sarmentosa* from pre-2000 and post 2000 samples (p-value = 0.3658).

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

K ppm

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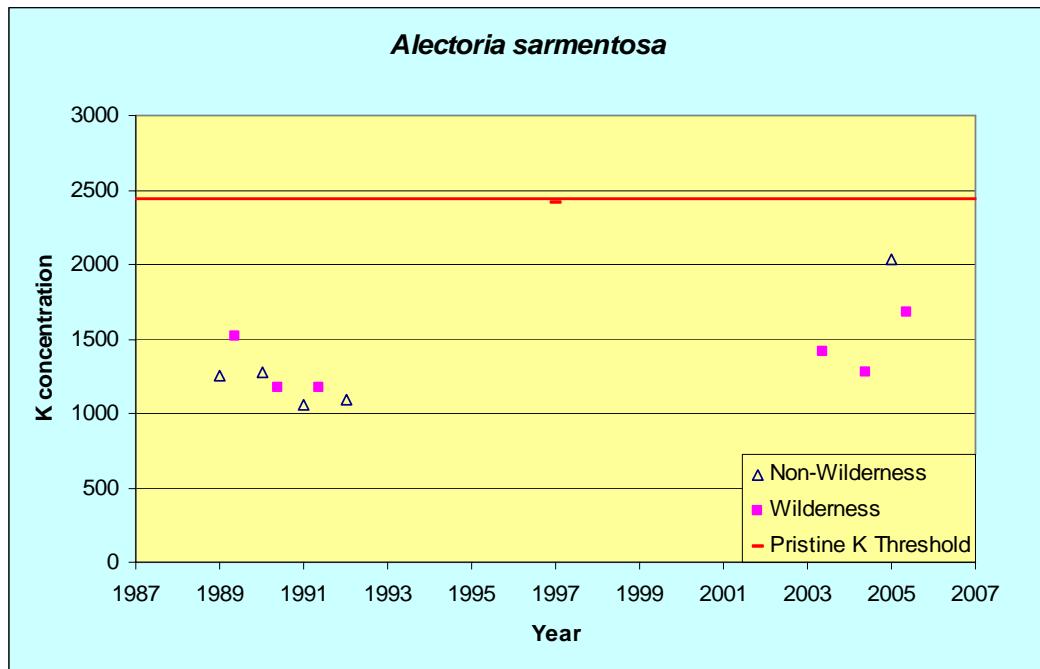


Figure XVII-3. Wilderness and Non-Wilderness yearly means of K ppm in *Alectoria sarmentosa* per year.

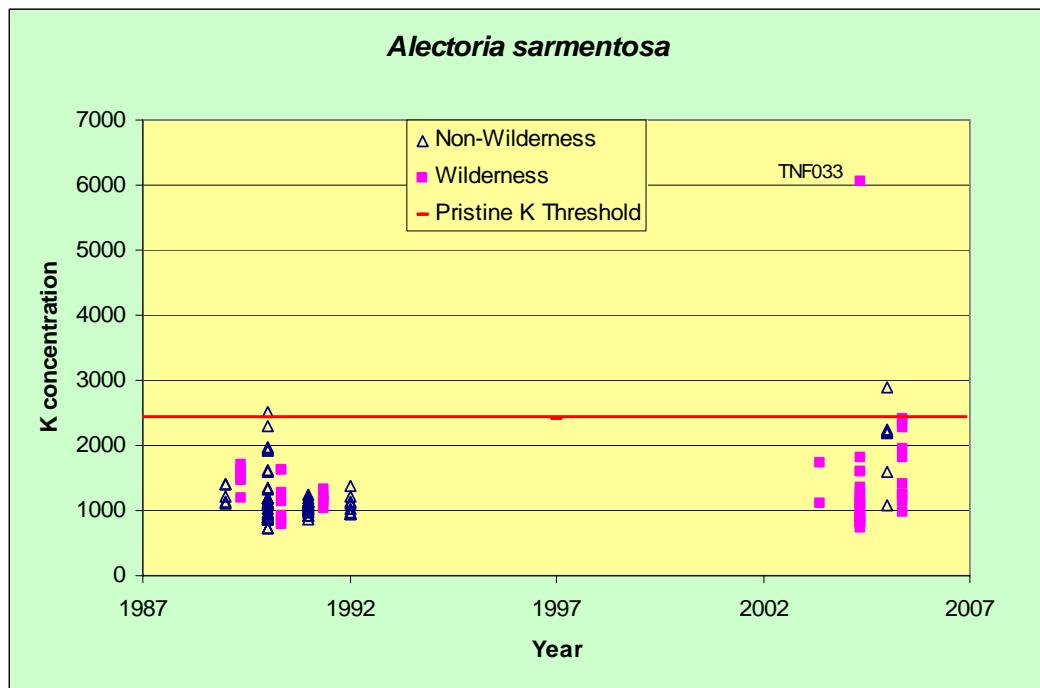


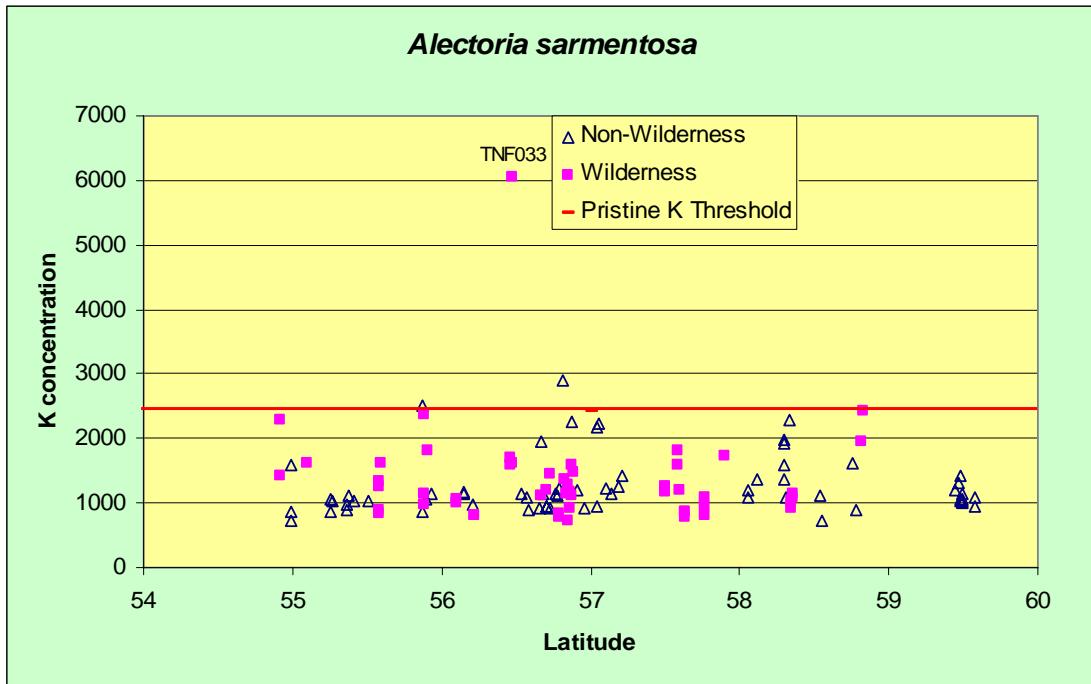
Figure XVII-4. Wilderness and Non-Wilderness plot means of K ppm in *Alectoria sarmentosa* per year.

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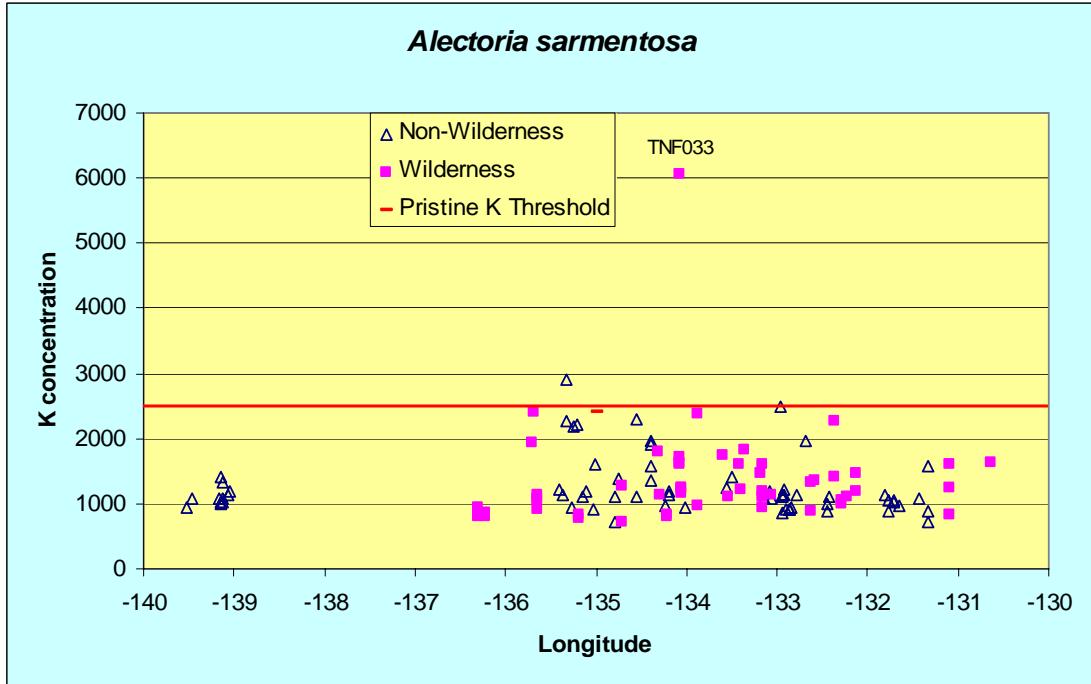
ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

K ppm

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**Figure XVII-5. Wilderness and Non-Wilderness plot means of K ppm
in *Alectoria sarmentosa* vs. plot Latitude.**



**Figure XVII-6. Wilderness and Non-Wilderness plot means of K ppm
in *Alectoria sarmentosa* vs. plot Longitude.**

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

K ppm

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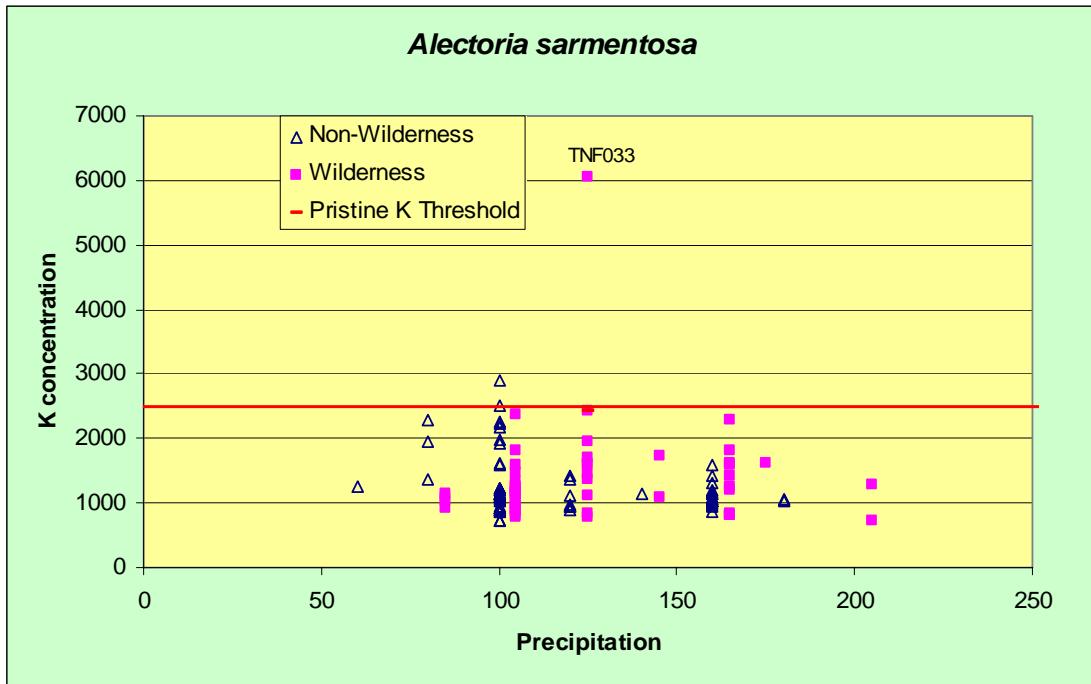


Figure XVII-7. Wilderness and Non-Wilderness plot means of K ppm in *Alectoria sarmentosa* vs. plot Precipitation.

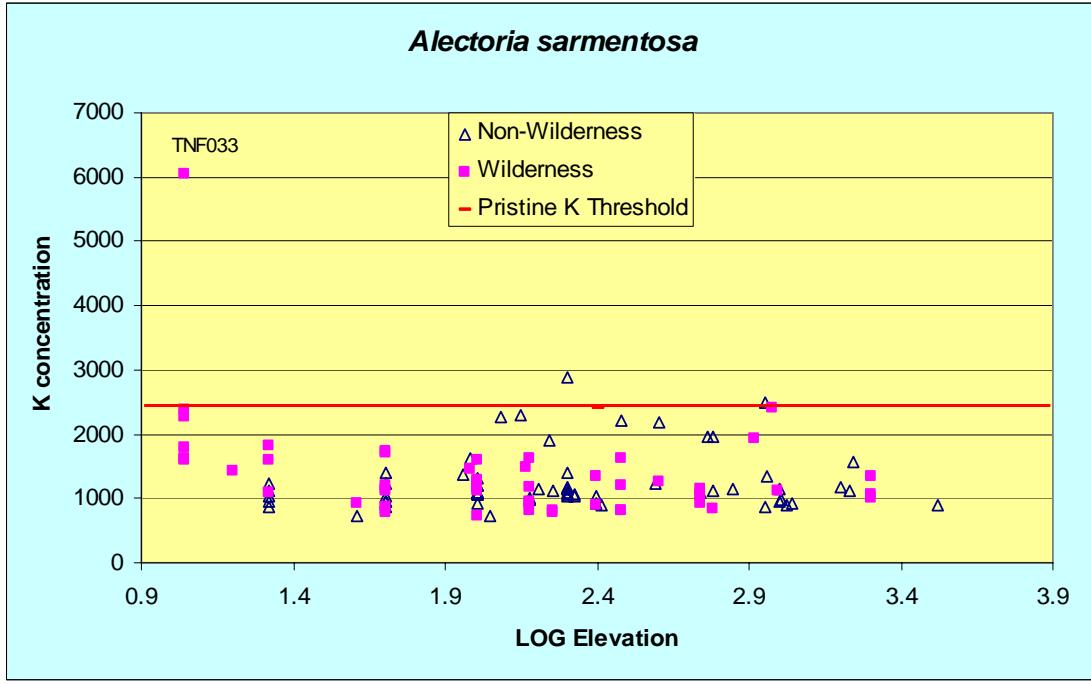


Figure XVII-8. Wilderness and Non-Wilderness plot means of K ppm in *Alectoria sarmentosa* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

K ppm

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Hypogymnia species

In this series, all of the *Hypogymnia* species were included as a group.

Table XVII-3. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the K ppm content of *Hypogymnia species* per year.

K ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	1592.00	234.0000	1381.2520	4565.2520
1989	Wilderness	2494.68	181.2406	1991.4787	2997.8879
1990	Non-Wilderness	2844.27	211.9626	2398.9549	3289.5889
1990	Wilderness	2004.57	206.6696	1498.8691	2510.2738
2003	Wilderness	1796.55	NA	NA	NA
2004	Wilderness	1867.89	73.4462	1679.0935	2056.6926
2005	Non-Wilderness	2773.52	507.6070	589.4602	4957.5732
2005	Wilderness	2566.66	125.3818	2277.5301	2855.7922

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

K ppm

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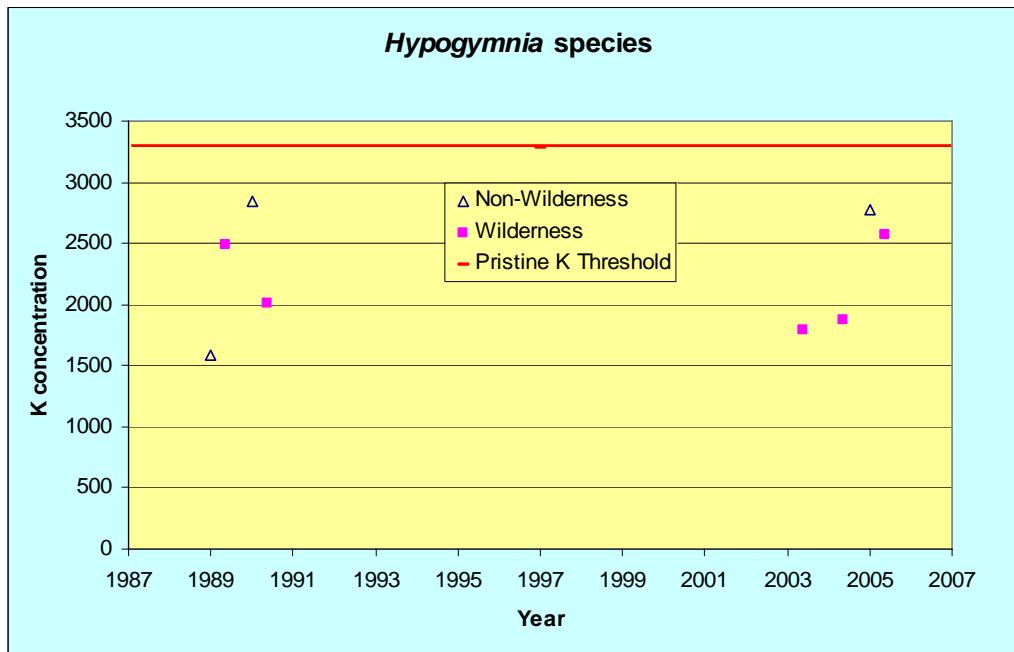


Figure XVII-9. Wilderness and Non-Wilderness yearly means of K ppm in *Hypogymnia* species per year.

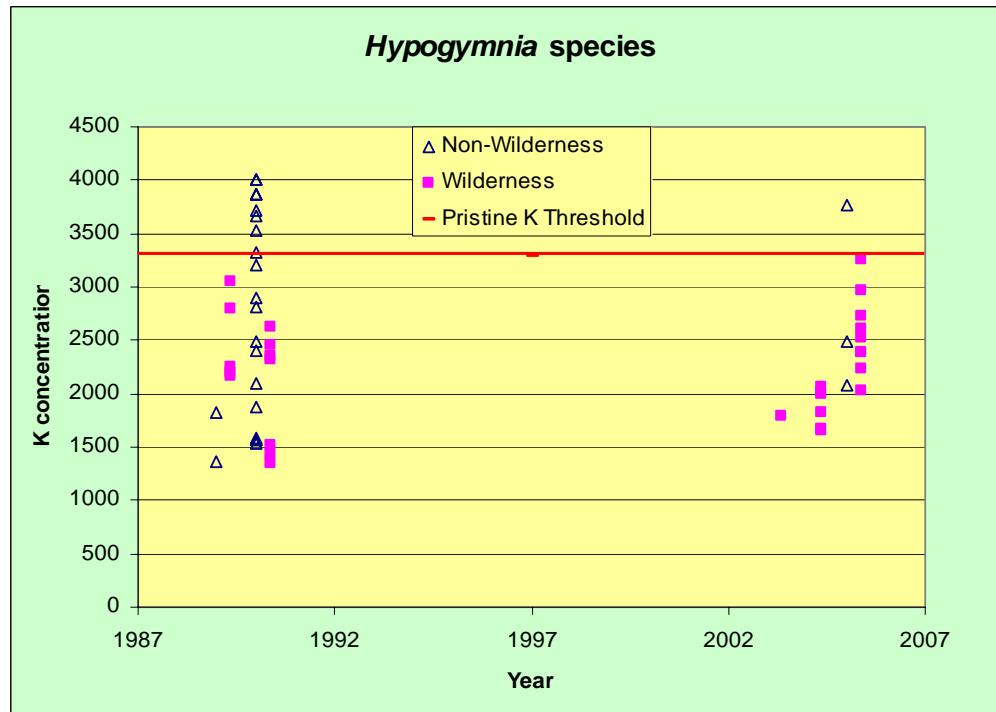


Figure XVII-10. Wilderness and Non-Wilderness plot means of K ppm in *Hypogymnia* species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

K ppm

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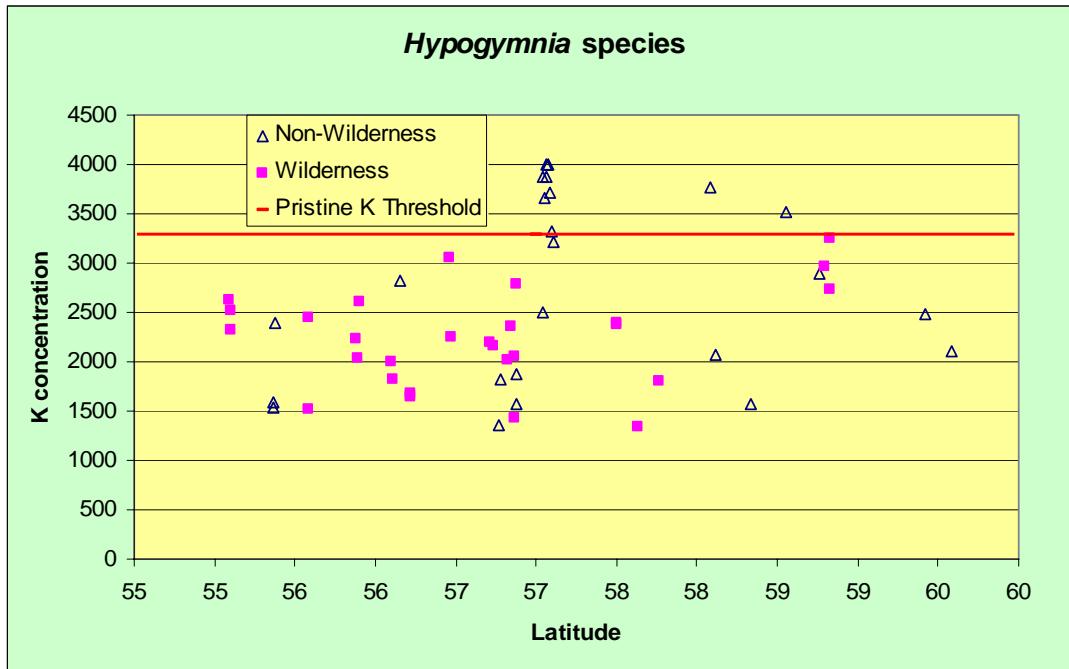


Figure XVII-11. Wilderness and Non-Wilderness plot means of K ppm in *Hypogymnia species* vs. plot Latitude.

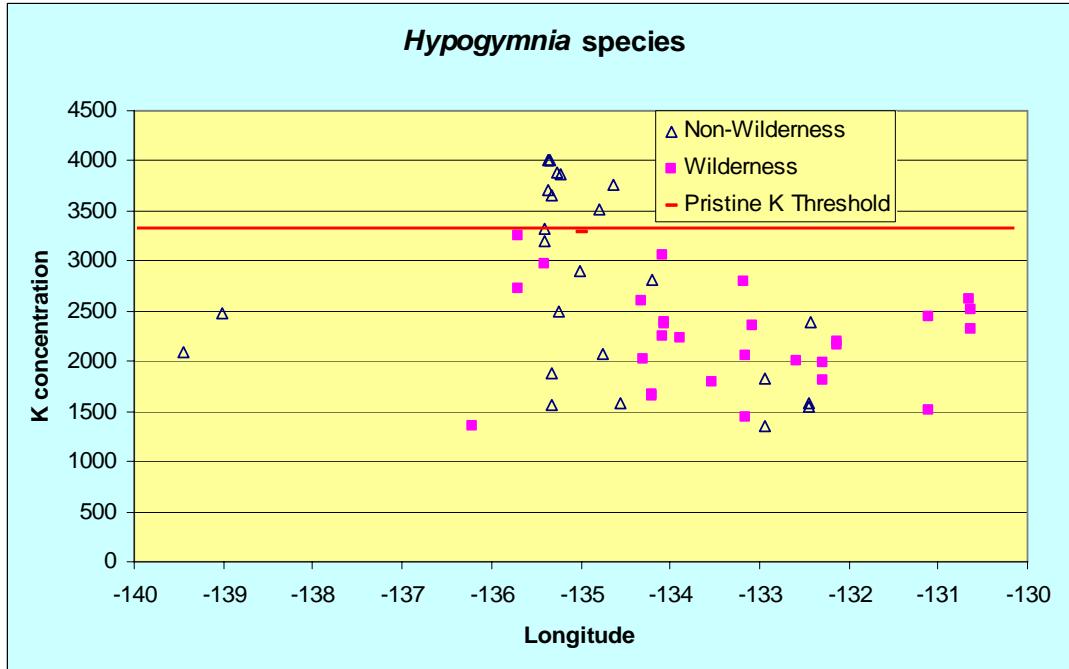


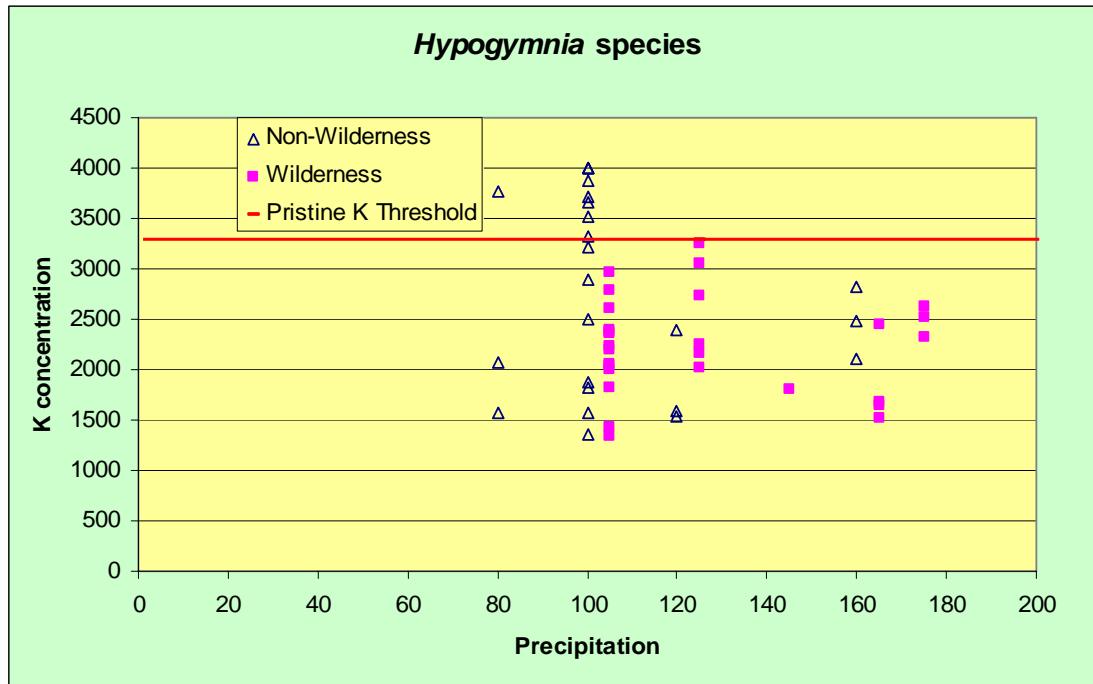
Figure XVII-12. Wilderness and Non-Wilderness plot means of K ppm in *Hypogymnia species* vs. plot Longitude.

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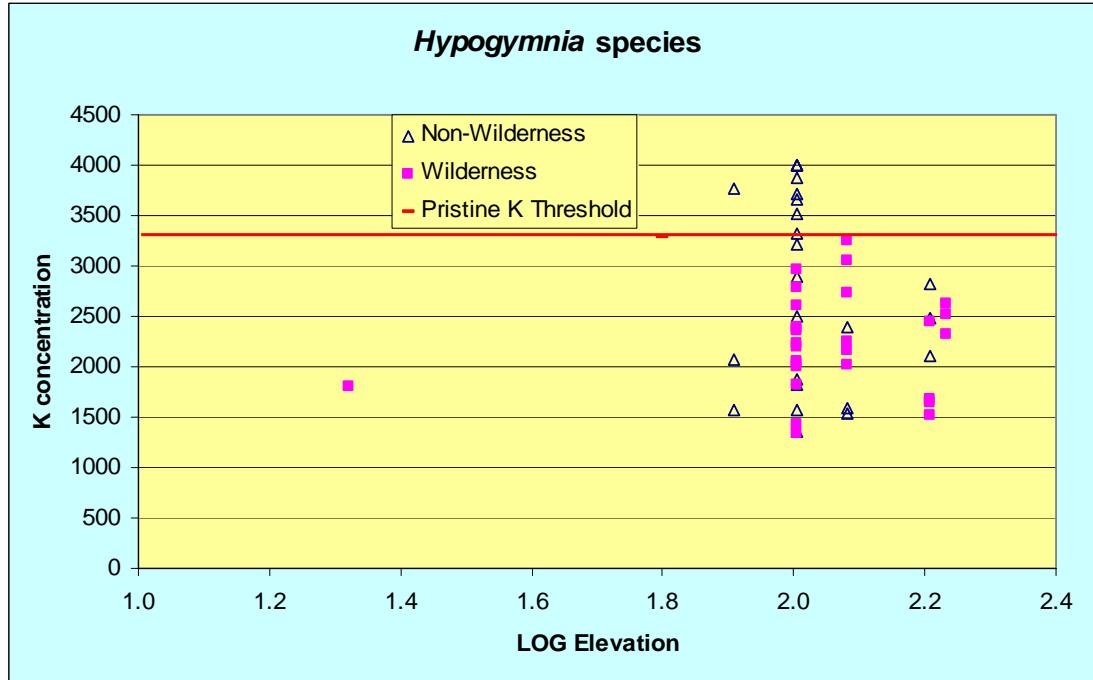
ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

K ppm

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**Figure XVII-13. Wilderness and Non-Wilderness plot means of K ppm
in *Hypogymnia* species vs. plot Precipitation.**



**Figure XVII-14. Wilderness and Non-Wilderness plot means of K ppm
in *Hypogymnia* species vs. plot Log-Elevation.**

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

K ppm

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Lobaria oregana

Table XVII-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the K ppm content of *Lobaria oregana* per year.

K ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	5585.83	499.2121	3997.1175	7174.5491
1989	Wilderness	6591.09	289.6130	5786.9990	7395.1880
1990	Non-Wilderness	6882.89	258.5972	6319.4562	7446.3258
1990	Wilderness	6804.17	315.5482	5993.0241	7615.3093
2004	Wilderness	5348.35	403.0401	4362.1477	6334.5547
2005	Non-Wilderness	6039.78	NA	NA	NA
2005	Wilderness	7313.54	415.7546	5990.4207	8636.6543

Summary of Statistical Tests:

$$t = 0.2312, \text{ df} = 4, \text{ p-value} = 0.8285$$

There is no evidence of a difference in K ppm content in *Lobaria oregana* from pre-2000 and post 2000 samples (p-value = 0.8285).

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

K ppm

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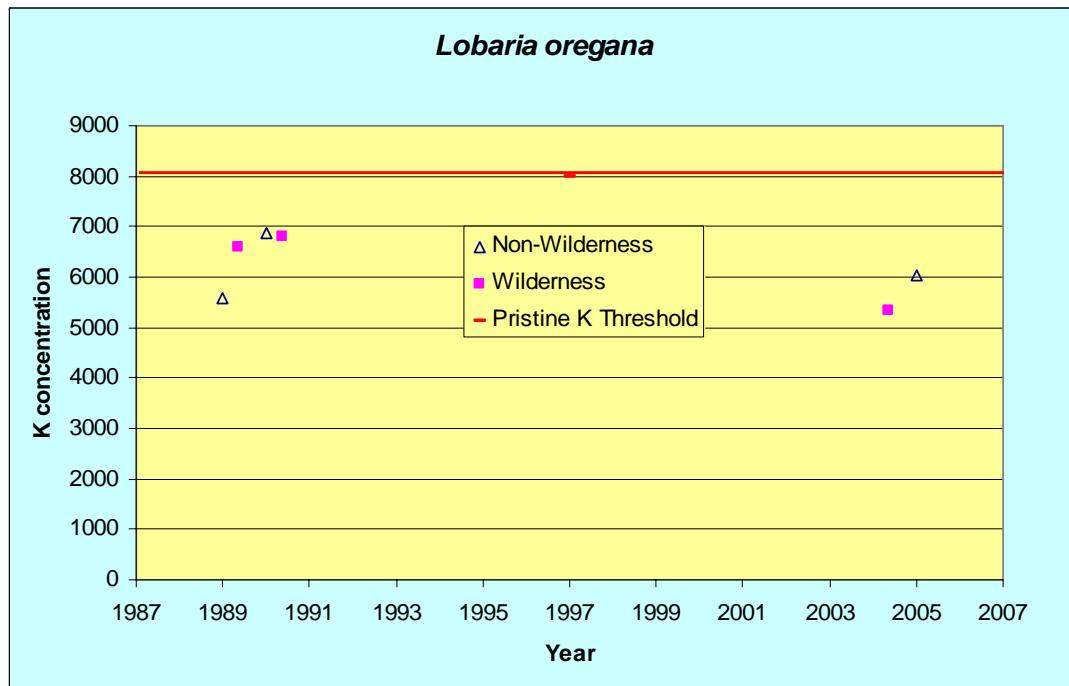


Figure XVII-15. Wilderness and Non-Wilderness yearly means of K ppm in *Lobaria oregana* per year.

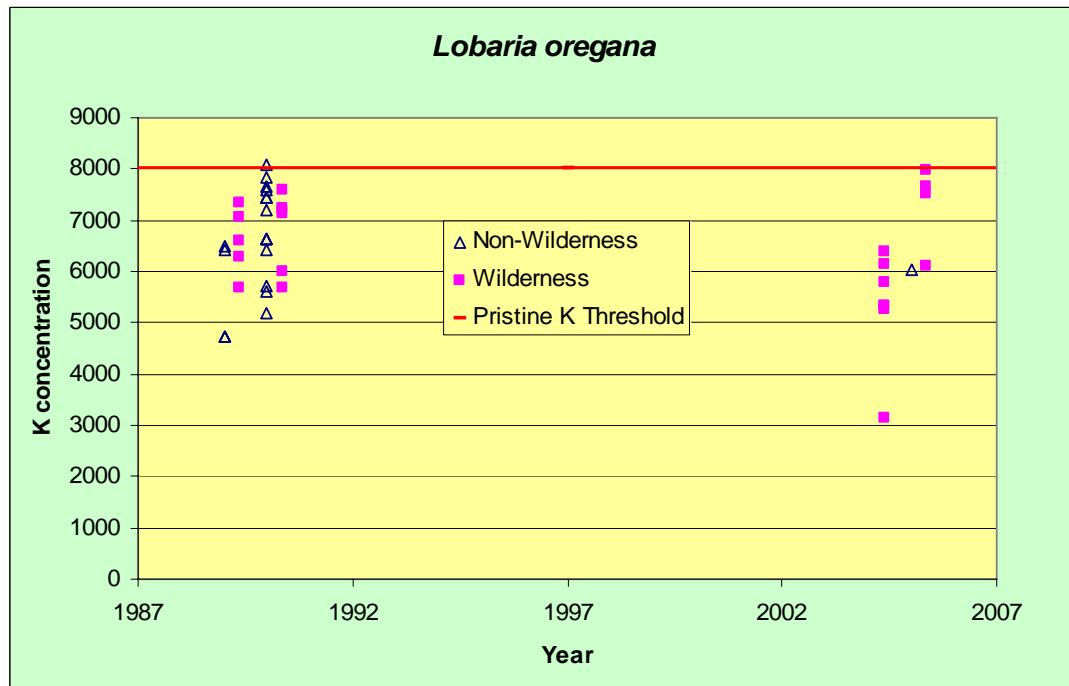


Figure XVII-16. Wilderness and Non-Wilderness plot means of K ppm in *Lobaria oregana* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

K ppm

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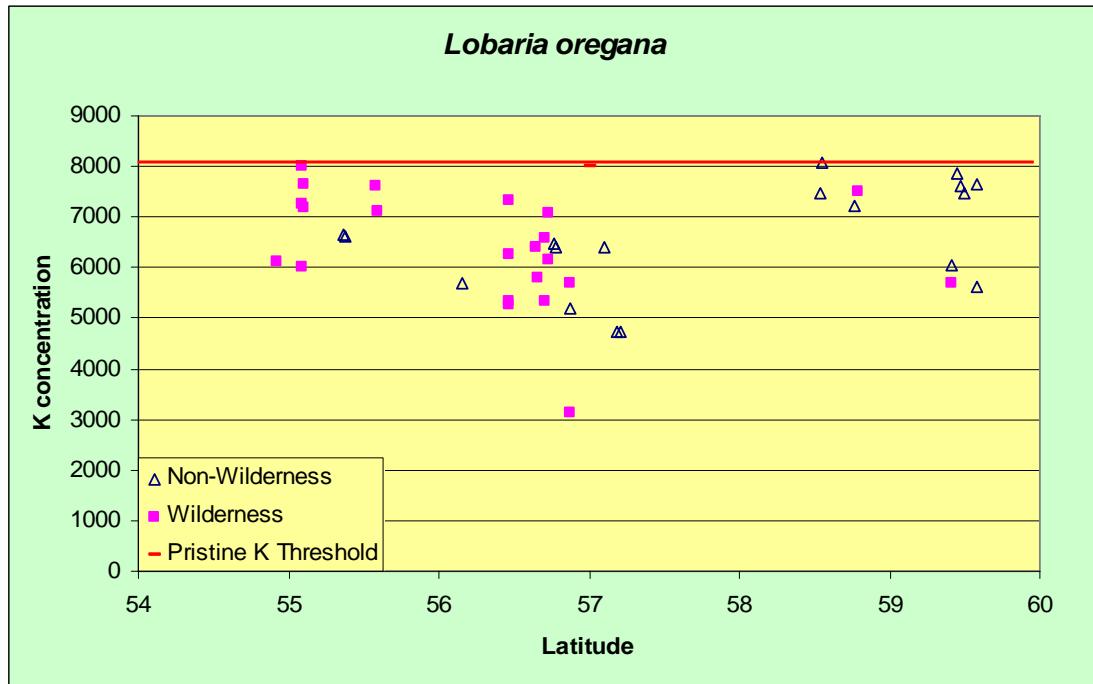


Figure XVII-17. Wilderness and Non-Wilderness plot means of K ppm in *Lobaria oregana* vs. plot Latitude.

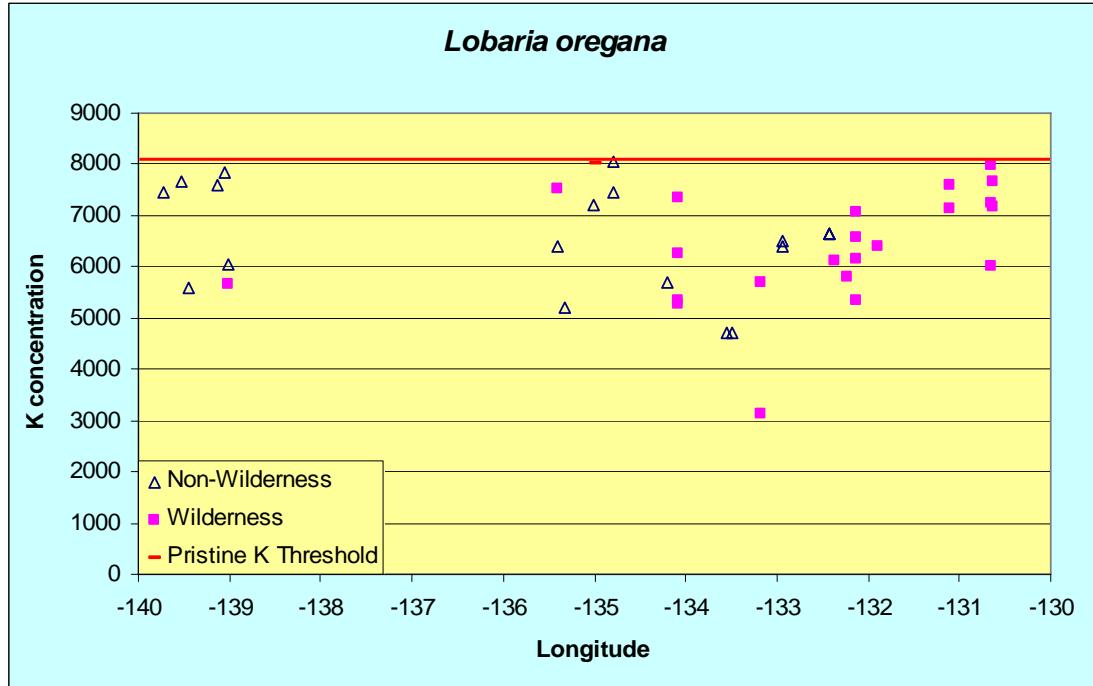


Figure XVII-18. Wilderness and Non-Wilderness plot means of K ppm in *Lobaria oregana* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

K ppm

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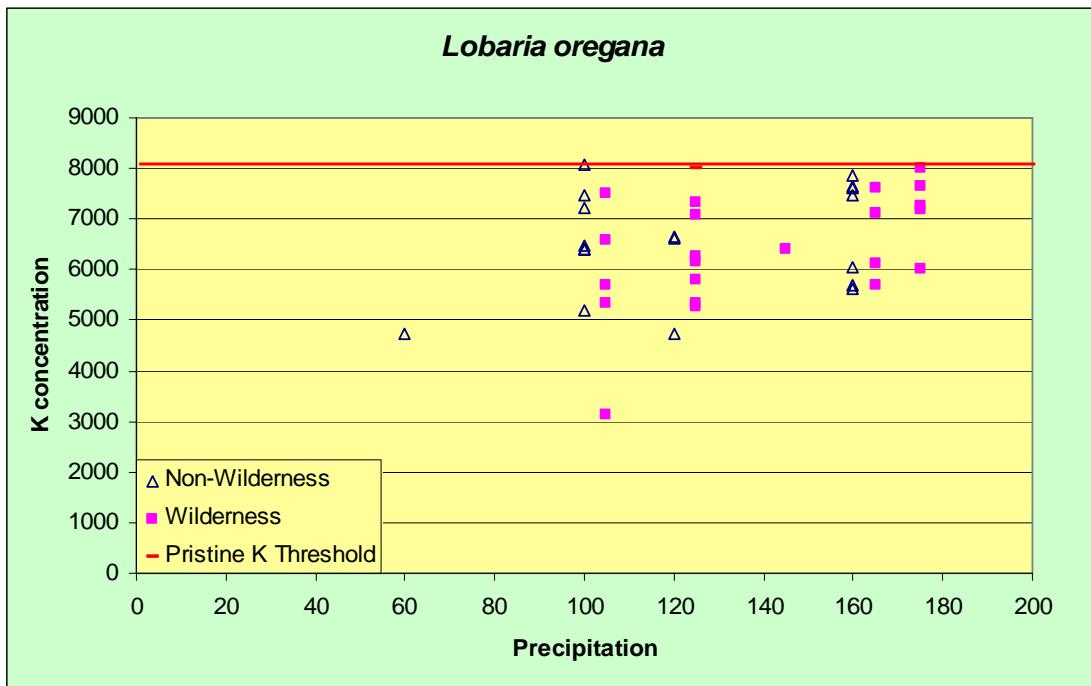


Figure XVII-19. Wilderness and Non-Wilderness plot means of K ppm in *Lobaria oregana* vs. plot Precipitation.

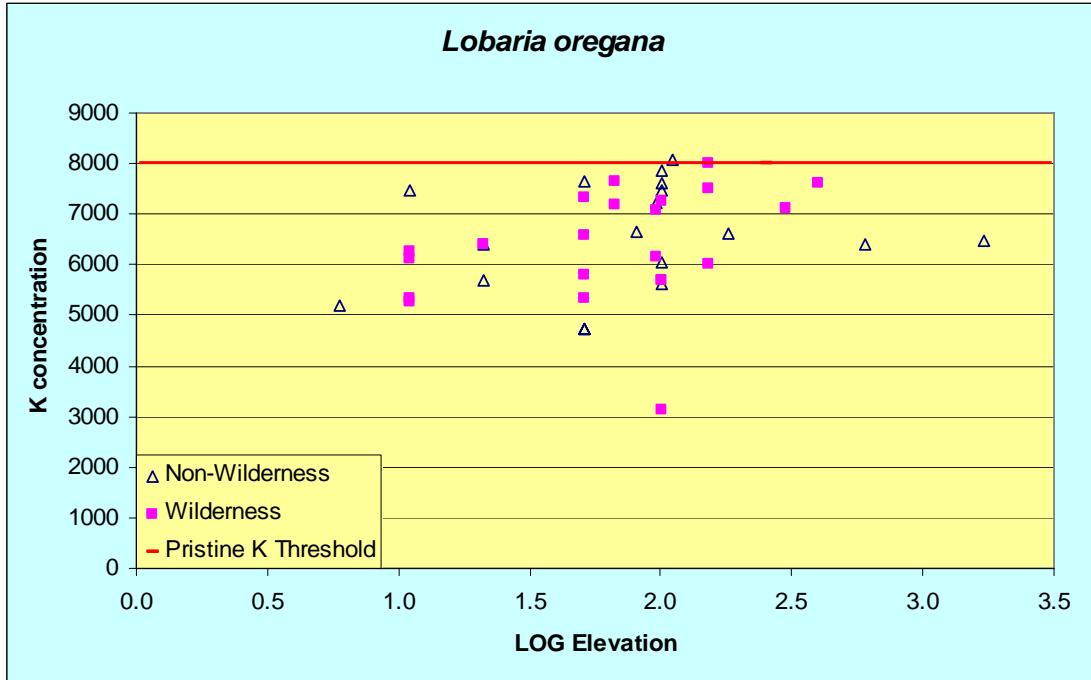


Figure XVII-20. Wilderness and Non-Wilderness plot means of K ppm in *Lobaria oregana* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

K ppm

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Platismatia glauca

Table XVII-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the K ppm content of *Platismatia glauca* per year.

K ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2003	Wilderness	1701.63	NA	NA	NA
2004	Wilderness	1847.07	98.5653	1624.1006	2070.0410
2005	Non-Wilderness	2937.66	283.6815	2295.9287	3579.3930
2005	Wilderness	2246.19	93.7031	2024.6150	2467.7600

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

K ppm

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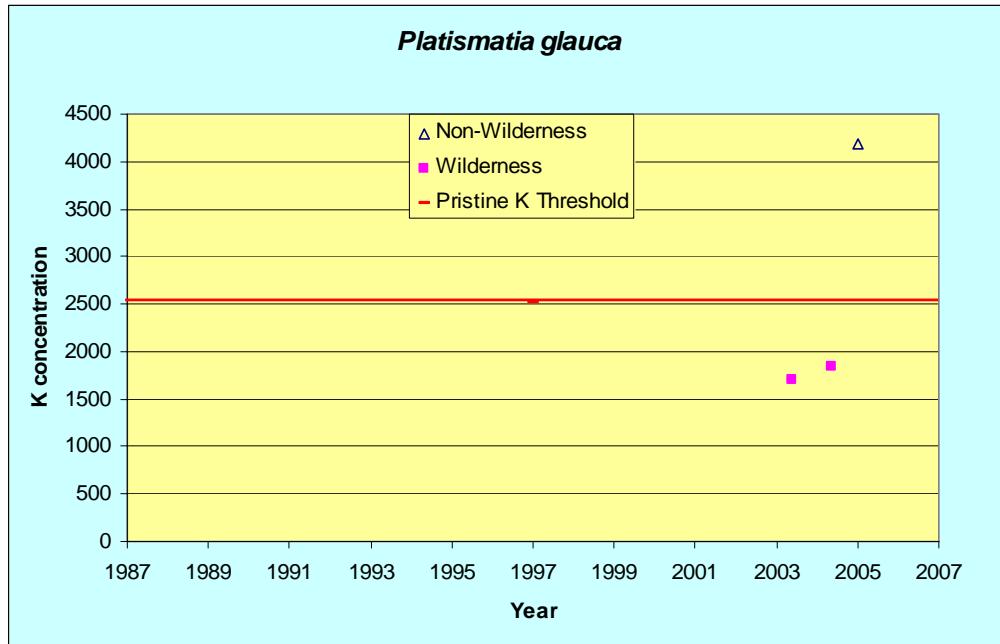


Figure XVII-21. Wilderness and Non-Wilderness yearly means of K ppm in *Platismatia glauca* per year.

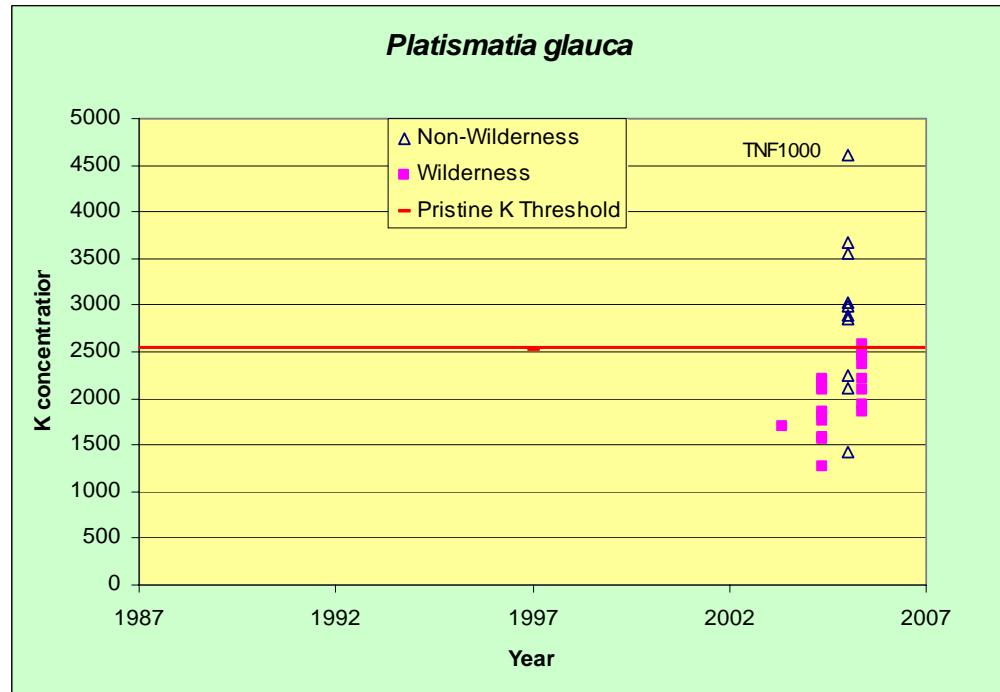


Figure XVII-22. Wilderness and Non-Wilderness plot means of K ppm in *Platismatia glauca* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

K ppm

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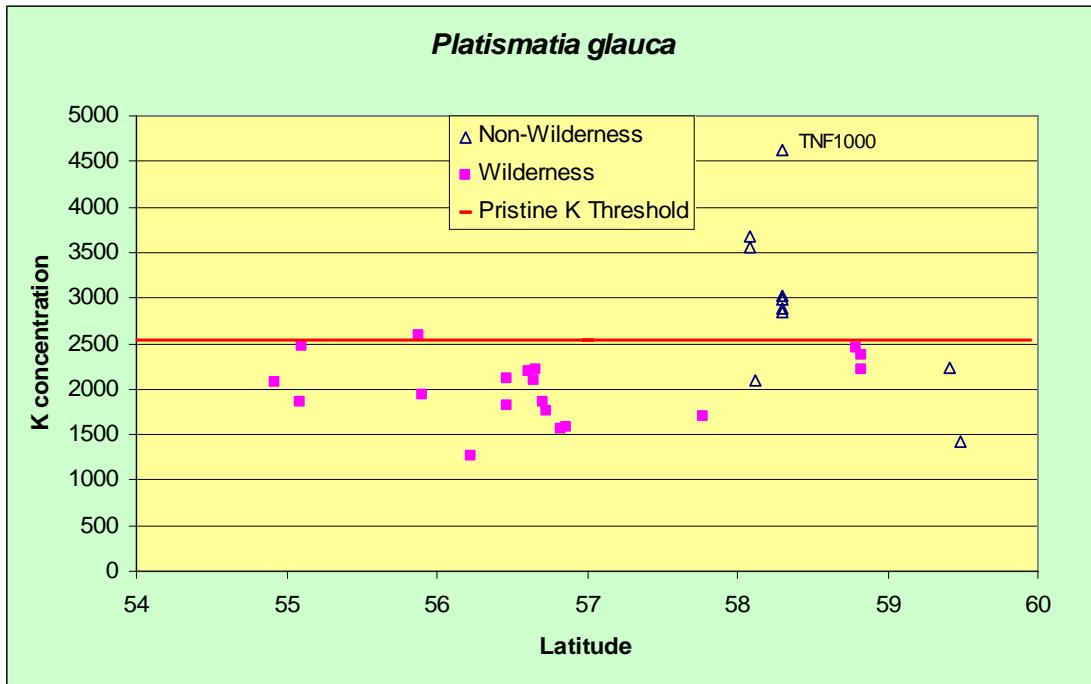


Figure XVII-23. Wilderness and Non-Wilderness plot means of K ppm in *Platismatia glauca* vs. plot Latitude.

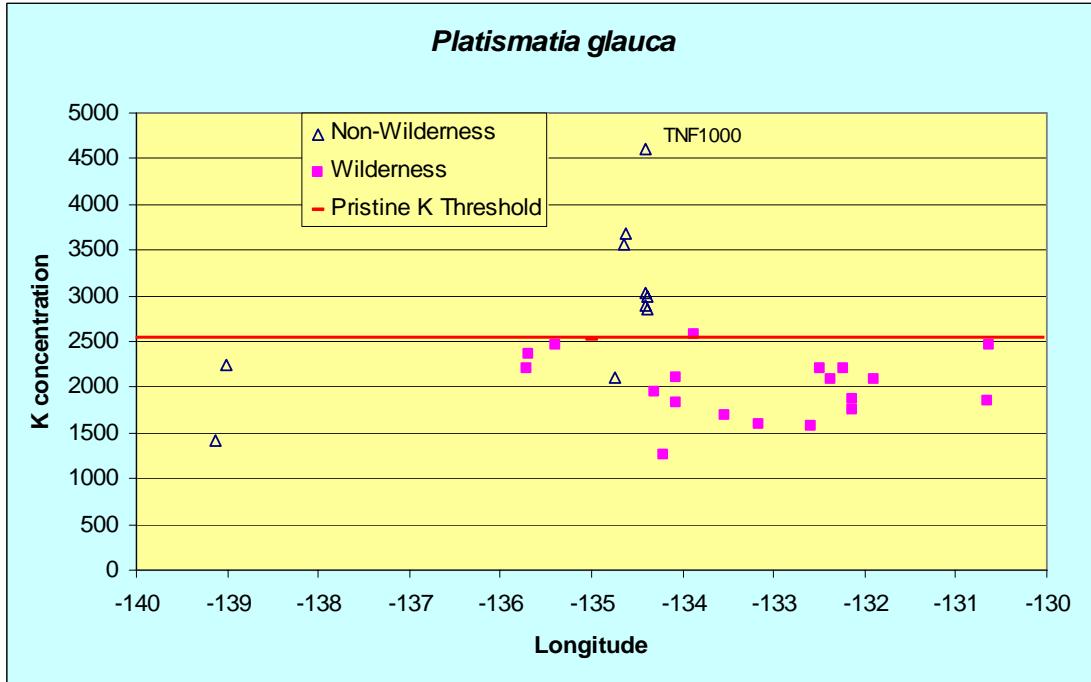


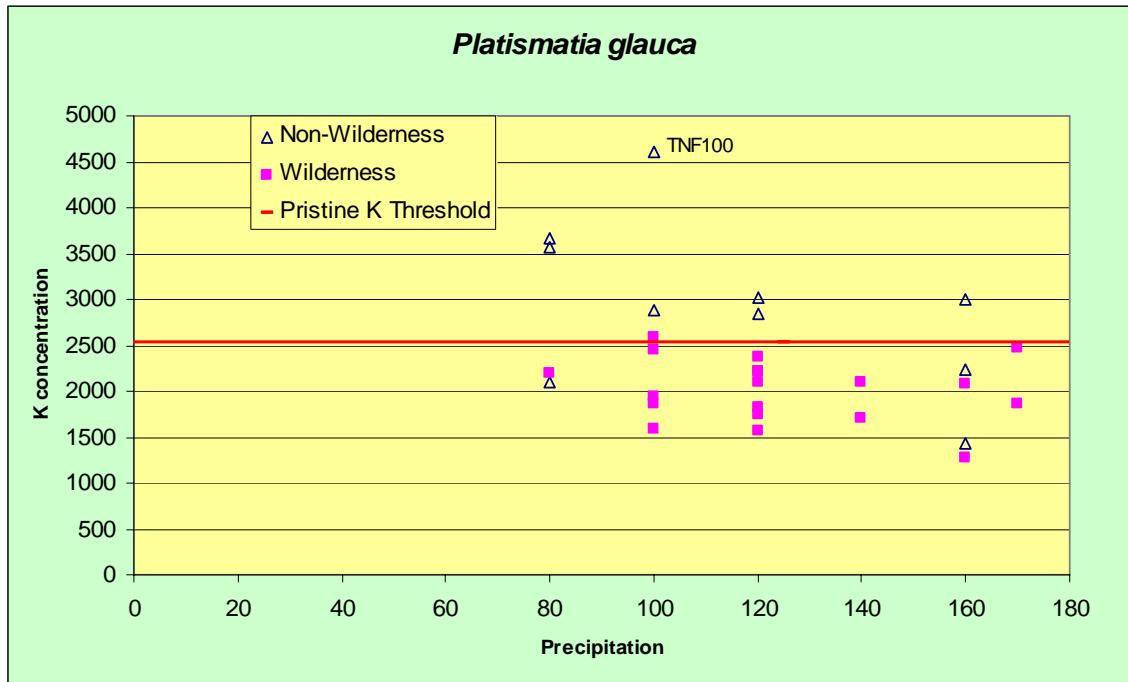
Figure XVII-24. Wilderness and Non-Wilderness plot means of K ppm in *Platismatia glauca* vs. plot Longitude.

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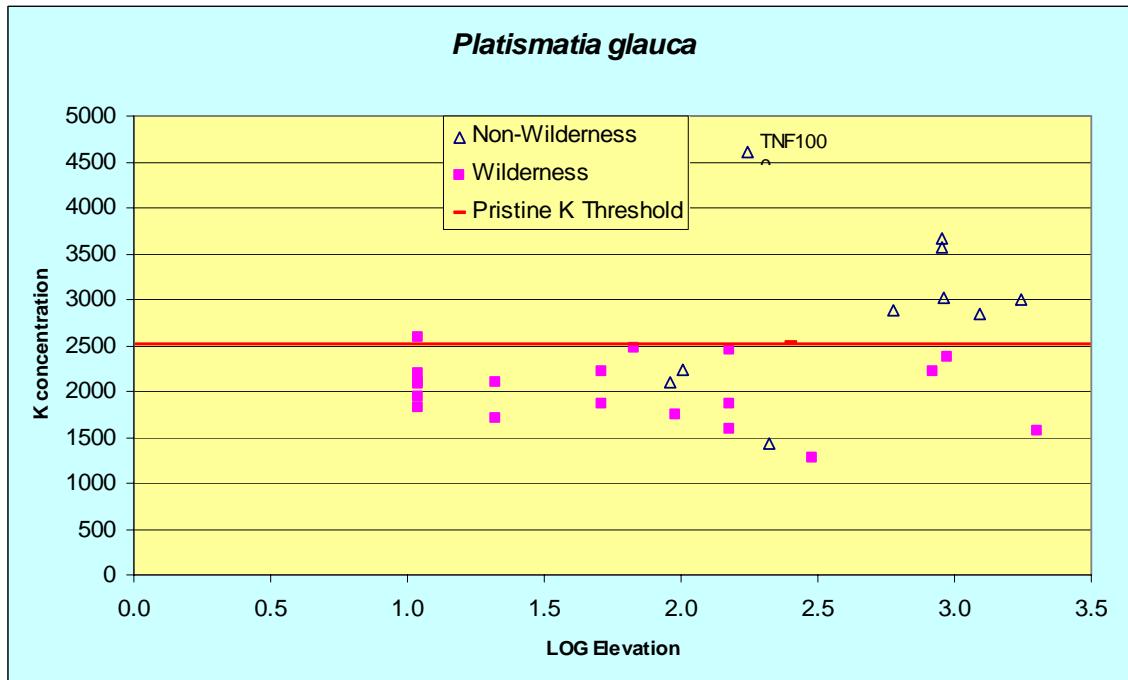
ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

K ppm

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**Figure XVII-25. Wilderness and Non-Wilderness plot means of K ppm
in *Platismatia glauca* vs. plot Precipitation.**



**Figure XVII-26. Wilderness and Non-Wilderness plot means of K ppm
in *Platismatia glauca* vs. plot Log-Elevation.**

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Li ppm

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XVIII. SUMMARY OF Li PPM DATA ANALYSIS

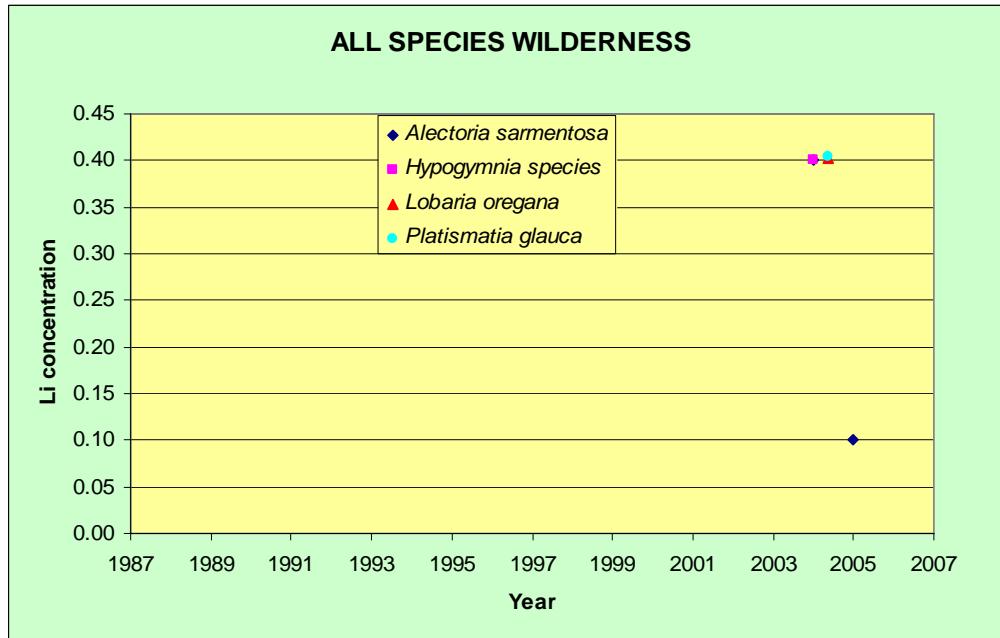


Figure XVIII-27. Wilderness plot means of Li ppm in *All Species* per year.

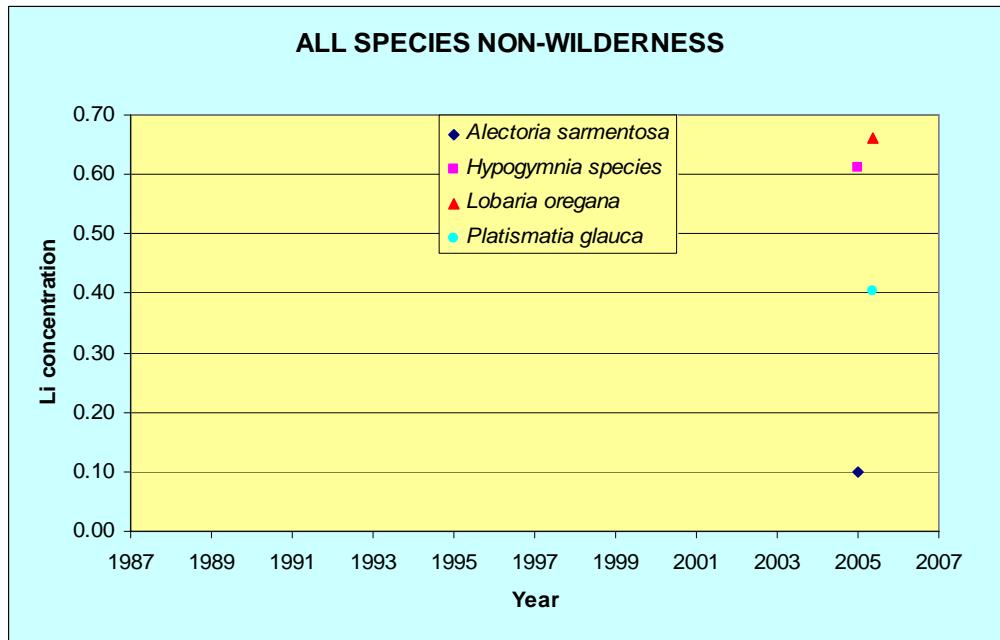


Figure XVIII-28. Non-Wilderness plot means of Li ppm in *All Species* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Li ppm

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Alectoria sarmentosa

Summary Statistics:

Table XVIII-2. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Li ppm content of *Alectoria sarmentosa* per year.

Li ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	0.40	0.0000	0.4000	0.4000
2005	Non-Wilderness	0.10	0.0000	0.1000	0.1000
2005	Wilderness	0.10	0.0000	0.1000	0.1000

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Li ppm

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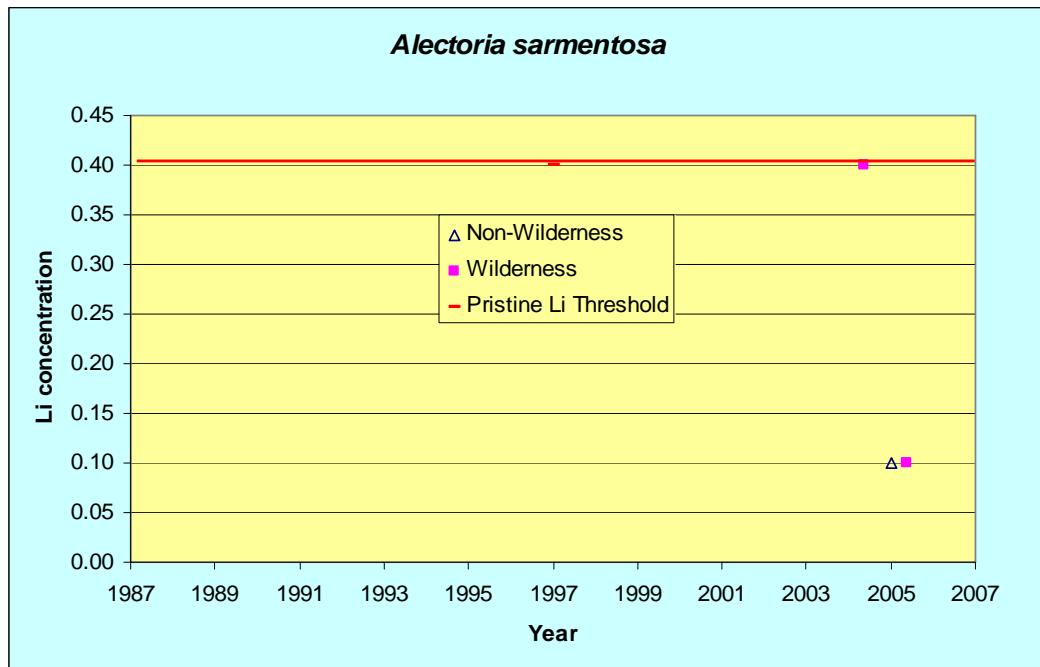


Figure XVIII-3. Wilderness and Non-Wilderness yearly means of Li ppm in *Alectoria sarmentosa* per year.

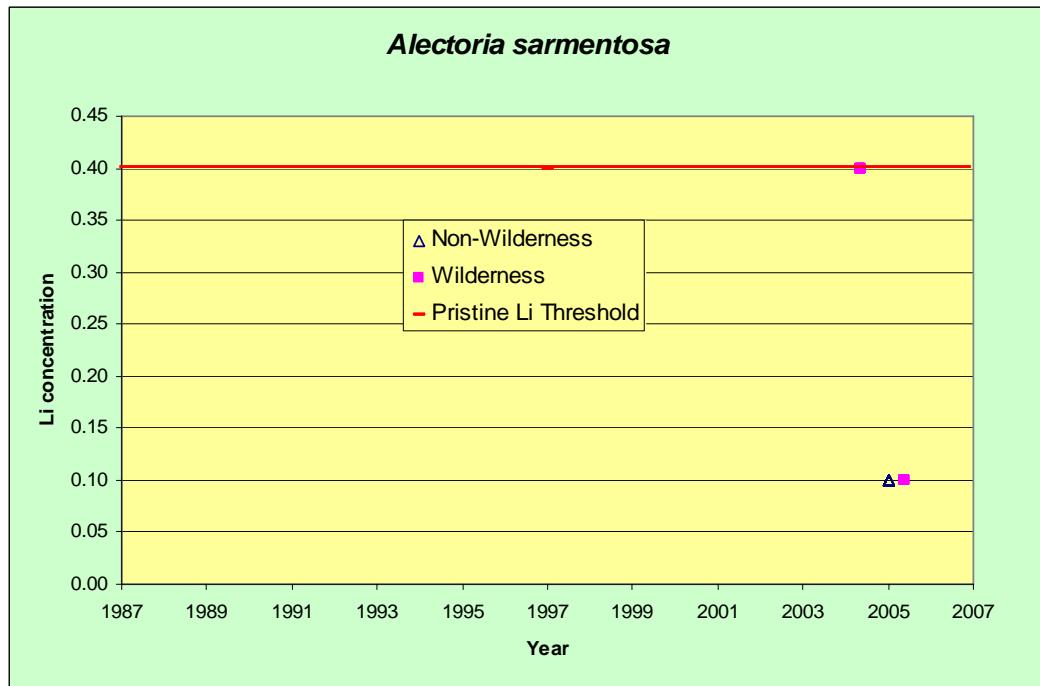


Figure XVIII-4. Wilderness and Non-Wilderness plot means of Li ppm in *Alectoria sarmentosa* per year.

ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Li ppm

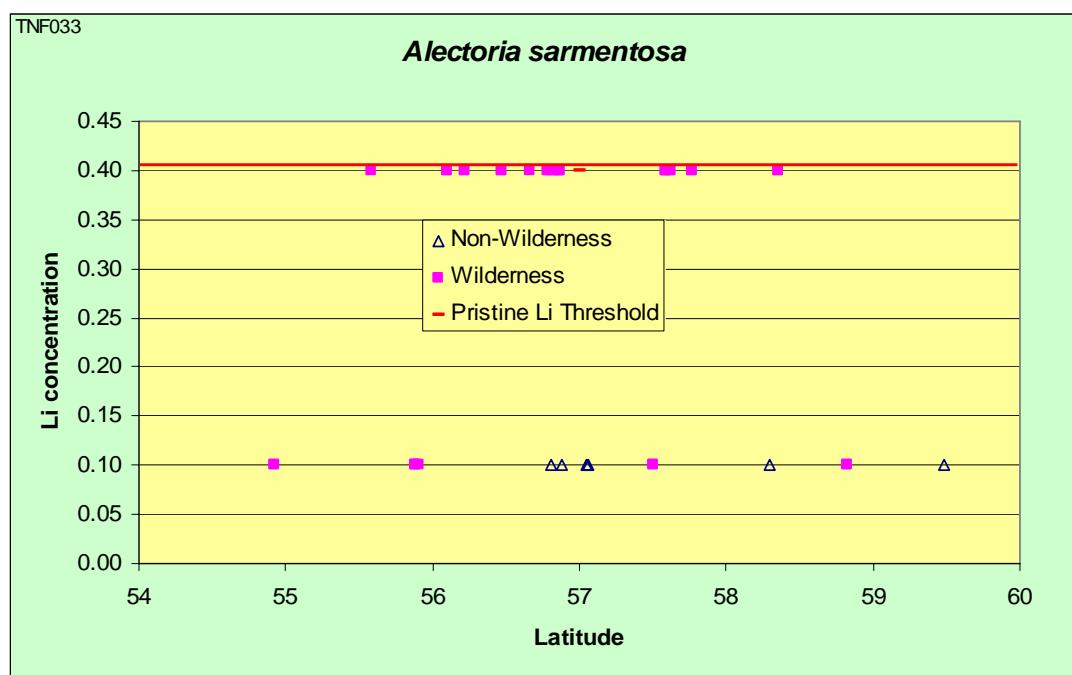


Figure XVIII-5. Wilderness and Non-Wilderness plot means of Li ppm in *Alectoria sarmentosa* vs. plot Latitude.

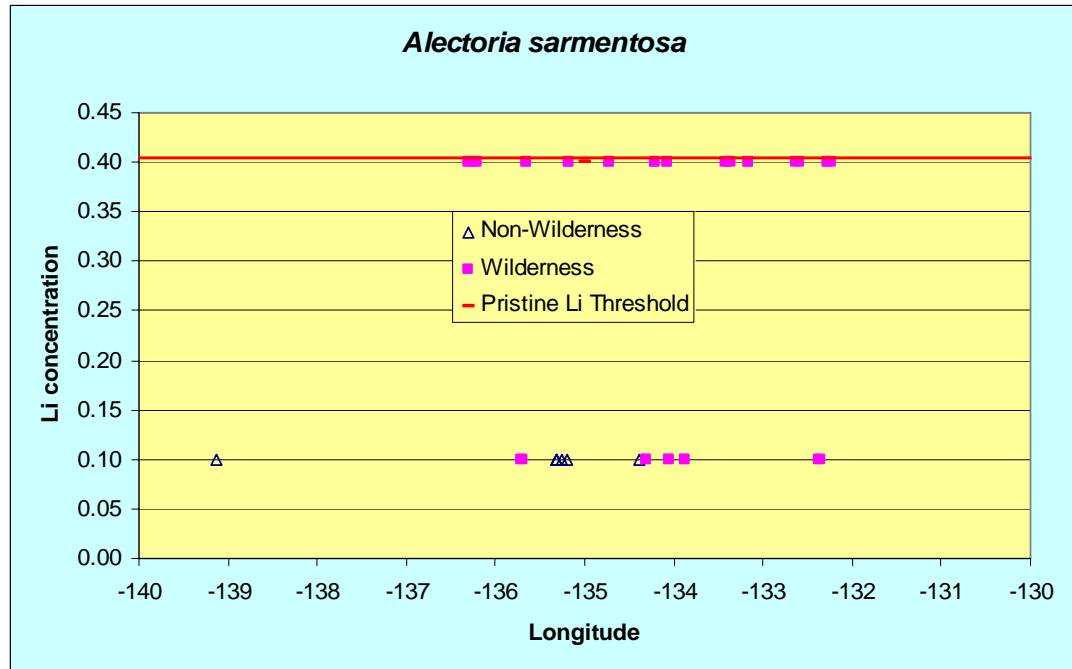


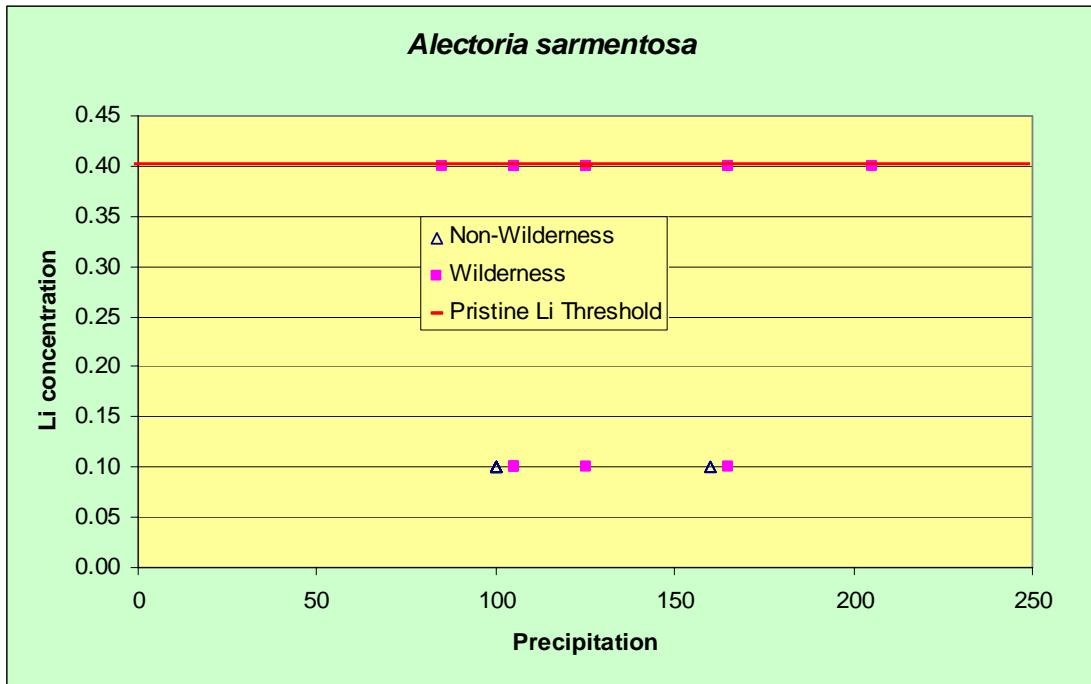
Figure XVIII-6. Wilderness and Non-Wilderness plot means of Li ppm in *Alectoria sarmentosa* vs. plot Longitude.

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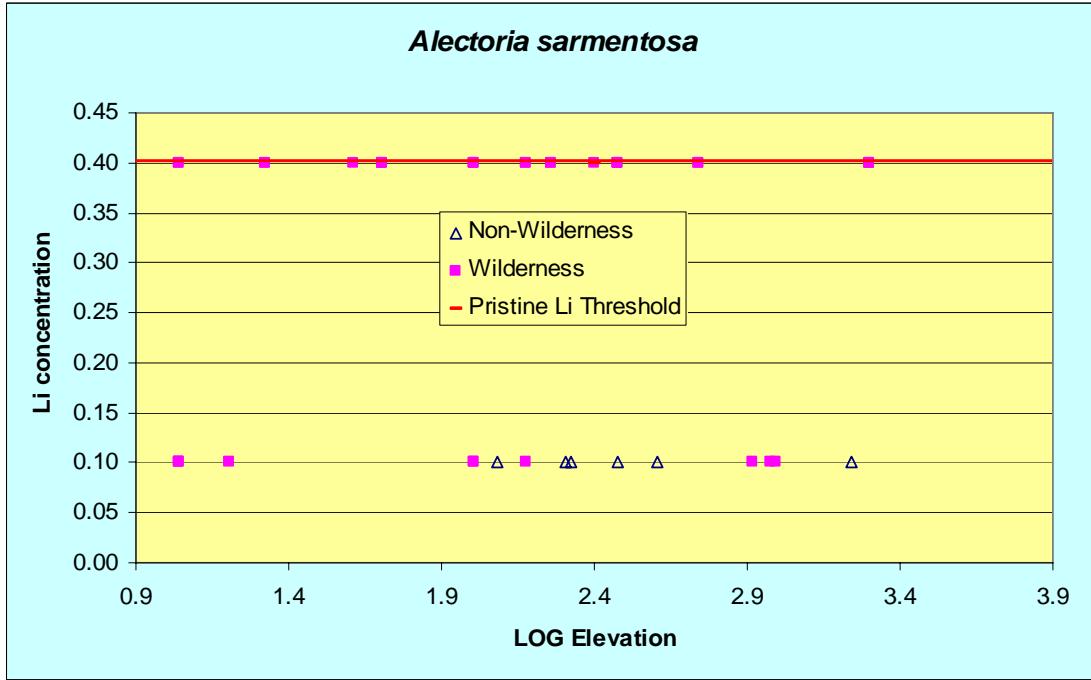
ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Li ppm

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**Figure XVIII-7. Wilderness and Non-Wilderness plot means of Li ppm
in *Alectoria sarmentosa* vs. plot Precipitation.**



**Figure XVIII-8. Wilderness and Non-Wilderness plot means of Li ppm
in *Alectoria sarmentosa* vs. plot Log-Elevation.**

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Li ppm

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Hypogymnia species

In this series, all of the *Hypogymnia* species were included as a group.

Table XVIII-3. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Li ppm content of *Hypogymnia species* per year.

Li ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	0.40	0.0000	0.4000	0.4000
2005	Non-Wilderness	0.61	0.1421	0.0004	1.2221
2005	Wilderness	0.22	0.0576	0.0835	0.3494

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Li ppm

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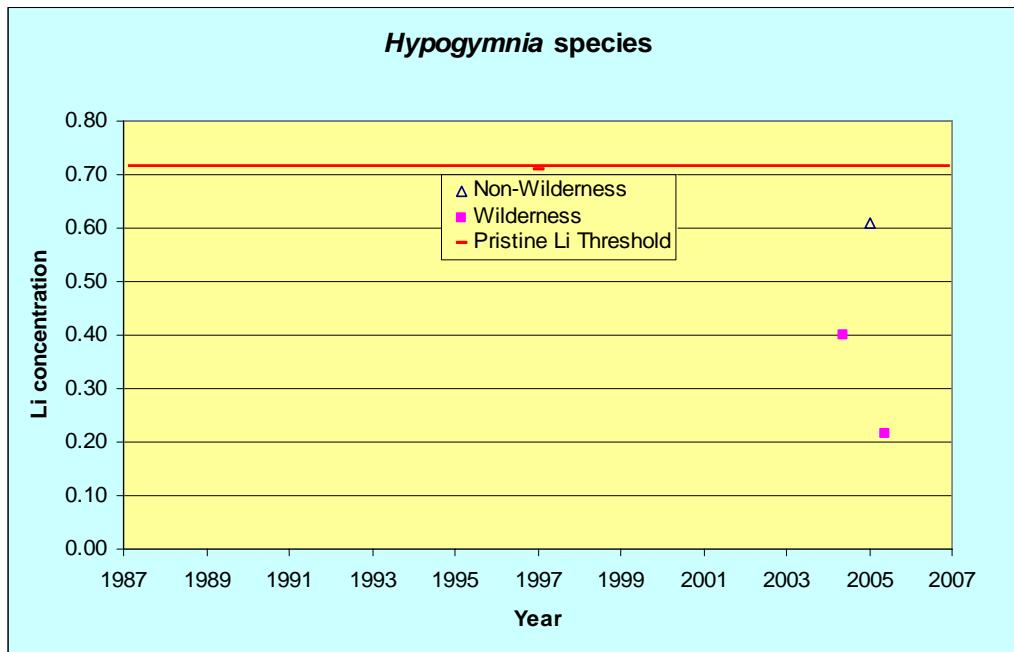


Figure XVIII-9. Wilderness and Non-Wilderness yearly means of Li ppm in *Hypogymnia* species per year.

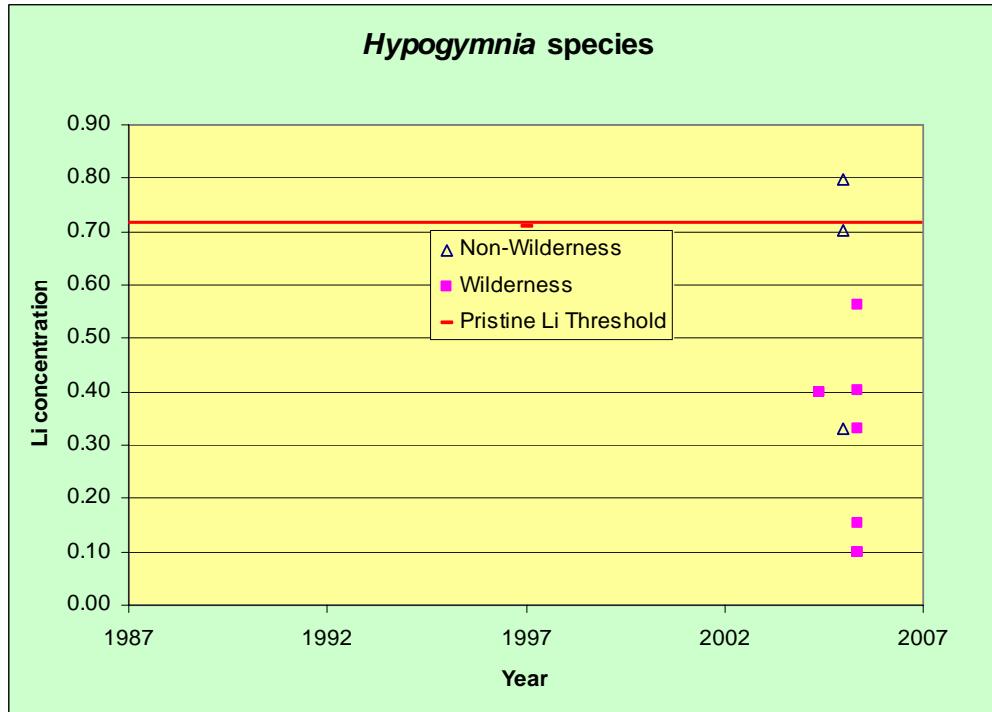


Figure XVIII-10. Wilderness and Non-Wilderness plot means of Li ppm in *Hypogymnia* species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Li ppm

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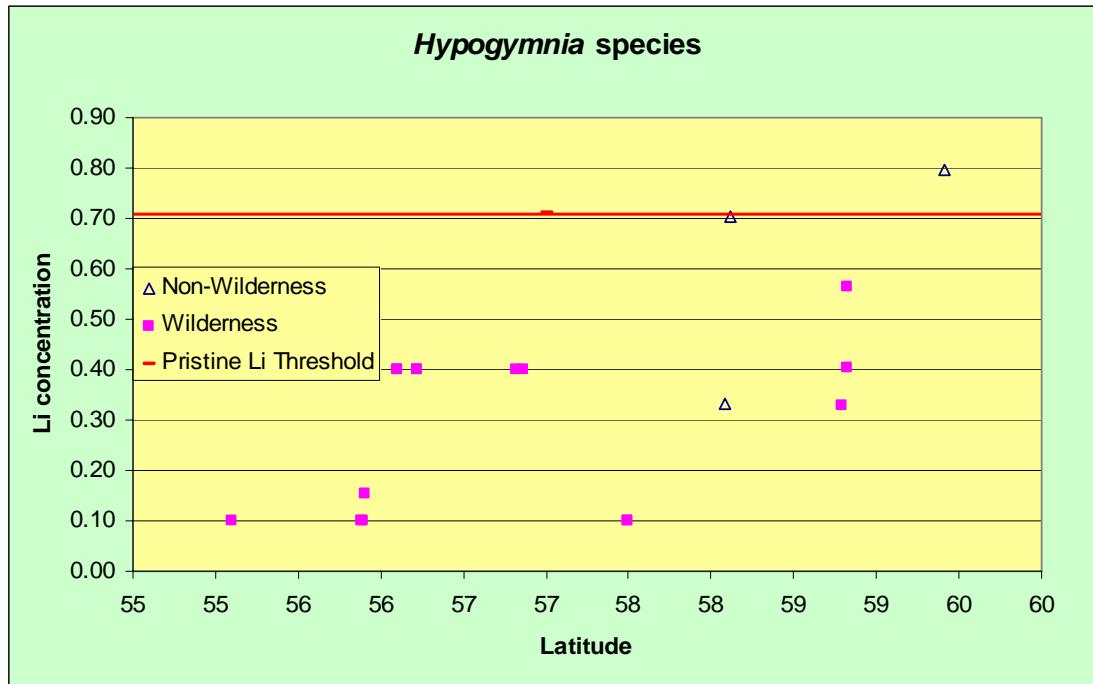


Figure XVIII-11. Wilderness and Non-Wilderness plot means of Li ppm in *Hypogymnia* species vs. plot Latitude.

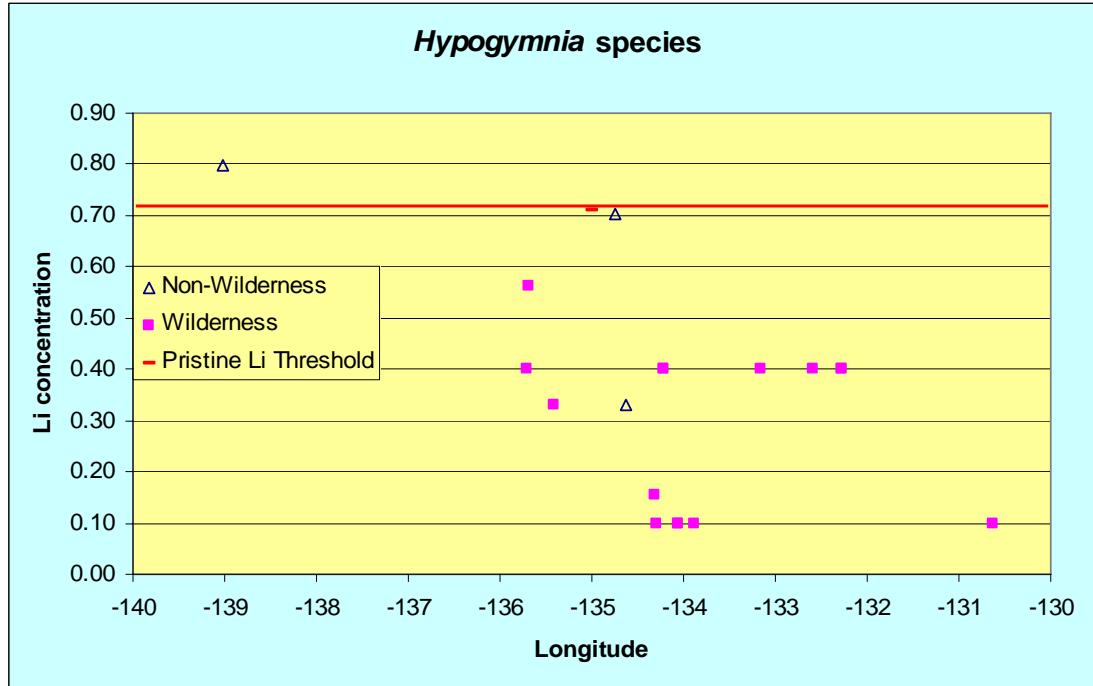


Figure XVIII-12. Wilderness and Non-Wilderness plot means of Li ppm in *Hypogymnia* species vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Li ppm

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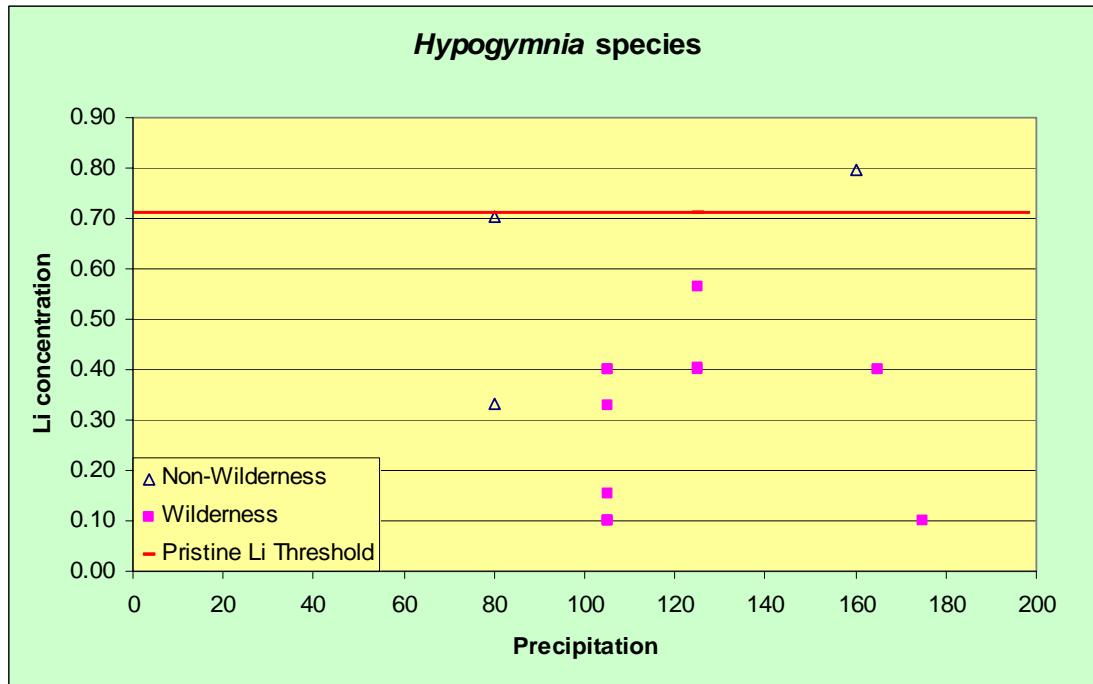


Figure XVIII-13. Wilderness and Non-Wilderness plot means of Li ppm in *Hypogymnia* species vs. plot Precipitation.

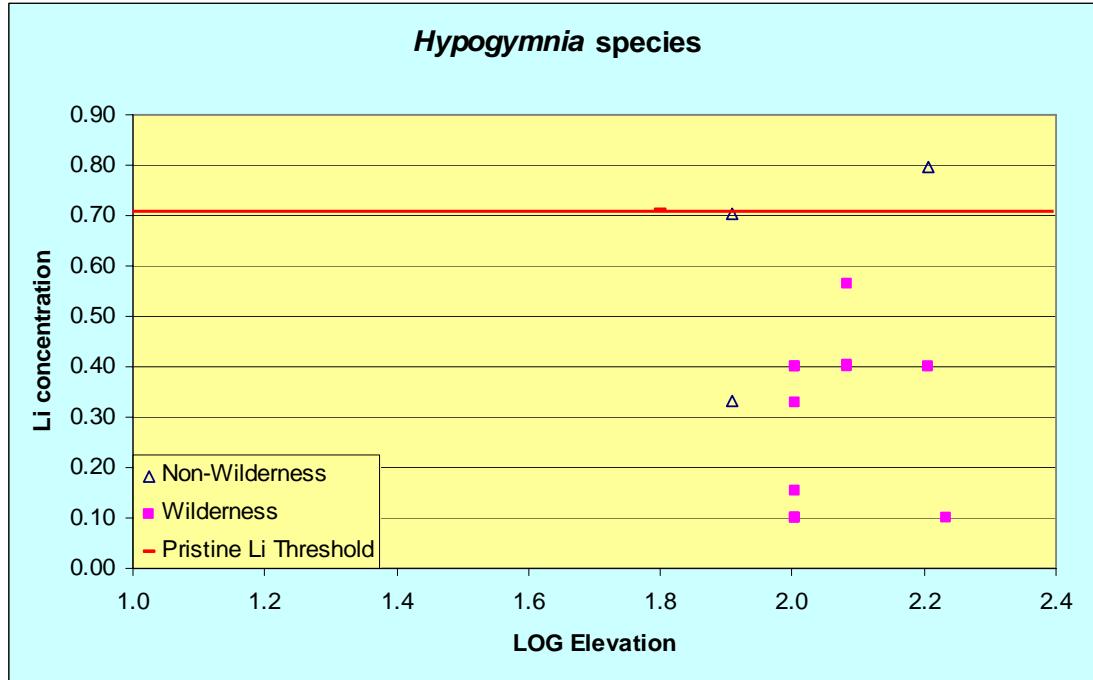


Figure XVIII-14. Wilderness and Non-Wilderness plot means of Li ppm in *Hypogymnia* species vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Li ppm

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Lobaria oregana

Table XVIII-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Li ppm content of *Lobaria oregana* per year.

Li ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	0.40	0.0029	0.3959	0.4098
2005	Non-Wilderness	0.66	NA	NA	NA
2005	Wilderness	0.1315	0.0315	0.0313	0.2317

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Li ppm

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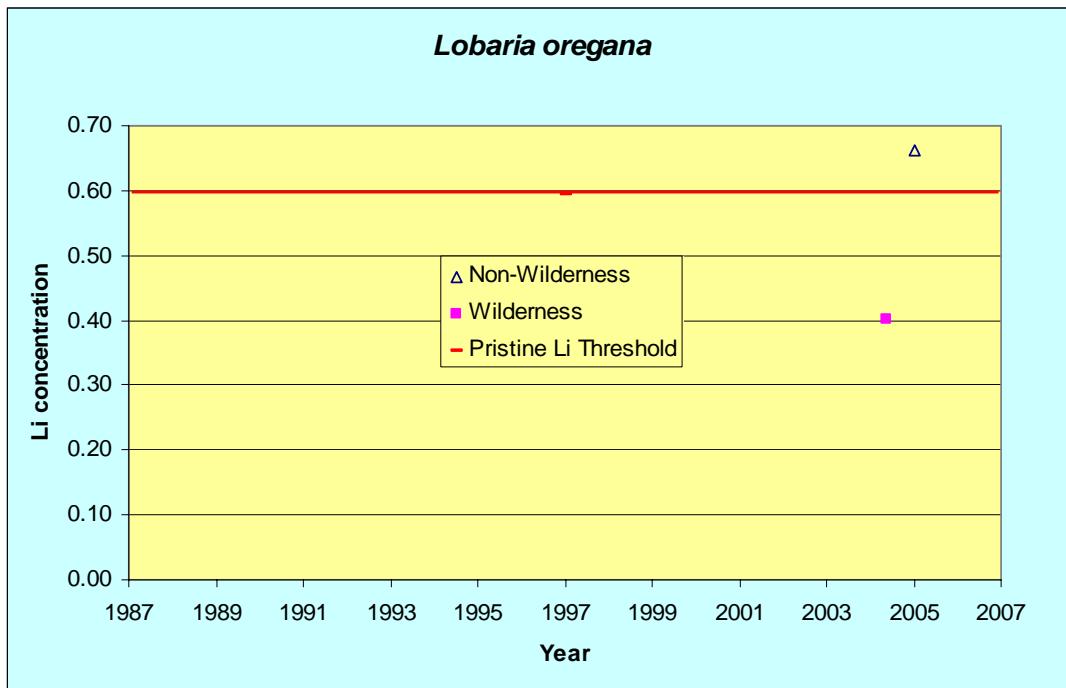


Figure XVIII-15. Wilderness and Non-Wilderness yearly means of Li ppm in *Lobaria oregana* per year.

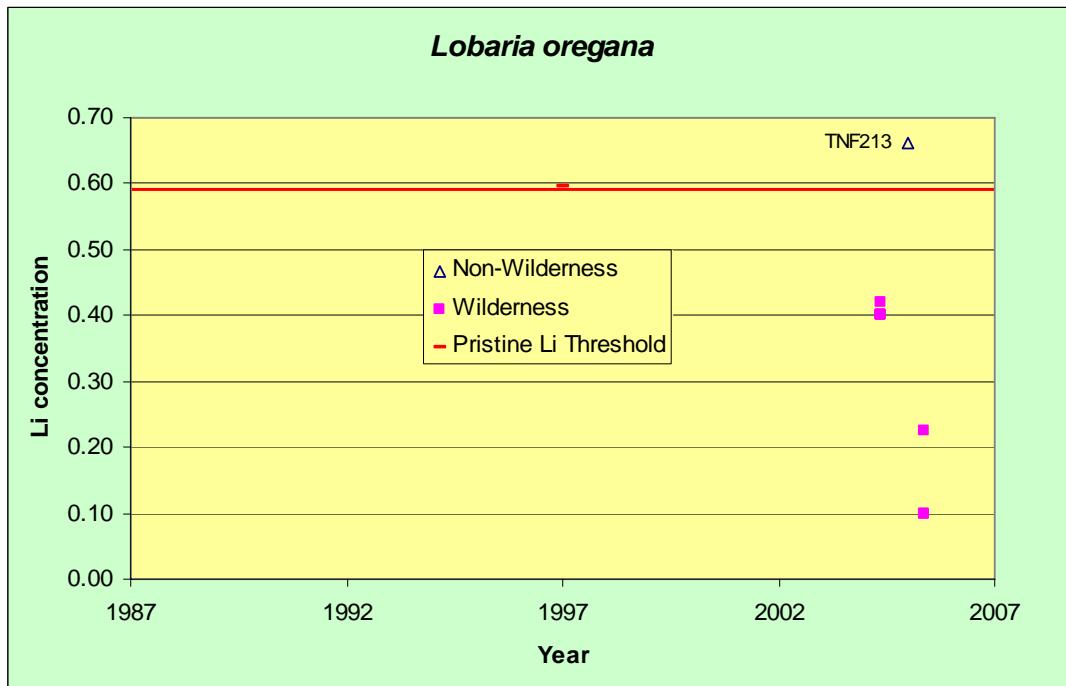


Figure XVIII-16. Wilderness and Non-Wilderness plot means of Li ppm in *Lobaria oregana* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Li ppm

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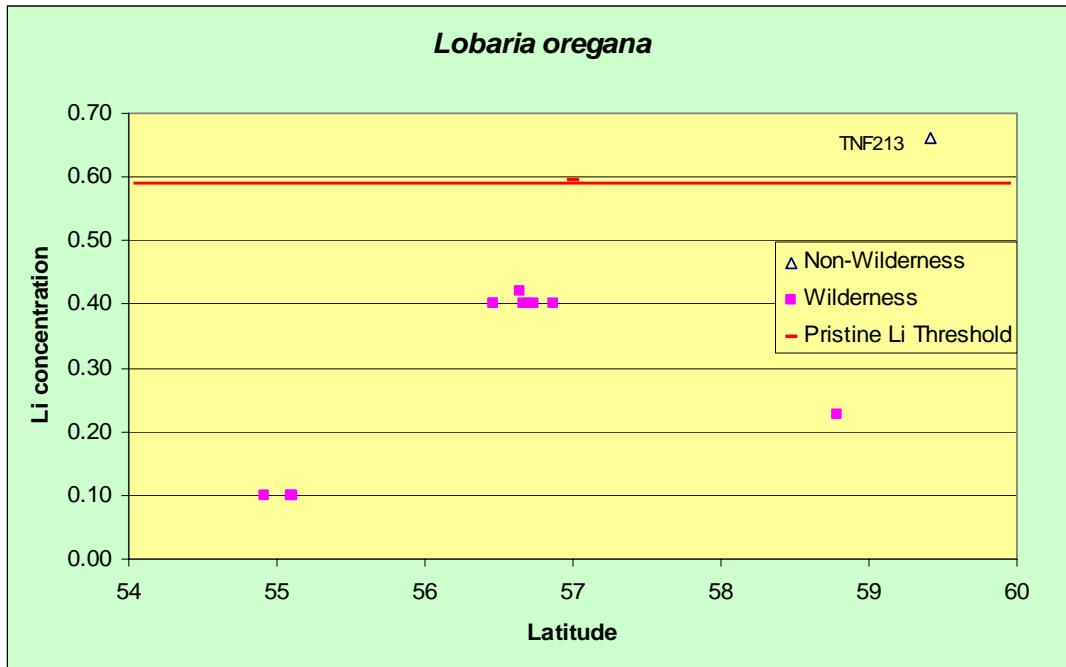


Figure XVIII-17. Wilderness and Non-Wilderness plot means of Li ppm in *Lobaria oregana* vs. plot Latitude.

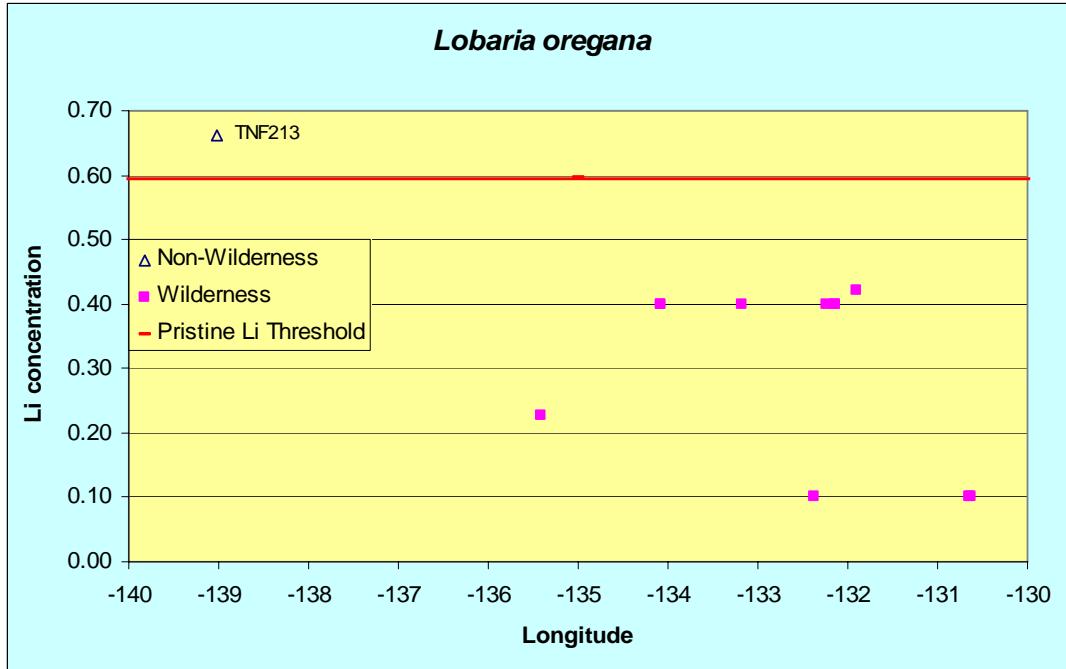


Figure XVIII-18. Wilderness and Non-Wilderness plot means of Li ppm in *Lobaria oregana* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Li ppm

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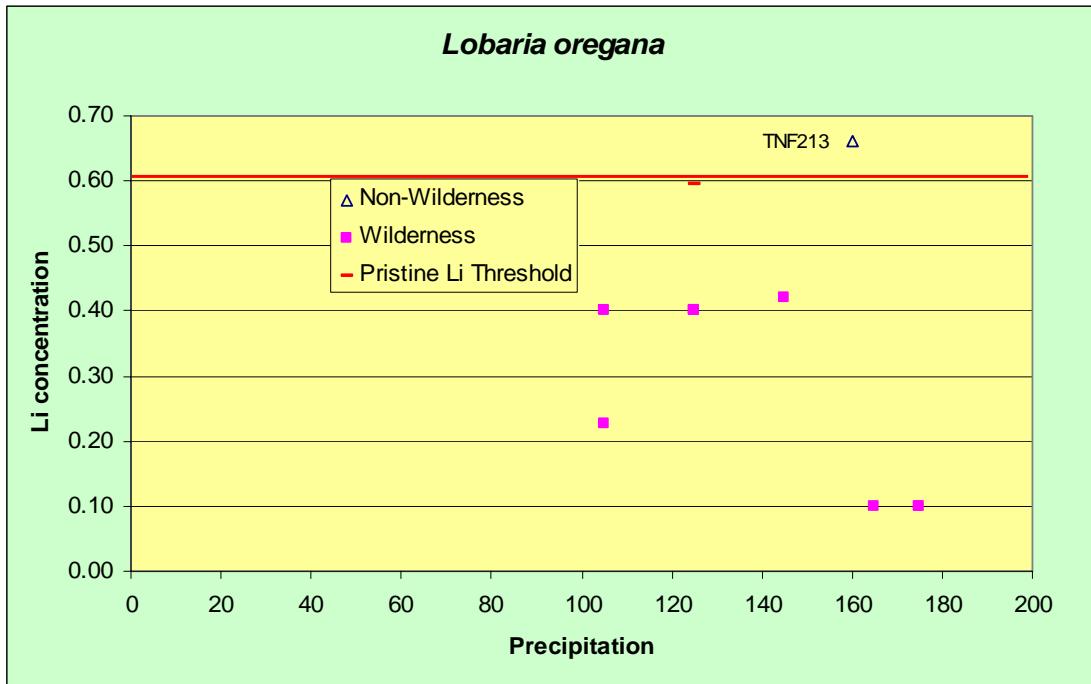


Figure XVIII-19. Wilderness and Non-Wilderness plot means of Li ppm in *Lobaria oregana* vs. plot Precipitation.

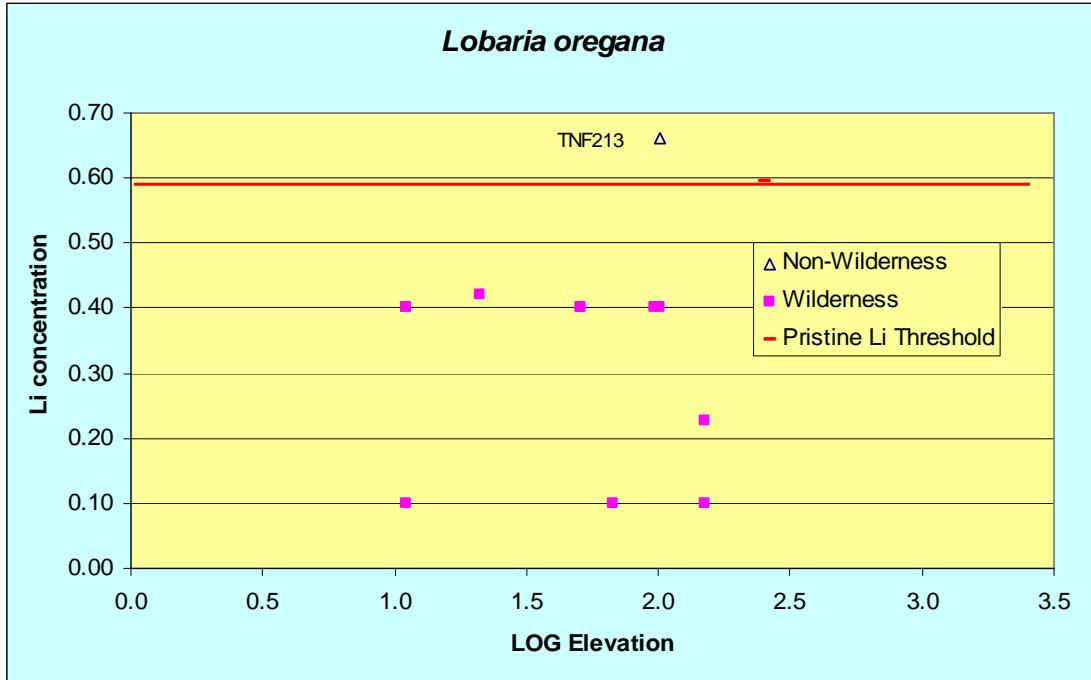


Figure XVIII-20. Wilderness and Non-Wilderness plot means of Li ppm in *Lobaria oregana* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Li ppm

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Platismatia glauca

Table XVIII-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Li ppm content of *Platismatia glauca* per year.

Li ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	0.40	0.0041	0.3948	0.4134
2005	Non-Wilderness	0.40	0.0667	0.2492	0.5511
2005	Wilderness	0.26	0.0622	0.1095	0.4038

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Li ppm

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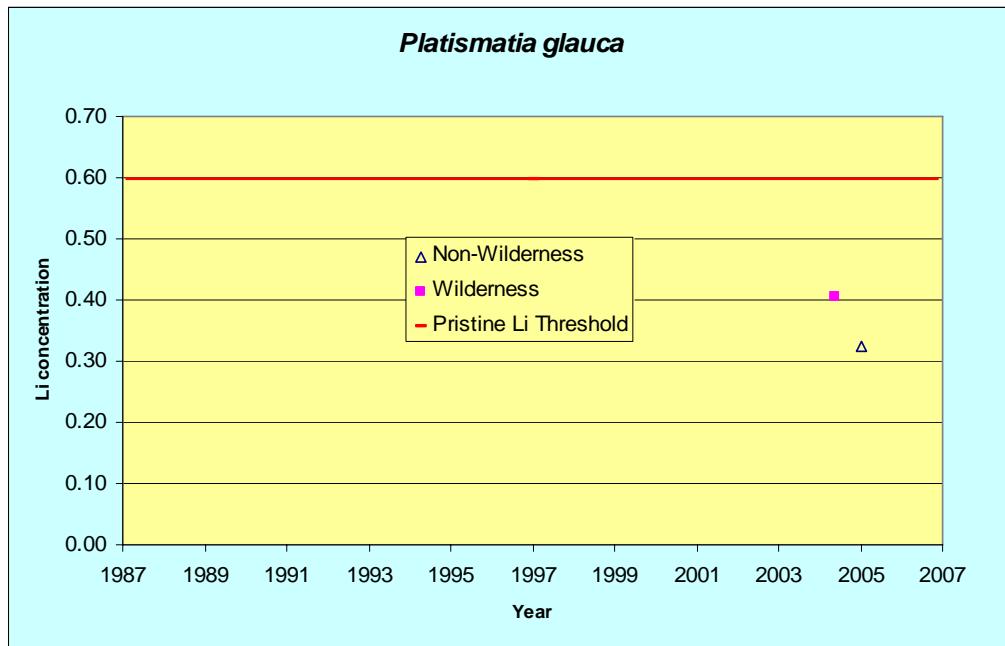


Figure XVIII-21. Wilderness and Non-Wilderness yearly means of Li ppm in *Platismatia glauca* per year.

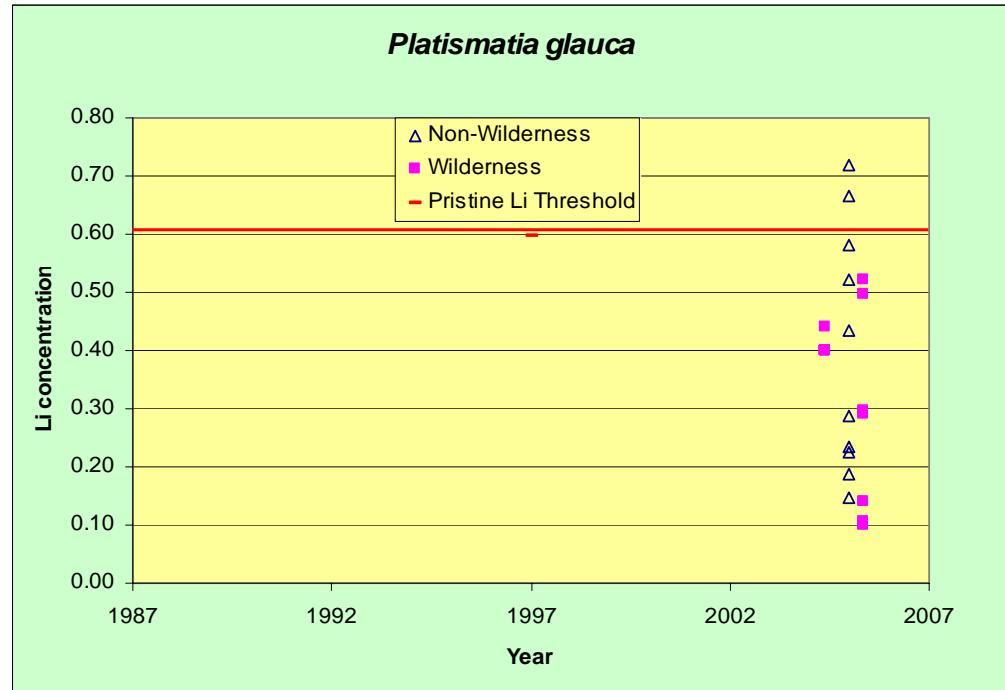


Figure XVIII-22. Wilderness and Non-Wilderness plot means of Li ppm in *Platismatia glauca* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Li ppm

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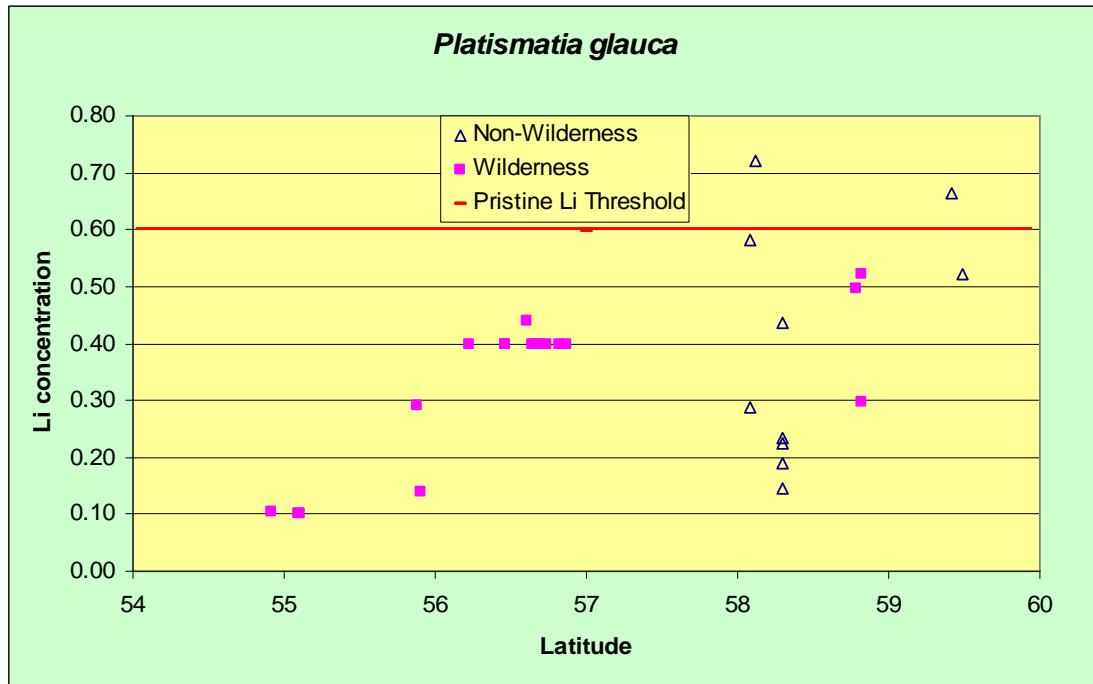


Figure XVIII-23. Wilderness and Non-Wilderness plot means of Li ppm in *Platismatia glauca* vs. plot Latitude.

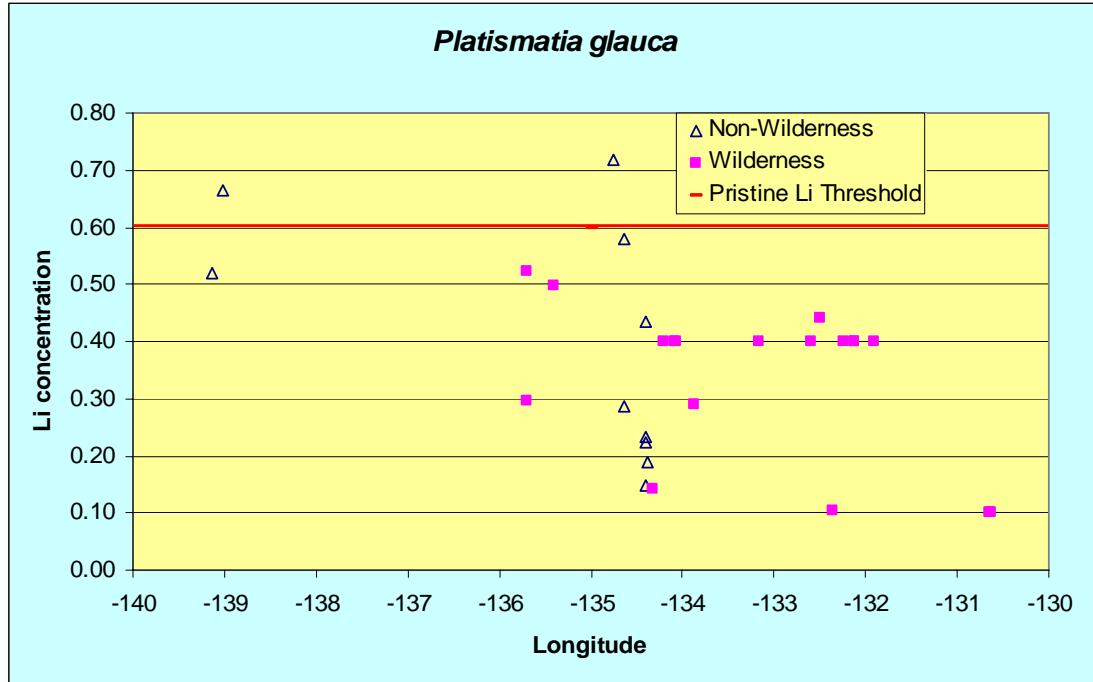


Figure XVIII-24. Wilderness and Non-Wilderness plot means of Li ppm in *Platismatia glauca* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Li ppm

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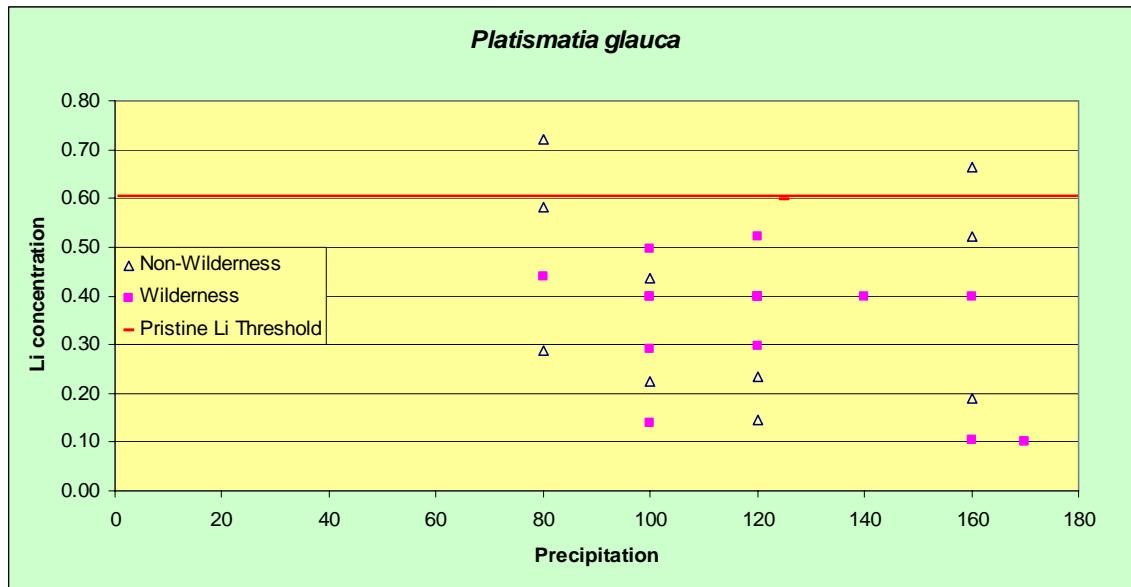


Figure XVIII-25. Wilderness and Non-Wilderness plot means of Li ppm in *Platismatia glauca* vs. plot Precipitation.

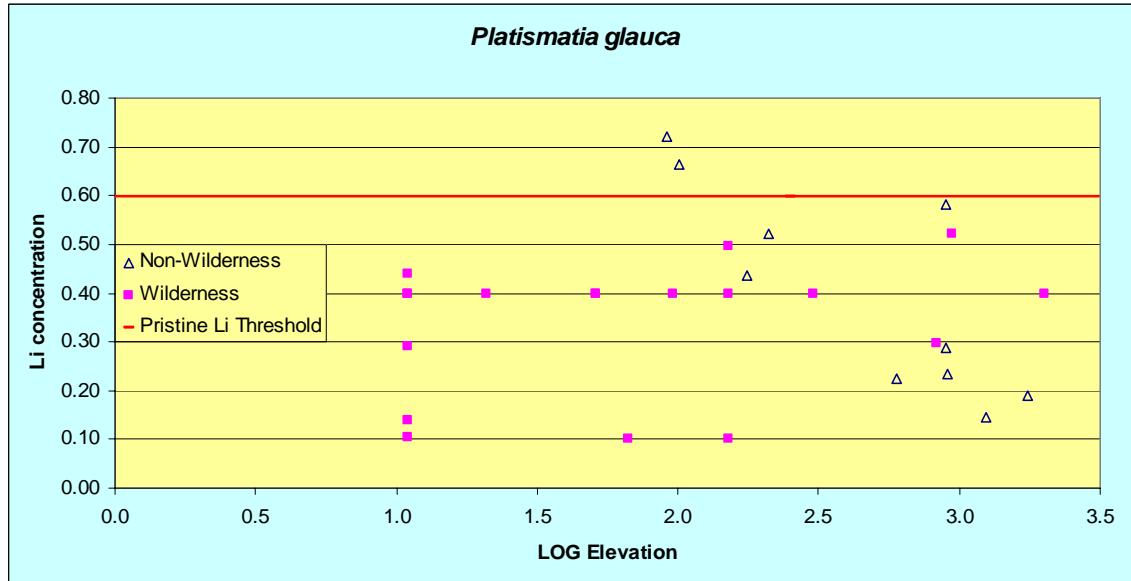


Figure XVIII-26. Wilderness and Non-Wilderness plot means of Li ppm in *Platismatia glauca* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mg ppm

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XIX. SUMMARY OF Mg PPM DATA ANALYSIS

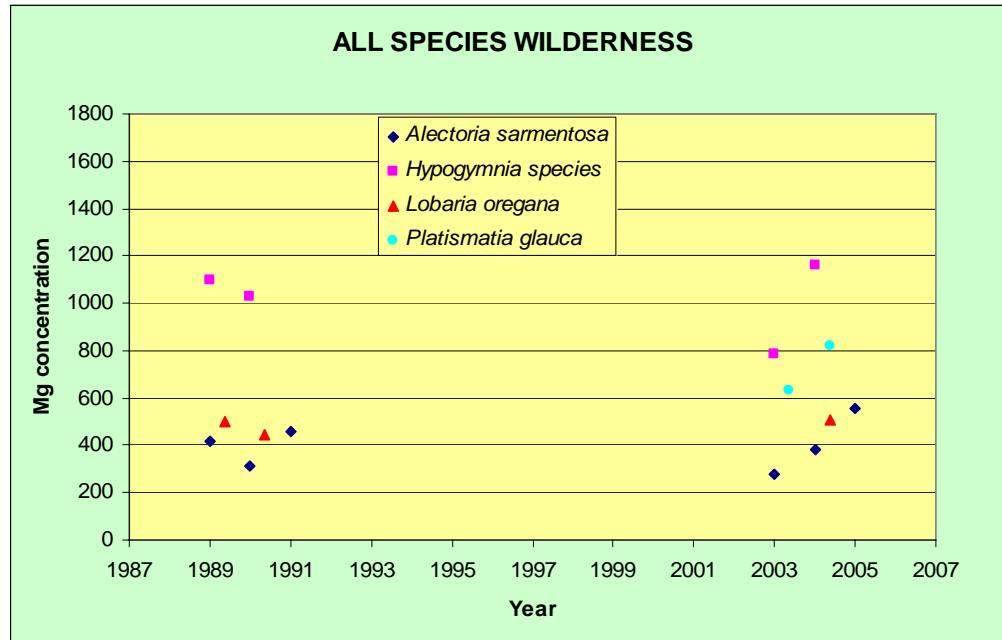


Figure XIX-27. Wilderness plot means of Mg ppm in *All Species* per year.

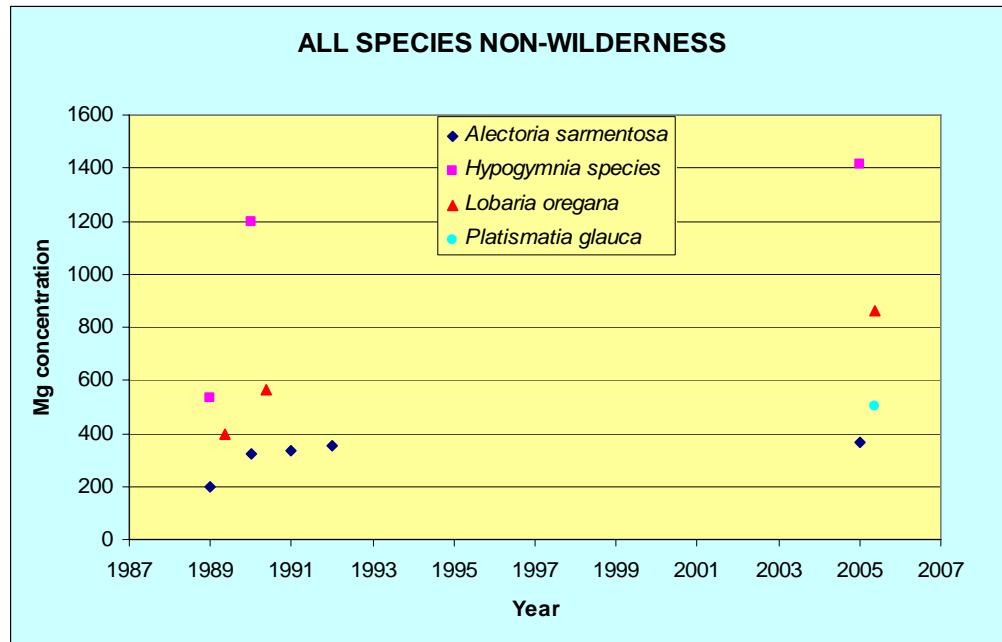


Figure XIX-28. Non-Wilderness plot means of Mg ppm in *All Species* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mg ppm

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Alectoria sarmentosa

Summary Statistics:

Table XIX-2. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Mg ppm content of *Alectoria sarmentosa* per year.

Mg ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	201.49	27.3259	125.6211	277.3589
1989	Wilderness	416.41	85.9430	195.4821	637.3290
1990	Non-Wilderness	322.90	28.6000	264.1091	381.6855
1990	Wilderness	310.33	32.3227	231.2434	389.4251
1991	Non-Wilderness	337.5974	32.7559	268.7798	406.4149
1991	Wilderness	458.77	46.2202	330.4383	587.0939
1992	Non-Wilderness	351.58	26.5861	288.7141	414.4465
2003	Wilderness	277.54	60.6483	493.0685	1048.1518
2004	Wilderness	384.78	24.7150	333.6580	435.9117
2005	Non-Wilderness	364.65	17.6155	319.3713	409.9354
2005	Wilderness	558.30	86.7444	362.0721	754.5309

Summary of Statistical Tests:

$$t = 0.9446, df = 8, p\text{-value} = 0.3725$$

There is no evidence of a difference in Mg ppm content in *Alectoria sarmentosa* from pre-2000 and post 2000 samples (p-value = 0.3725).

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mg ppm

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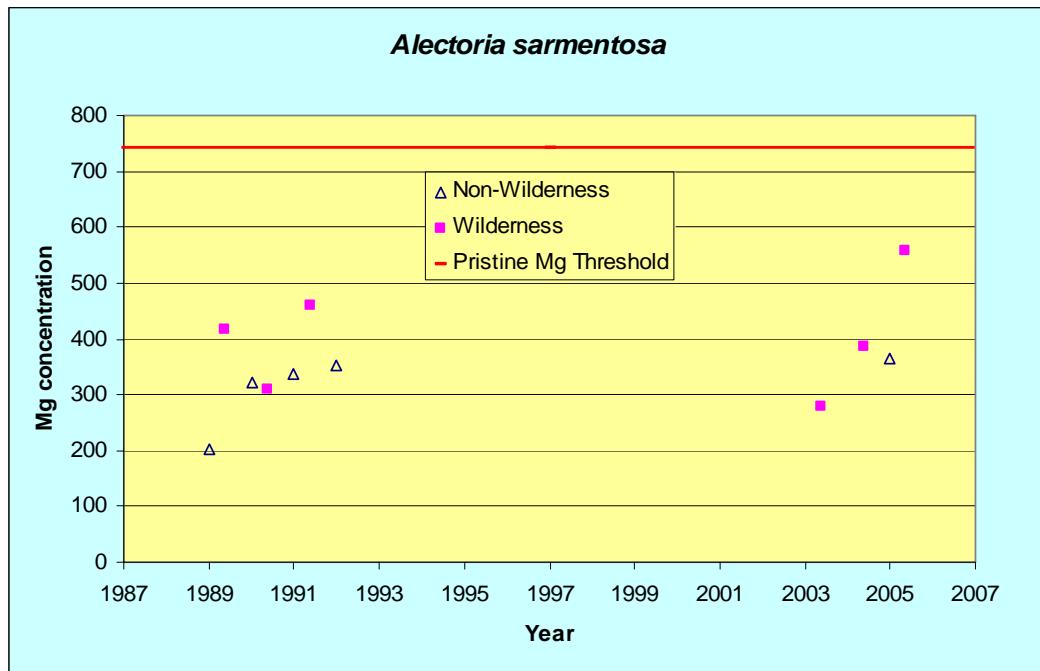


Figure XIX-3. Wilderness and Non-Wilderness yearly means of Mg ppm in *Alectoria sarmentosa* per year.

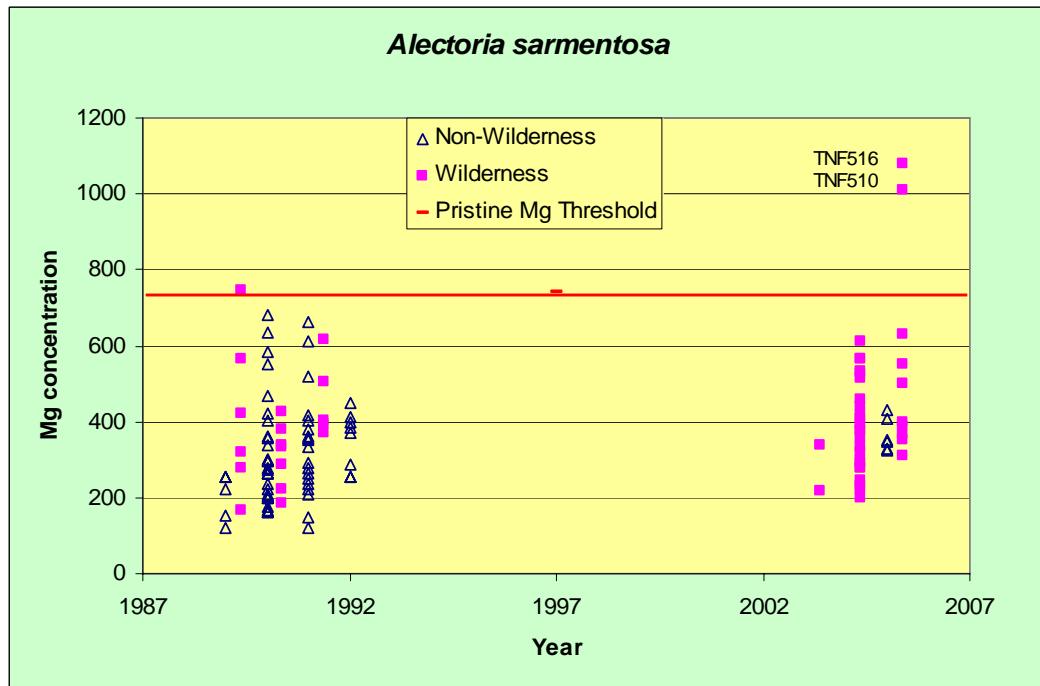


Figure XIX-4. Wilderness and Non-Wilderness plot means of Mg ppm in *Alectoria sarmentosa* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mg ppm

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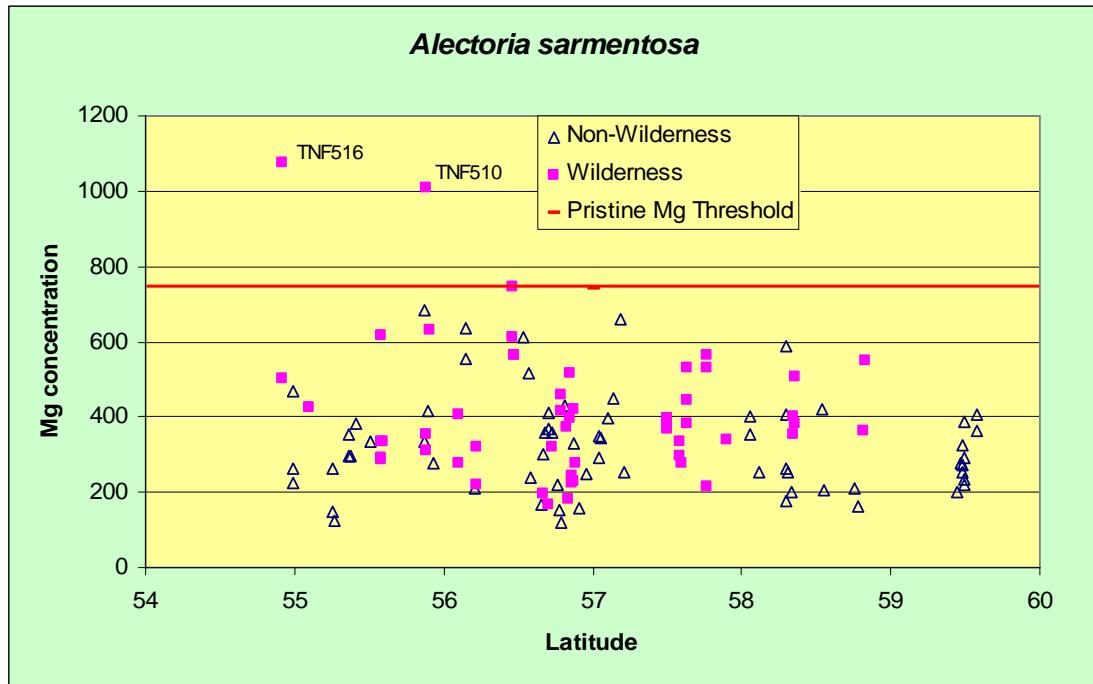


Figure XIX-5. Wilderness and Non-Wilderness plot means of Mg ppm in *Alectoria sarmentosa* vs. plot Latitude.

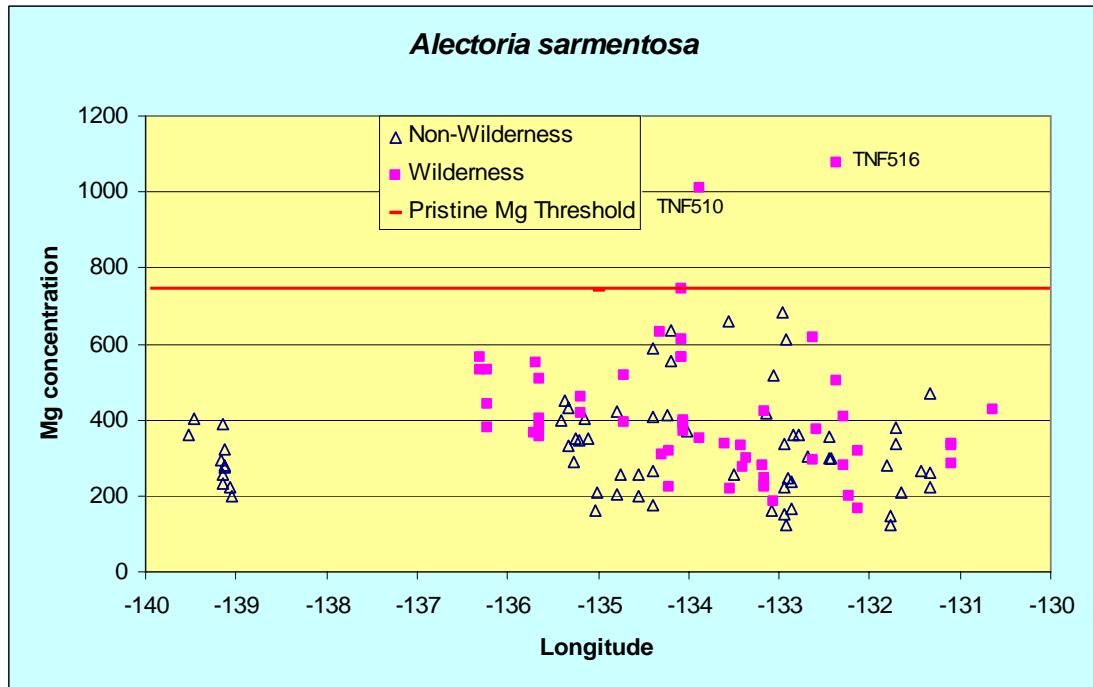


Figure XIX-6. Wilderness and Non-Wilderness plot means of Mg ppm in *Alectoria sarmentosa* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mg ppm

██

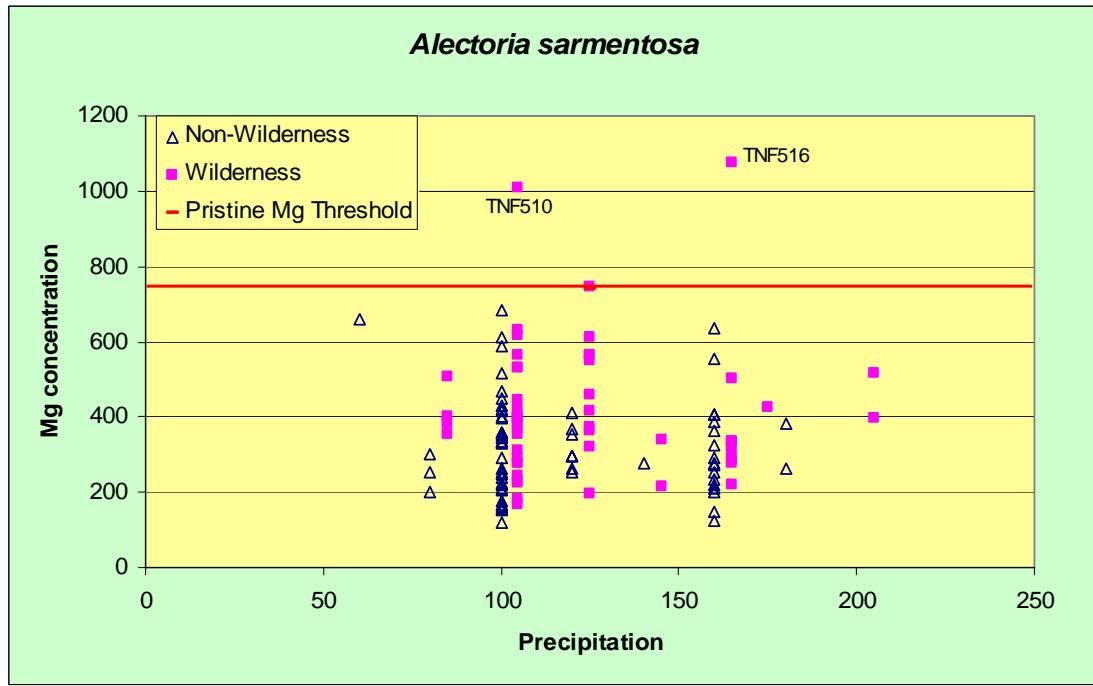


Figure XIX-7. Wilderness and Non-Wilderness plot means of Mg ppm in *Alectoria sarmentosa* vs. plot Precipitation.

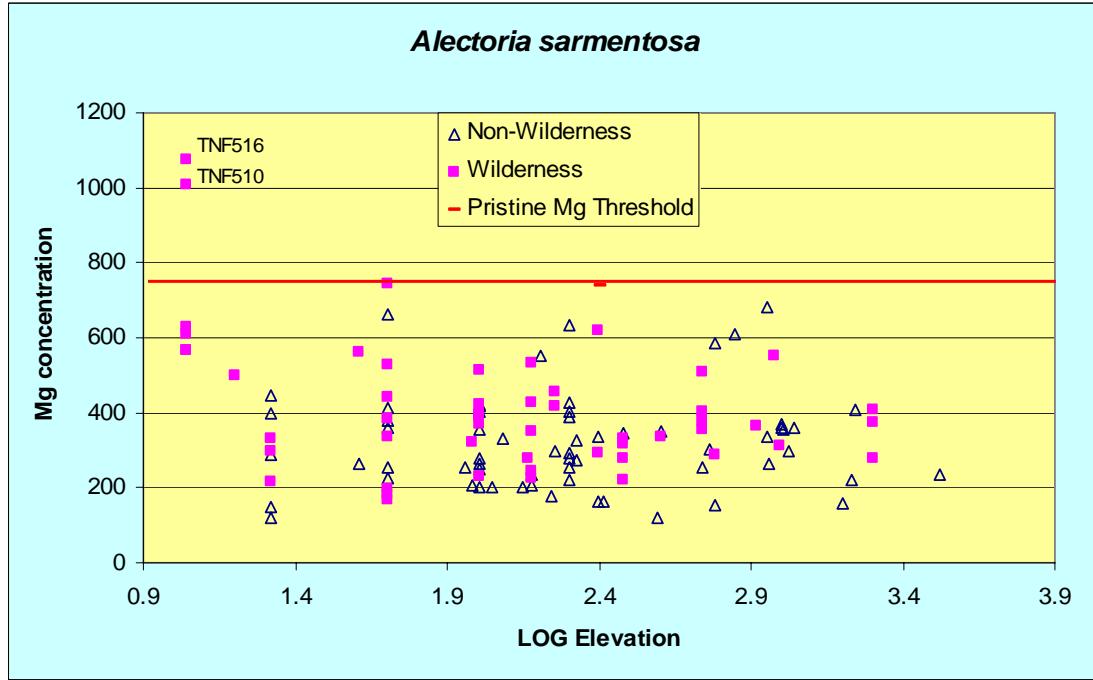


Figure XIX-8. Wilderness and Non-Wilderness plot means of Mg ppm in *Alectoria sarmentosa* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mg ppm

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Hypogymnia species

In this series, all of the *Hypogymnia* species were included as a group.

Table XIX-3. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Mg ppm content of *Hypogymnia species* per year.

Mg ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	534.50	299.5000	3271.0080	4340.0080
1989	Wilderness	1101.33	126.8623	749.1070	1453.5597
1990	Non-Wilderness	1199.58	120.6124	946.1817	1452.9762
1990	Wilderness	1028.44	121.1508	731.9928	1324.8834
2003	Wilderness	788.53	NA	NA	NA
2004	Wilderness	1160.34	143.6093	791.1828	1529.5017
2005	Non-Wilderness	1412.92	157.5674	734.9587	2090.8747
2005	Wilderness	1554.76	165.1665	1173.8865	1935.6357

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mg ppm

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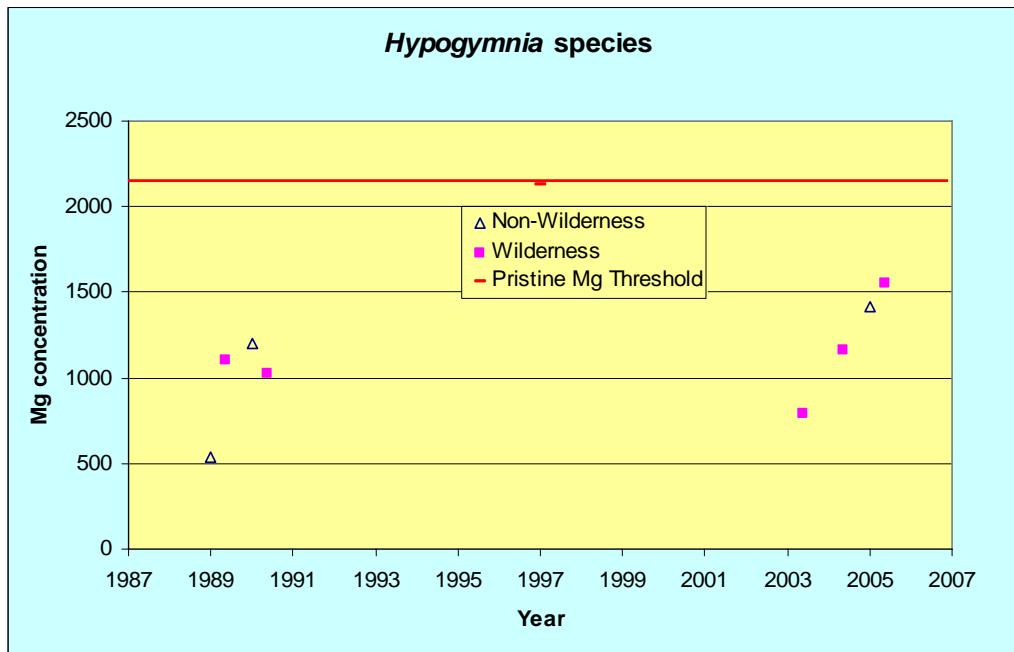


Figure XIX-9. Wilderness and Non-Wilderness yearly means of Mg ppm in *Hypogymnia* species per year.

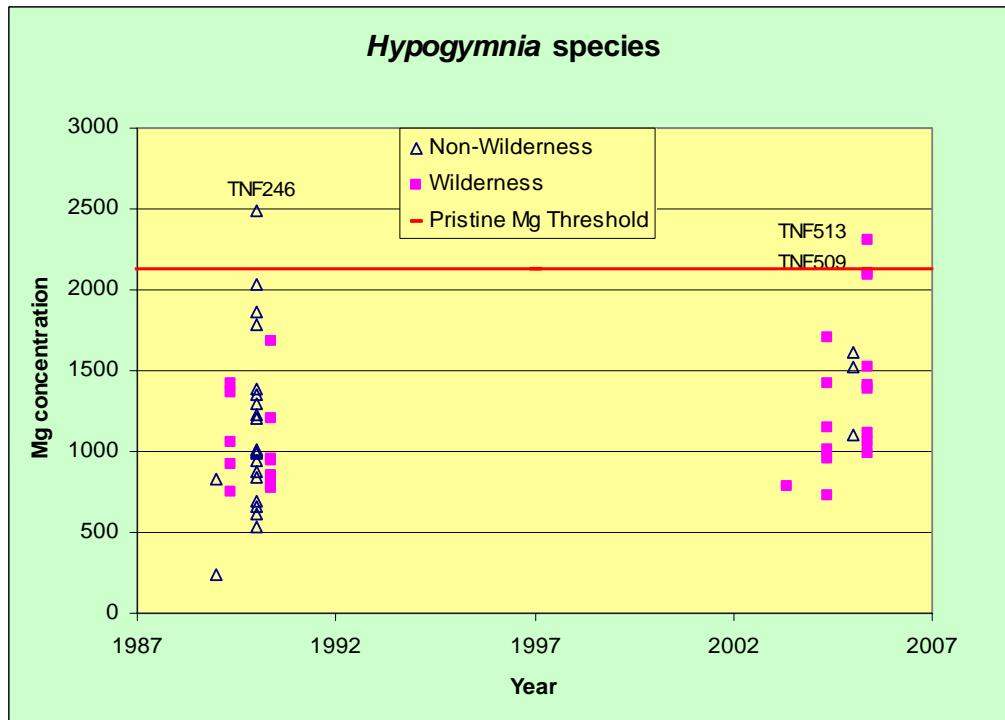


Figure XIX-10. Wilderness and Non-Wilderness plot means of Mg ppm in *Hypogymnia* species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mg ppm

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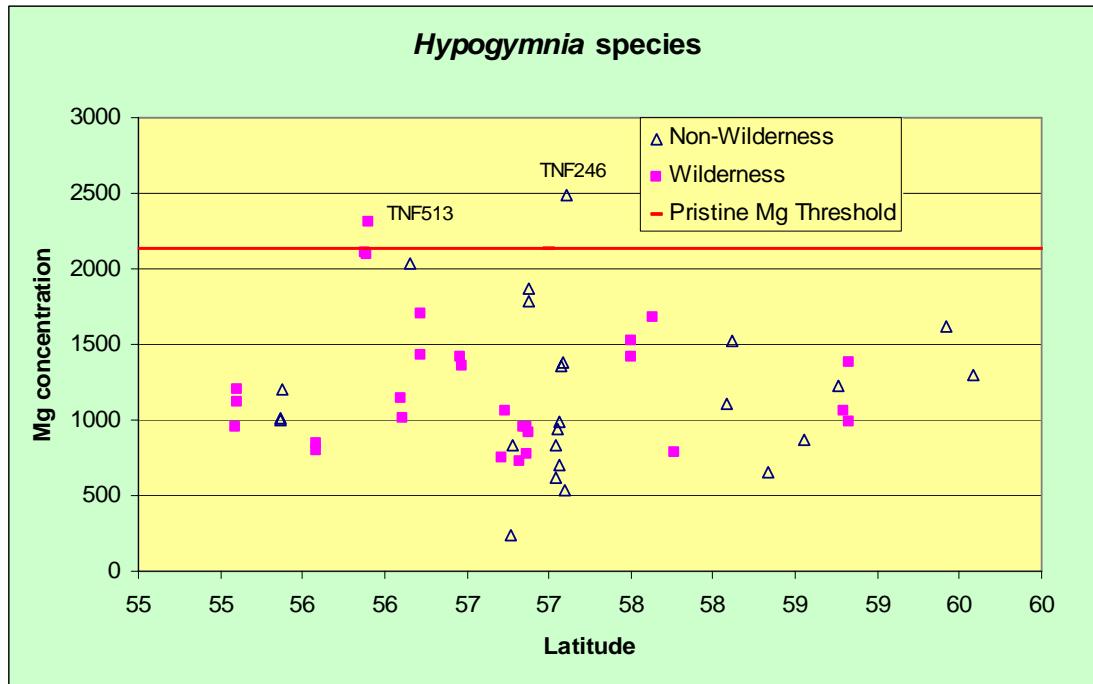


Figure XIX-11. Wilderness and Non-Wilderness plot means of Mg ppm in *Hypogymnia* species vs. plot Latitude.

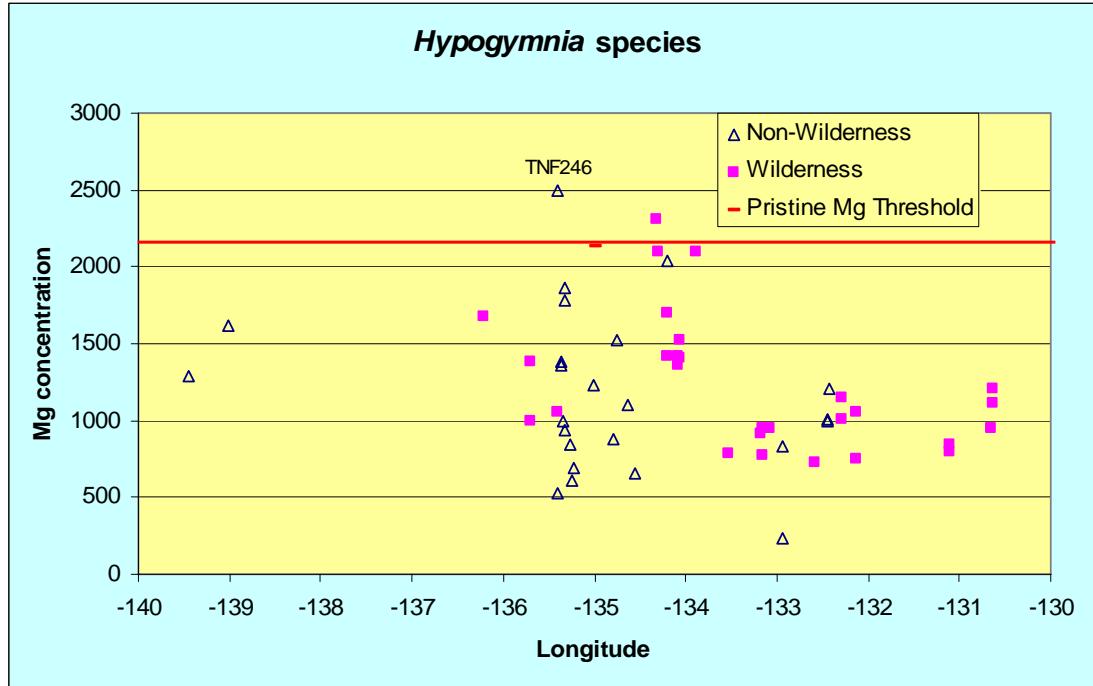


Figure XIX-12. Wilderness and Non-Wilderness plot means of Mg ppm in *Hypogymnia* species vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mg ppm

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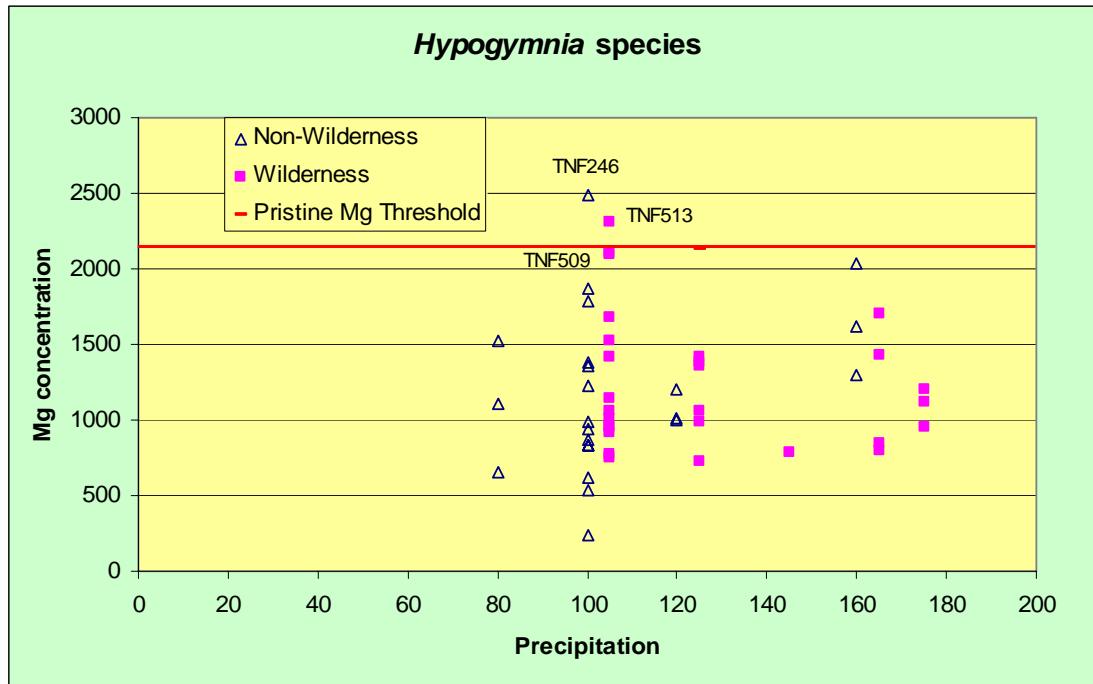


Figure XIX-13. Wilderness and Non-Wilderness plot means of Mg ppm in *Hypogymnia* species vs. plot Precipitation.

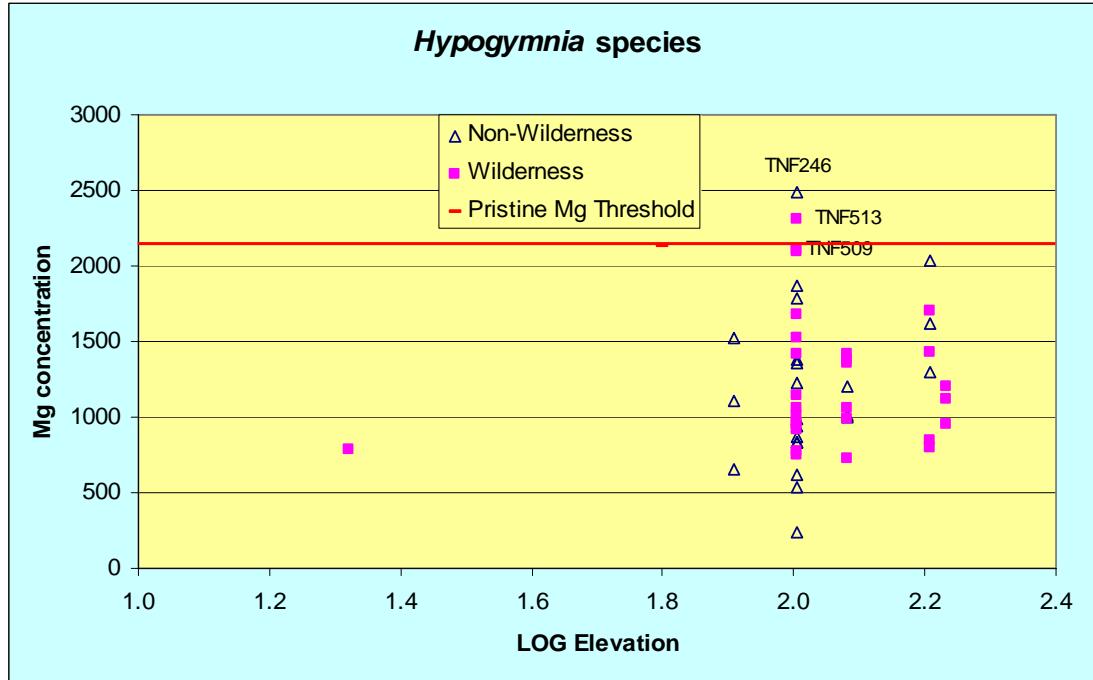


Figure XIX-14. Wilderness and Non-Wilderness plot means of Mg ppm in *Hypogymnia* species vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mg ppm

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Lobaria oregana

Table XIX-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Mg ppm content of *Lobaria oregana* per year.

Mg ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	399.92	21.1915	332.4758	467.3576
1989	Wilderness	500.10	51.8422	356.1631	644.0369
1990	Non-Wilderness	562.60	36.7034	482.6328	642.5723
1990	Wilderness	447.67	22.7190	389.2708	506.0731
2004	Wilderness	504.17	55.9632	367.2364	641.1105
2005	Non-Wilderness	864.42	NA	NA	NA
2005	Wilderness	534.6888	51.7891	369.8729	699.5047

Summary of Statistical Tests:

$$t = -0.2692, \text{ df} = 4, \text{ p-value} = 0.8011$$

There is no evidence of a difference in Mg ppm content in *Lobaria oregana* from pre-2000 and post 2000 samples (p-value = 0.8011).

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mg ppm

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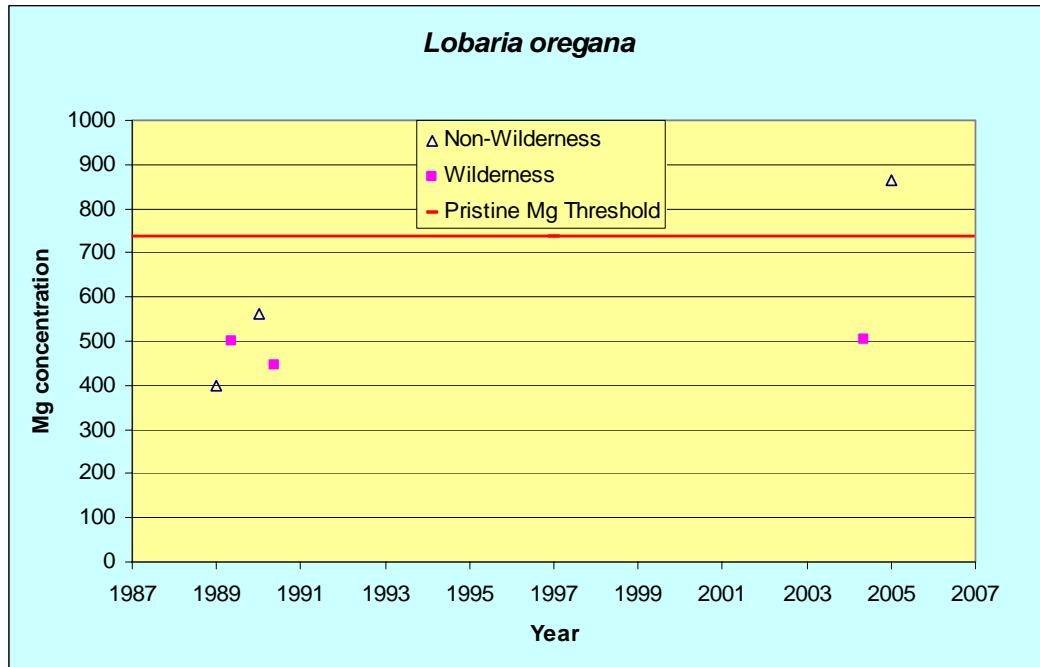


Figure XIX-15. Wilderness and Non-Wilderness yearly means of Mg ppm in *Lobaria oregana* per year.

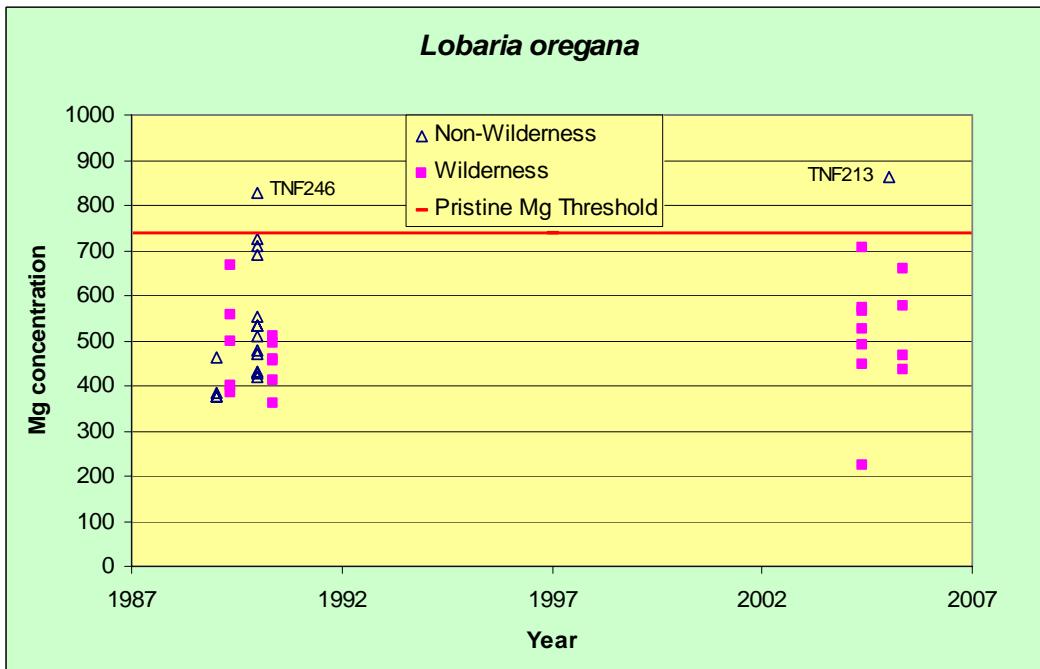


Figure XIX-16. Wilderness and Non-Wilderness plot means of Mg ppm in *Lobaria oregana* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mg ppm

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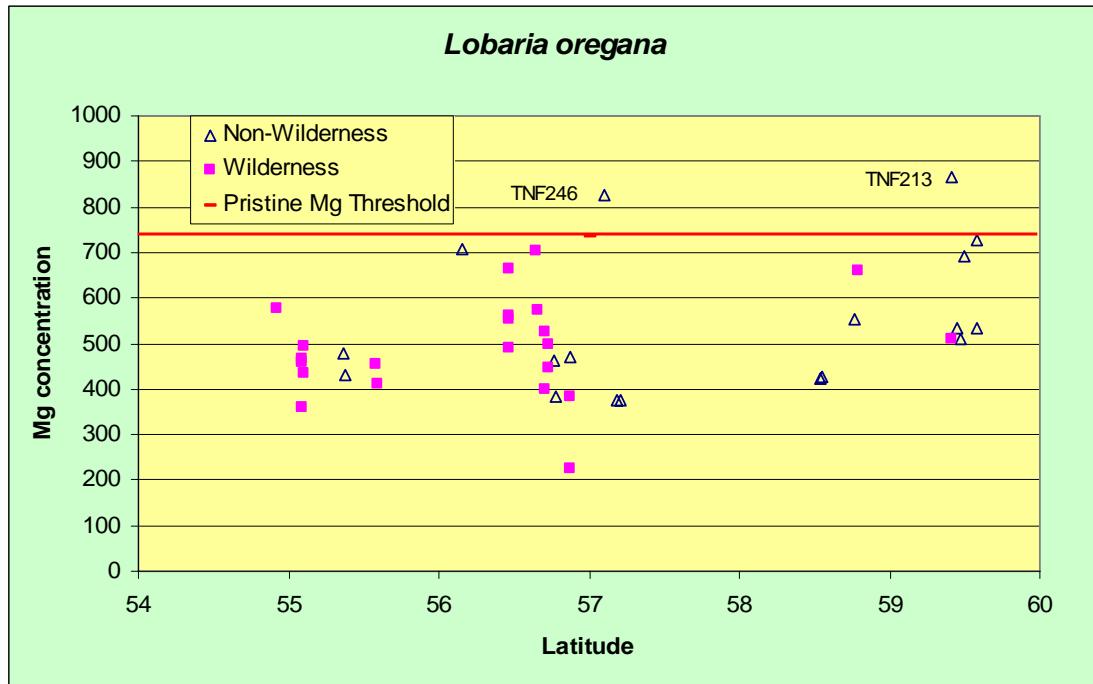


Figure XIX-17. Wilderness and Non-Wilderness plot means of Mg ppm in *Lobaria oregana* vs. plot Latitude.

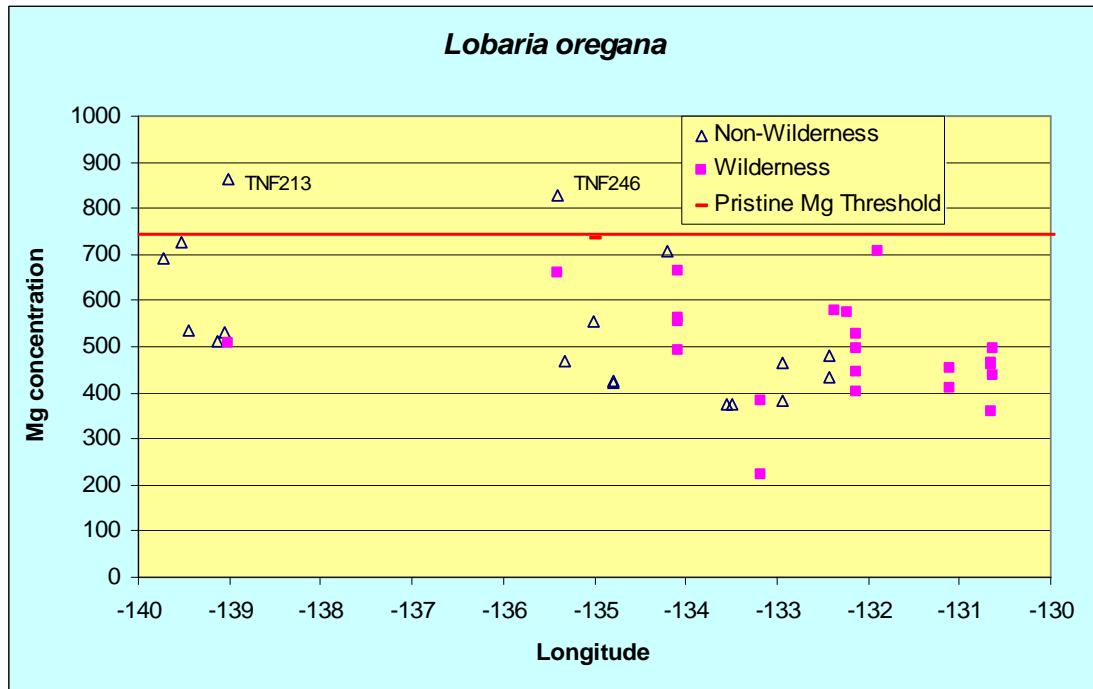


Figure XIX-18. Wilderness and Non-Wilderness plot means of Mg ppm in *Lobaria oregana* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mg ppm

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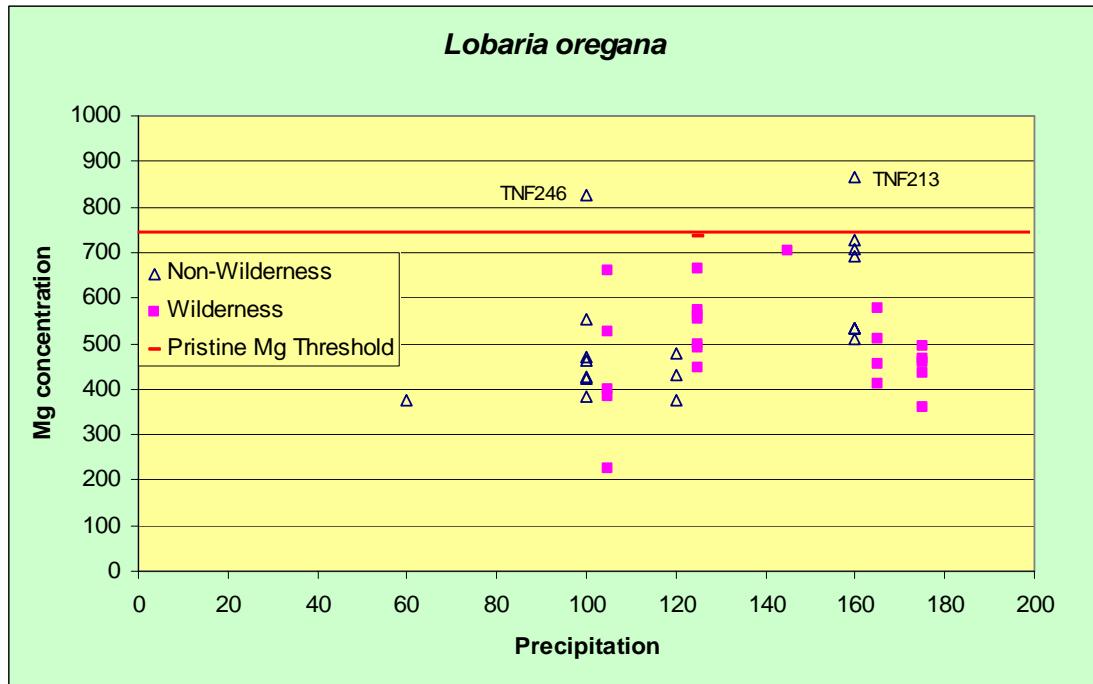


Figure XIX-19. Wilderness and Non-Wilderness plot means of Mg ppm in *Lobaria oregana* vs. plot Precipitation.

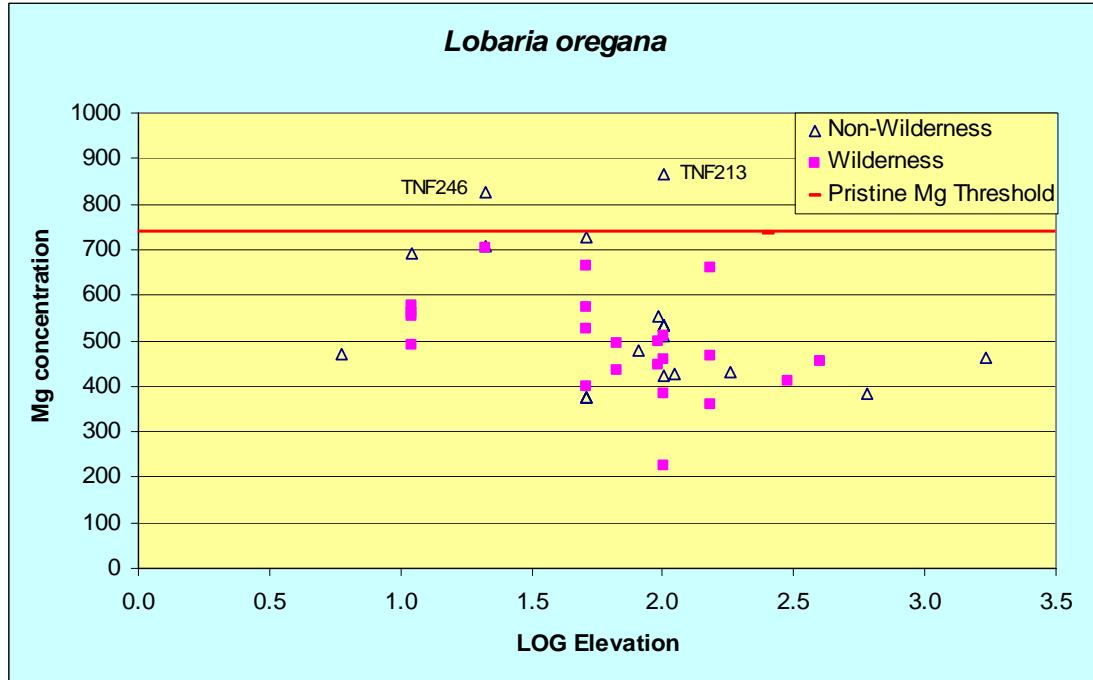


Figure XIX-20. Wilderness and Non-Wilderness plot means of Mg ppm in *Lobaria oregana* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mg ppm

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Platismatia glauca

Table XIX-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Mg ppm content of *Platismatia glauca* per year.

Mg ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2003	Wilderness	631.63	NA	NA	NA
2004	Wilderness	821.80	71.2282	660.6702	982.9288
2005	Non-Wilderness	960.25	112.0473	706.7770	1213.7144
2005	Wilderness	1147.34	155.5752	779.4636	1515.2176

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mg ppm

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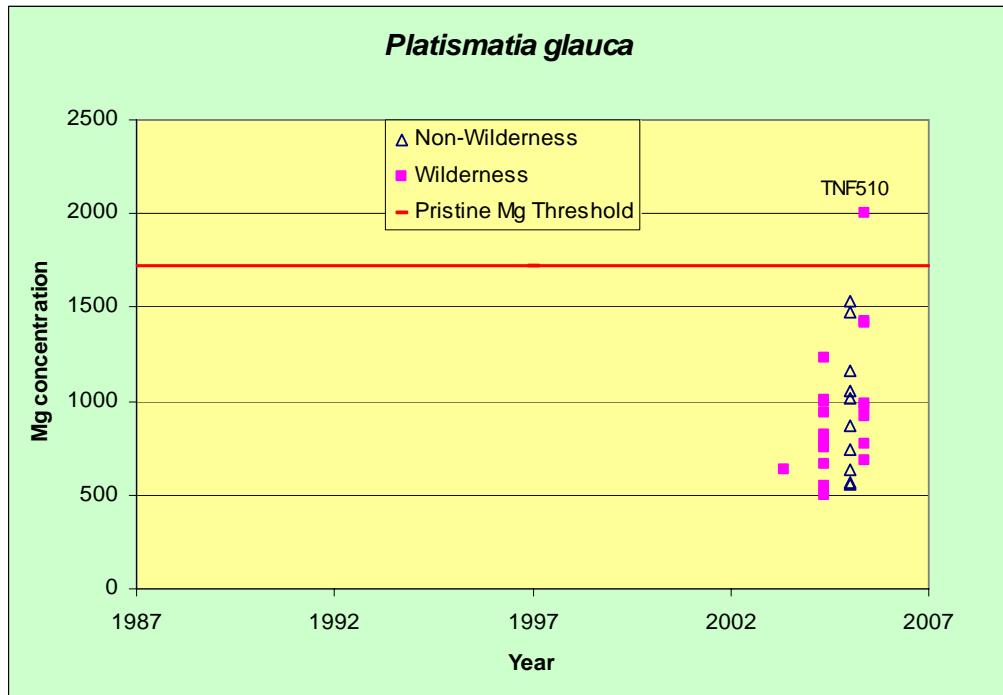


Figure XIX-21. Wilderness and Non-Wilderness yearly means of Mg ppm in *Platismatia glauca* per year.

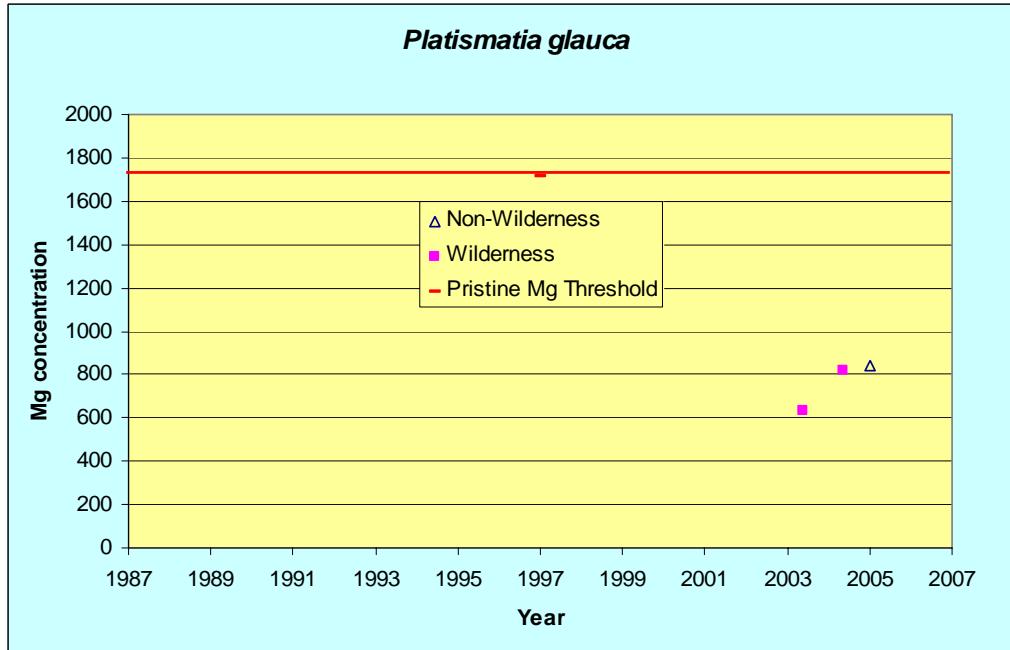


Figure XIX-22. Wilderness and Non-Wilderness plot means of Mg ppm in *Platismatia glauca* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mg ppm

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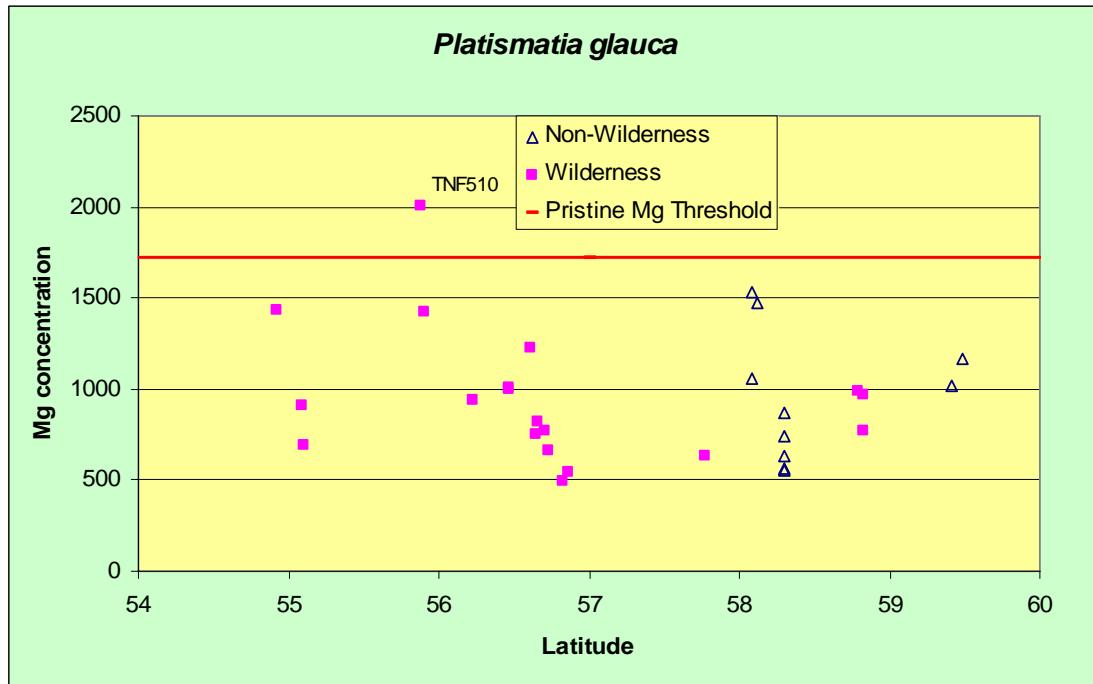


Figure XIX-23. Wilderness and Non-Wilderness plot means of Mg ppm in *Platismatia glauca* vs. plot Latitude.

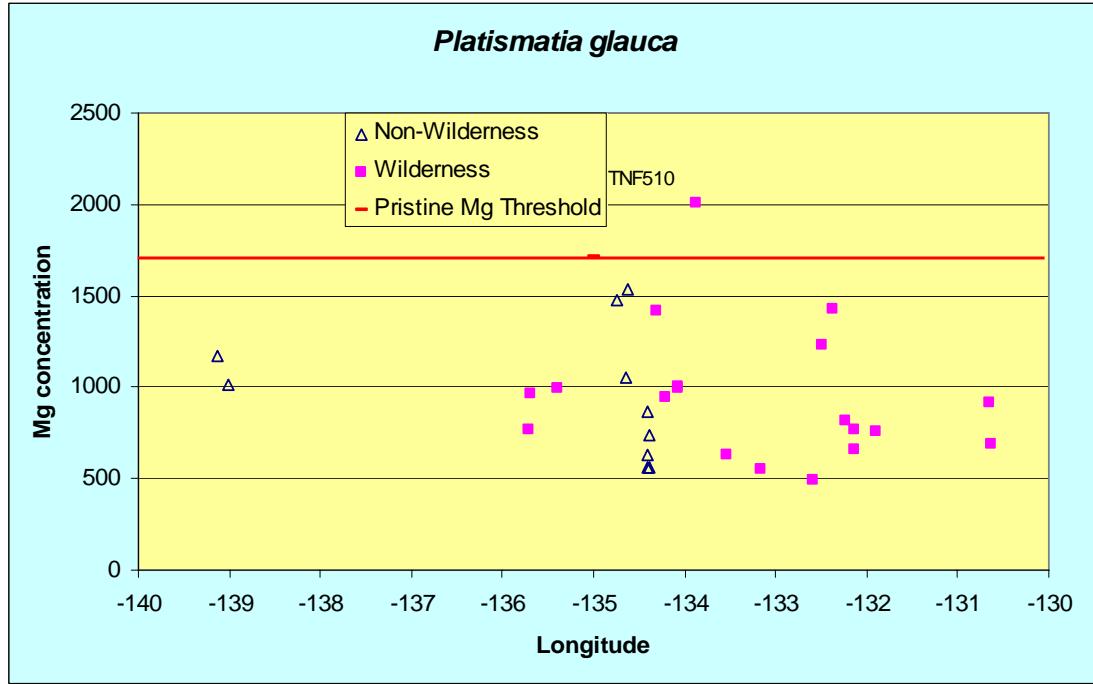


Figure XIX-24. Wilderness and Non-Wilderness plot means of Mg ppm in *Platismatia glauca* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mg ppm

██

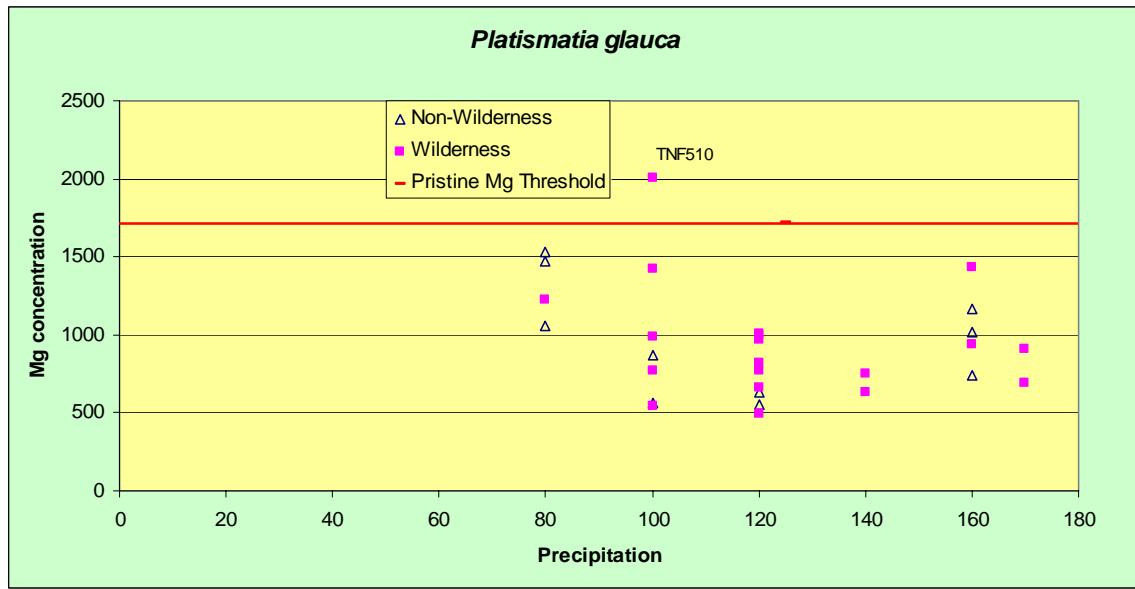


Figure XIX-25. Wilderness and Non-Wilderness plot means of Mg ppm in *Platismatia glauca* vs. plot Precipitation.

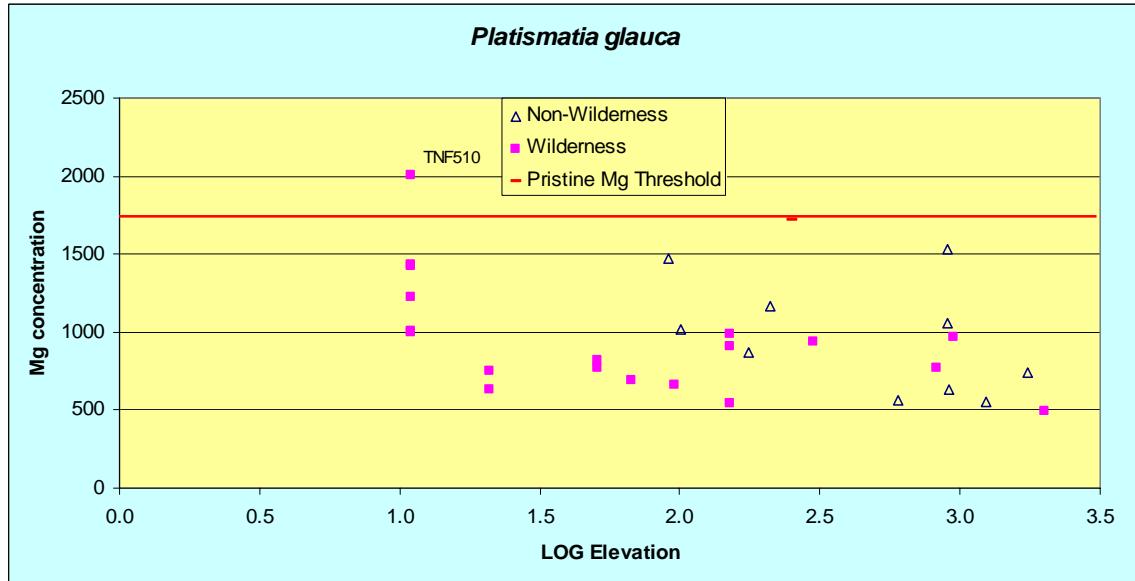


Figure XIX-26. Wilderness and Non-Wilderness plot means of Mg ppm in *Platismatia glauca* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mn ppm

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XX. SUMMARY OF Mn PPM DATA ANALYSIS

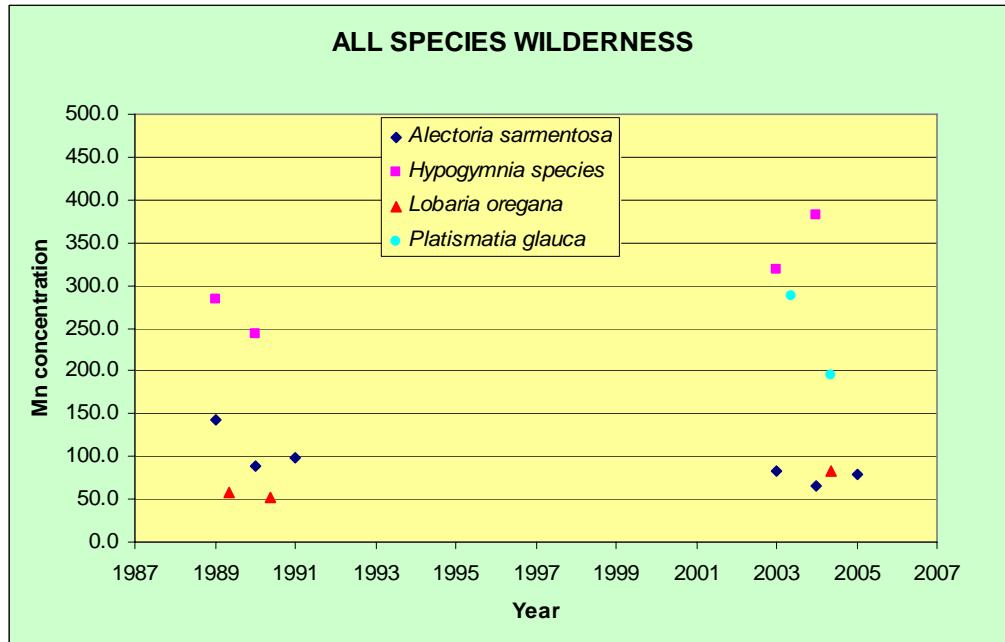


Figure XX-27. Wilderness plot means of Mn ppm
in All Species per year.

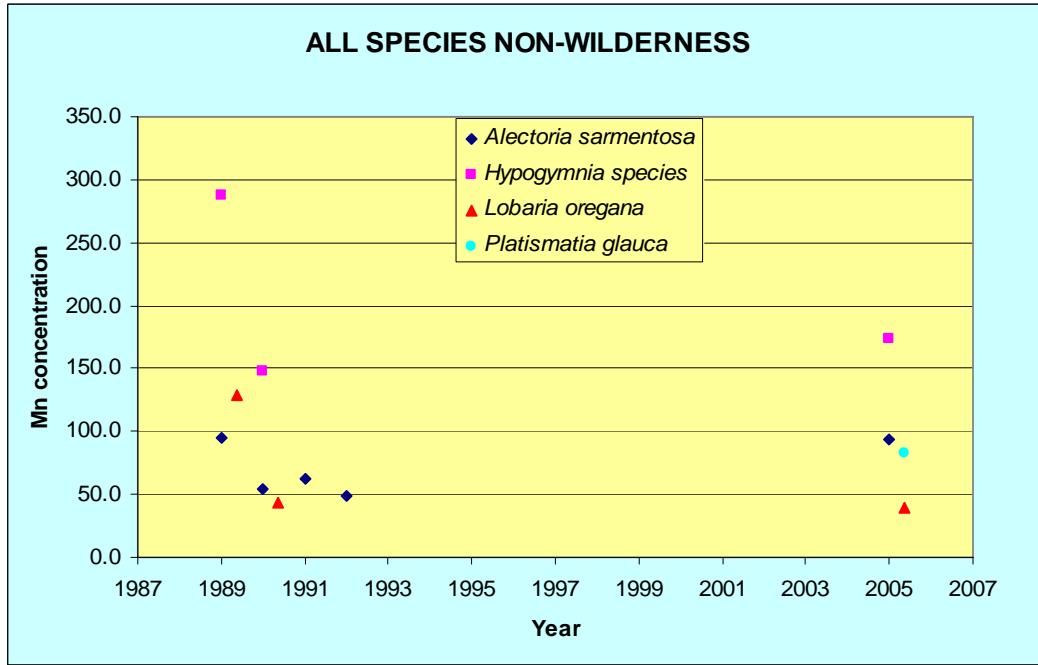


Figure XX-28. Non-Wilderness plot means of Mn ppm
in All Species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mn ppm

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Alectoria sarmentosa

Summary Statistics:

Table XX-2. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Mn ppm content of *Alectoria sarmentosa* per year.

Mn ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	95.34	8.0985	72.8550	117.8250
1989	Wilderness	142.28	32.4231	58.9316	225.6239
1990	Non-Wilderness	54.44	11.3047	31.2013	77.6755
1990	Wilderness	89.00	23.6286	31.1840	146.8179
1991	Non-Wilderness	62.2600	8.9156	43.5290	80.9910
1991	Wilderness	98.32	18.8259	46.0557	150.5939
1992	Non-Wilderness	Mn	49.23	14.8371	14.1507
2003	Wilderness	83.84	0.4025	78.7306	88.9591
2004	Wilderness	64.91	10.8394	42.4861	87.3323
2005	Non-Wilderness	93.57	19.2022	44.2128	142.9343
2005	Wilderness	79.77	16.7386	41.9016	117.6321

Summary of Statistical Tests:

$$t = -0.9515, df = 8, p\text{-value} = 0.3692$$

There is no evidence of a difference in Mn ppm content in *Alectoria sarmentosa* from pre-2000 and post 2000 samples (p-value = 0.3692).

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mn ppm

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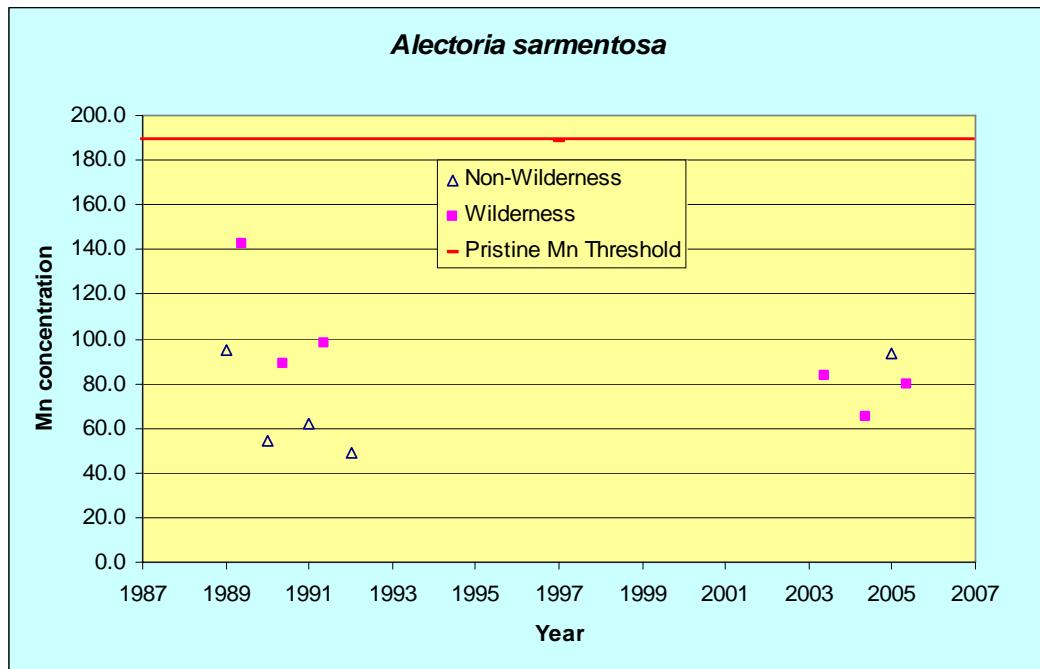


Figure XX-3. Wilderness and Non-Wilderness yearly means of Mn ppm in *Alectoria sarmentosa* per year.

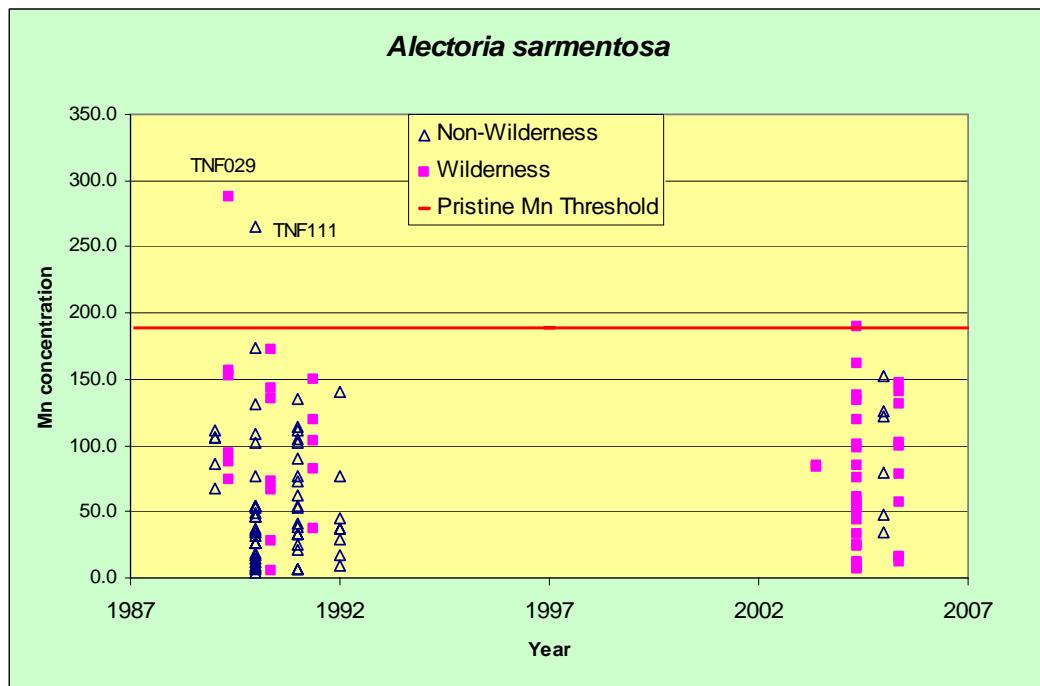


Figure XX-4. Wilderness and Non-Wilderness plot means of Mn ppm in *Alectoria sarmentosa* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mn ppm

██

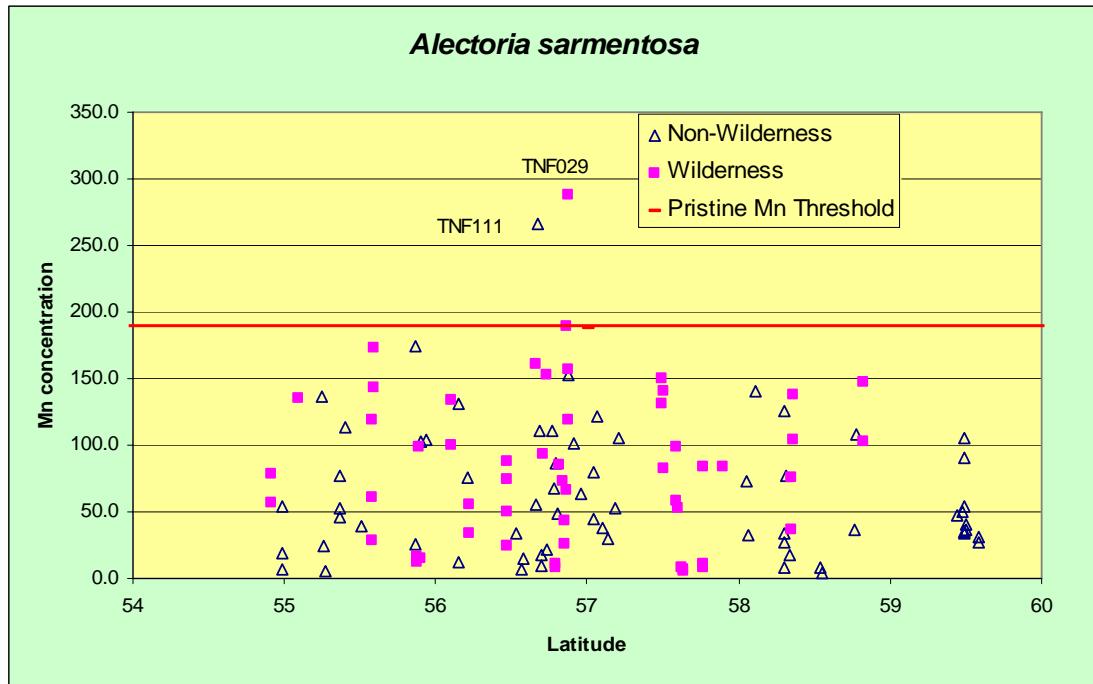


Figure XX-5. Wilderness and Non-Wilderness plot means of Mn ppm in *Alectoria sarmentosa* vs. plot Latitude.

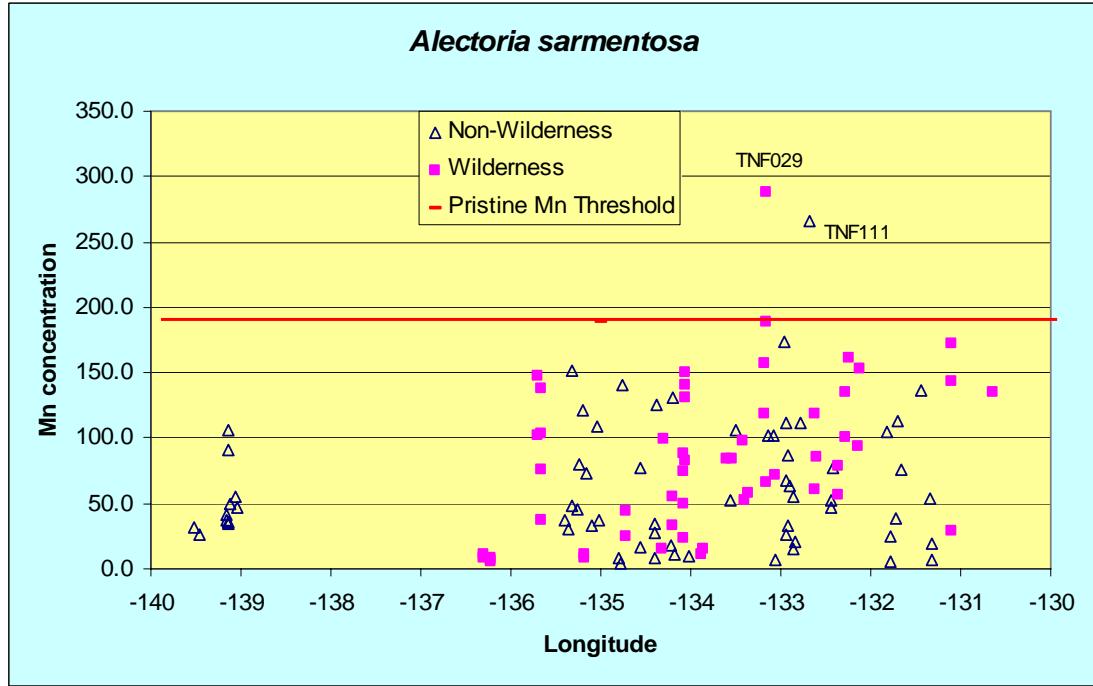


Figure XX-6. Wilderness and Non-Wilderness plot means of Mn ppm in *Alectoria sarmentosa* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mn ppm

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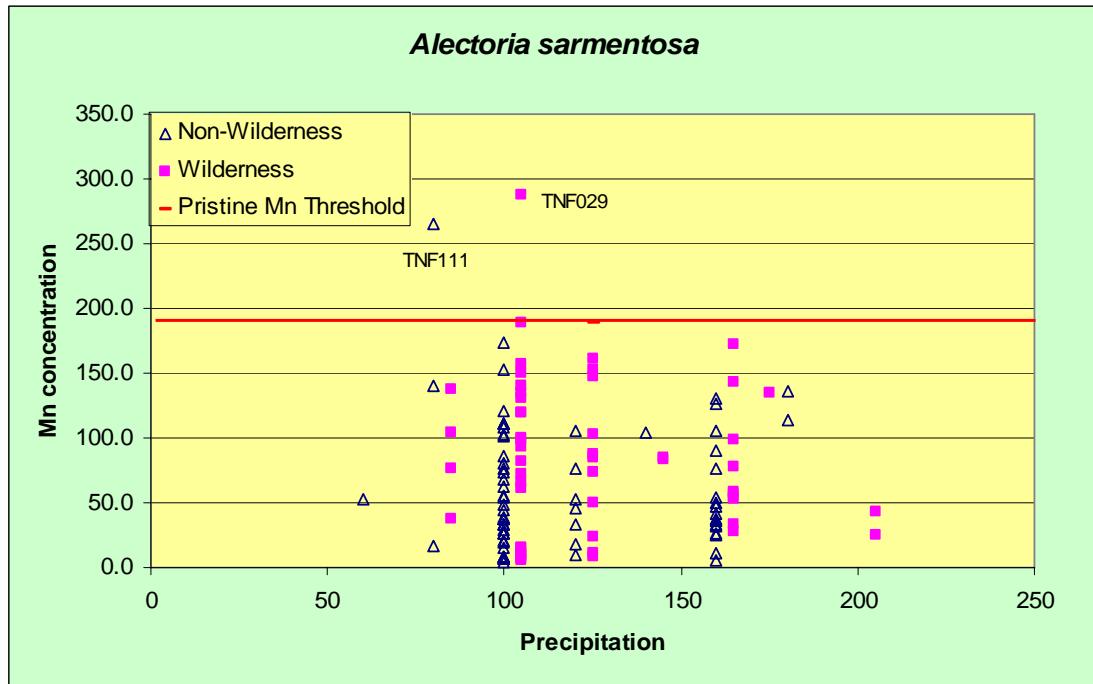


Figure XX-7. Wilderness and Non-Wilderness plot means of Mn ppm in *Alectoria sarmentosa* vs. plot Precipitation.

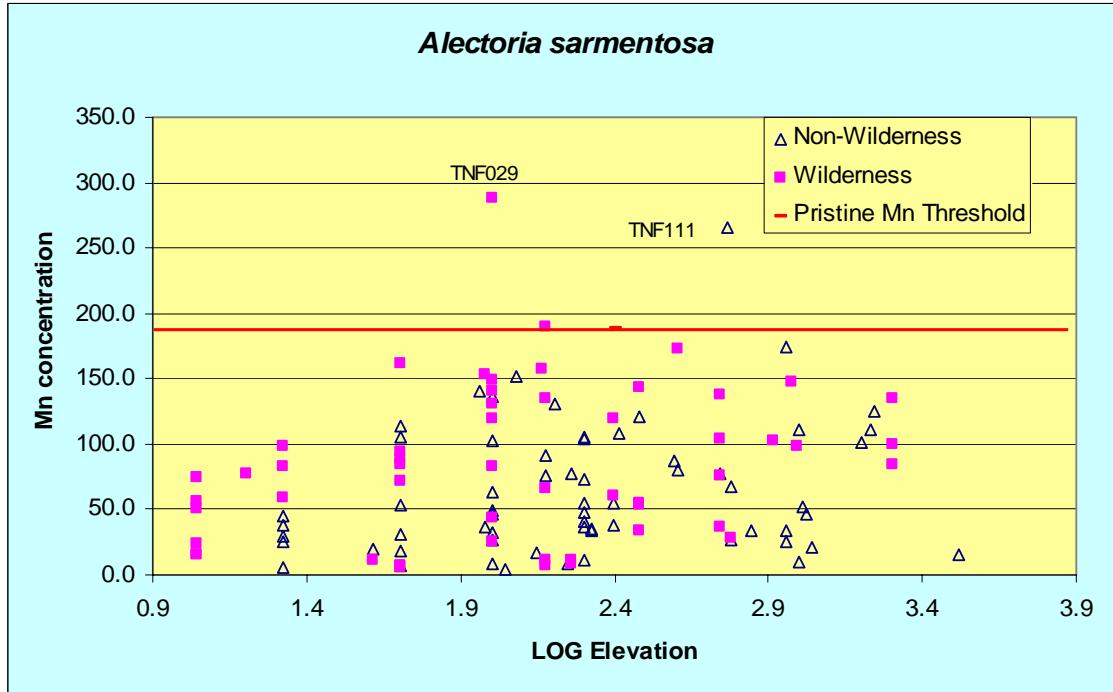


Figure XX-8. Wilderness and Non-Wilderness plot means of Mn ppm in *Alectoria sarmentosa* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mn ppm

██

Hypogymnia species

In this series, all of the *Hypogymnia* species were included as a group.

Table XX-3. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Mn ppm content of *Hypogymnia species* per year.

Mn ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	287.00	169.0000	1860.3490	2434.3490
1989	Wilderness	284.58	56.9713	126.4058	442.7609
1990	Non-Wilderness	147.90	36.2956	71.6494	224.1576
1990	Wilderness	242.52	56.3119	104.7337	380.3140
2003	Wilderness	318.23	NA	NA	NA
2004	Wilderness	381.90	62.5739	221.0461	542.7489
2005	Non-Wilderness	173.83	38.5061	8.1562	339.5131
2005	Wilderness	432.29	102.9860	194.8039	669.7764

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mn ppm

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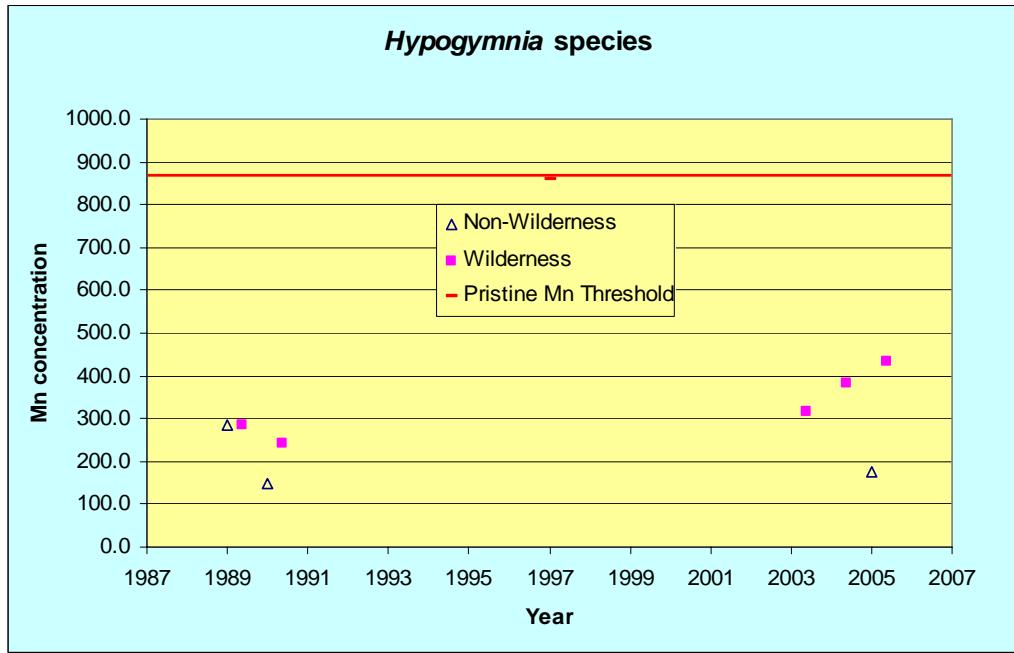


Figure XX-9. Wilderness and Non-Wilderness yearly means of Mn ppm in *Hypogymnia* species per year.

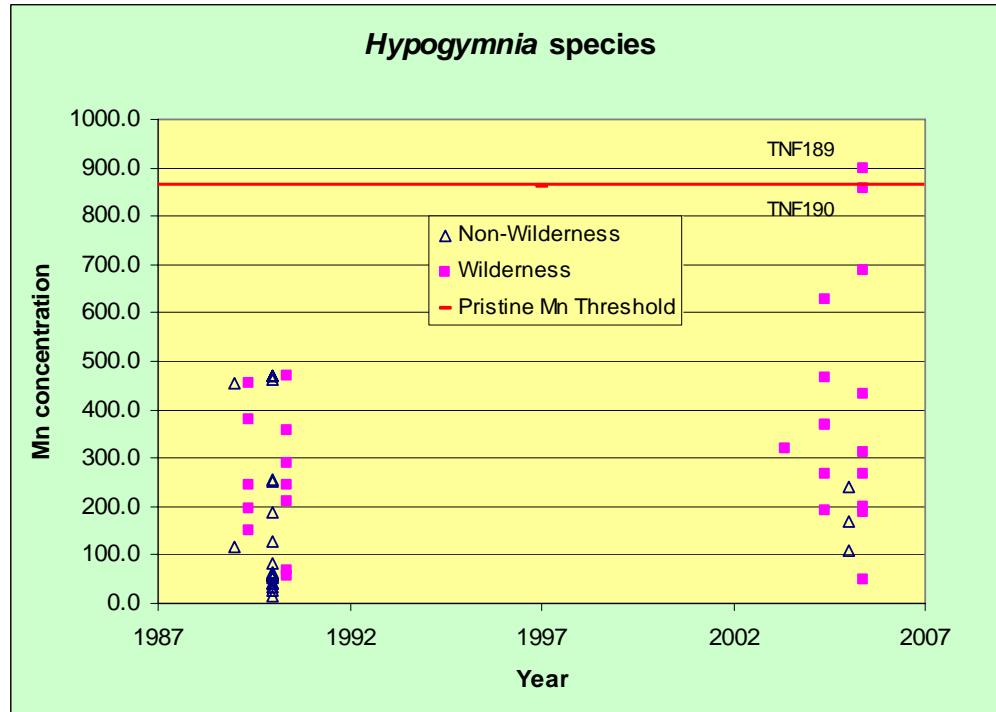


Figure XX-10. Wilderness and Non-Wilderness plot means of Mn ppm in *Hypogymnia* species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mn ppm

██

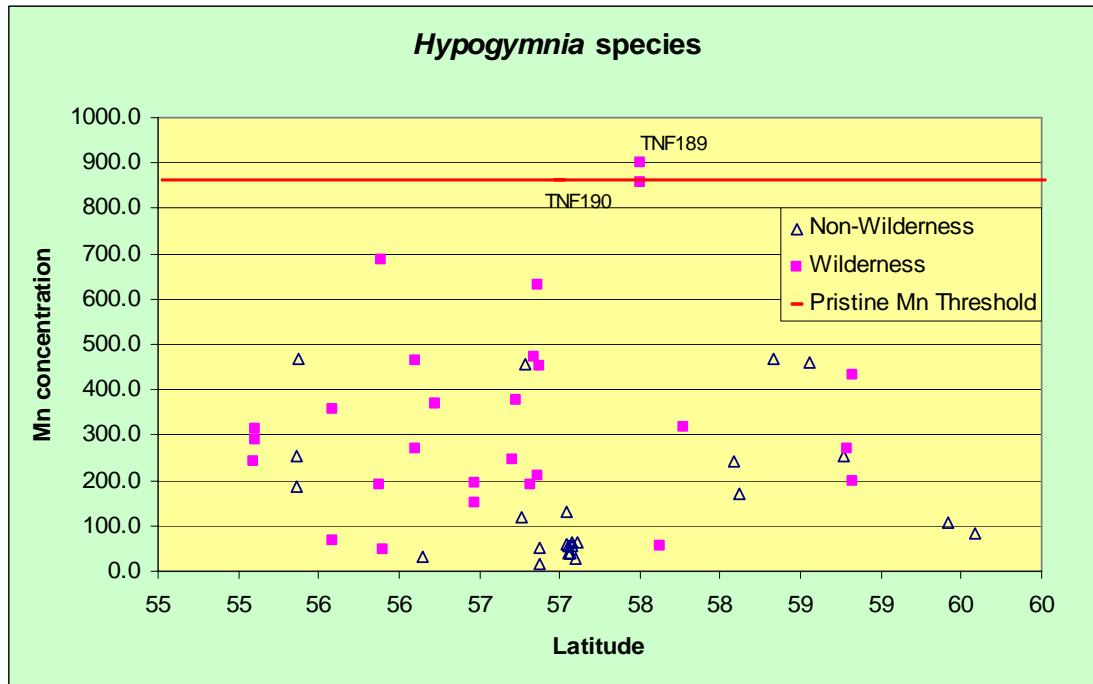


Figure XX-11. Wilderness and Non-Wilderness plot means of Mn ppm in *Hypogymnia* species vs. plot Latitude.

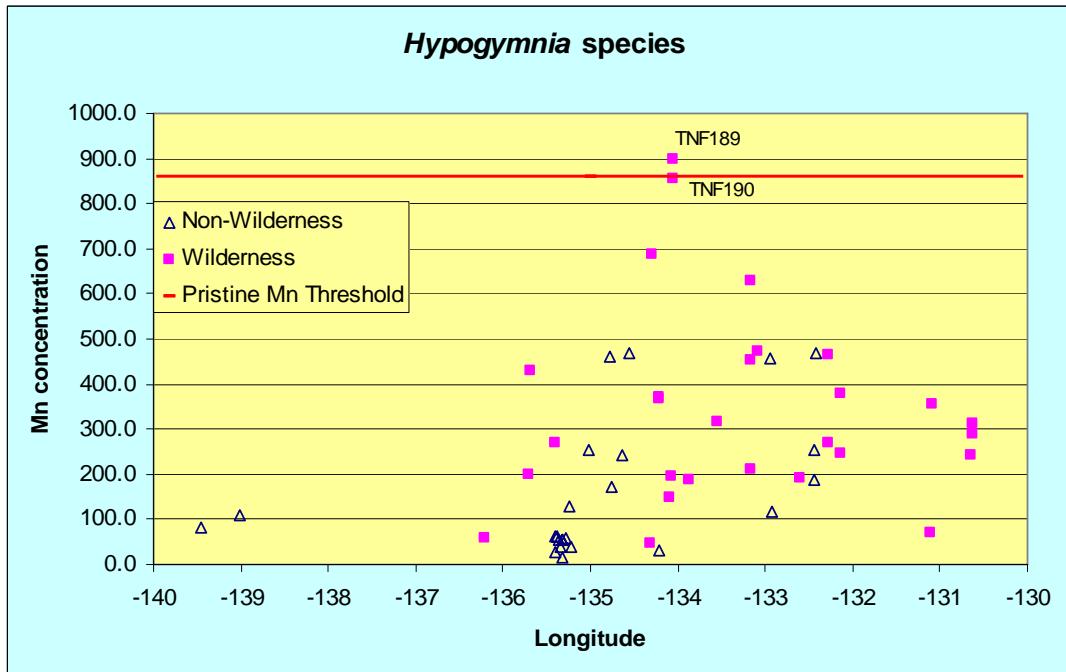


Figure XX-12. Wilderness and Non-Wilderness plot means of Mn ppm in *Hypogymnia* species vs. plot Longitude.

██

ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mn ppm

██

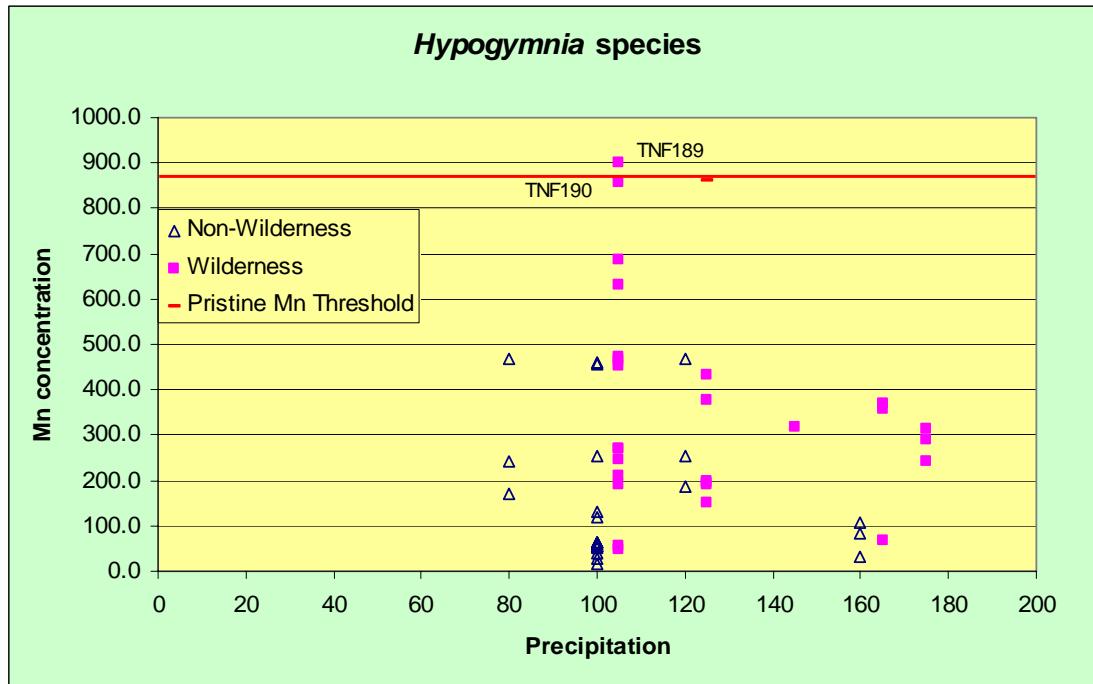


Figure XX-13. Wilderness and Non-Wilderness plot means of Mn ppm in *Hypogymnia species* vs. plot Precipitation.

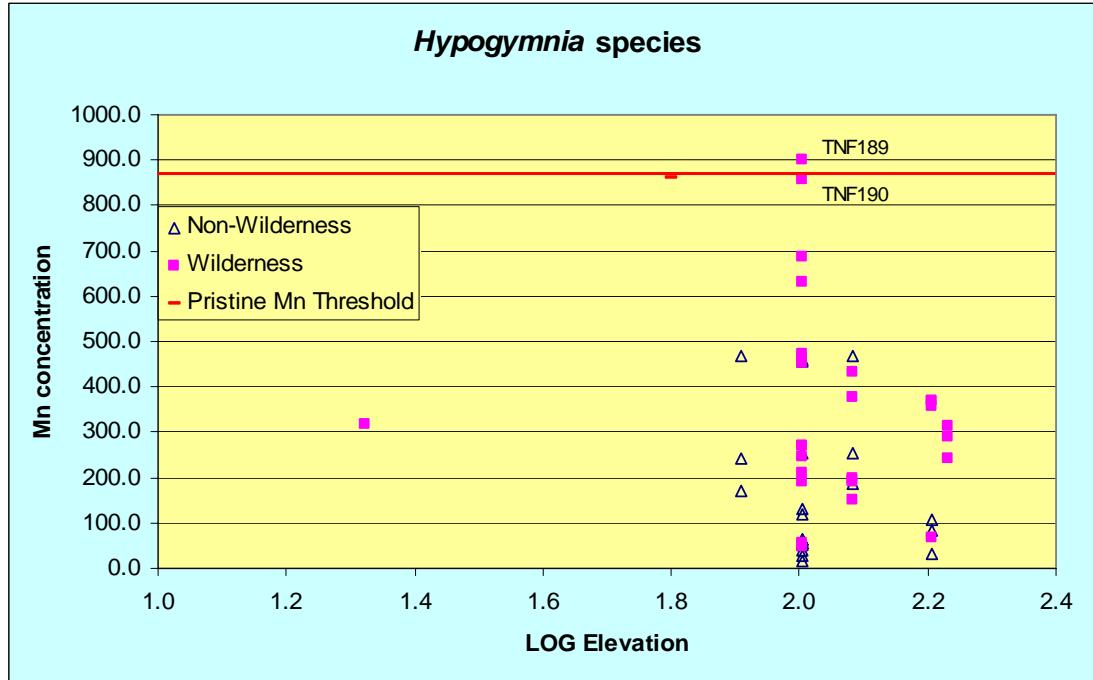


Figure XX-14. Wilderness and Non-Wilderness plot means of Mn ppm in *Hypogymnia species* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mn ppm

██

Lobaria oregana

Table XX-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Mn ppm content of *Lobaria oregana* per year.

Mn ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	129.42	22.5883	57.5308	201.3026
1989	Wilderness	58.81	12.0128	25.4606	92.1661
1990	Non-Wilderness	43.58	8.8066	24.3890	62.7648
1990	Wilderness	51.84	9.9798	26.1863	77.4942
2004	Wilderness	82.33	13.2018	50.0224	114.6297
2005	Non-Wilderness	39.24	NA	NA	NA
2005	Wilderness	71.0396	14.6810	24.3182	117.7611

Summary of Statistical Tests:

$$t = -1.9289, df = 4, p\text{-value} = 0.126$$

There is no evidence of a difference in Mn ppm content in *Lobaria oregana* from pre-2000 and post 2000 samples (p-value = 0.1260).

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mn ppm

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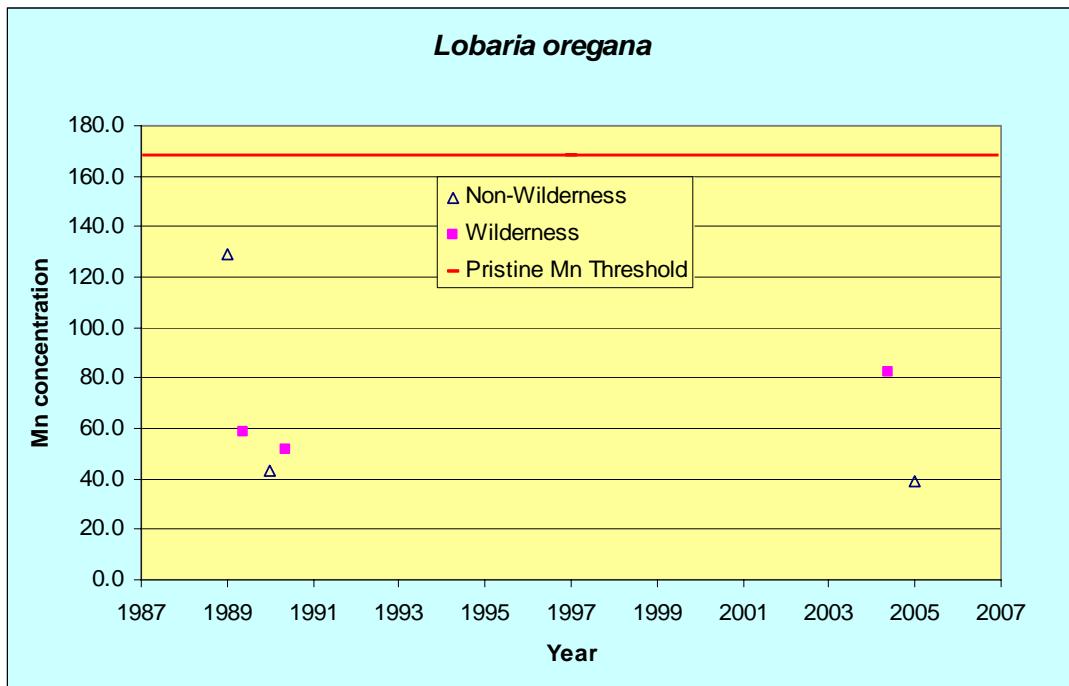


Figure XX-15. Wilderness and Non-Wilderness yearly means of Mn ppm in *Lobaria oregana* per year.

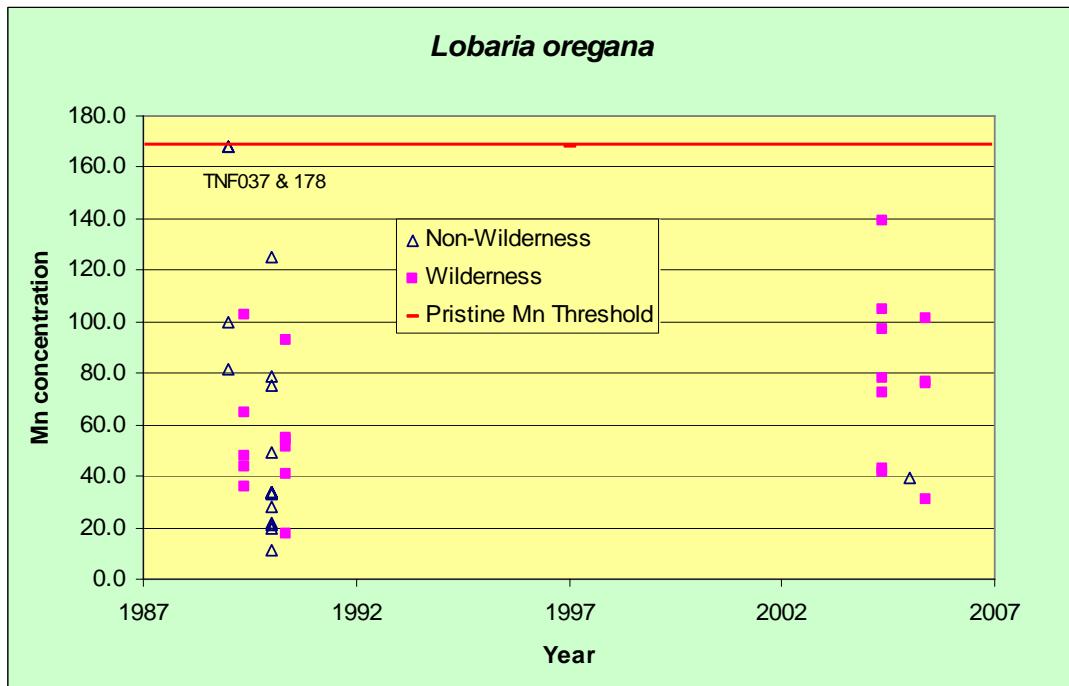


Figure XX-16. Wilderness and Non-Wilderness plot means of Mn ppm in *Lobaria oregana* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mn ppm

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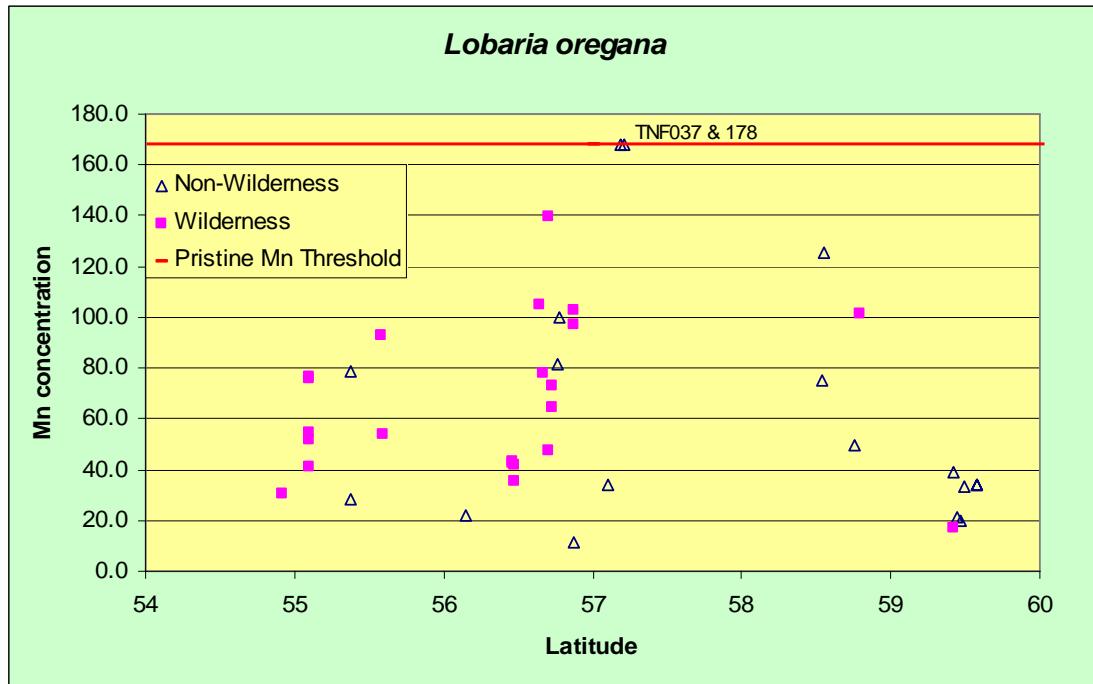


Figure XX-17. Wilderness and Non-Wilderness plot means of Mn ppm in *Lobaria oregana* vs. plot Latitude.

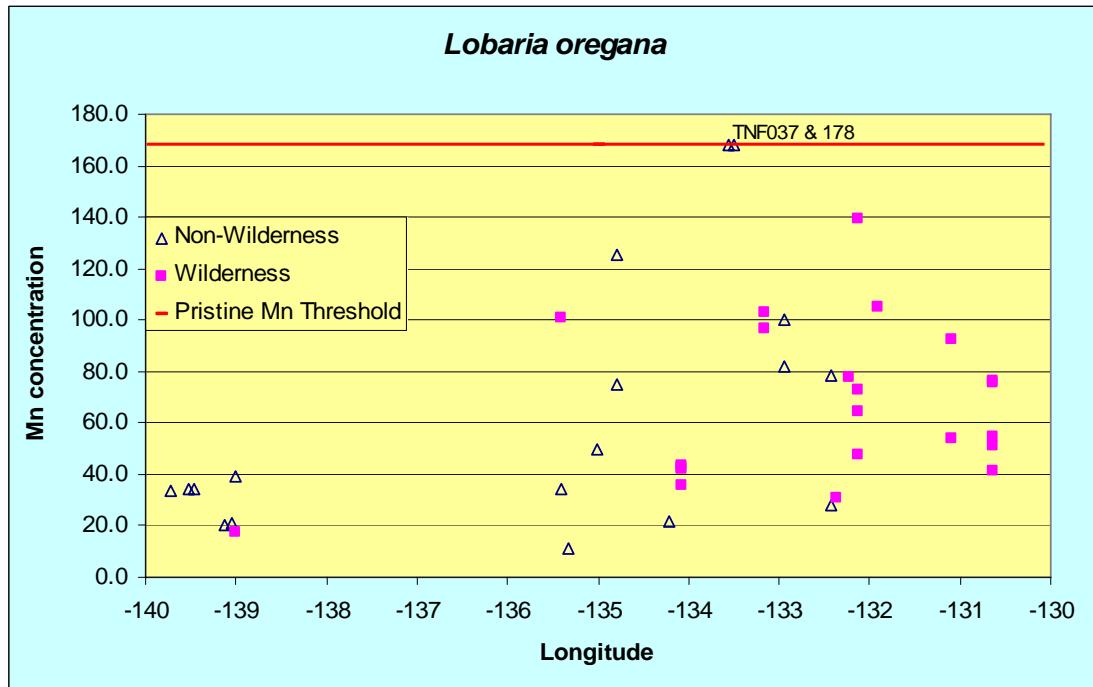


Figure XX-18. Wilderness and Non-Wilderness plot means of Mn ppm in *Lobaria oregana* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mn ppm

██

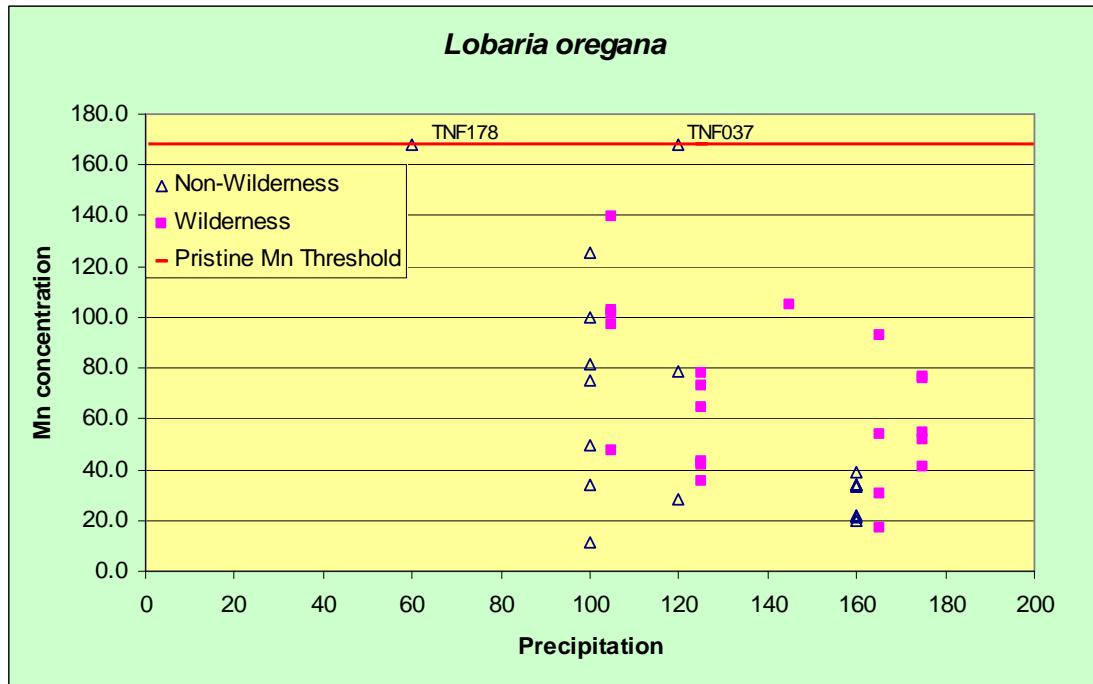


Figure XX-19. Wilderness and Non-Wilderness plot means of Mn ppm in *Lobaria oregana* vs. plot Precipitation.

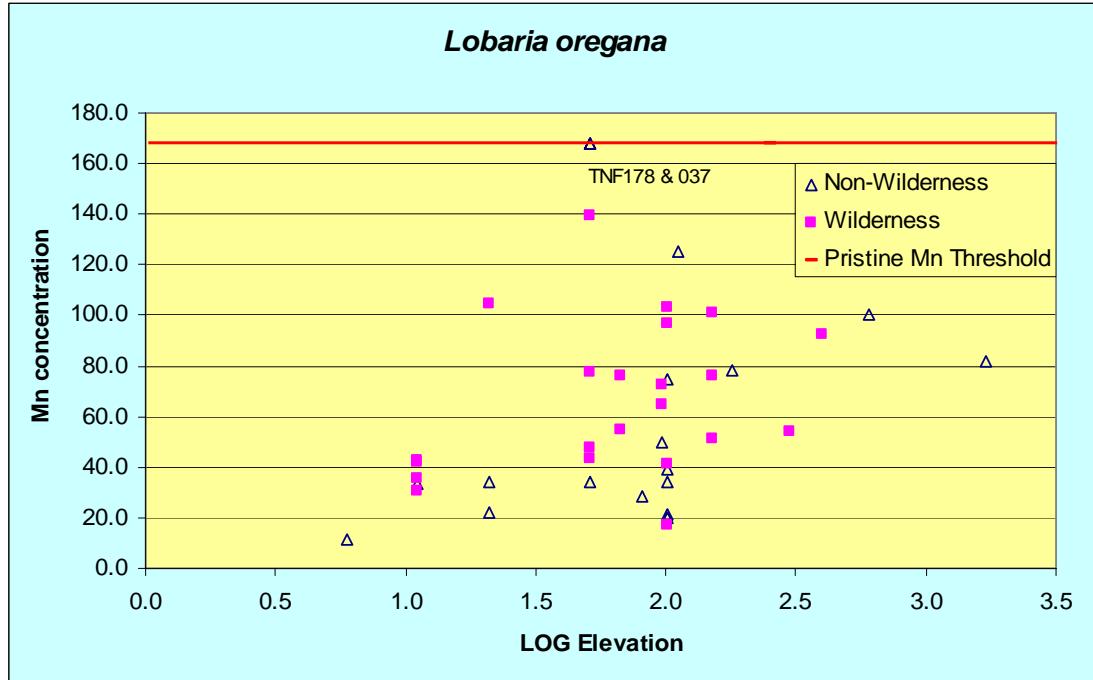


Figure XX-20. Wilderness and Non-Wilderness plot means of Mn ppm in *Lobaria oregana* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mn ppm

██

Platismatia glauca

Table XX-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Mn ppm content of *Platismatia glauca* per year.

Mn ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2003	Wilderness	287.02	NA	NA	NA
2004	Wilderness	195.17	49.4364	83.3405	307.0063
2005	Non-Wilderness	155.24	21.9739	105.5308	204.9476
2005	Wilderness	148.13	51.7702	25.7136	270.5479

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mn ppm

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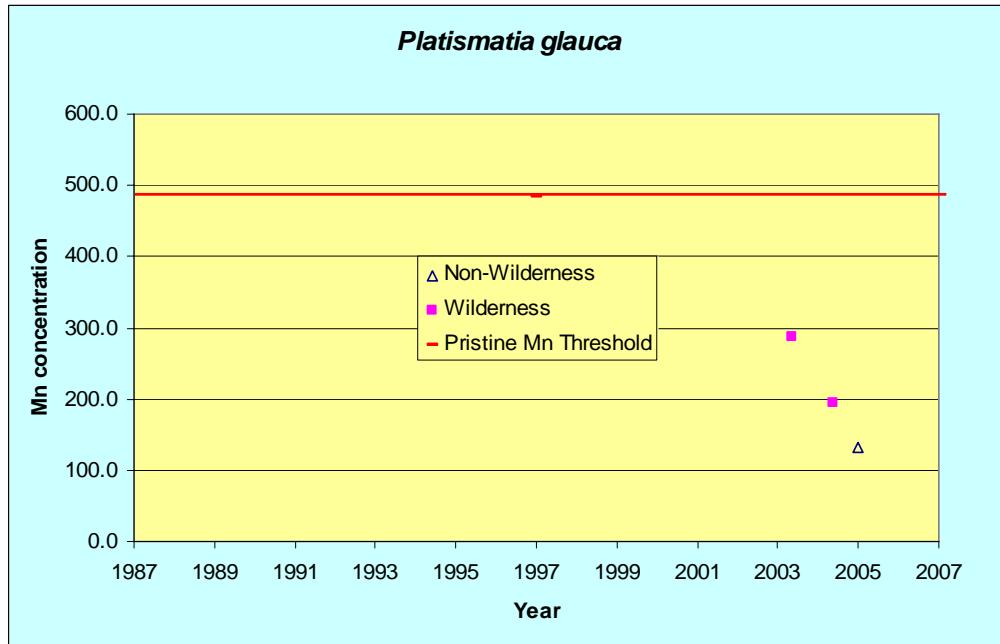


Figure XX-21. Wilderness and Non-Wilderness yearly means of Mn ppm in *Platismatia glauca* per year.

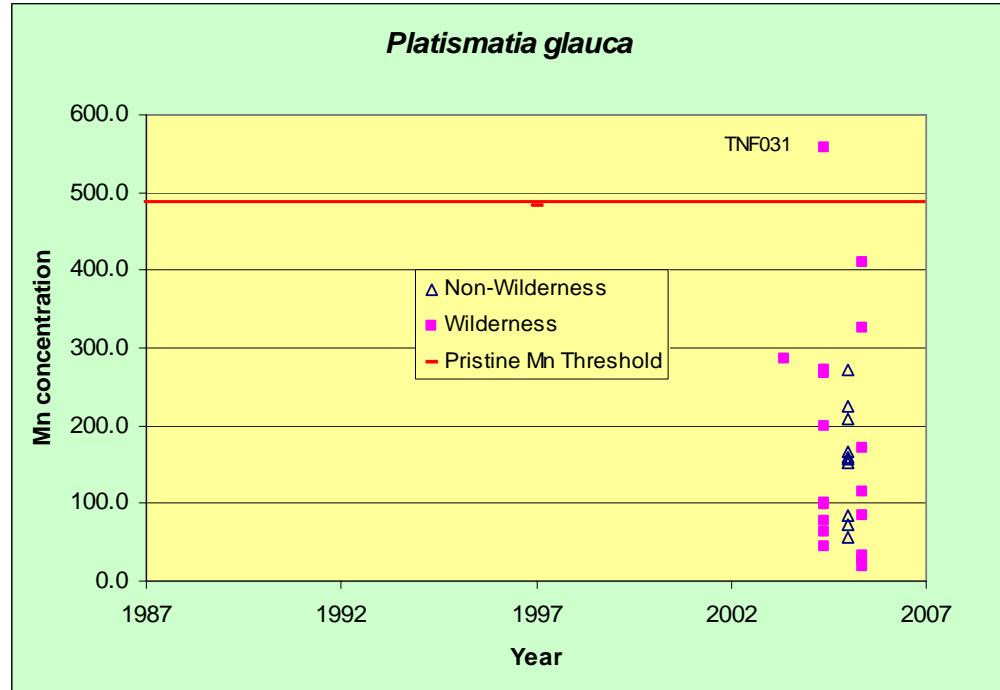


Figure XX-22. Wilderness and Non-Wilderness plot means of Mn ppm in *Platismatia glauca* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mn ppm

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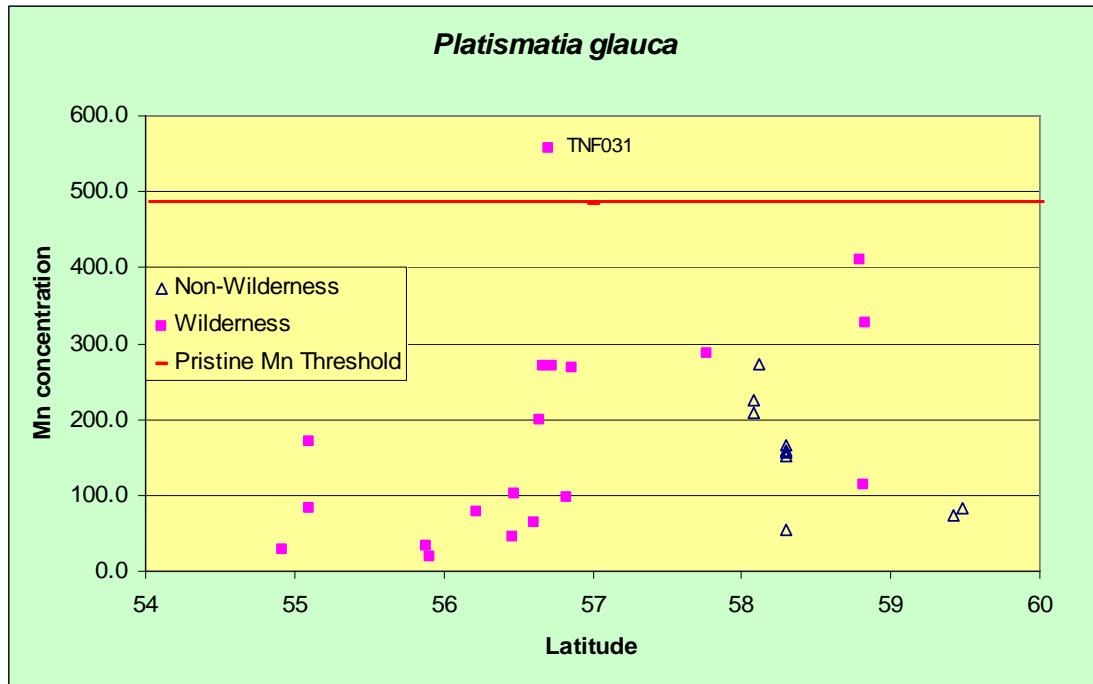


Figure XX-23. Wilderness and Non-Wilderness plot means of Mn ppm in *Platismatia glauca* vs. plot Latitude.

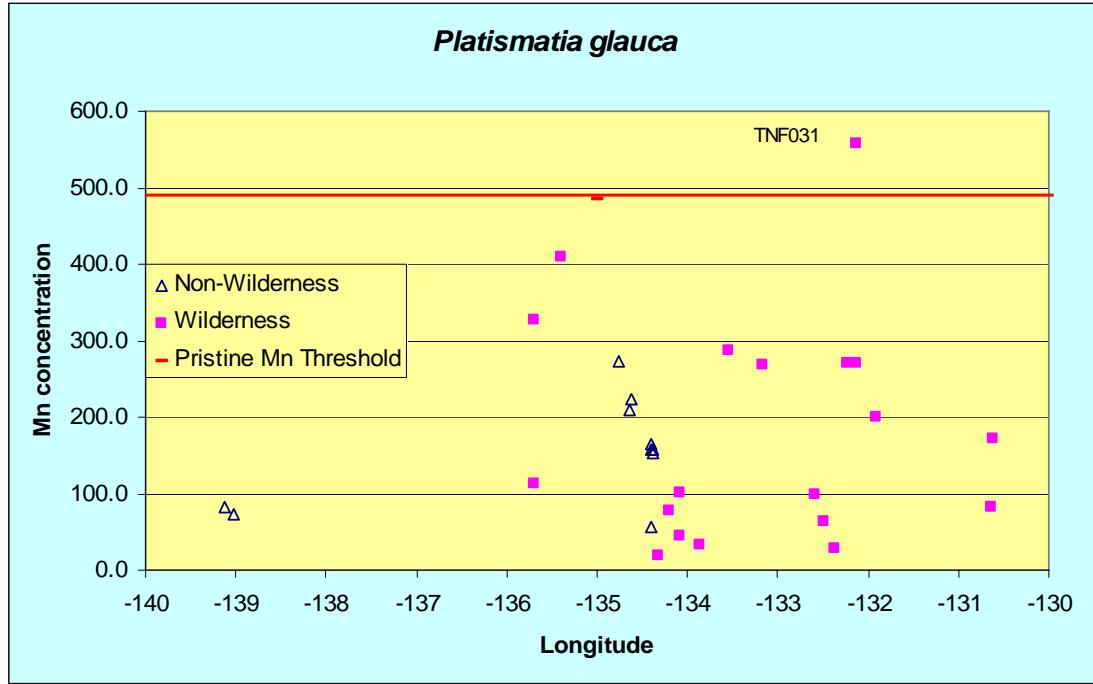


Figure XX-24. Wilderness and Non-Wilderness plot means of Mn ppm in *Platismatia glauca* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mn ppm

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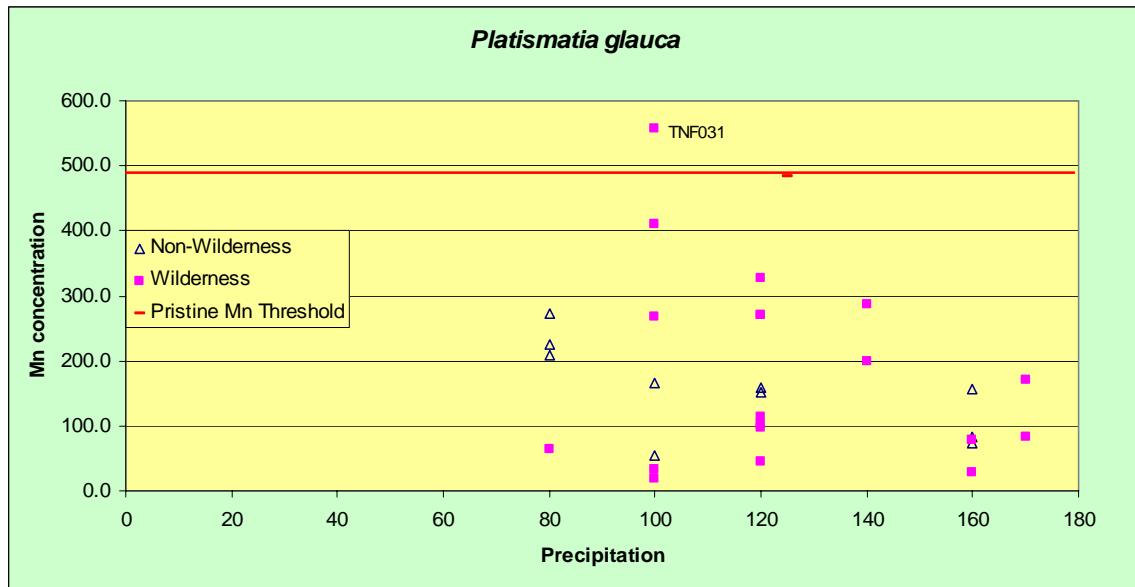


Figure XX-25. Wilderness and Non-Wilderness plot means of Mn ppm in *Platismatia glauca* vs. plot Precipitation.

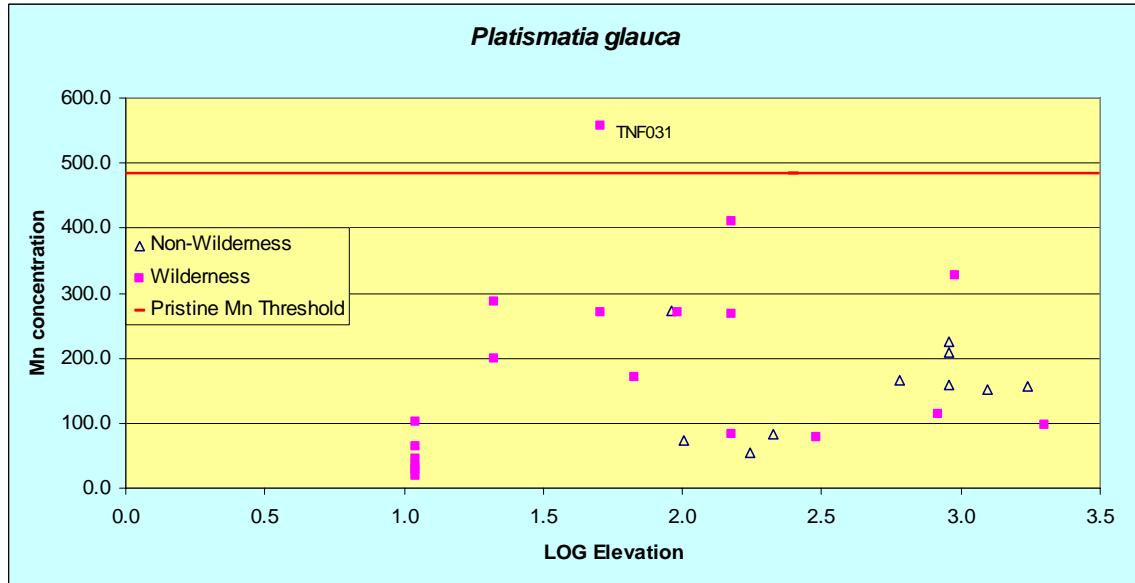


Figure XX-26. Wilderness and Non-Wilderness plot means of Mn ppm in *Platismatia glauca* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mo ppm

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XXI. SUMMARY OF Mo PPM DATA ANALYSIS

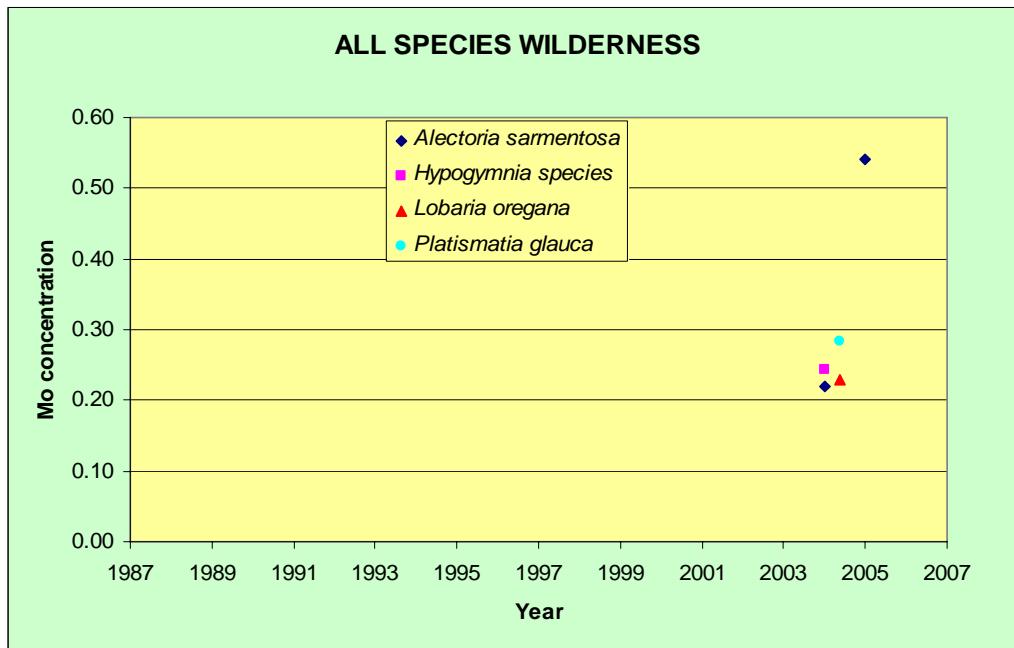


Figure XXI-27. Wilderness plot means of Mo ppm in All Species per year.

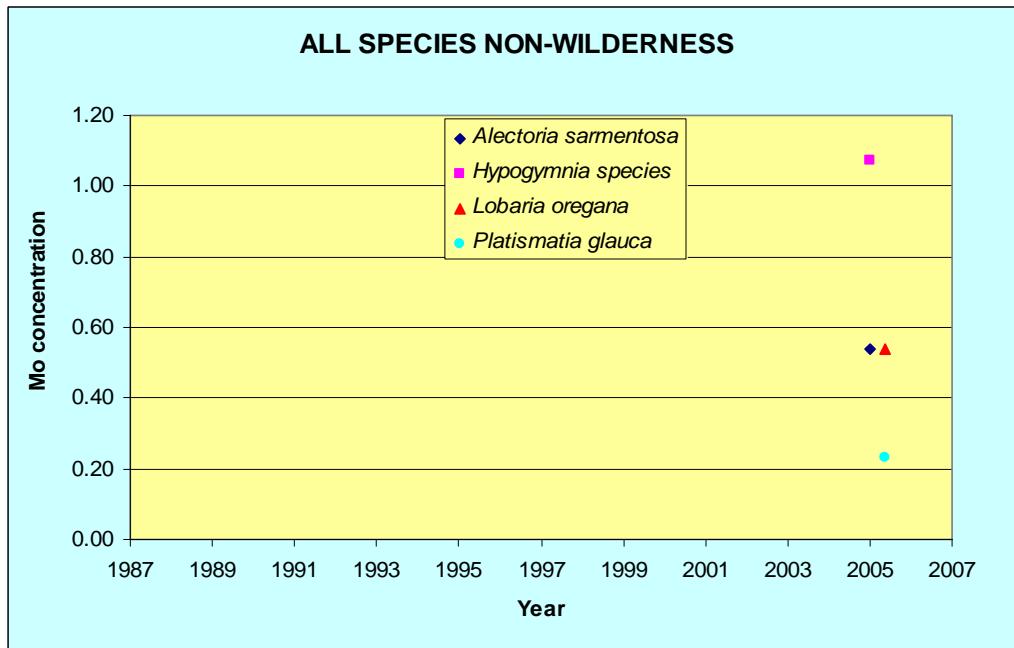


Figure XXI-28. Non-Wilderness plot means of Mo ppm in All Species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mo ppm

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Alectoria sarmentosa

Summary Statistics:

Table XXI-2. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Mo ppm content of *Alectoria sarmentosa* per year.

Mo ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	0.22	0.0000	0.2200	0.2200
2005	Non-Wilderness	0.54	0.0008	0.5388	0.5427
2005	Wilderness	0.54	0.0000	0.5400	0.5400

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mo ppm

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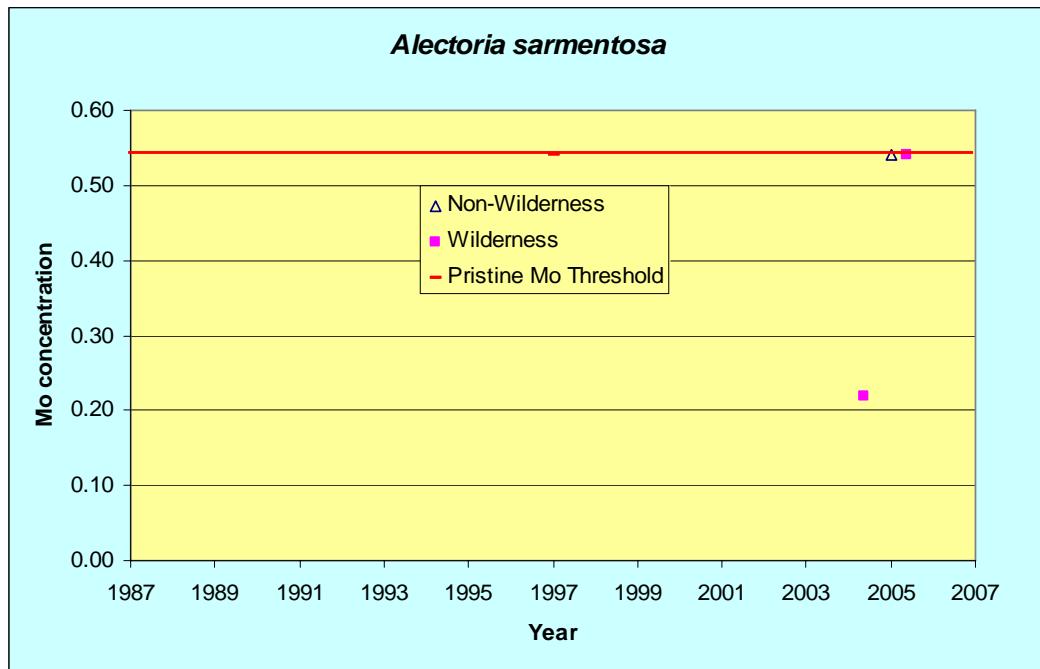


Figure XXI-3. Wilderness and Non-Wilderness yearly means of Mo ppm in *Alectoria sarmentosa* per year.

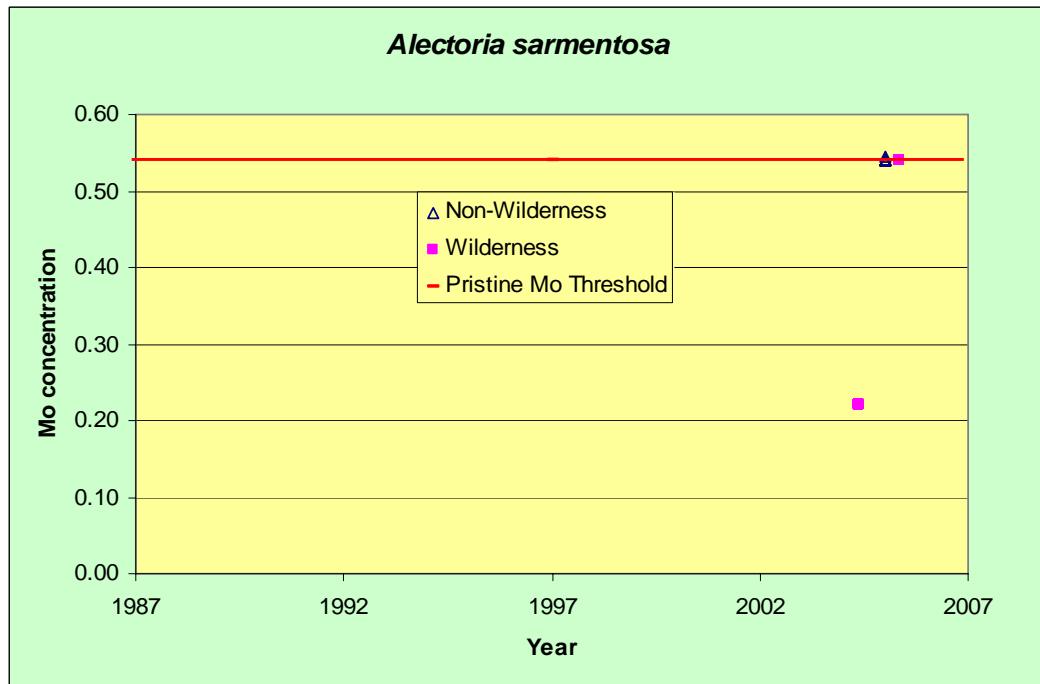


Figure XXI-4. Wilderness and Non-Wilderness plot means of Mo ppm in *Alectoria sarmentosa* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mo ppm

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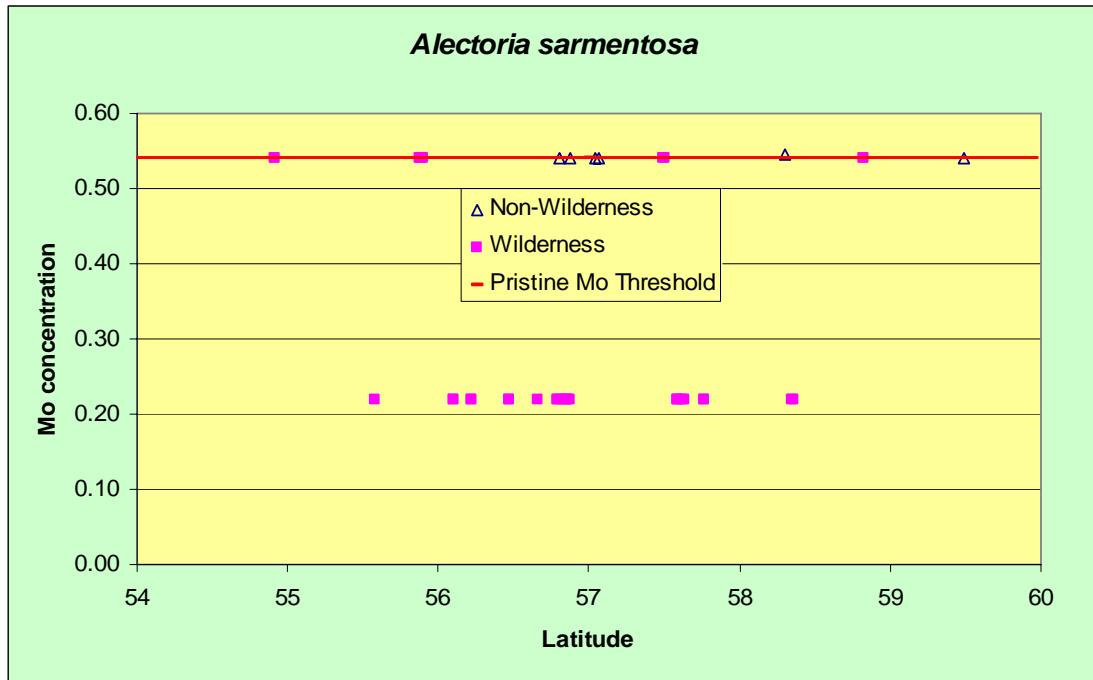


Figure XXI-5. Wilderness and Non-Wilderness plot means of Mo ppm in *Alectoria sarmentosa* vs. plot Latitude.

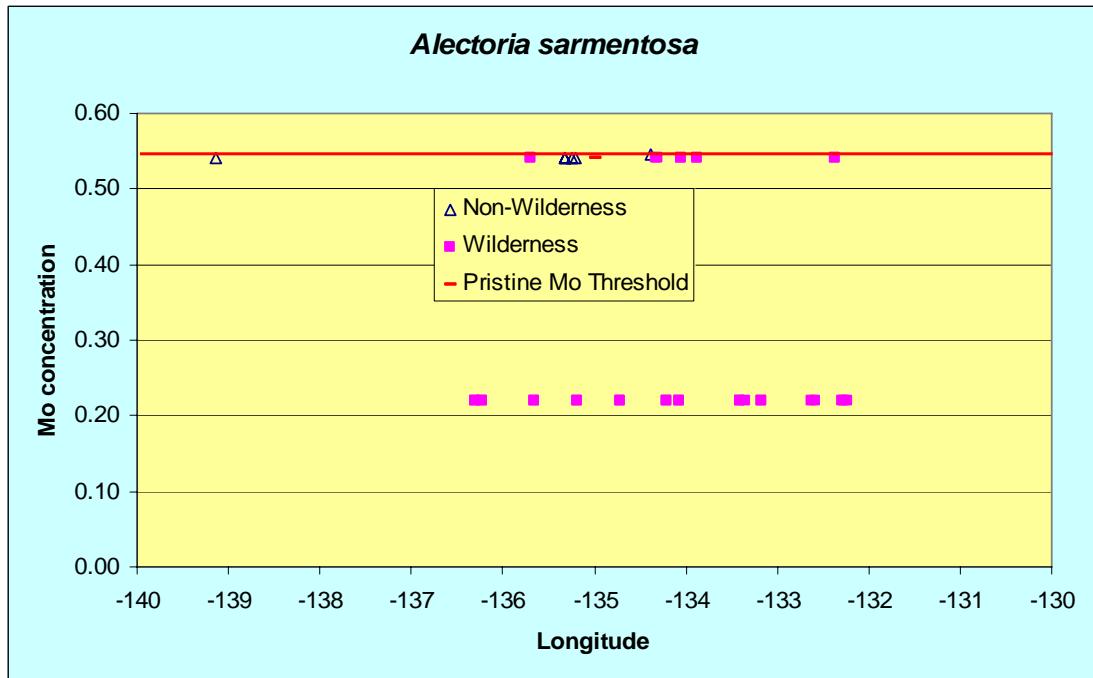


Figure XXI-6. Wilderness and Non-Wilderness plot means of Mo ppm in *Alectoria sarmentosa* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mo ppm

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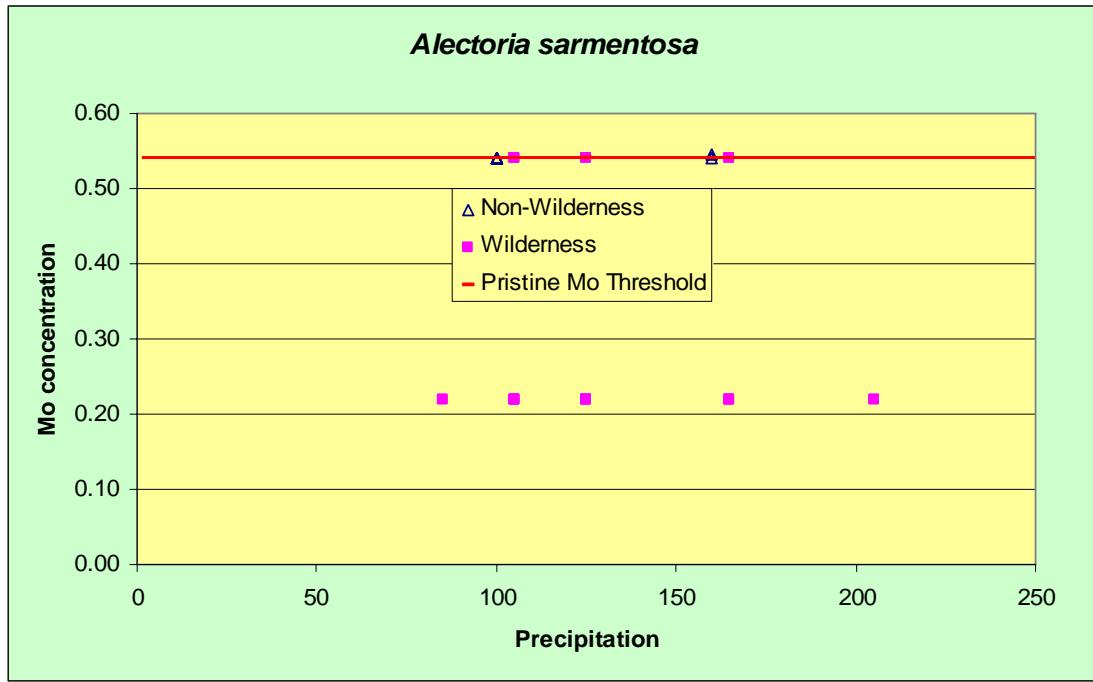


Figure XXI-7. Wilderness and Non-Wilderness plot means of Mo ppm in *Alectoria sarmentosa* vs. plot Precipitation.

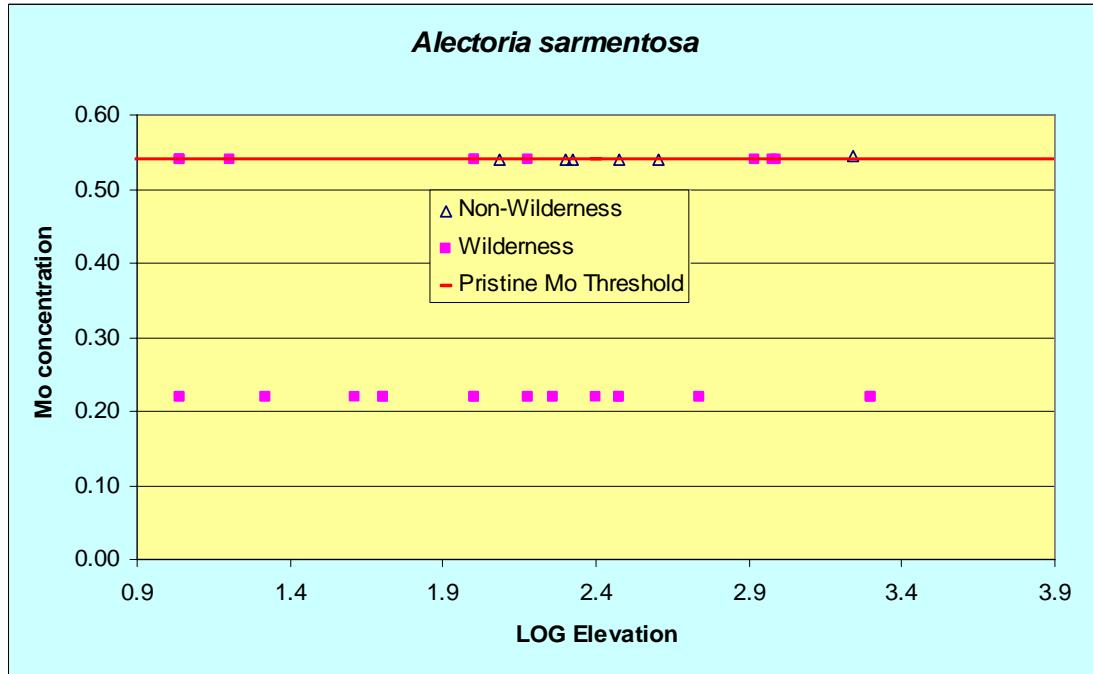


Figure XXI-8. Wilderness and Non-Wilderness plot means of Mo ppm in *Alectoria sarmentosa* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mo ppm

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Hypogymnia species

In this series, all of the *Hypogymnia* species were included as a group.

Table XXI-3. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Mo ppm content of *Hypogymnia species* per year.

Mo ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	0.24	0.0104	0.2168	0.2704
2005	Non-Wilderness	1.07	0.2828	0.1433	2.2907
2005	Wilderness	0.54	0.0000	0.5400	0.5400

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mo ppm

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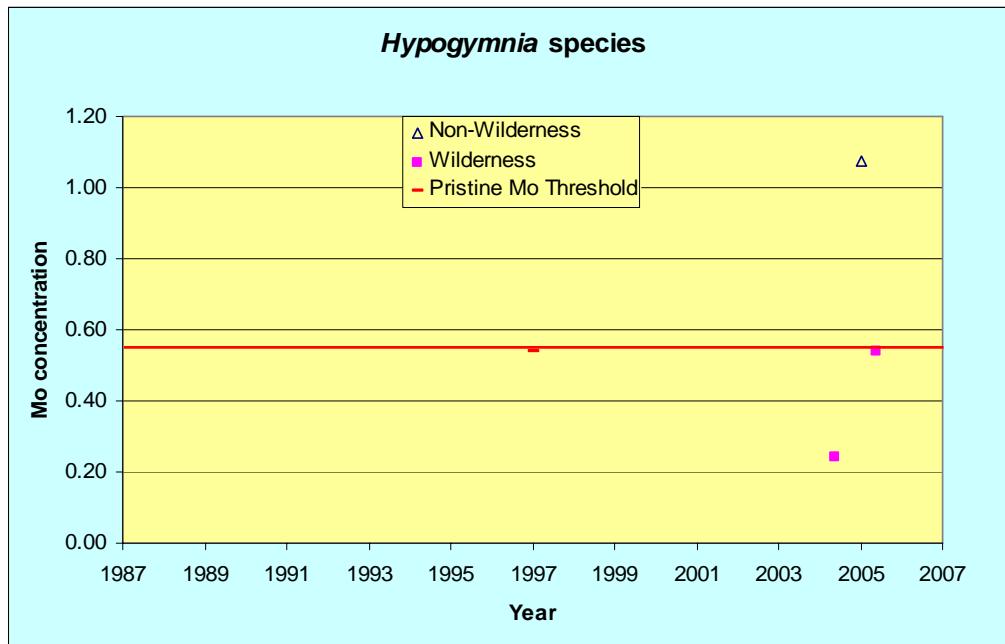


Figure XXI-9. Wilderness and Non-Wilderness yearly means of Mo ppm in *Hypogymnia* species per year.

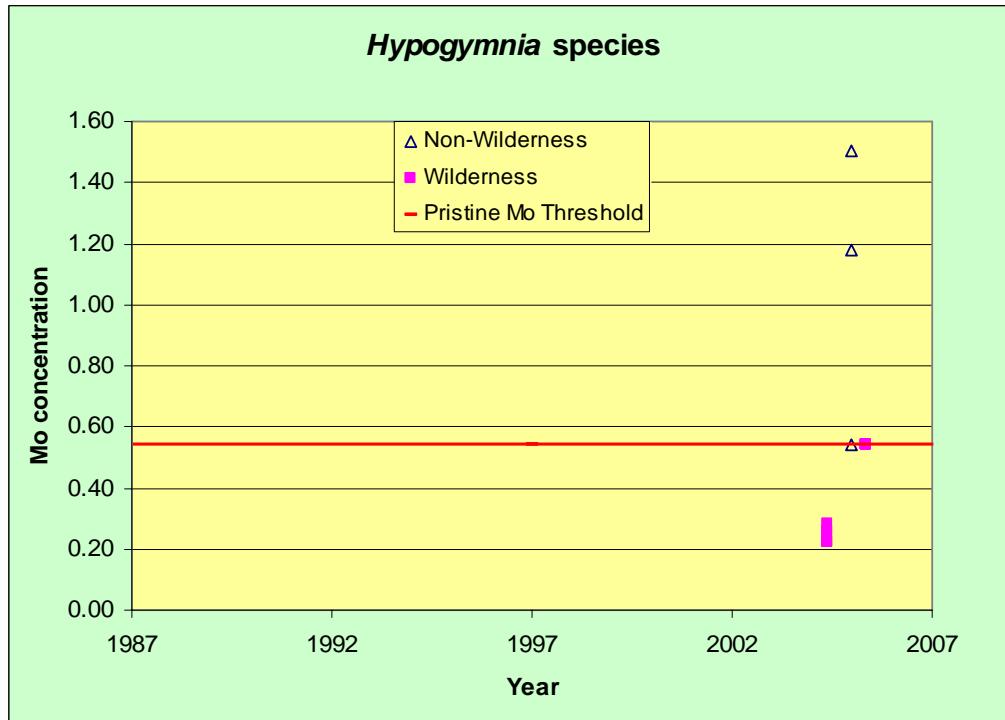


Figure XXI-10. Wilderness and Non-Wilderness plot means of Mo ppm in *Hypogymnia* species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mo ppm

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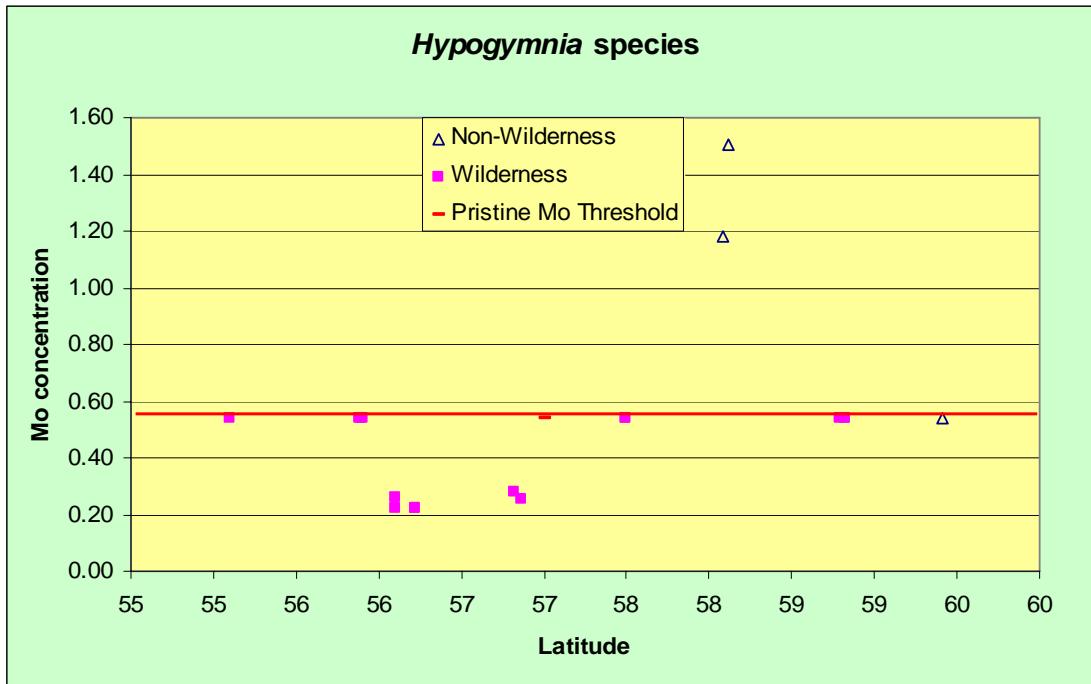


Figure XXI-11. Wilderness and Non-Wilderness plot means of Mo ppm in *Hypogymnia* species vs. plot Latitude.

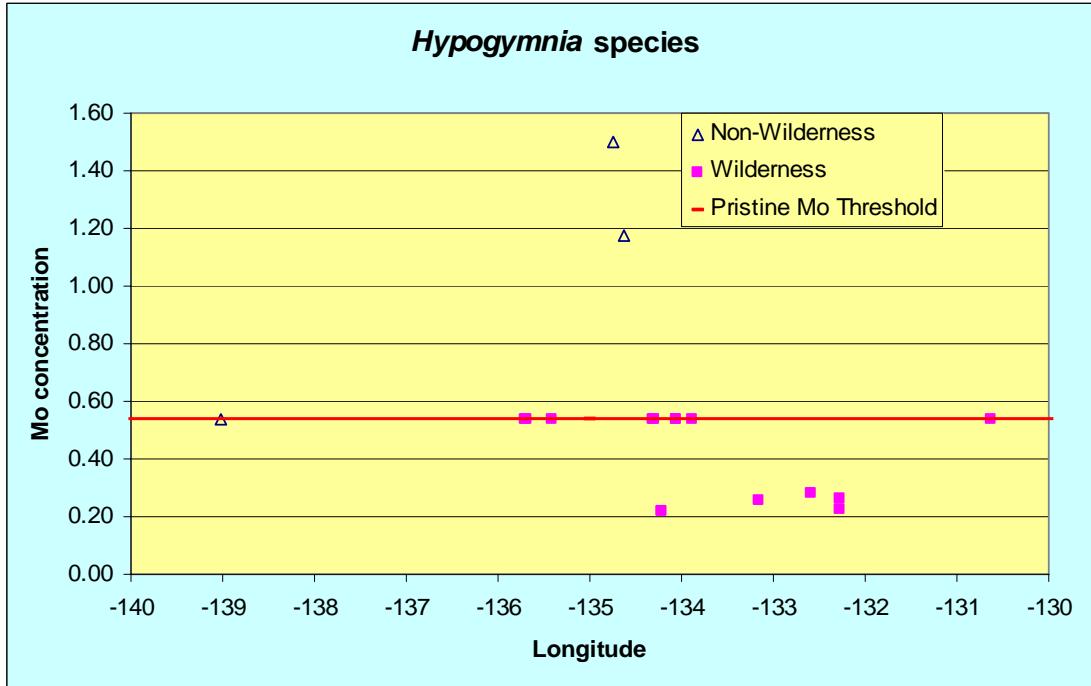


Figure XXI-12. Wilderness and Non-Wilderness plot means of Mo ppm in *Hypogymnia* species vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mo ppm

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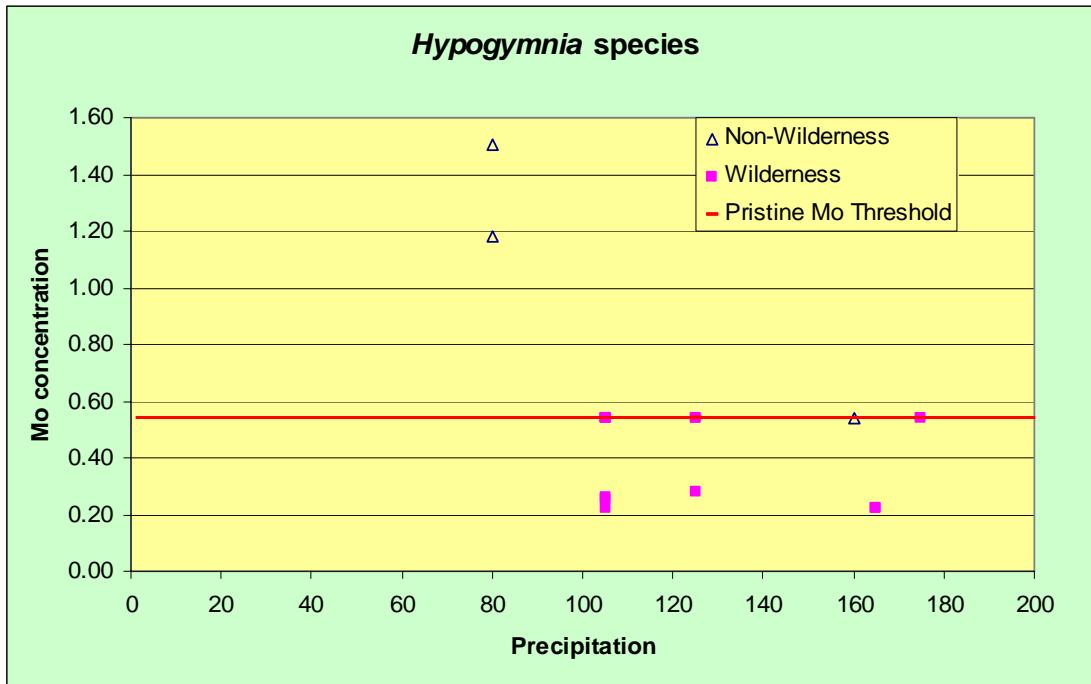


Figure XXI-13. Wilderness and Non-Wilderness plot means of Mo ppm in *Hypogymnia* species vs. plot Precipitation.

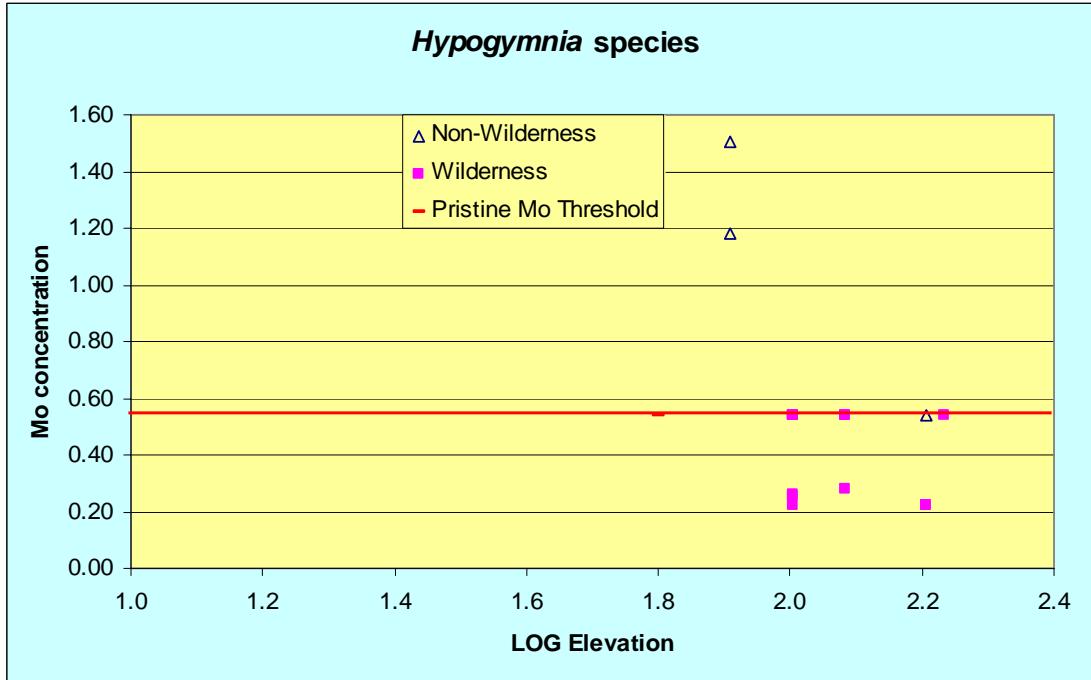


Figure XXI-14. Wilderness and Non-Wilderness plot means of Mo ppm in *Hypogymnia* species vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mo ppm

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Lobaria oregana

Table XXI-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Mo ppm content of *Lobaria oregana* per year.

Mo ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	0.23	0.0081	0.2097	0.2494
2005	Non-Wilderness	0.54	NA	NA	NA
2005	Wilderness	0.5400	0.0000	0.5400	0.5400

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mo ppm

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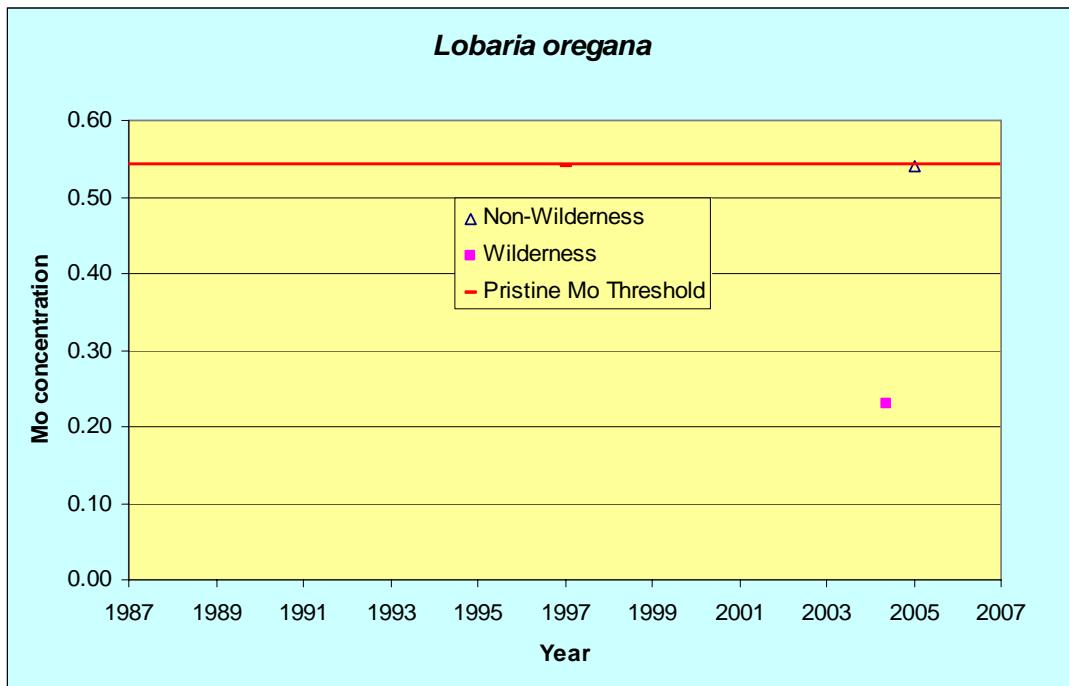


Figure XXI-15. Wilderness and Non-Wilderness yearly means of Mo ppm in *Lobaria oregana* per year.

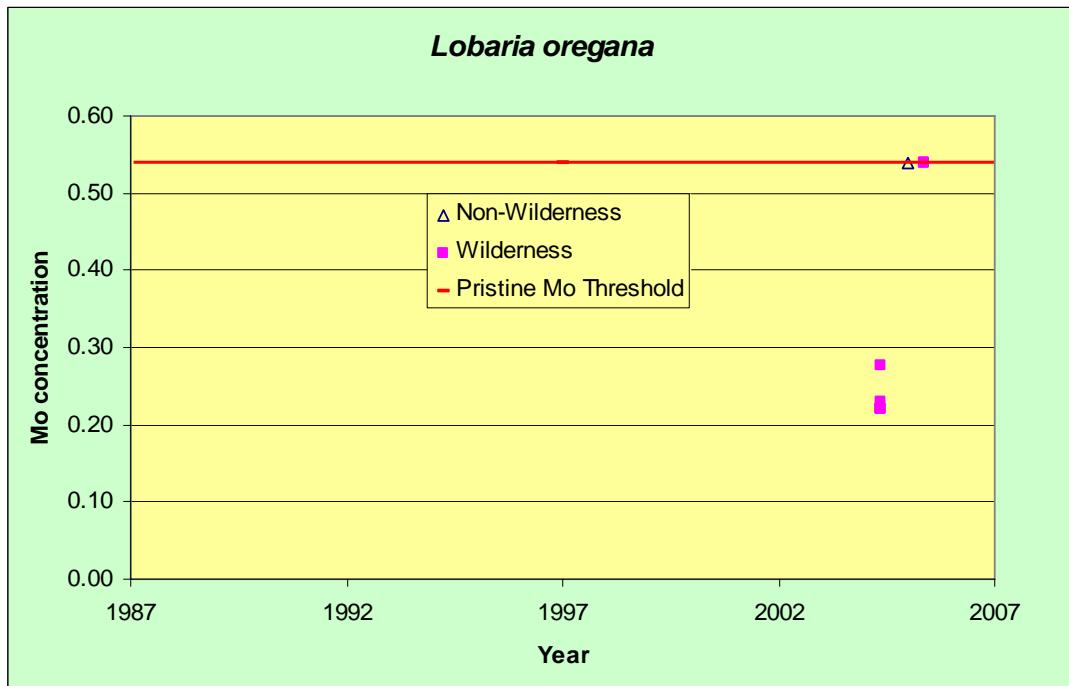


Figure XXI-16. Wilderness and Non-Wilderness plot means of Mo ppm in *Lobaria oregana* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mo ppm

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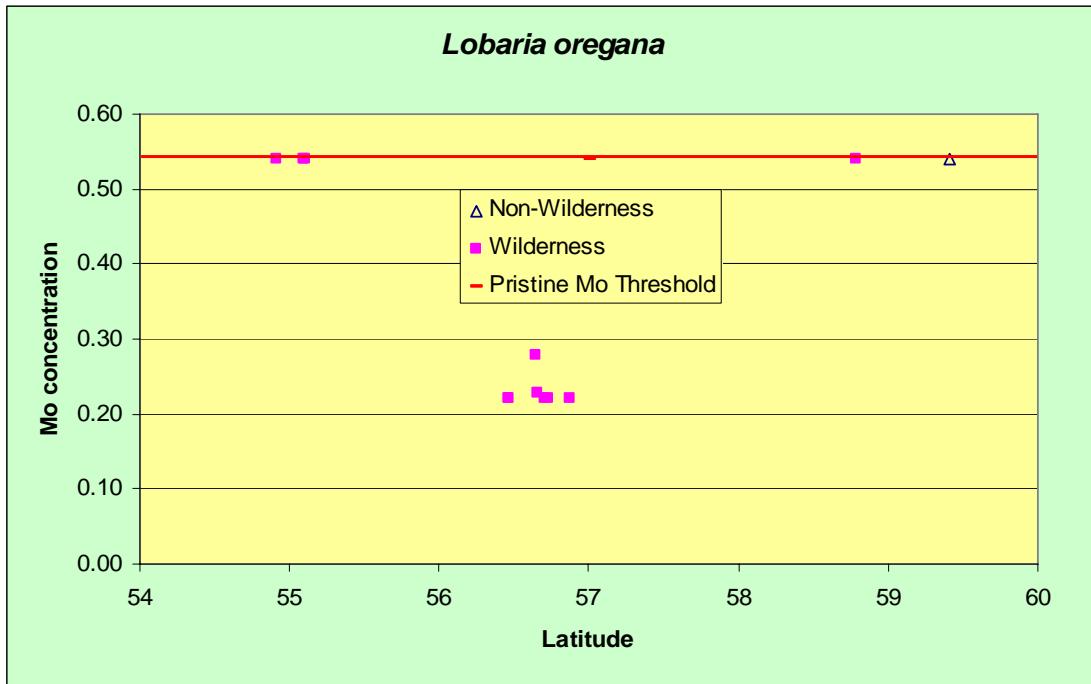


Figure XXI-17. Wilderness and Non-Wilderness plot means of Mo ppm in *Lobaria oregana* vs. plot Latitude.

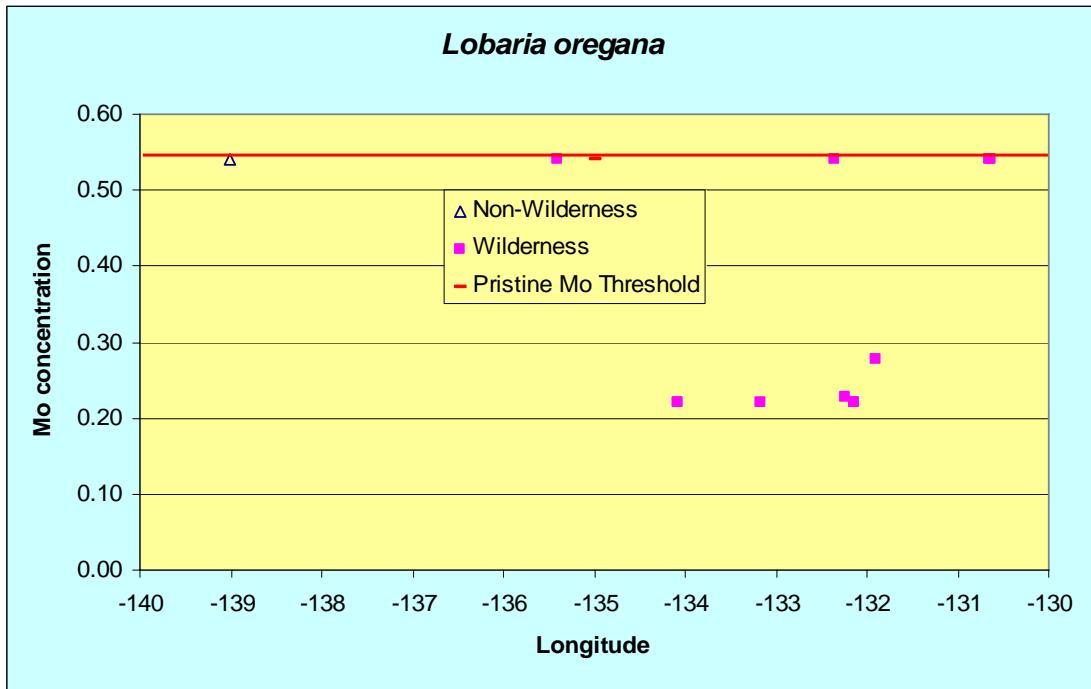


Figure XXI-18. Wilderness and Non-Wilderness plot means of Mo ppm in *Lobaria oregana* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mo ppm

██

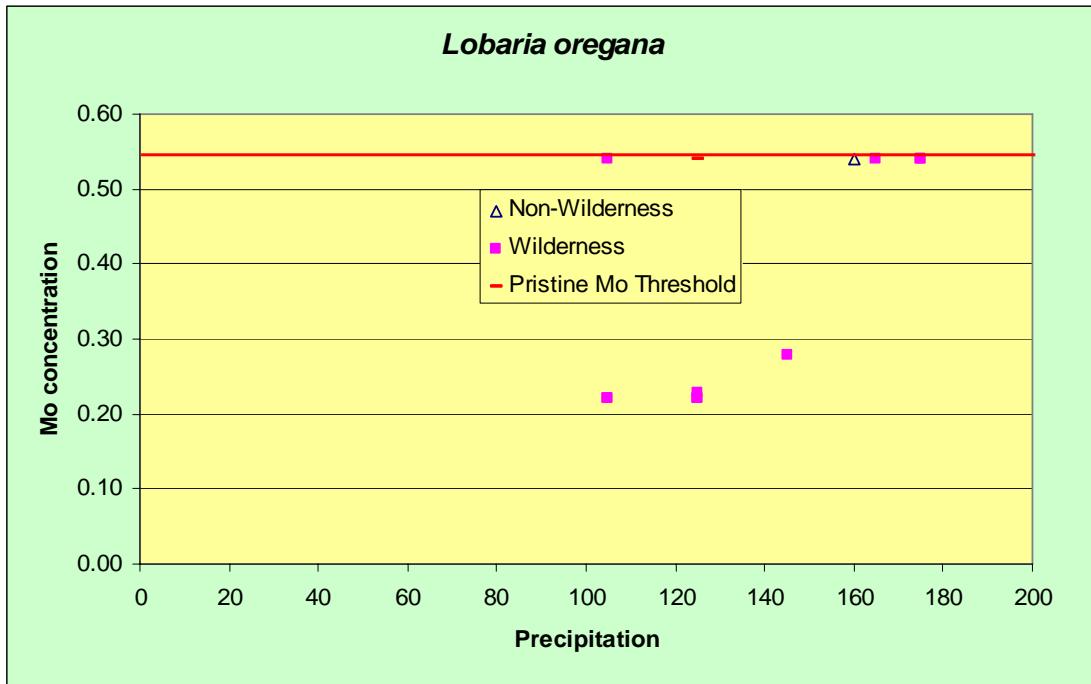


Figure XXI-19. Wilderness and Non-Wilderness plot means of Mo ppm in *Lobaria oregana* vs. plot Precipitation.

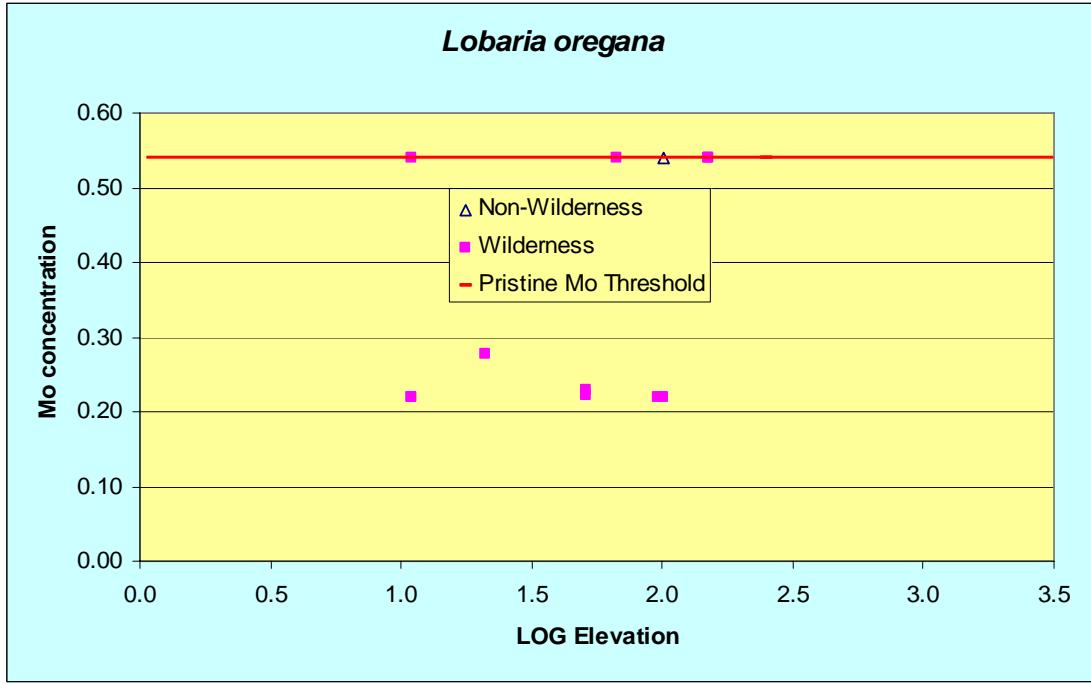


Figure XXI-20. Wilderness and Non-Wilderness plot means of Mo ppm in *Lobaria oregana* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mo ppm

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Platismatia glauca

Table XXI-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Mo ppm content of *Platismatia glauca* per year.

Mo ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	0.28	0.0215	0.2339	0.3310
2005	Non-Wilderness	0.79	0.1801	0.3858	1.2006
2005	Wilderness	0.54	0.0000	0.5400	0.5400

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mo ppm

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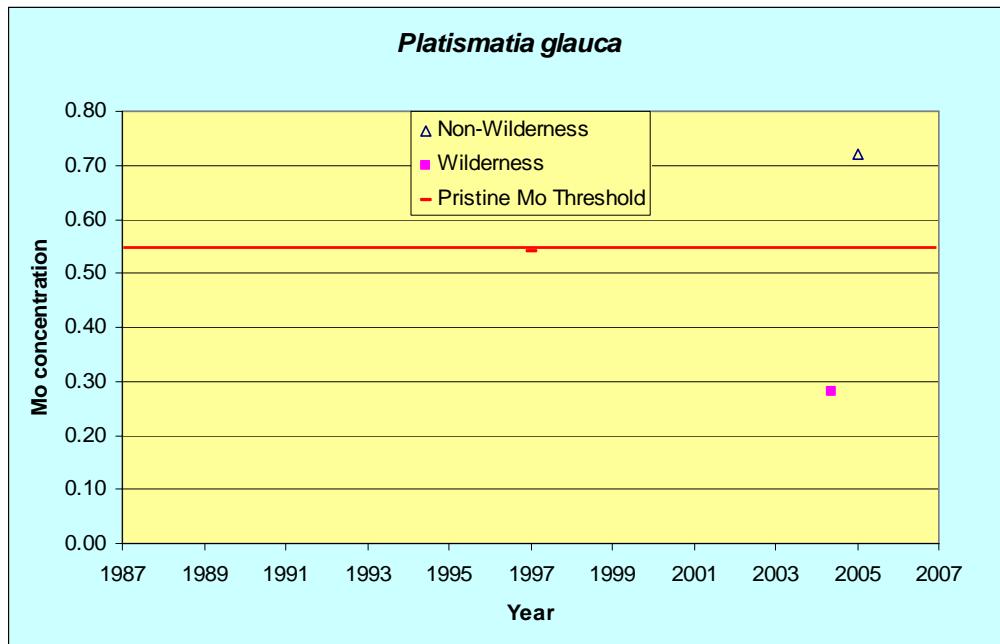


Figure XXI-21. Wilderness and Non-Wilderness yearly means of Mo ppm in *Platismatia glauca* per year.

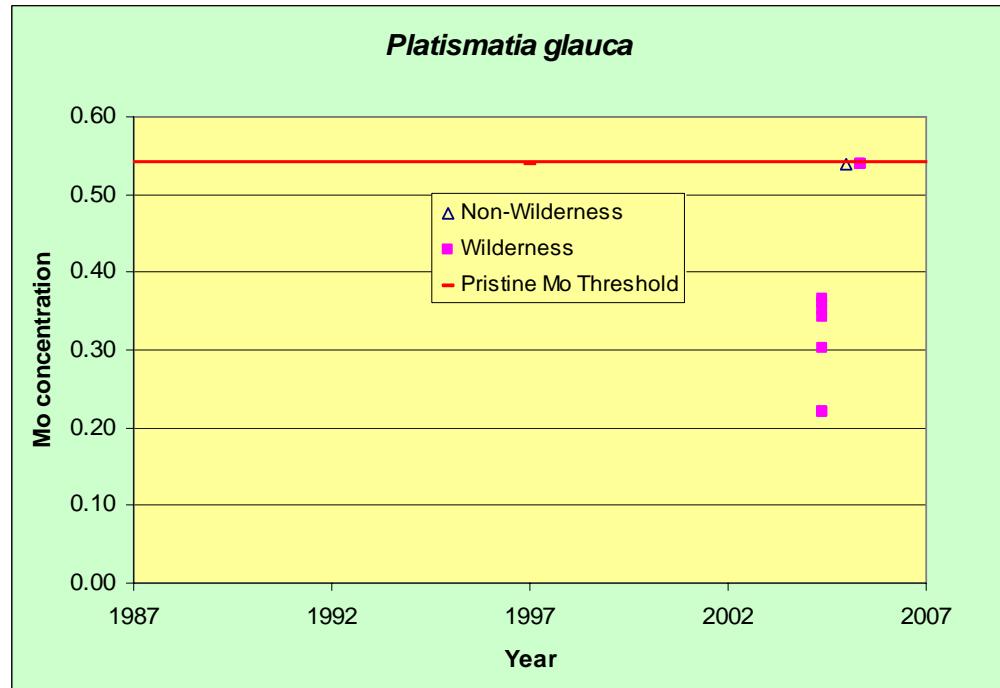


Figure XXI-22. Wilderness and Non-Wilderness plot means of Mo ppm in *Platismatia glauca* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mo ppm

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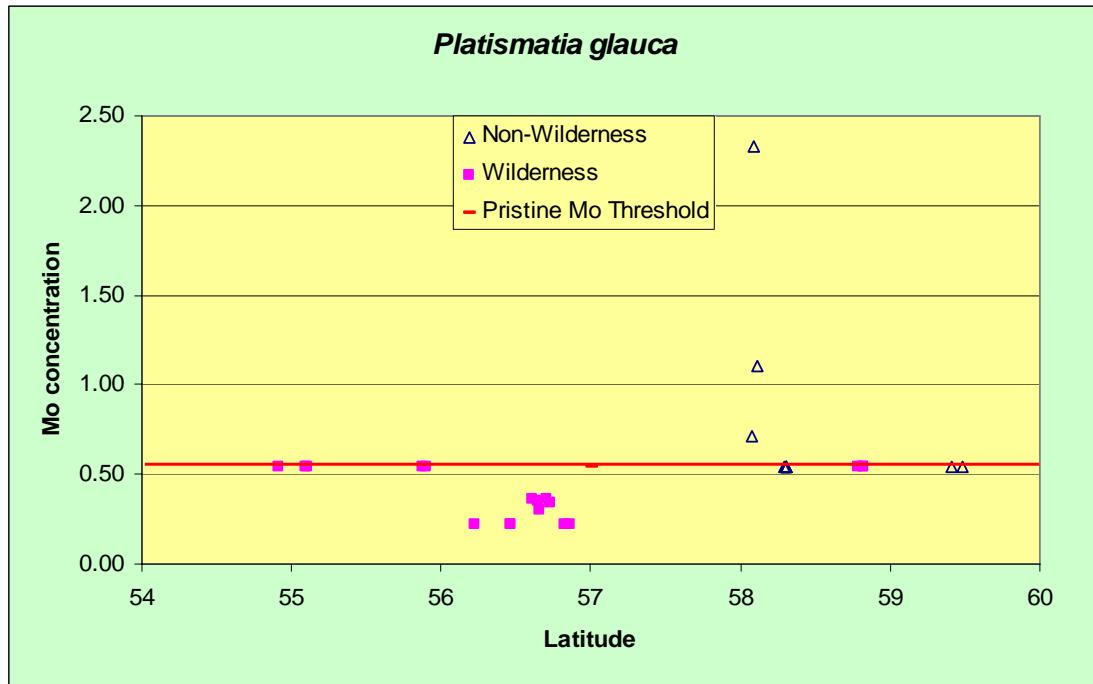


Figure XXI-23. Wilderness and Non-Wilderness plot means of Mo ppm in *Platismatia glauca* vs. plot Latitude.

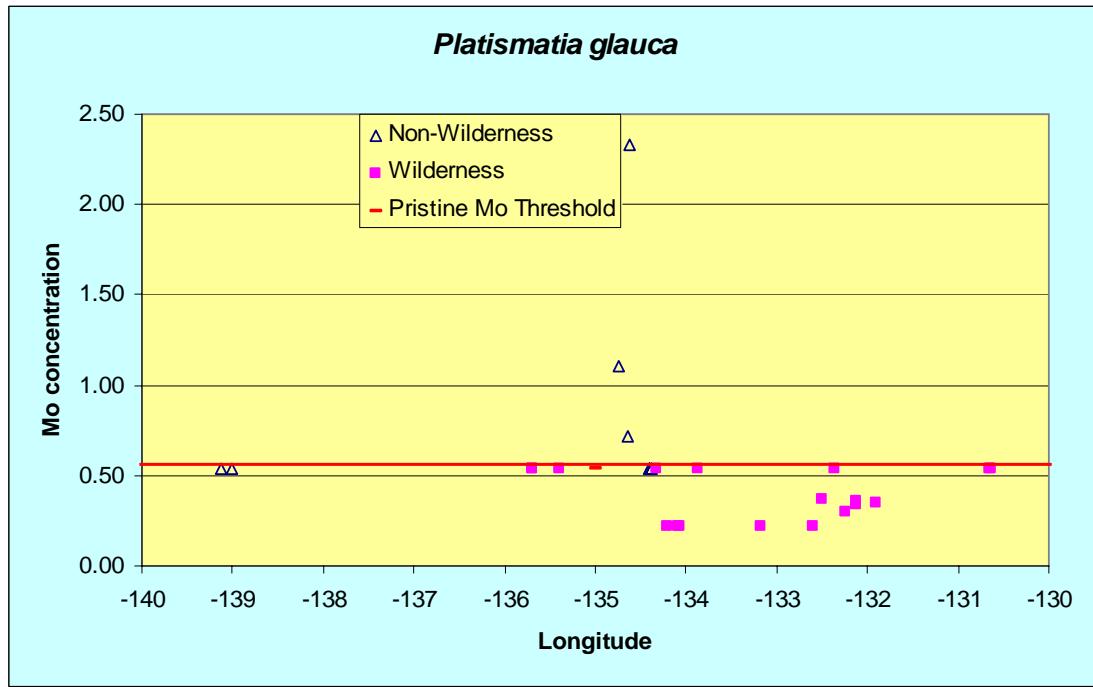


Figure XXI-24. Wilderness and Non-Wilderness plot means of Mo ppm in *Platismatia glauca* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Mo ppm

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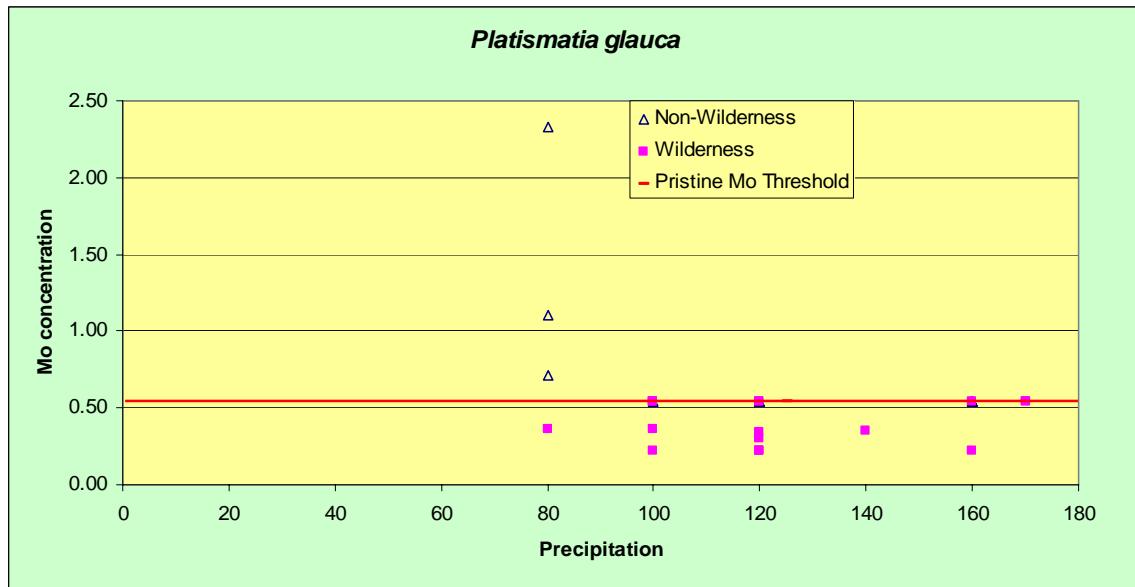


Figure XXI-25. Wilderness and Non-Wilderness plot means of Mo ppm in *Platismatia glauca* vs. plot Precipitation.

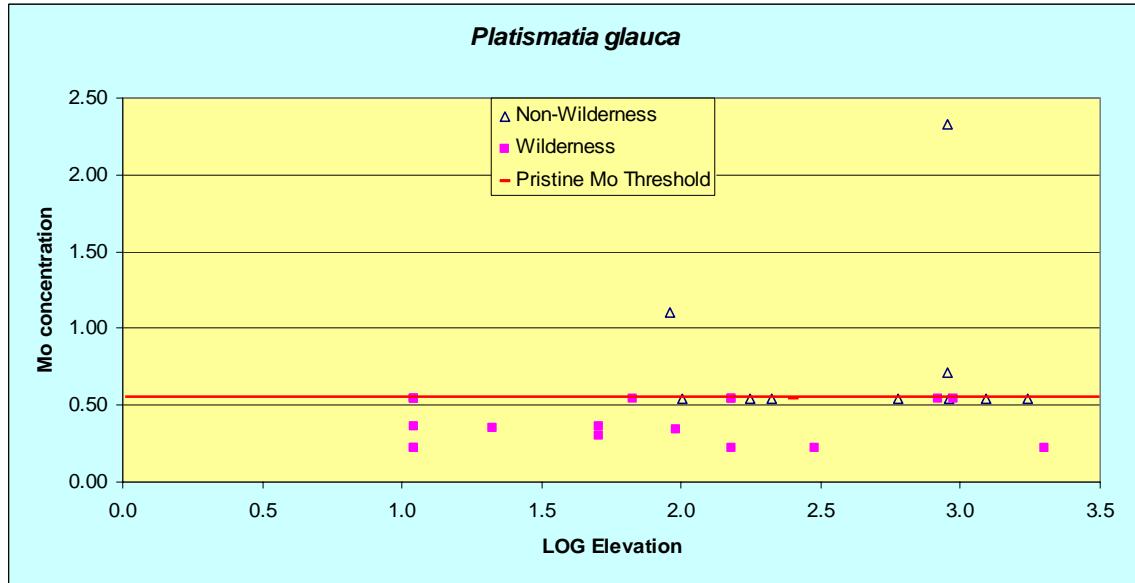


Figure XXI-26. Wilderness and Non-Wilderness plot means of Mo ppm in *Platismatia glauca* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Na ppm

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XXII. SUMMARY OF Na PPM DATA ANALYSIS

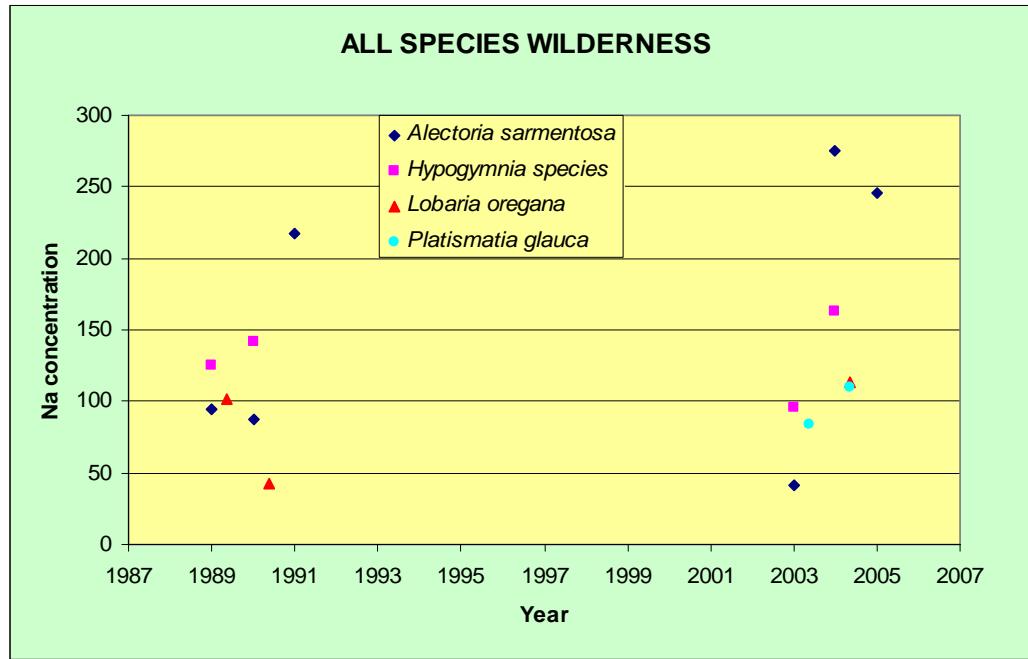


Figure XXII-27. Wilderness plot means of Na ppm in All Species per year.

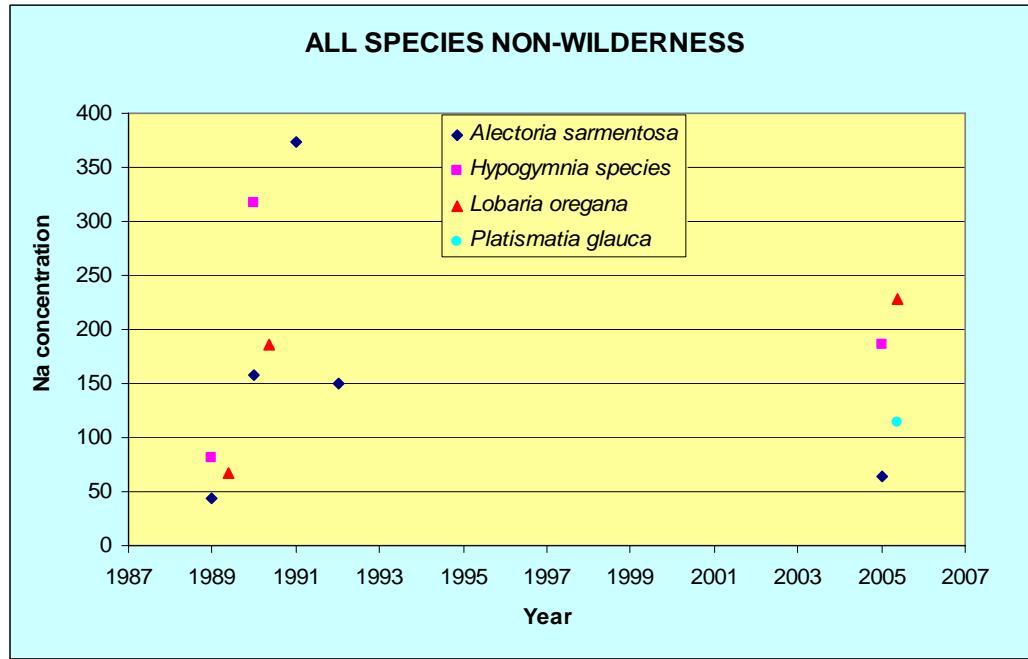


Figure XXII-28. Non-Wilderness plot means of Na ppm in All Species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Na ppm

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Alectoria sarmentosa

Summary Statistics:

Table XXII-2. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Na ppm content of *Alectoria sarmentosa* per year.

Na ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	43.61	11.0530	12.9220	74.2980
1989	Wilderness	94.19	39.4578	7.2406	195.6184
1990	Non-Wilderness	157.51	29.1796	97.5313	217.4903
1990	Wilderness	87.57	53.8385	44.1692	219.3068
1991	Non-Wilderness	373.3452	211.0759	70.1089	816.7992
1991	Wilderness	217.74	51.5771	74.5424	360.9444
1992	Non-Wilderness	150.68	31.1323	77.0637	224.2959
2003	Wilderness	41.03	0.8856	29.7732	52.2780
2004	Wilderness	274.96	71.8197	126.3855	423.5261
2005	Non-Wilderness	63.52	22.2502	6.3219	120.7139
2005	Wilderness	246.22	65.1305	98.8841	393.5551

Summary of Statistical Tests:

$$t = -0.244, \text{ df} = 8, \text{ p-value} = 0.8134$$

There is no evidence of a difference in Na ppm content in *Alectoria sarmentosa* from pre-2000 and post 2000 samples (p-value = 0.8134).

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Na ppm

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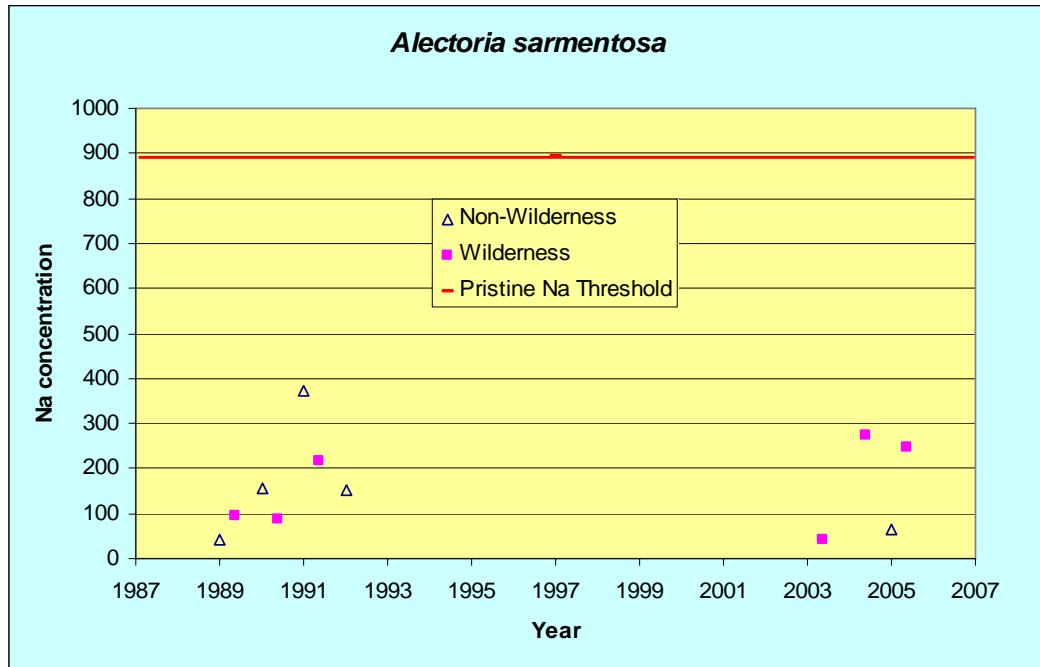


Figure XXII-3. Wilderness and Non-Wilderness yearly means of Na ppm in *Alectoria sarmentosa* per year.

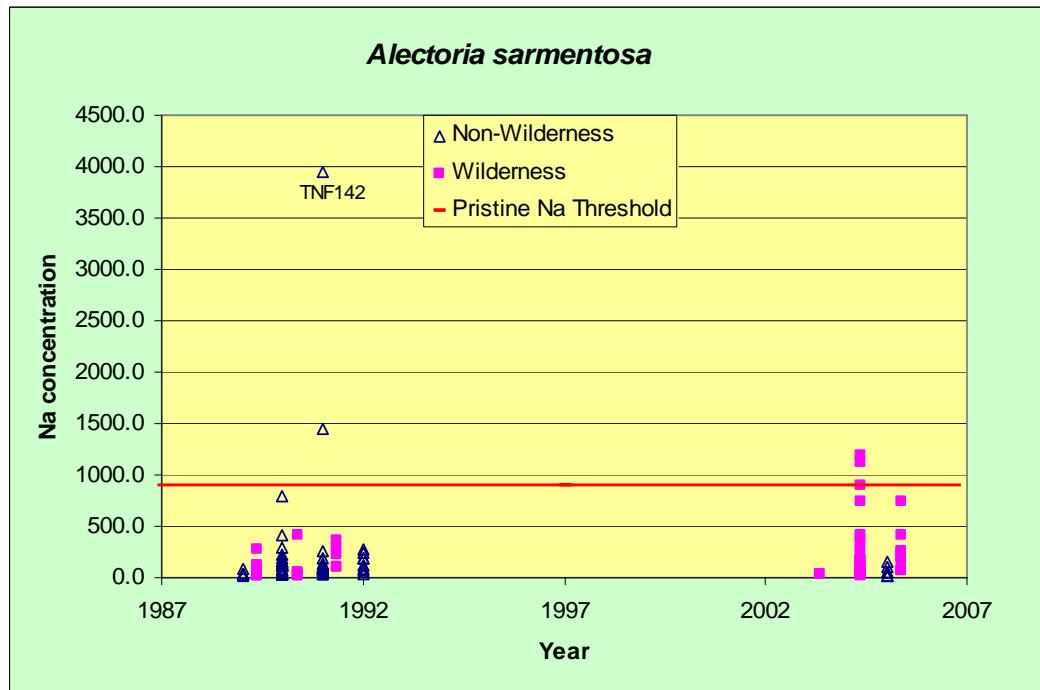


Figure XXII-4. Wilderness and Non-Wilderness plot means of Na ppm in *Alectoria sarmentosa* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Na ppm

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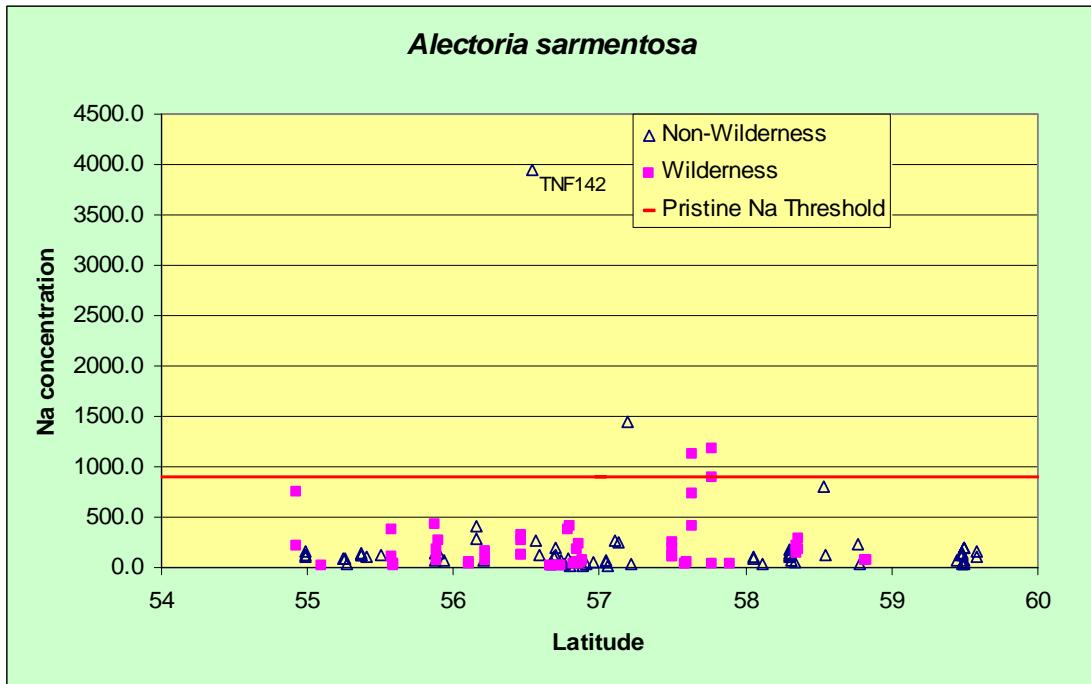


Figure XXII-5. Wilderness and Non-Wilderness plot means of Na ppm in *Alectoria sarmentosa* vs. plot Latitude.

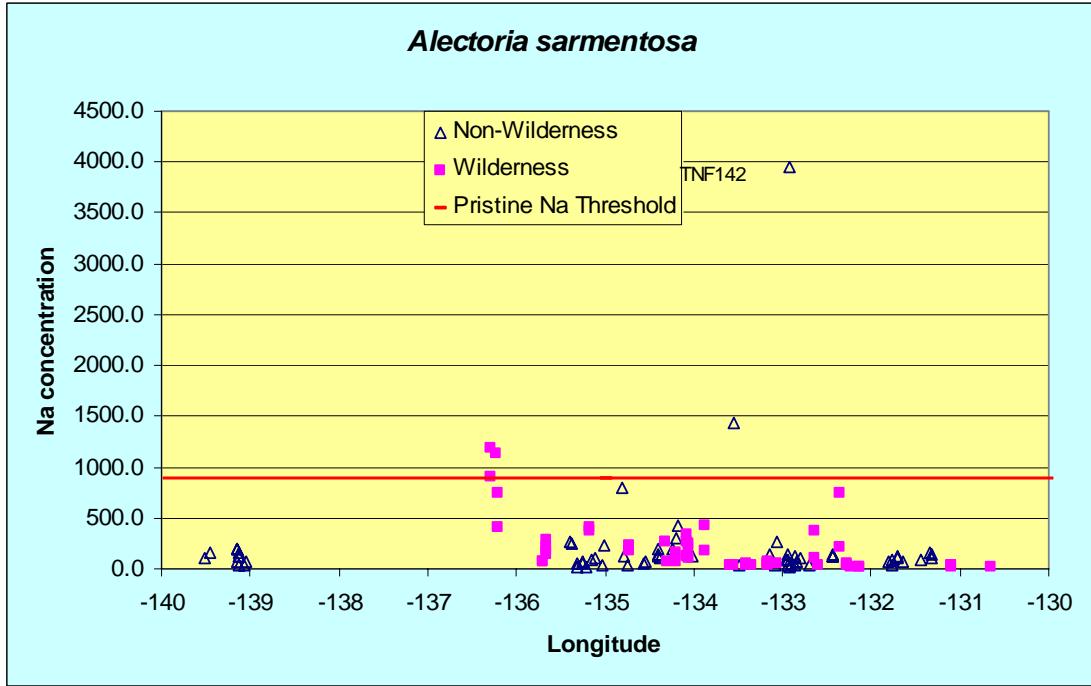


Figure XXII-6. Wilderness and Non-Wilderness plot means of Na ppm in *Alectoria sarmentosa* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Na ppm

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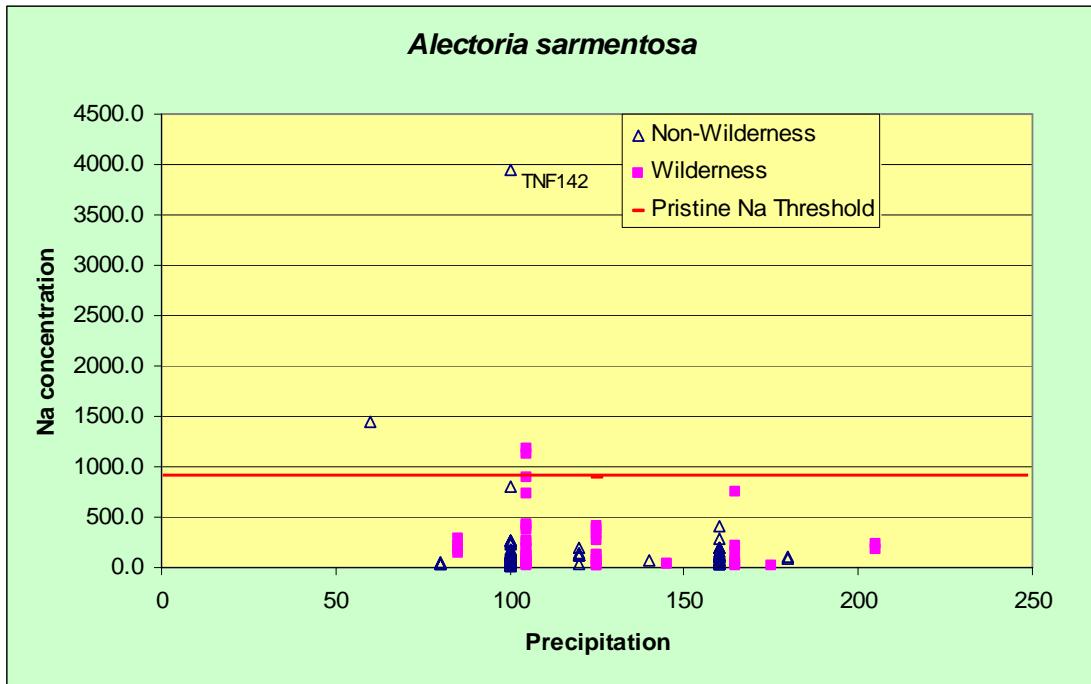


Figure XXII-7. Wilderness and Non-Wilderness plot means of Na ppm in *Alectoria sarmentosa* vs. plot Precipitation.

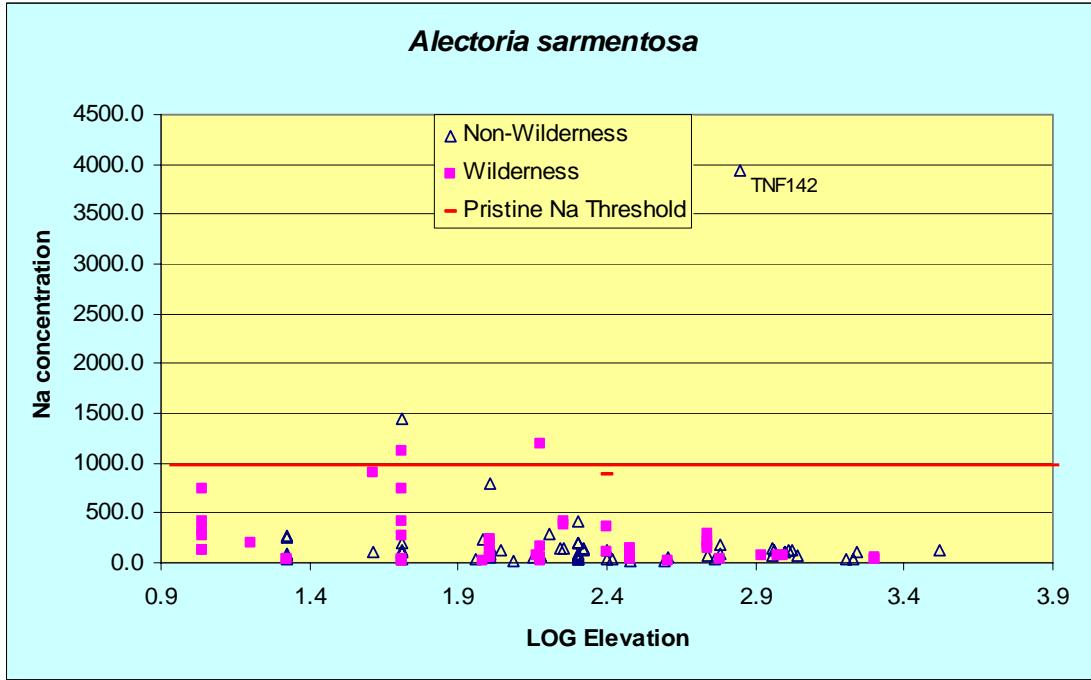


Figure XXII-8. Wilderness and Non-Wilderness plot means of Na ppm in *Alectoria sarmentosa* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Na ppm

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Hypogymnia species

In this series, all of the *Hypogymnia* species were included as a group.

Table XXII-3. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Na ppm content of *Hypogymnia species* per year.

Na ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	80.50	57.5000	650.1068	811.1068
1989	Wilderness	124.68	31.5730	37.0226	212.3440
1990	Non-Wilderness	317.78	81.4198	146.7241	488.8373
1990	Wilderness	141.86	75.2562	42.2883	326.0025
2003	Wilderness	95.31	NA	NA	NA
2004	Wilderness	163.16	35.4967	71.9172	254.4116
2005	Non-Wilderness	185.51	37.7393	23.1328	347.8906
2005	Wilderness	278.23	48.8804	165.5076	390.9444

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Na ppm

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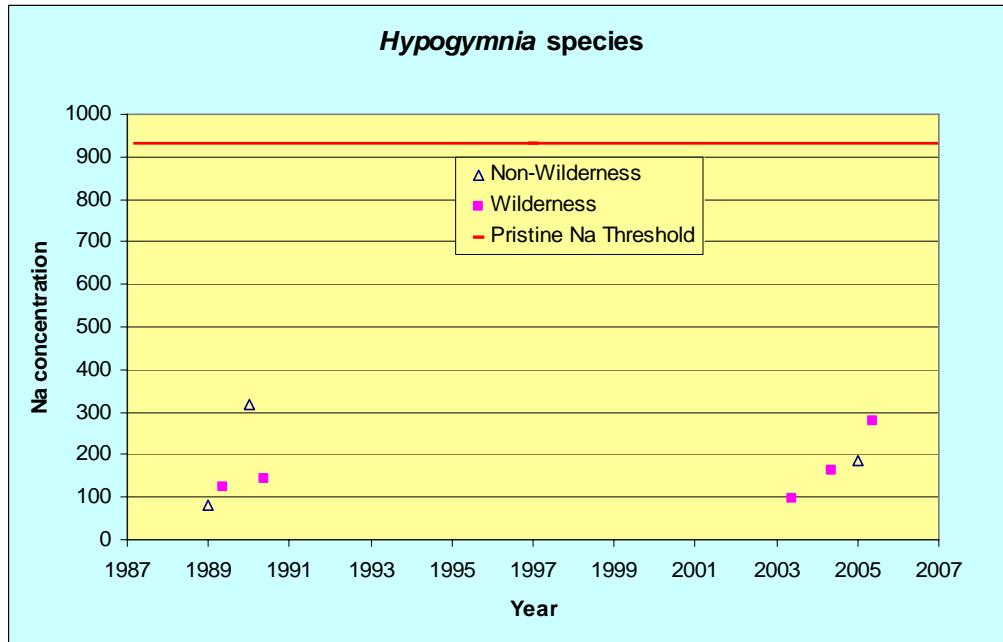


Figure XXII-9. Wilderness and Non-Wilderness yearly means of Na ppm in *Hypogymnia* species per year.

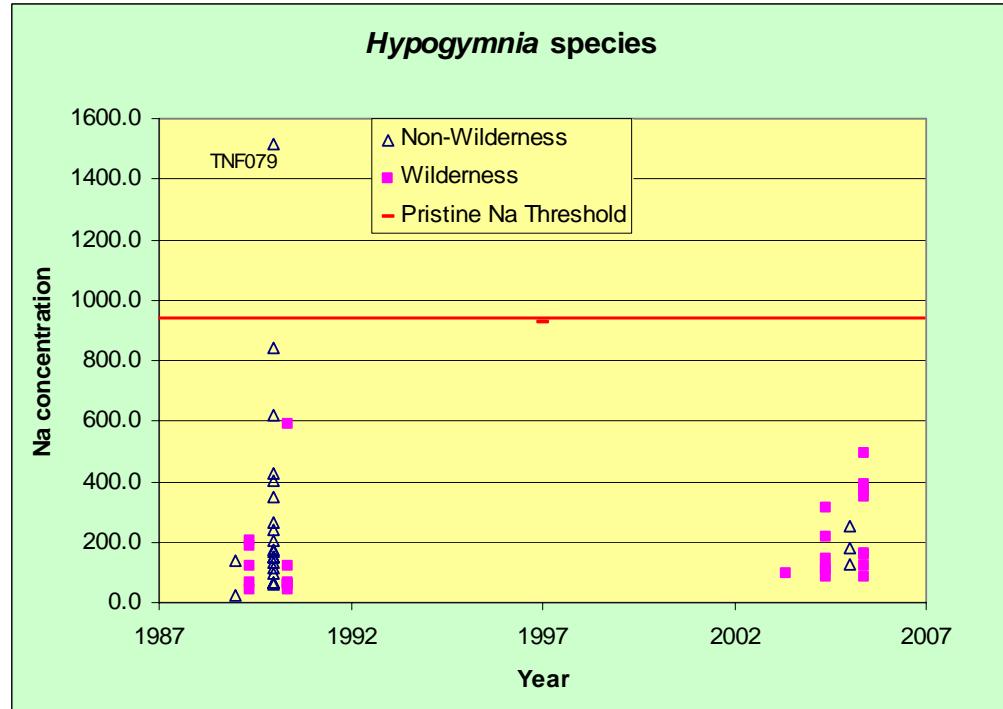


Figure XXII-10. Wilderness and Non-Wilderness plot means of Na ppm in *Hypogymnia* species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Na ppm

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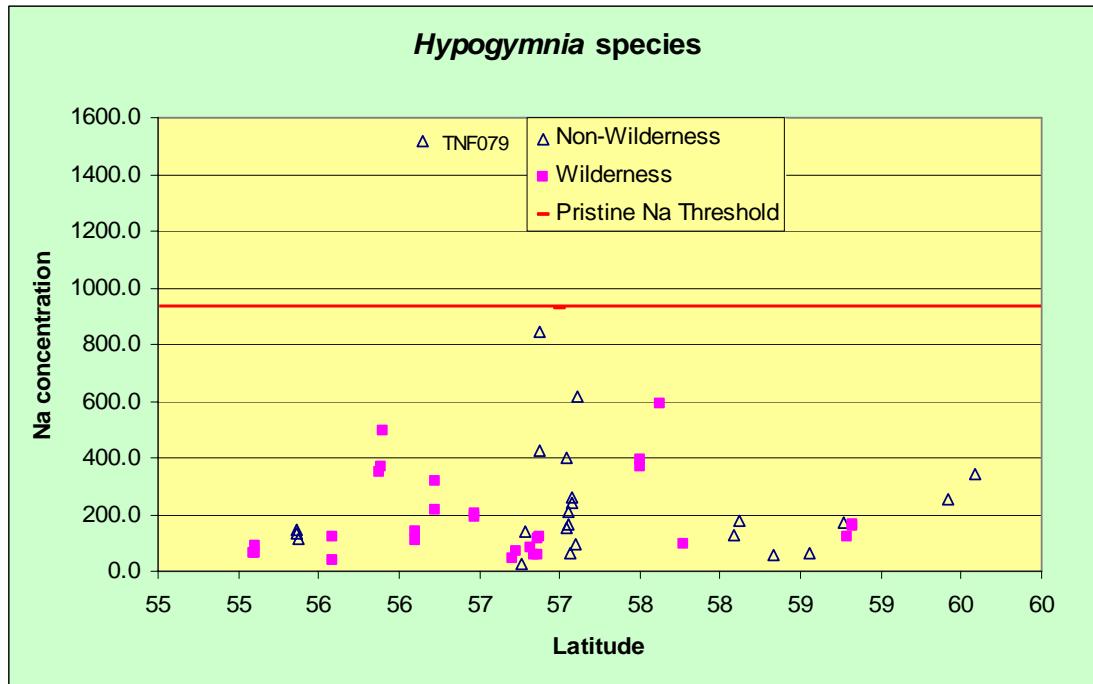


Figure XXII-11. Wilderness and Non-Wilderness plot means of Na ppm in *Hypogymnia* species vs. plot Latitude.

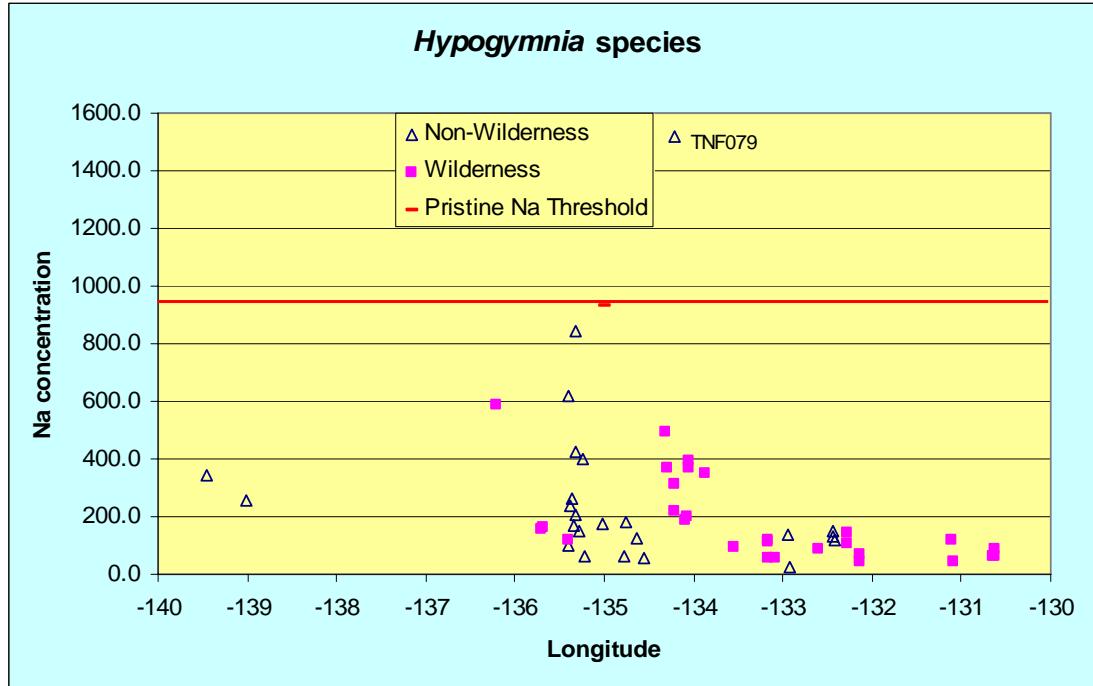


Figure XXII-12. Wilderness and Non-Wilderness plot means of Na ppm in *Hypogymnia* species vs. plot Longitude.

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## ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Na ppm

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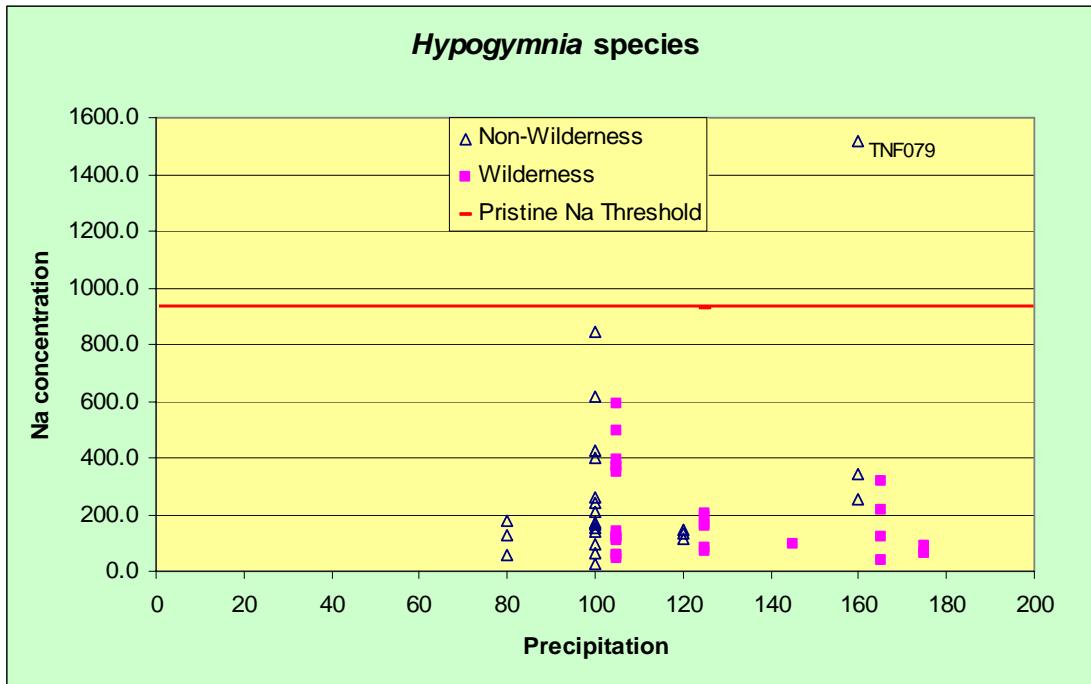


Figure XXII-13. Wilderness and Non-Wilderness plot means of Na ppm in *Hypogymnia* species vs. plot Precipitation.

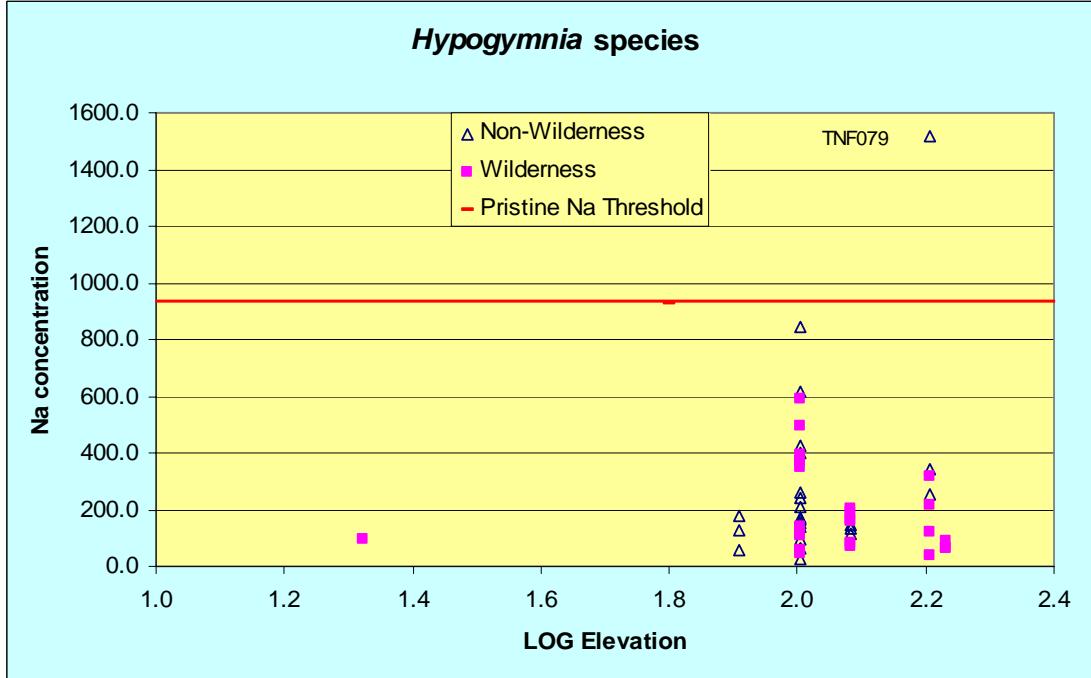


Figure XXII-14. Wilderness and Non-Wilderness plot means of Na ppm in *Hypogymnia* species vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Na ppm

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Lobaria oregana

Table XXII-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Na ppm content of *Lobaria oregana* per year.

Na ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	67.75	9.9083	36.2175	99.2825
1989	Wilderness	101.25	41.1489	NA	215.5010
1990	Non-Wilderness	186.03	51.5276	73.7568	298.2945
1990	Wilderness	42.22	4.3542	31.0257	53.4115
2004	Wilderness	113.72	20.5302	63.4887	163.9599
2005	Non-Wilderness	227.55	NA	NA	NA
2005	Wilderness	156.6590	62.7977	NA	356.5093

Summary of Statistical Tests:

$$t = -2.5951, df = 4, p\text{-value} = 0.0604$$

There is suggestive evidence of a difference in Na ppm content in *Lobaria oregana* from pre-2000 and post 2000 samples (p-value = 0.0604).

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Na ppm

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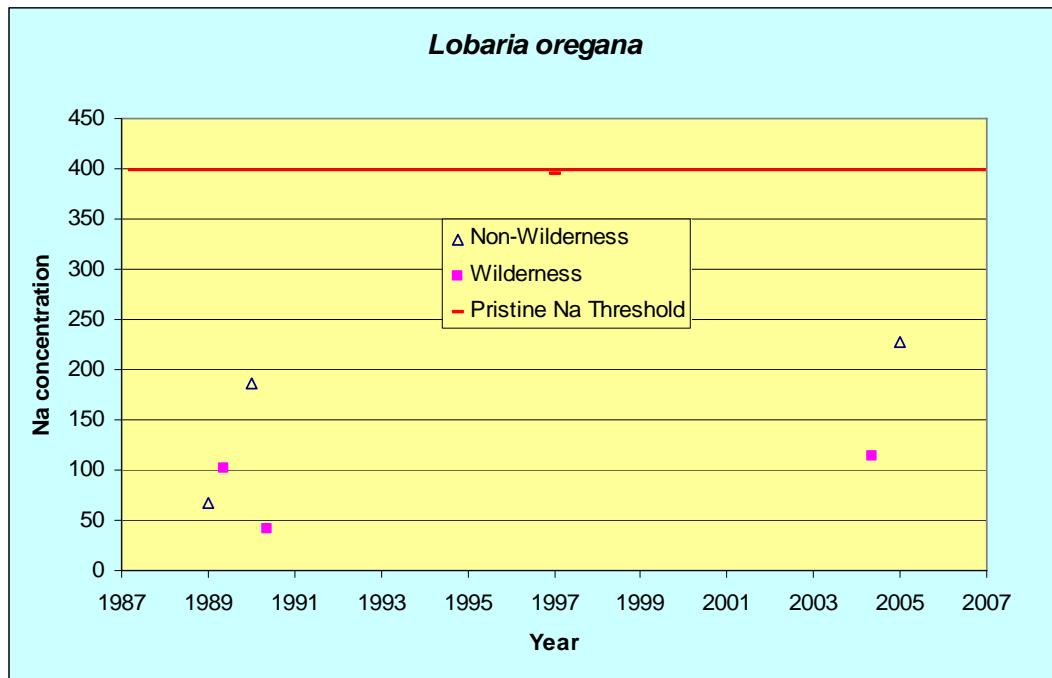


Figure XXII-15. Wilderness and Non-Wilderness yearly means of Na ppm in *Lobaria oregana* per year.

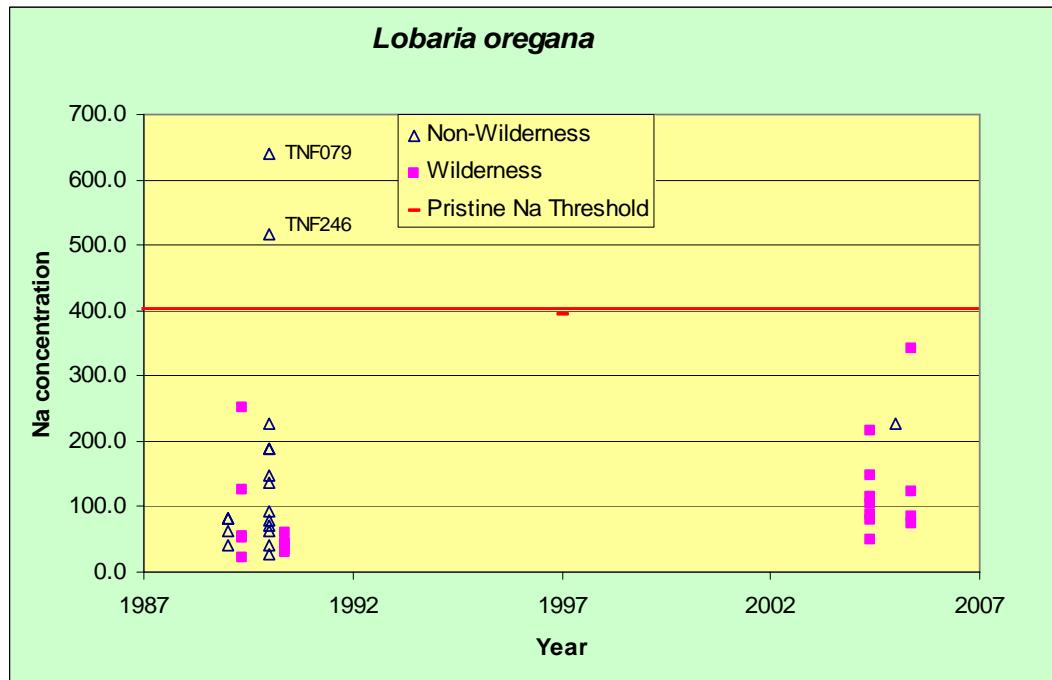


Figure XXII-16. Wilderness and Non-Wilderness plot means of Na ppm in *Lobaria oregana* per year.

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## ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Na ppm

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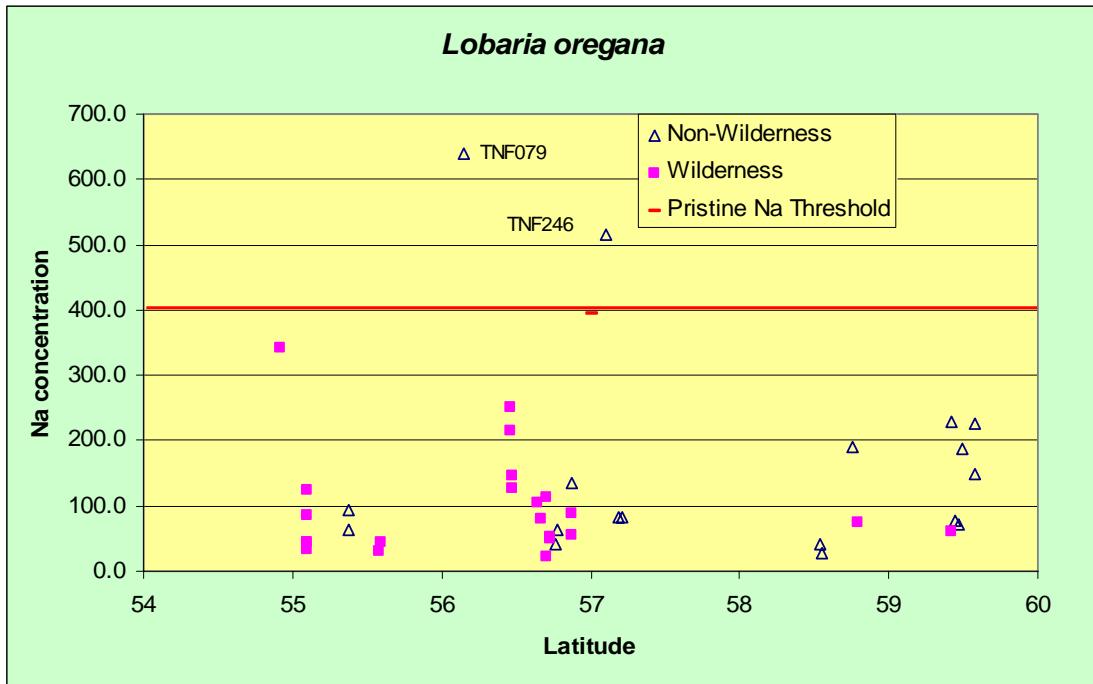


Figure XXII-17. Wilderness and Non-Wilderness plot means of Na ppm in *Lobaria oregana* vs. plot Latitude.

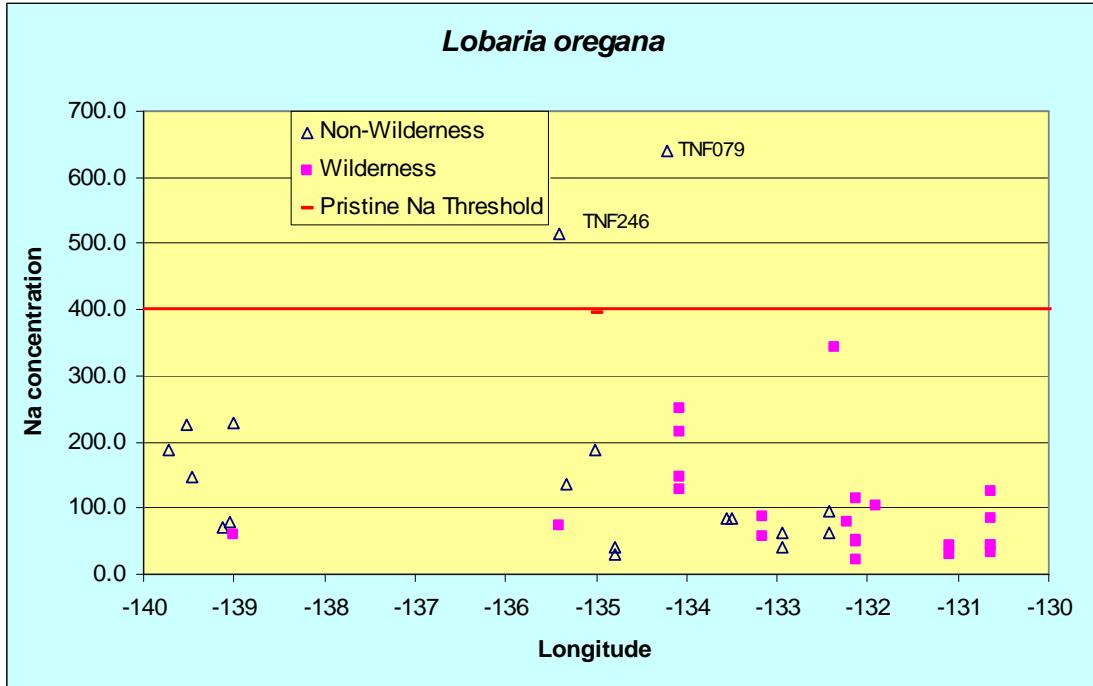


Figure XXII-18. Wilderness and Non-Wilderness plot means of Na ppm in *Lobaria oregana* vs. plot Longitude.

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## ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Na ppm

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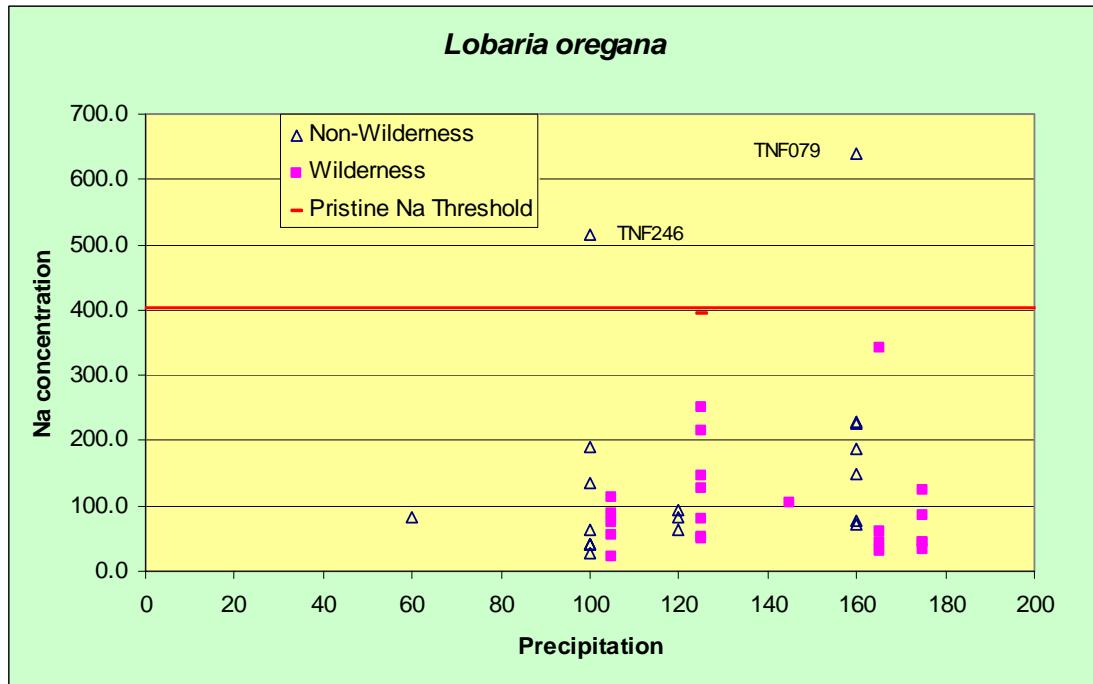


Figure XXII-19. Wilderness and Non-Wilderness plot means of Na ppm in *Lobaria oregana* vs. plot Precipitation.

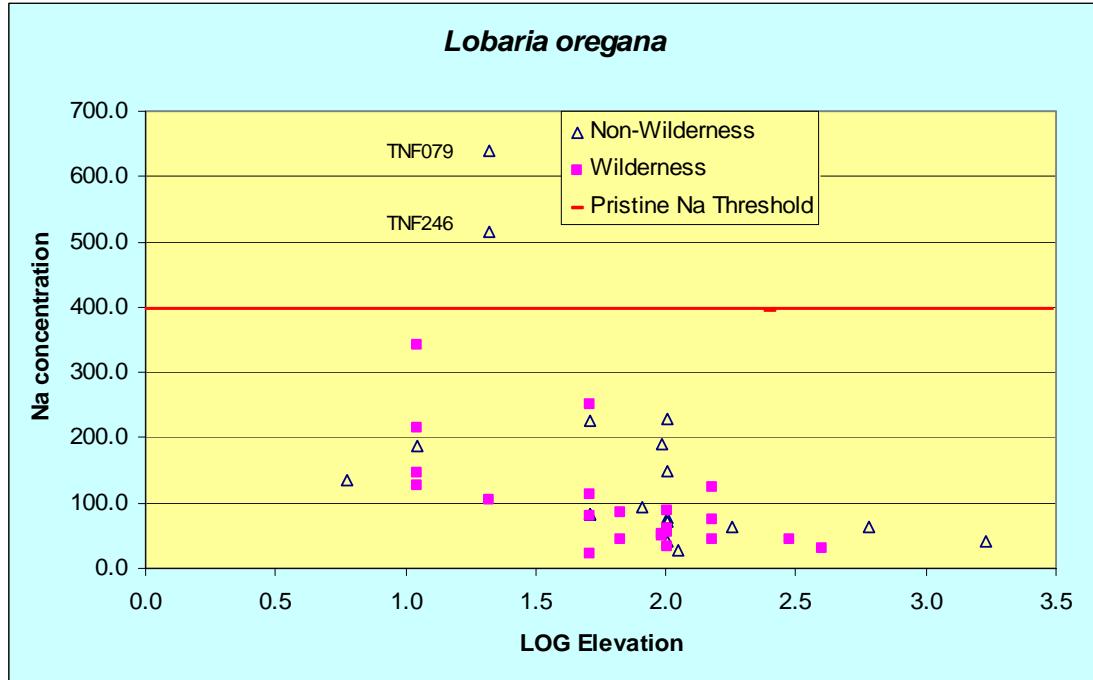


Figure XXII-20. Wilderness and Non-Wilderness plot means of Na ppm in *Lobaria oregana* vs. plot Log-Elevation.

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**ANALYSIS OF ICP LICHEN BIO-MONITORING DATA**

**Na ppm**

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Platismatia glauca

Table XXII-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Na ppm content of *Platismatia glauca* per year.

Na ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2003	Wilderness	84.24	NA	NA	NA
2004	Wilderness	109.80	27.2354	48.1855	171.4071
2005	Non-Wilderness	116.53	15.7153	80.9790	152.0797
2005	Wilderness	278.81	101.5439	38.6939	518.9202

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Na ppm

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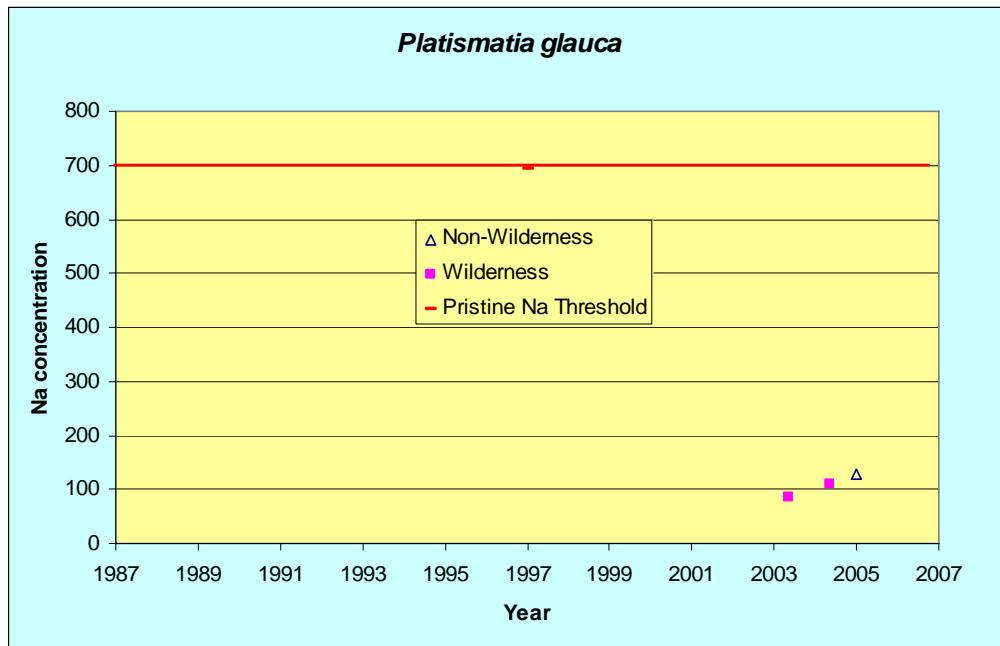


Figure XXII-21. Wilderness and Non-Wilderness yearly means of Na ppm in *Platismatia glauca* per year.

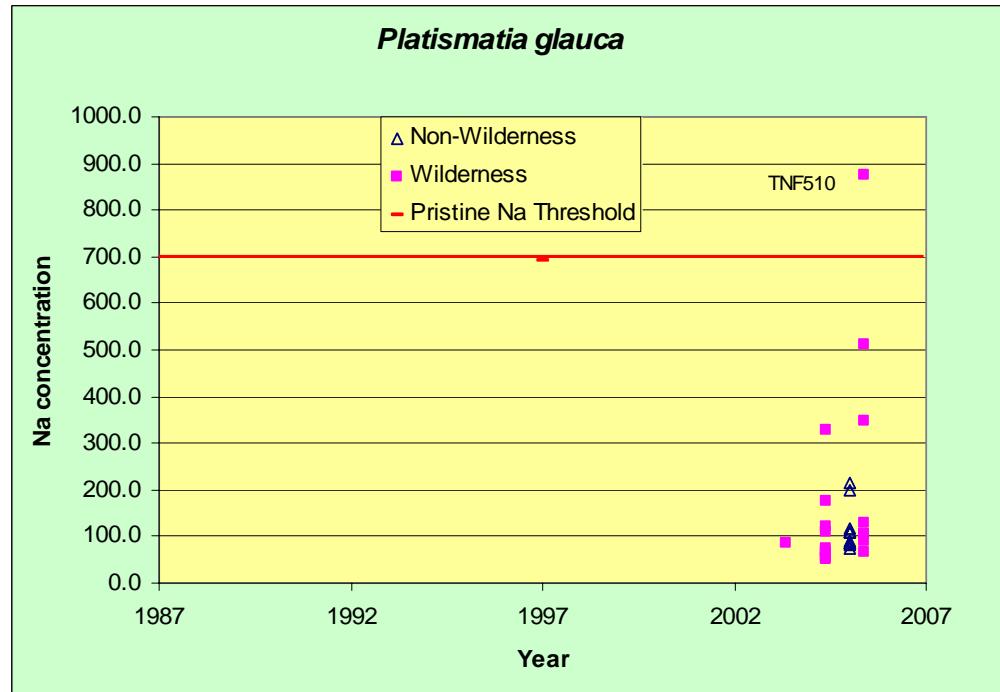


Figure XXII-22. Wilderness and Non-Wilderness plot means of Na ppm in *Platismatia glauca* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Na ppm

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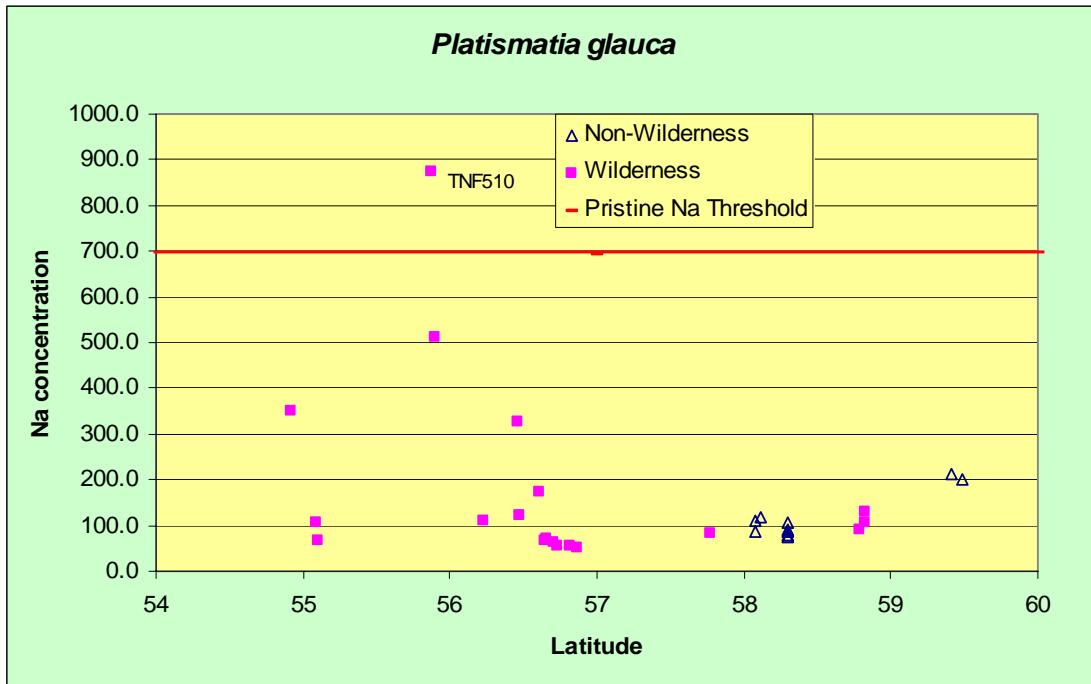


Figure XXII-23. Wilderness and Non-Wilderness plot means of Na ppm in *Platismatia glauca* vs. plot Latitude.

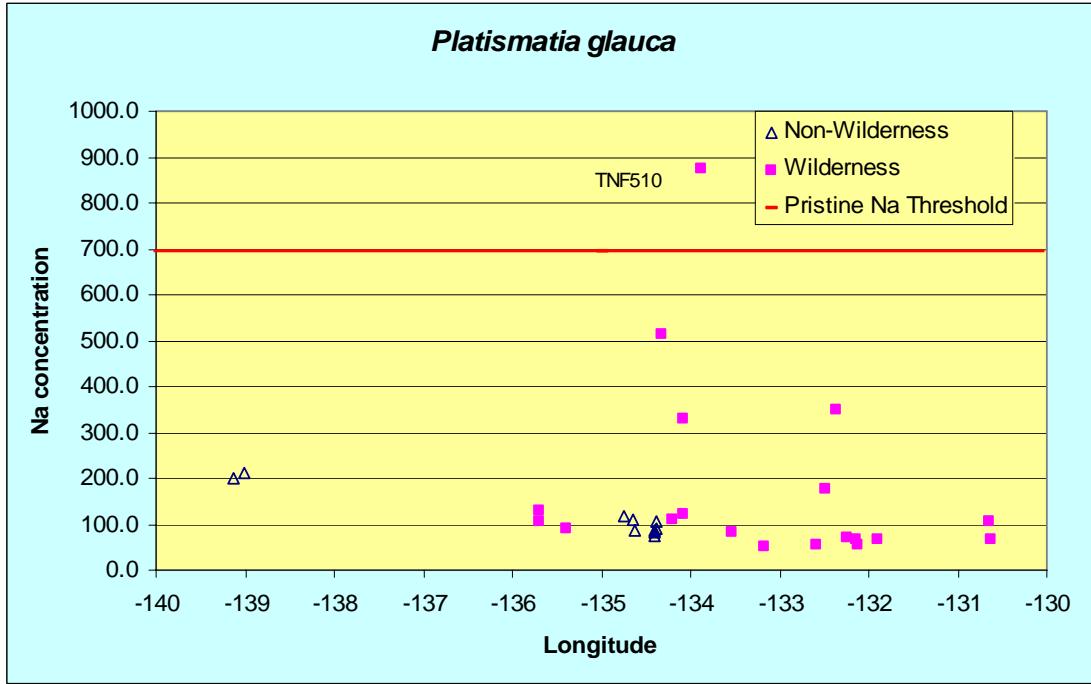


Figure XXII-24. Wilderness and Non-Wilderness plot means of Na ppm in *Platismatia glauca* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Na ppm

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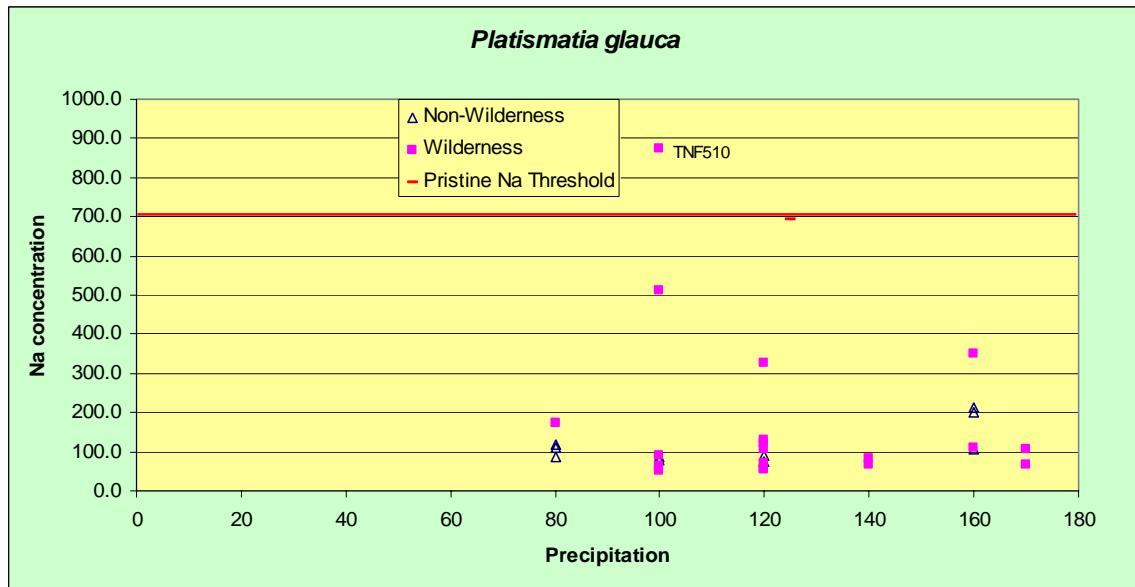


Figure XXII-25. Wilderness and Non-Wilderness plot means of Na ppm in *Platismatia glauca* vs. plot Precipitation.

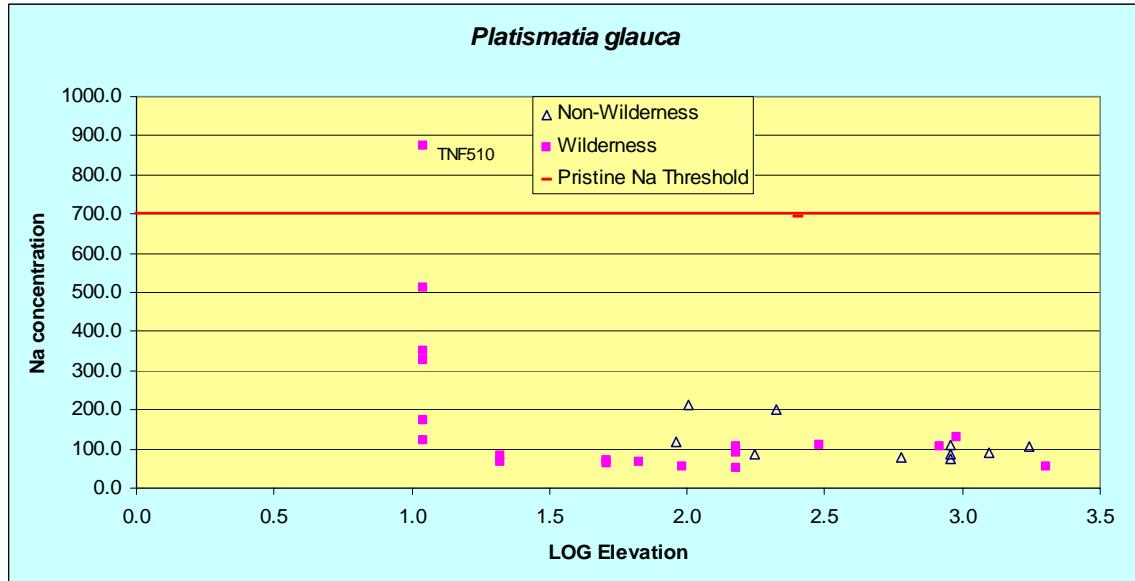


Figure XXII-26. Wilderness and Non-Wilderness plot means of Na ppm in *Platismatia glauca* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ni ppm

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XXIII. SUMMARY OF Ni PPM DATA ANALYSIS

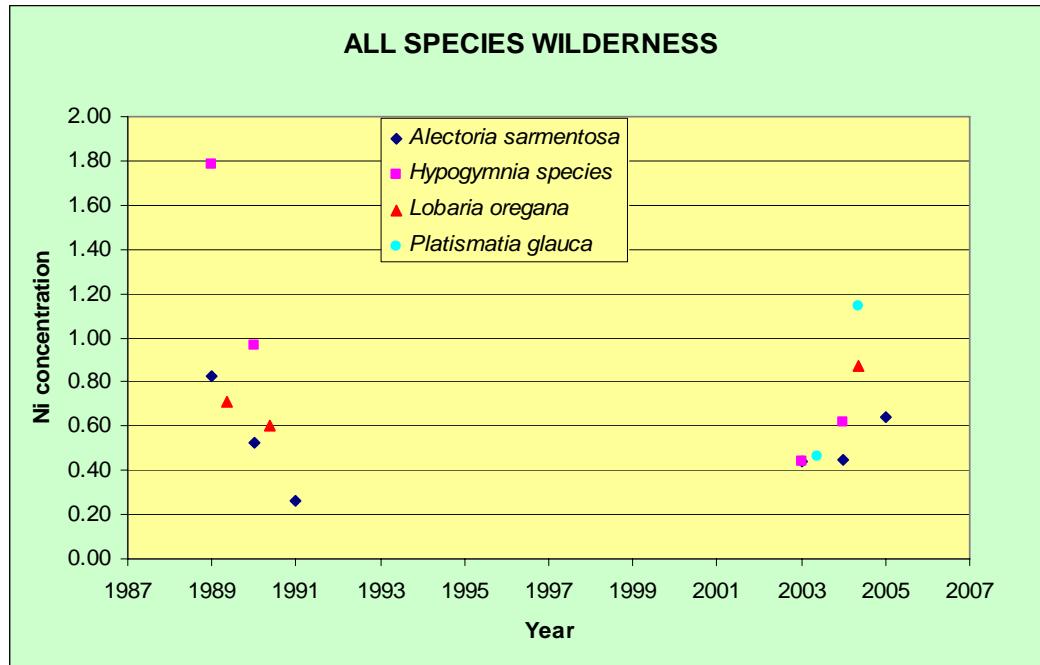


Figure XXIII-27. Wilderness plot means of Ni ppm in All Species per year.

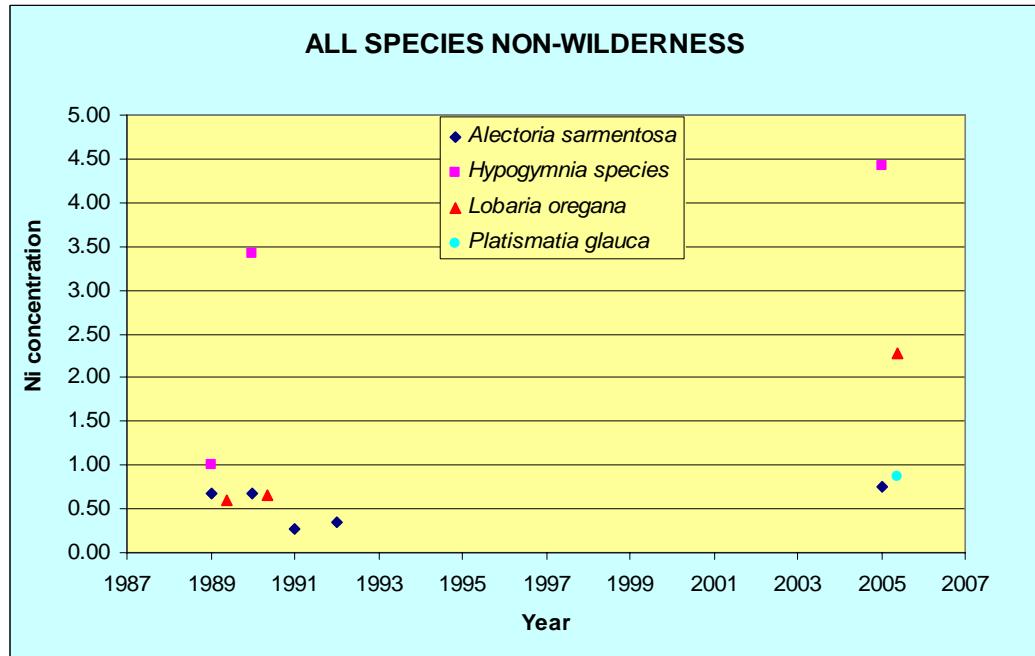


Figure XXIII-28. Non-Wilderness plot means of Ni ppm in All Species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ni ppm

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Alectoria sarmentosa

Summary Statistics:

Table XXIII-2. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Ni ppm content of *Alectoria sarmentosa* per year.

Ni ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	0.67	0.0526	0.5213	0.8131
1989	Wilderness	0.82	0.1291	0.4920	1.1559
1990	Non-Wilderness	0.67	0.0807	0.5013	0.8330
1990	Wilderness	0.52	0.0255	0.4618	0.5863
1991	Non-Wilderness	0.2682	0.0212	0.2237	0.3127
1991	Wilderness	0.27	0.0195	0.2115	0.3201
1992	Non-Wilderness	0.35	0.0361	0.2643	0.4349
2003	Wilderness	0.44	0.0000	0.4400	0.4400
2004	Wilderness	0.45	0.0095	0.4311	0.4705
2005	Non-Wilderness	0.75	0.0986	0.5004	1.0072
2005	Wilderness	0.64	0.0000	0.6400	0.6400

Summary of Statistical Tests:

$$t = -1.2513, df = 8, p\text{-value} = 0.2462$$

There is no evidence of a difference in Ni ppm content in *Alectoria sarmentosa* from pre-2000 and post 2000 samples (p-value = 0.2462).

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ni ppm

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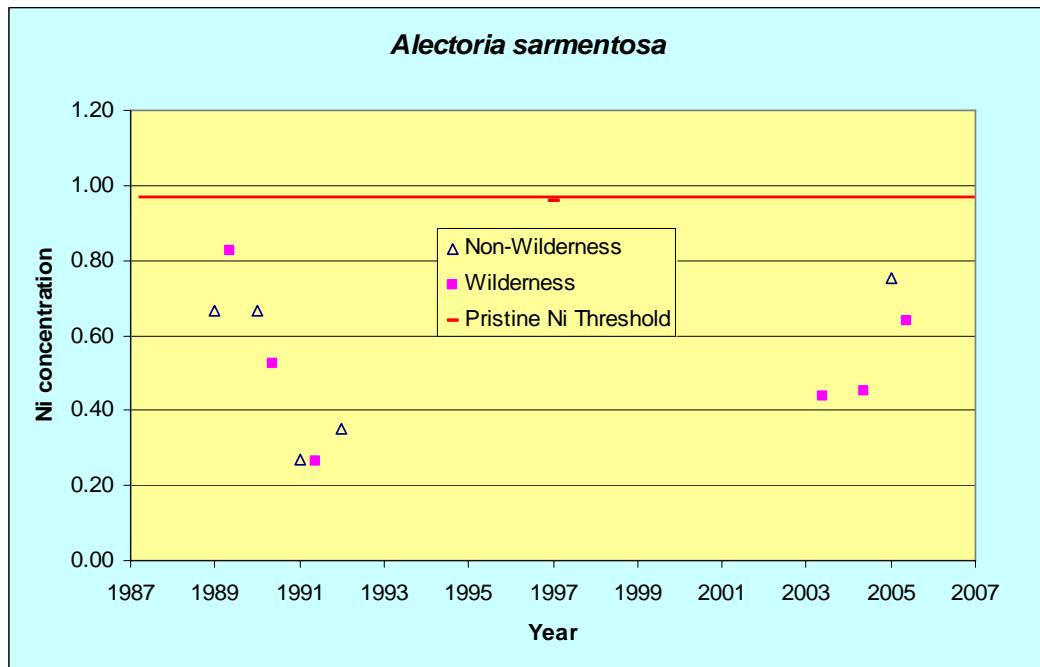


Figure XXIII-3. Wilderness and Non-Wilderness yearly means of Ni ppm in *Alectoria sarmentosa* per year.

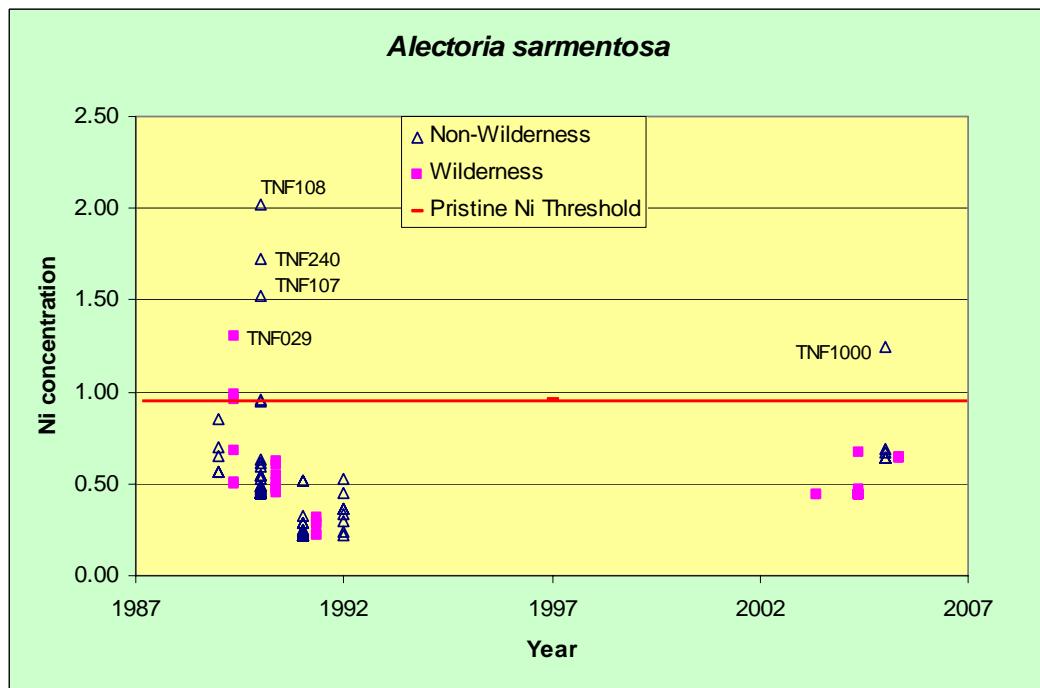


Figure XXIII-4. Wilderness and Non-Wilderness plot means of Ni ppm in *Alectoria sarmentosa* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ni ppm

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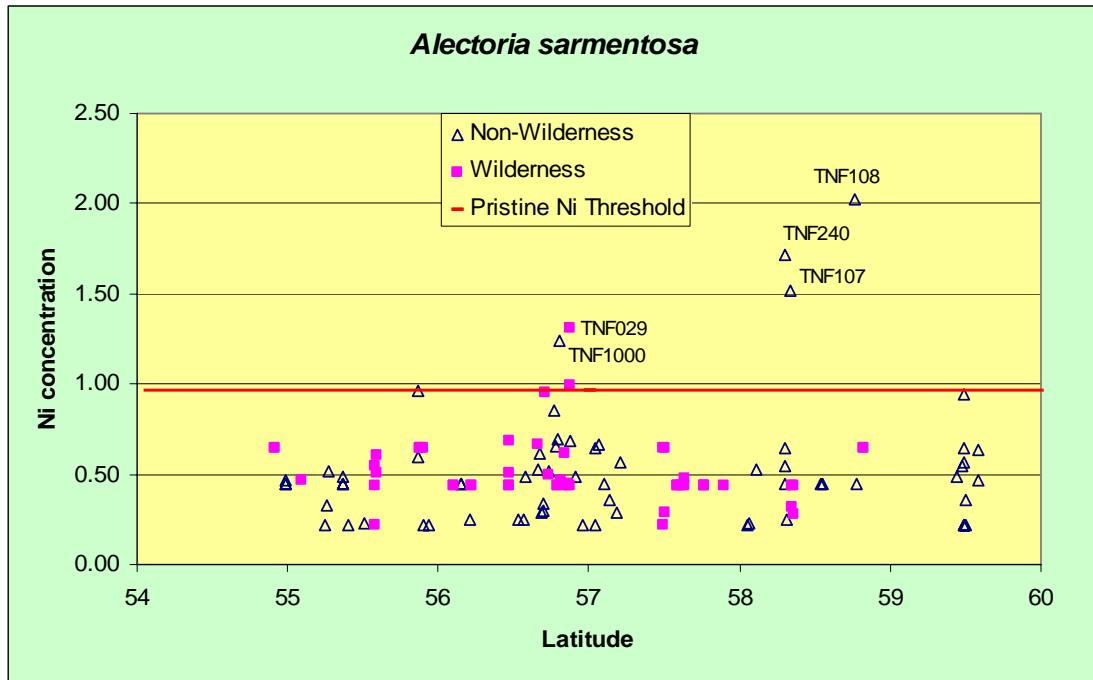


Figure XXIII-5. Wilderness and Non-Wilderness plot means of Ni ppm in *Alectoria sarmentosa* vs. plot Latitude.

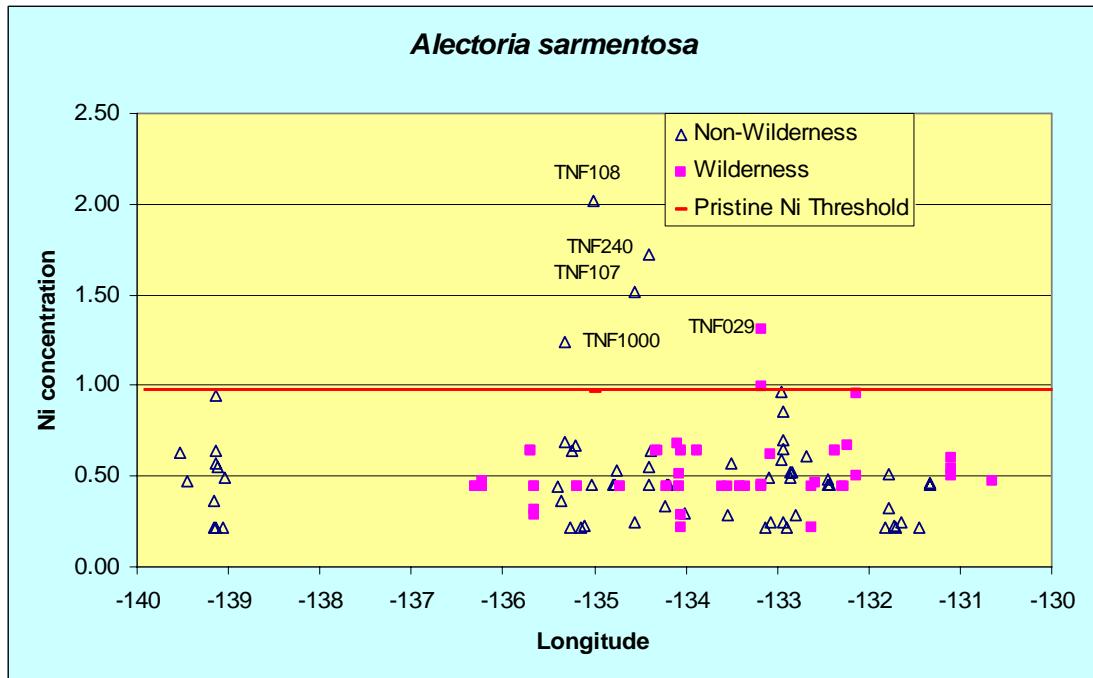


Figure XXIII-6. Wilderness and Non-Wilderness plot means of Ni ppm in *Alectoria sarmentosa* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ni ppm

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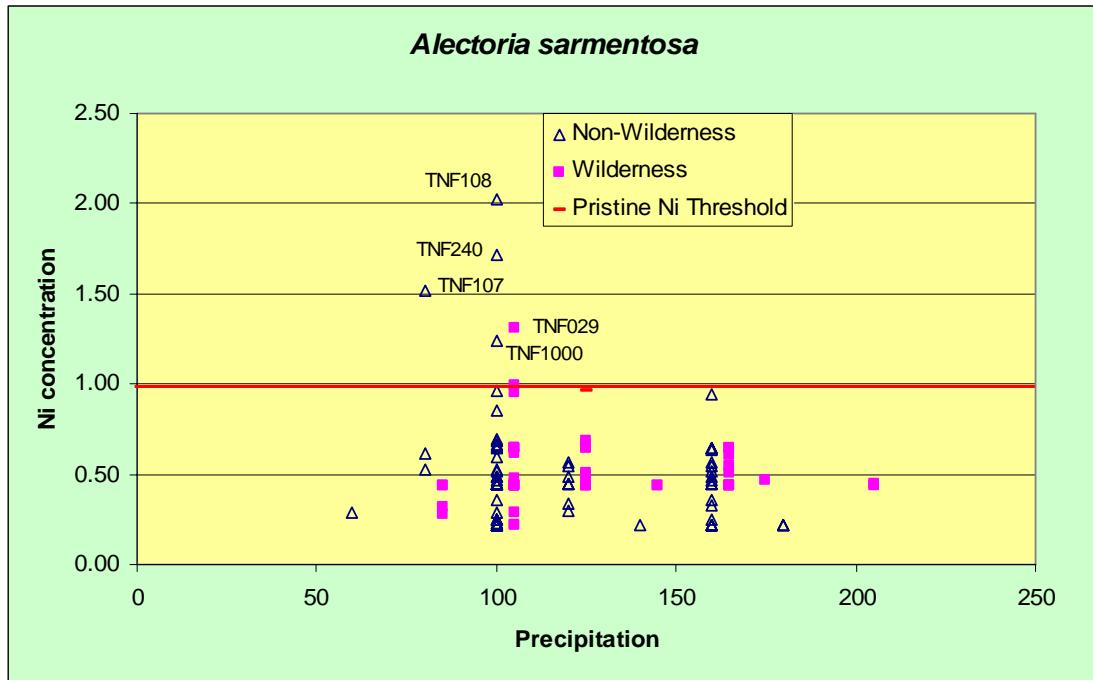


Figure XXIII-7. Wilderness and Non-Wilderness plot means of Ni ppm
in *Alectoria sarmentosa* vs. plot Precipitation.

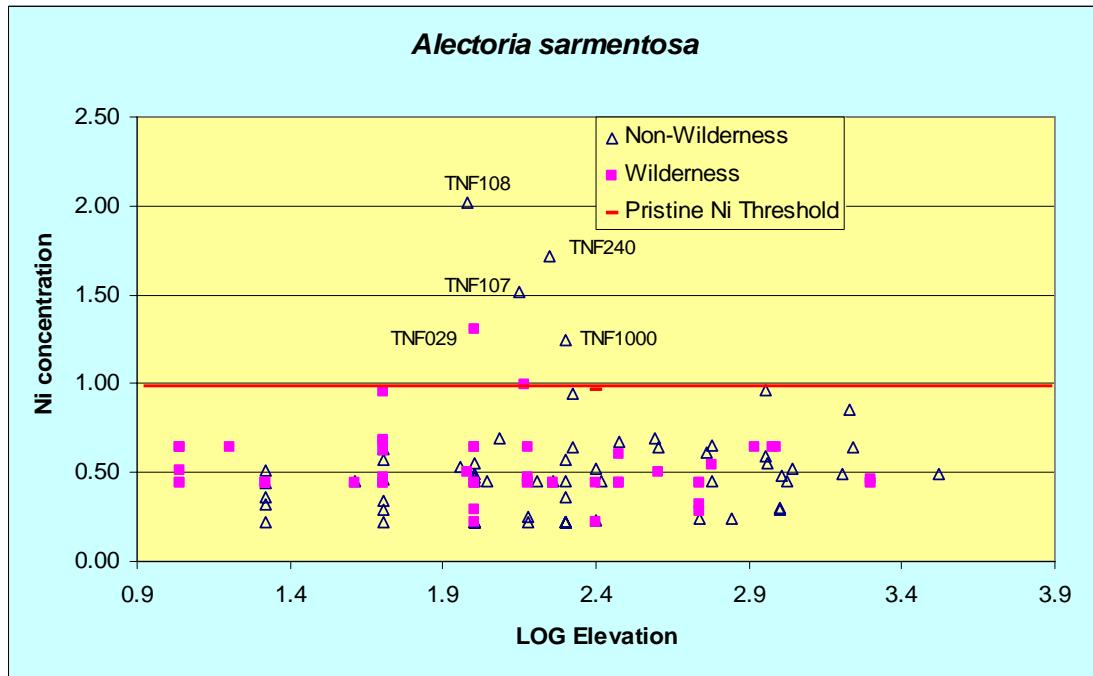


Figure XXIII-8. Wilderness and Non-Wilderness plot means of Ni ppm
in *Alectoria sarmentosa* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ni ppm

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Hypogymnia species

In this series, all of the *Hypogymnia* species were included as a group.

Table XXIII-3. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Ni ppm content of *Hypogymnia species* per year.

Ni ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	1.00	0.4450	4.6593	6.6493
1989	Wilderness	1.78	0.6156	0.0726	3.4910
1990	Non-Wilderness	3.42	0.6978	1.9523	4.8844
1990	Wilderness	0.96	0.2020	0.4672	1.4557
2003	Wilderness	0.44	NA	NA	NA
2004	Wilderness	0.62	0.0628	0.4591	0.7818
2005	Non-Wilderness	4.42	0.1727	3.6736	5.1598
2005	Wilderness	1.17	0.2816	0.5226	1.8214

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ni ppm

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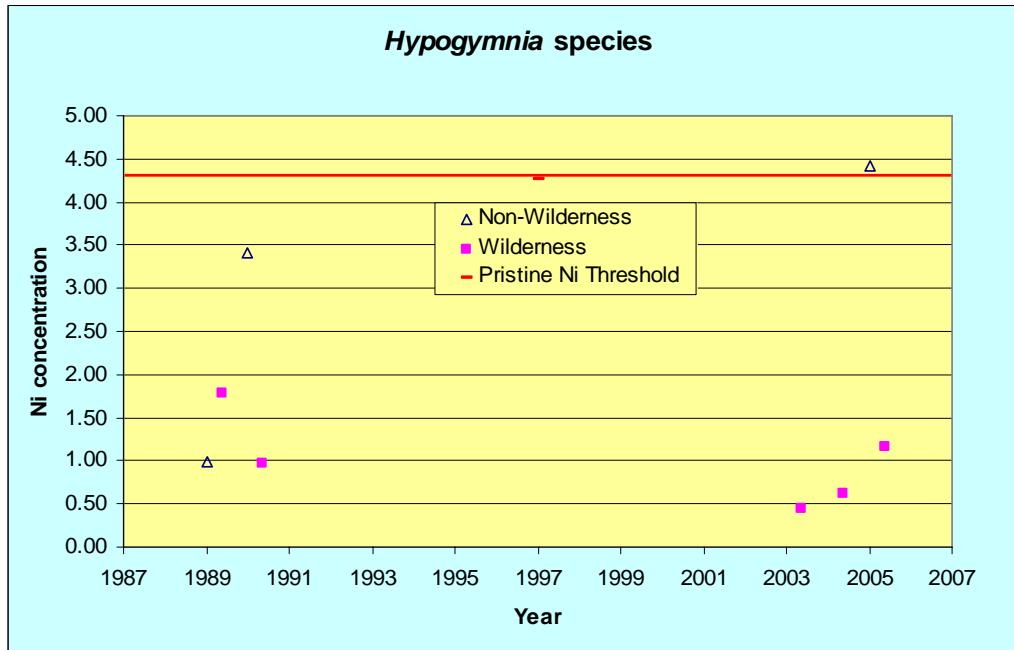


Figure XXIII-9. Wilderness and Non-Wilderness yearly means of Ni ppm in *Hypogymnia* species per year.

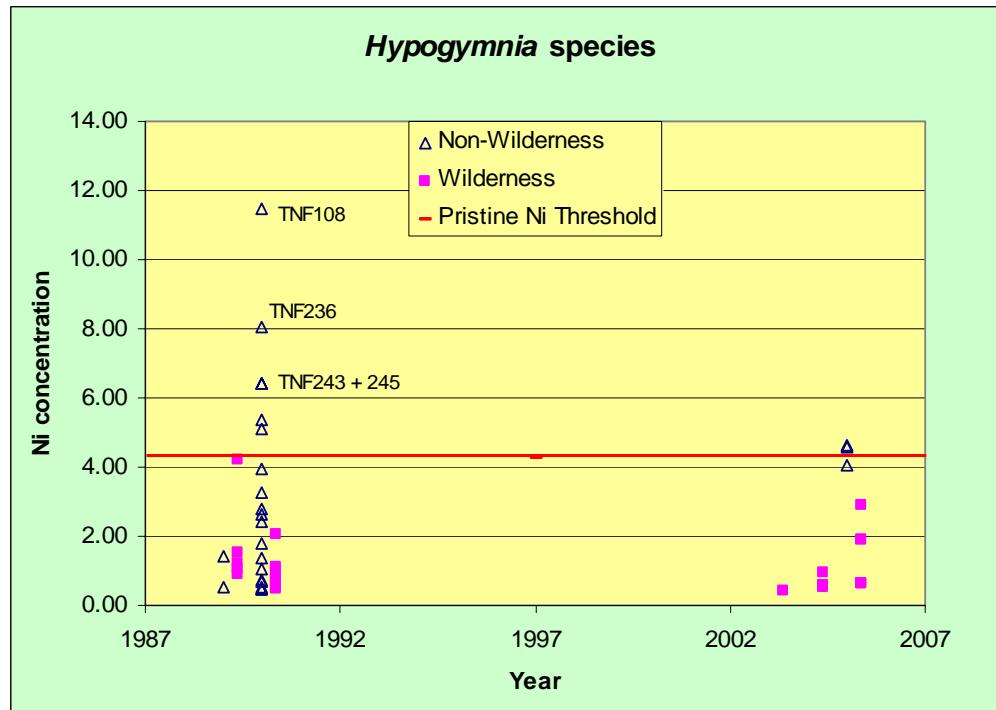


Figure XXIII-10. Wilderness and Non-Wilderness plot means of Ni ppm in *Hypogymnia* species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ni ppm

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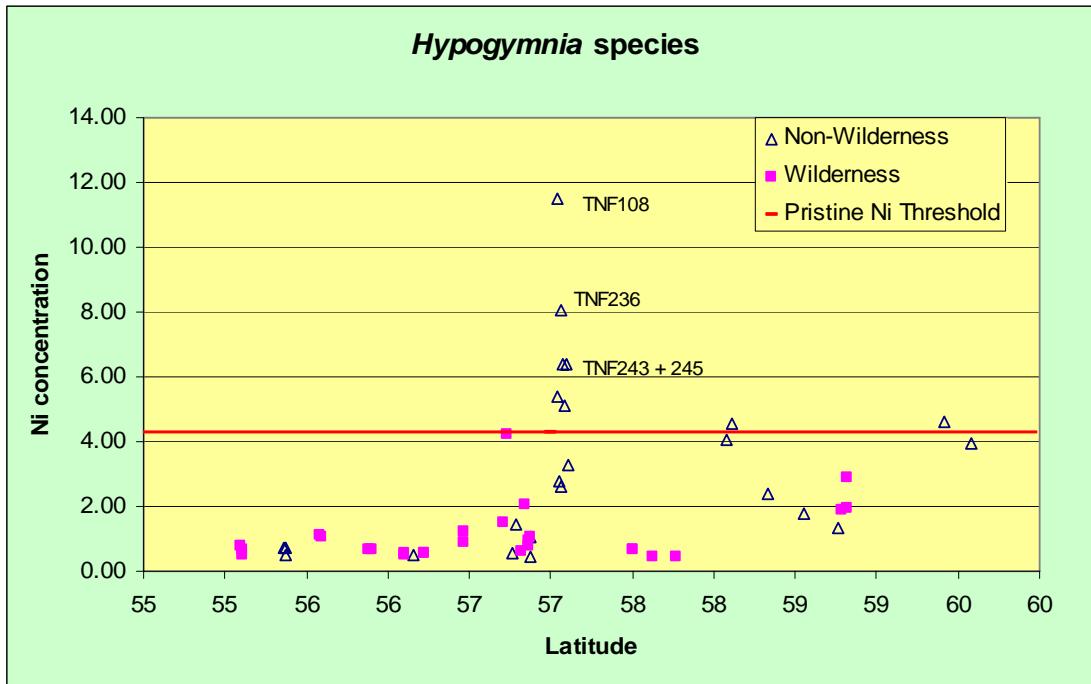


Figure XXIII-11. Wilderness and Non-Wilderness plot means of Ni ppm in *Hypogymnia* species vs. plot Latitude.

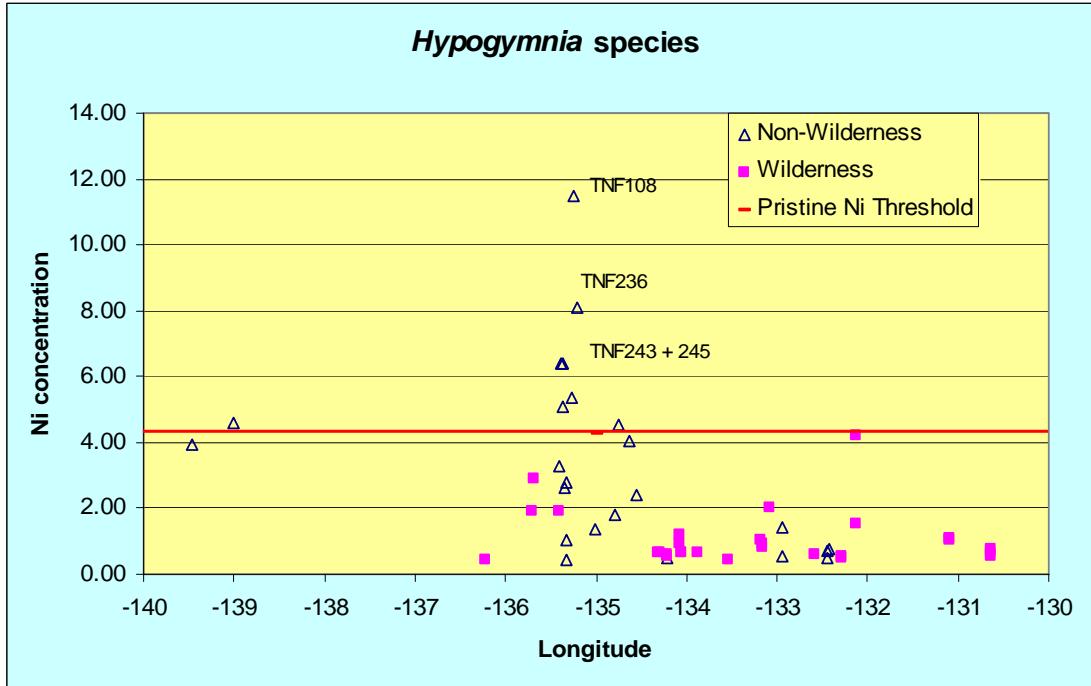


Figure XXIII-12. Wilderness and Non-Wilderness plot means of Ni ppm in *Hypogymnia* species vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ni ppm

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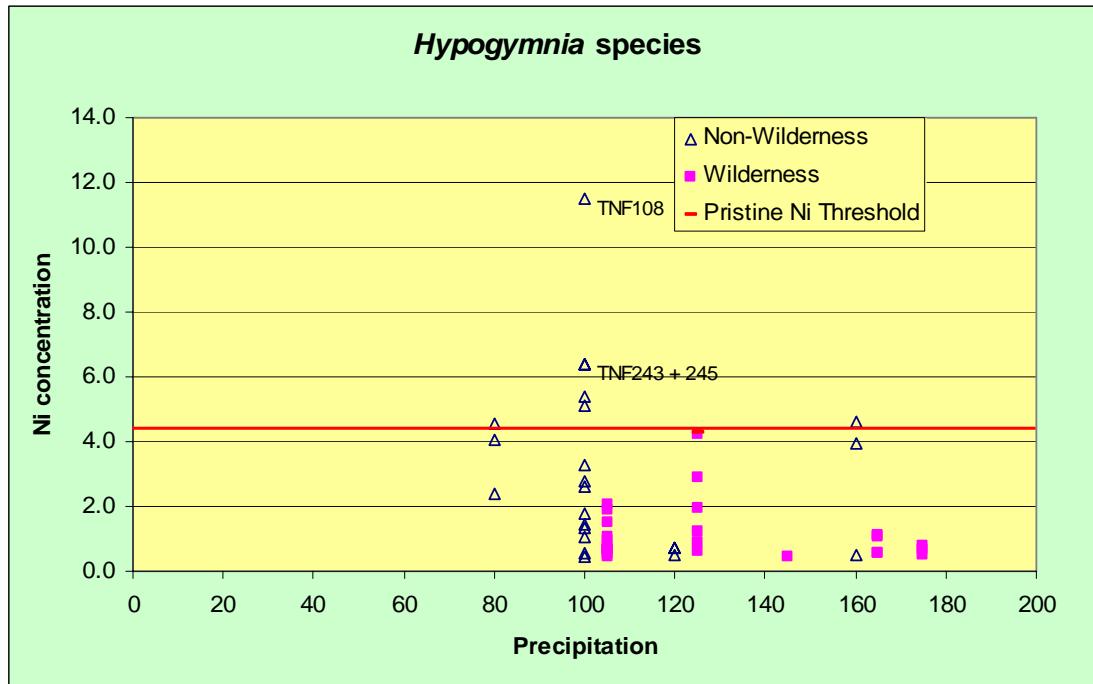


Figure XXIII-13. Wilderness and Non-Wilderness plot means of Ni ppm in *Hypogymnia* species vs. plot Precipitation.

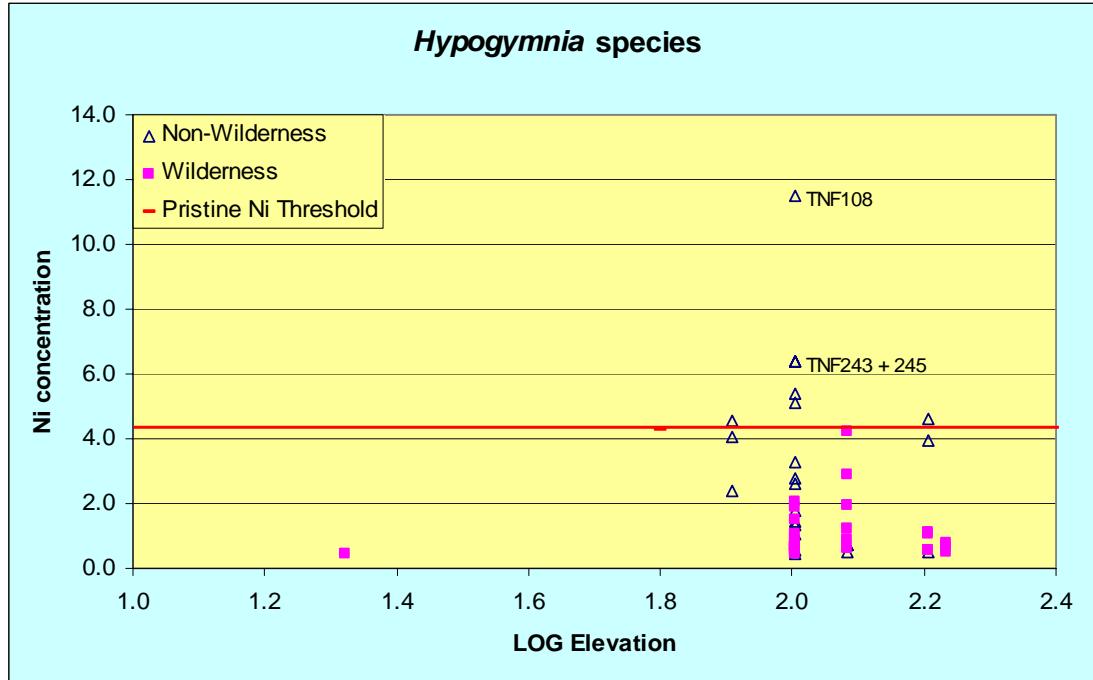


Figure XXIII-14. Wilderness and Non-Wilderness plot means of Ni ppm in *Hypogymnia* species vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ni ppm

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Lobaria oregana

Table XXIII-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Ni ppm content of *Lobaria oregana* per year.

Ni ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	0.60	0.0511	0.4417	0.7666
1989	Wilderness	0.71	0.1613	0.2597	1.1553
1990	Non-Wilderness	0.66	0.0597	0.5250	0.7854
1990	Wilderness	0.60	0.0694	0.4203	0.7771
2004	Wilderness	0.87	0.1459	0.5167	1.2305
2005	Non-Wilderness	2.27	NA	NA	NA
2005	Wilderness	0.7168	0.0768	0.4725	0.9610

Summary of Statistical Tests:

$$t = -2.0942, \text{ df} = 4, \text{ p-value} = 0.1043$$

There is no evidence of a difference in Ni ppm content in *Lobaria oregana* from pre-2000 and post 2000 samples (p-value = 0.1043).

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ni ppm

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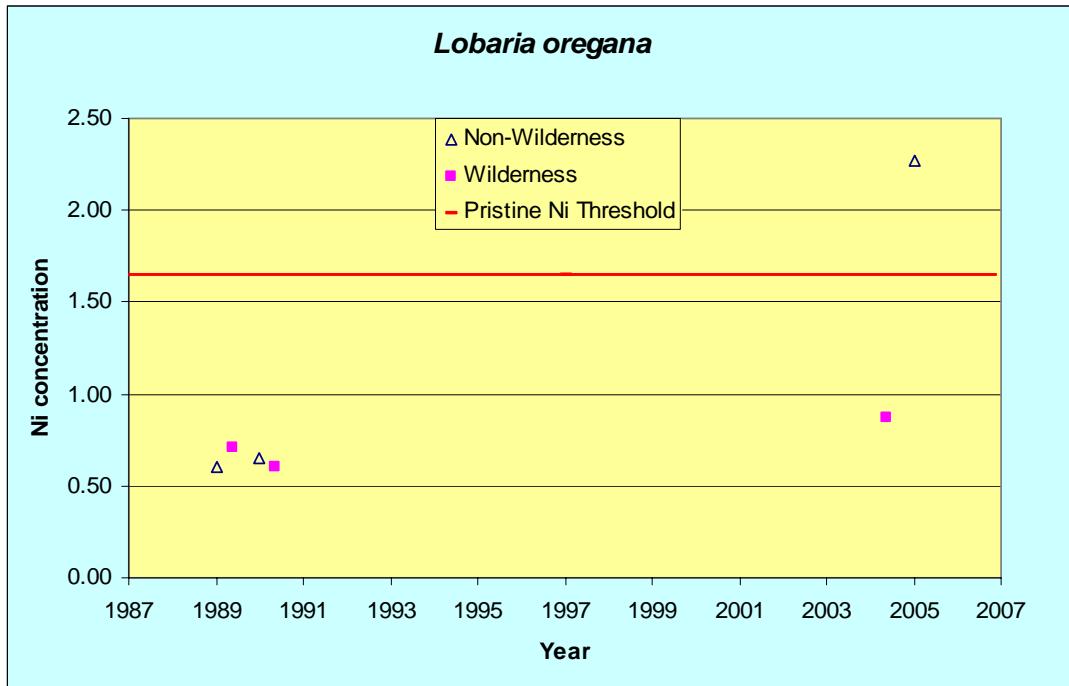


Figure XXIII-15. Wilderness and Non-Wilderness yearly means of Ni ppm in *Lobaria oregana* per year.

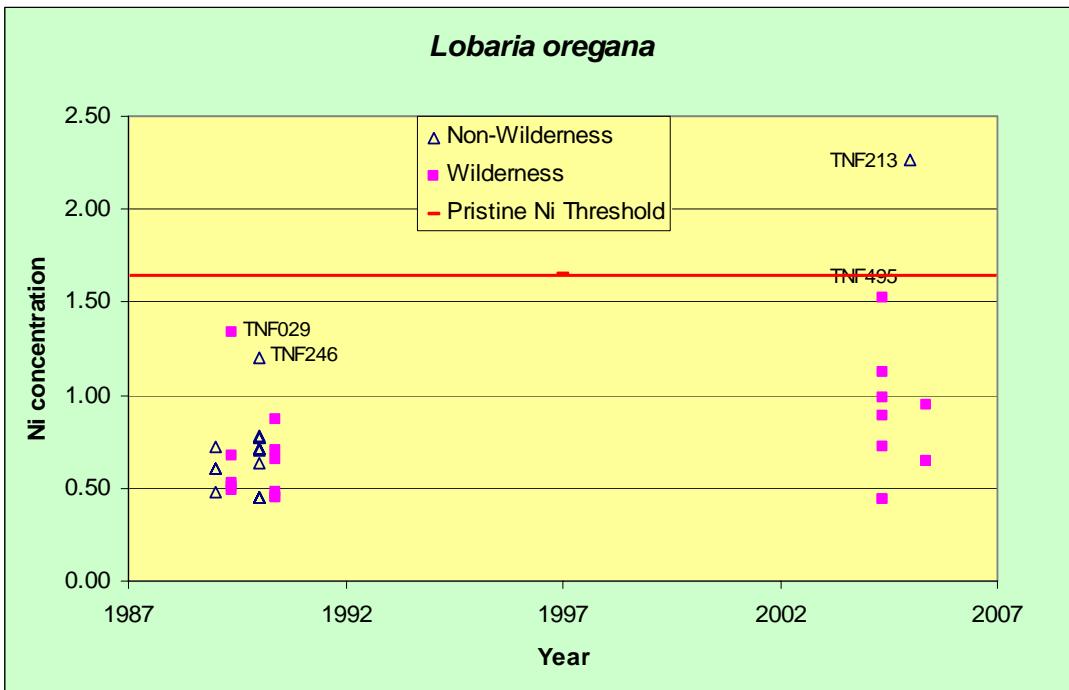


Figure XXIII-16. Wilderness and Non-Wilderness plot means of Ni ppm in *Lobaria oregana* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ni ppm

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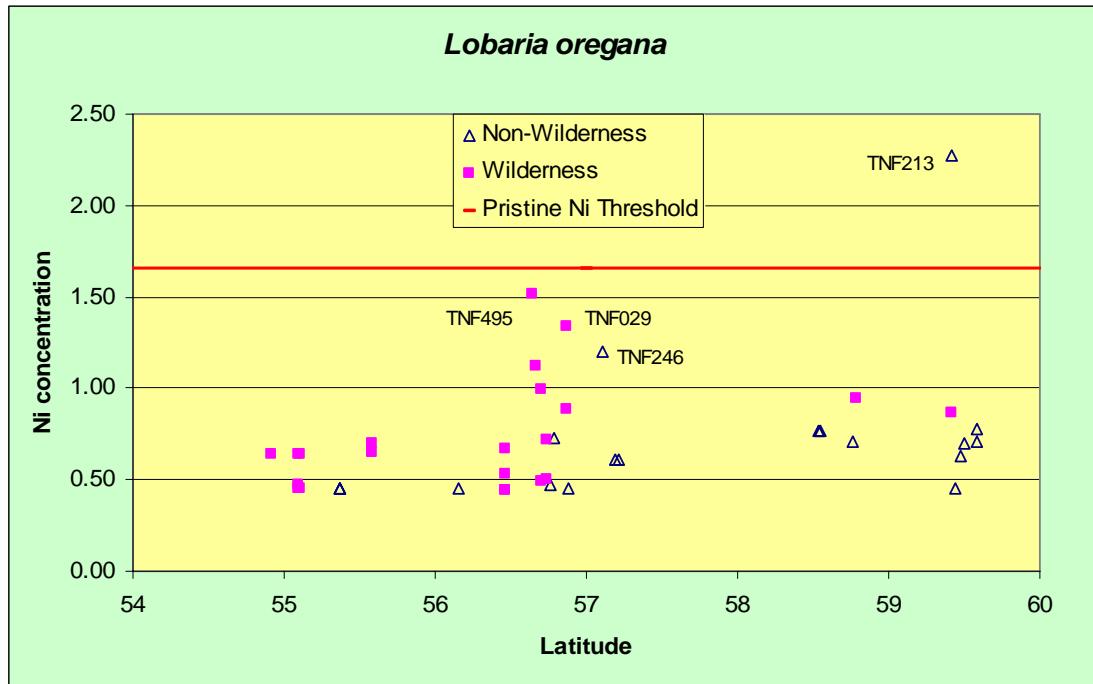


Figure XXIII-17. Wilderness and Non-Wilderness plot means of Ni ppm in *Lobaria oregana* vs. plot Latitude.

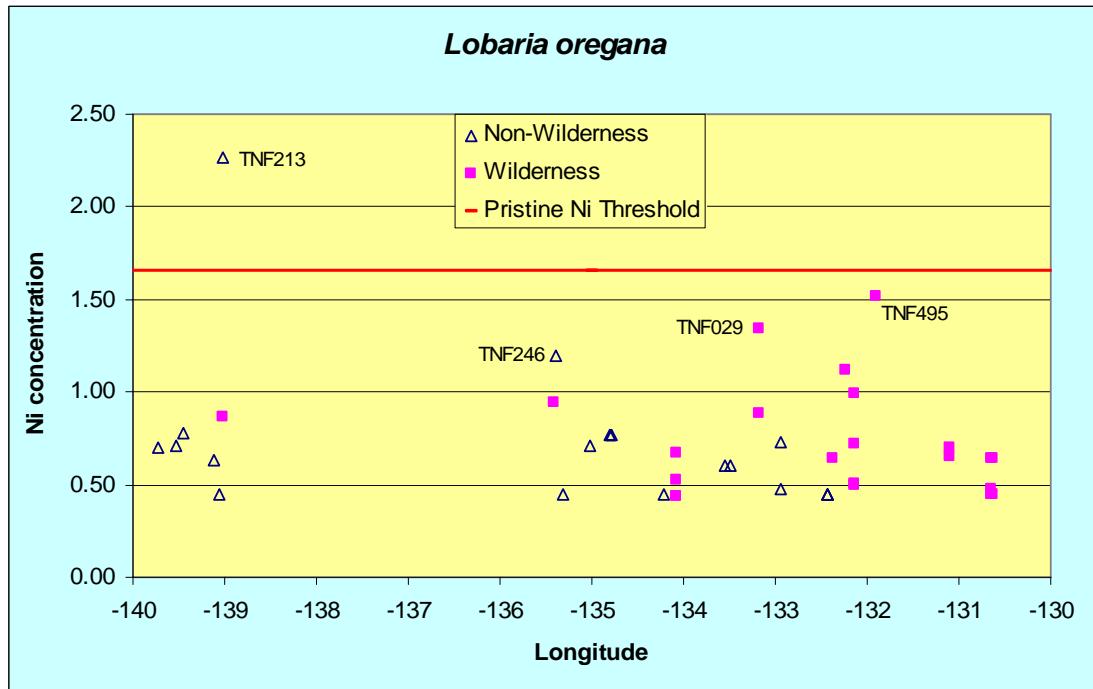


Figure XXIII-18. Wilderness and Non-Wilderness plot means of Ni ppm in *Lobaria oregana* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ni ppm

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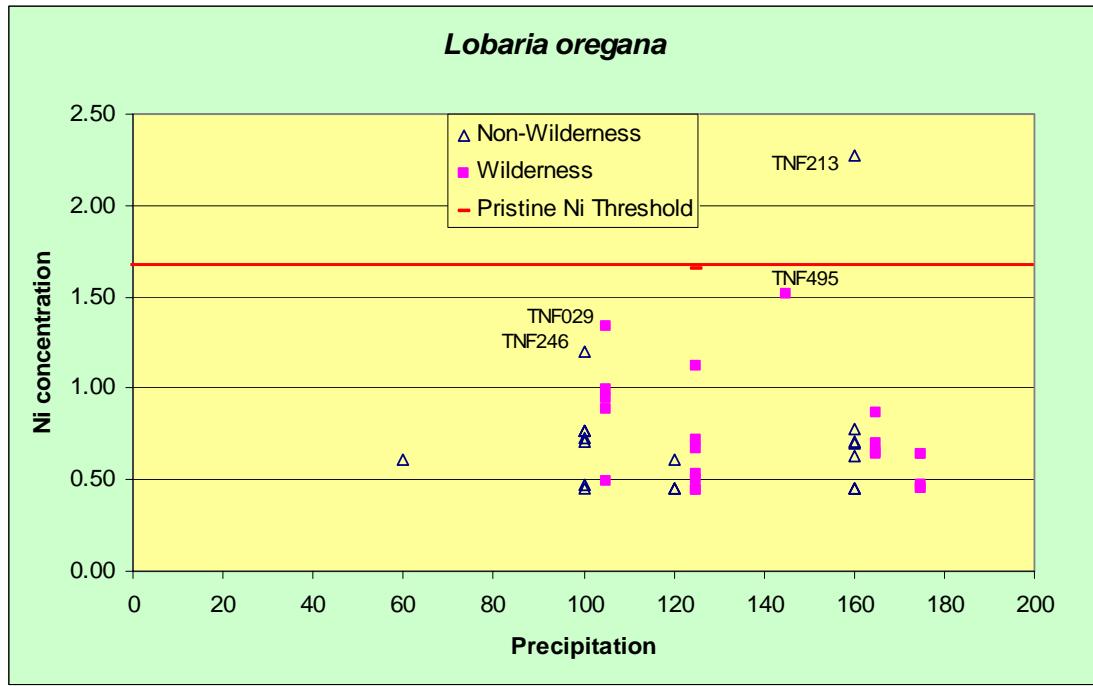


Figure XXIII-19. Wilderness and Non-Wilderness plot means of Ni ppm in *Lobaria oregana* vs. plot Precipitation.

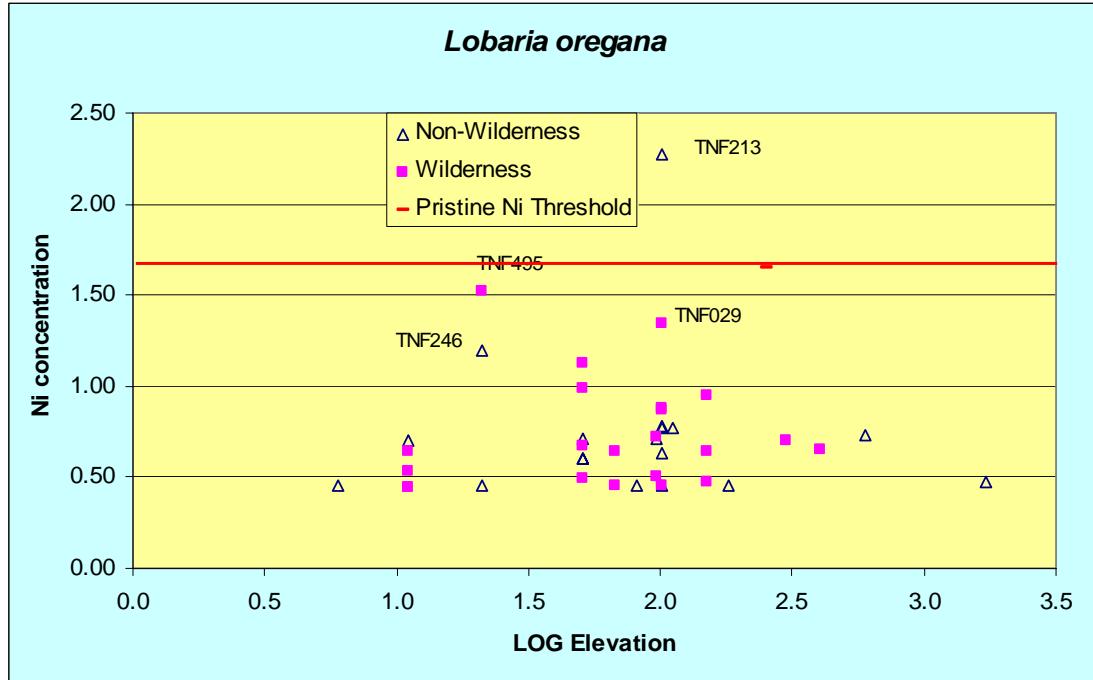


Figure XXIII-20. Wilderness and Non-Wilderness plot means of Ni ppm in *Lobaria oregana* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ni ppm

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Platismatia glauca

Table XXIII-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Ni ppm content of *Platismatia glauca* per year.

Ni ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2003	Wilderness	0.46	NA	NA	NA
2004	Wilderness	1.14	0.2169	0.6531	1.6344
2005	Non-Wilderness	3.08	0.2923	2.4230	3.7454
2005	Wilderness	1.14	0.2565	0.5321	1.7451

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ni ppm

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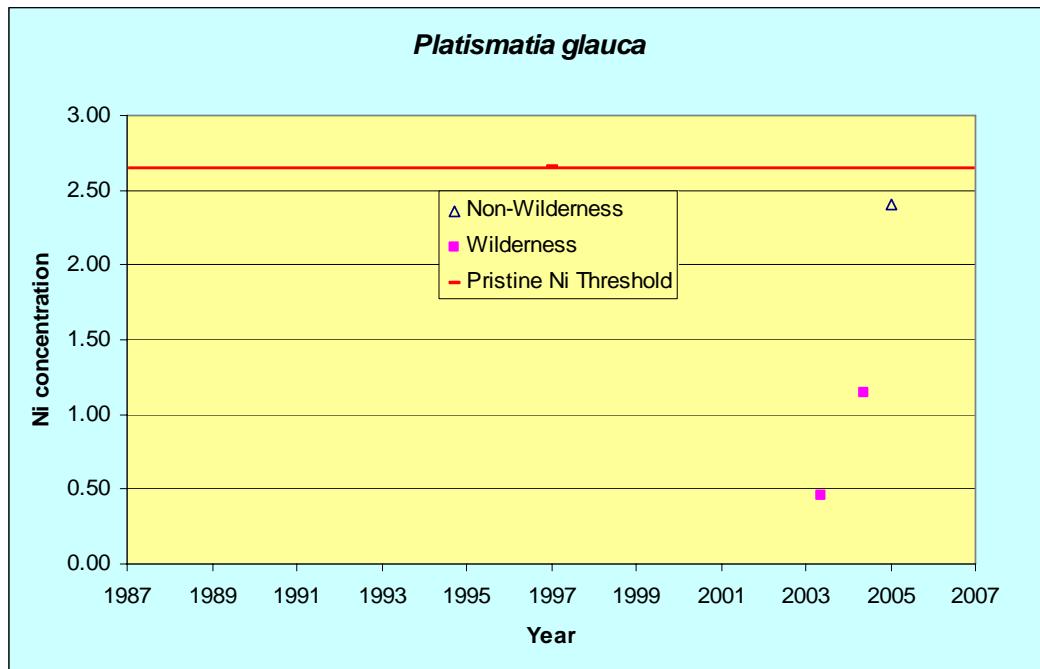


Figure XXIII-21. Wilderness and Non-Wilderness yearly means of Ni ppm in *Platismatia glauca* per year.

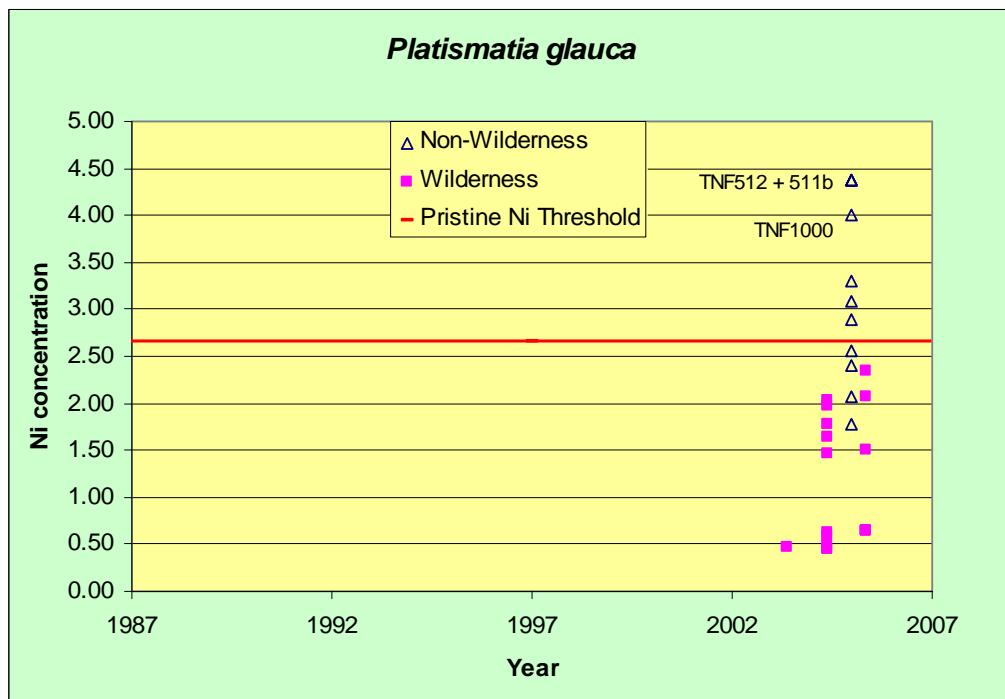


Figure XXIII-22. Wilderness and Non-Wilderness plot means of Ni ppm in *Platismatia glauca* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ni ppm

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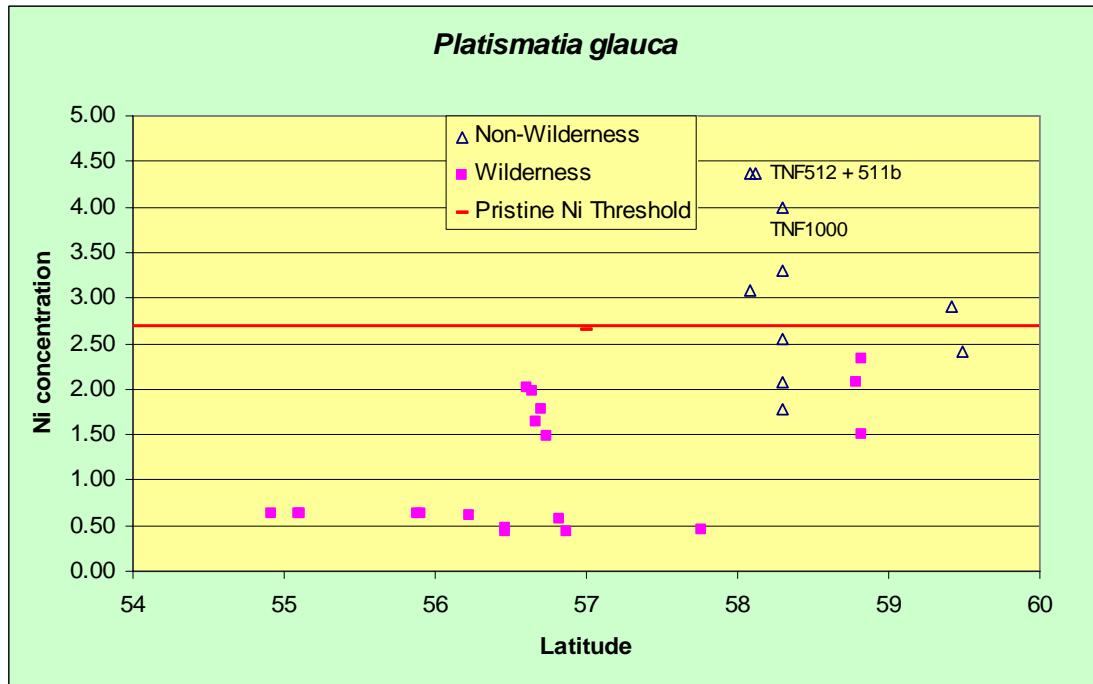


Figure XXIII-23. Wilderness and Non-Wilderness plot means of Ni ppm in *Platismatia glauca* vs. plot Latitude.

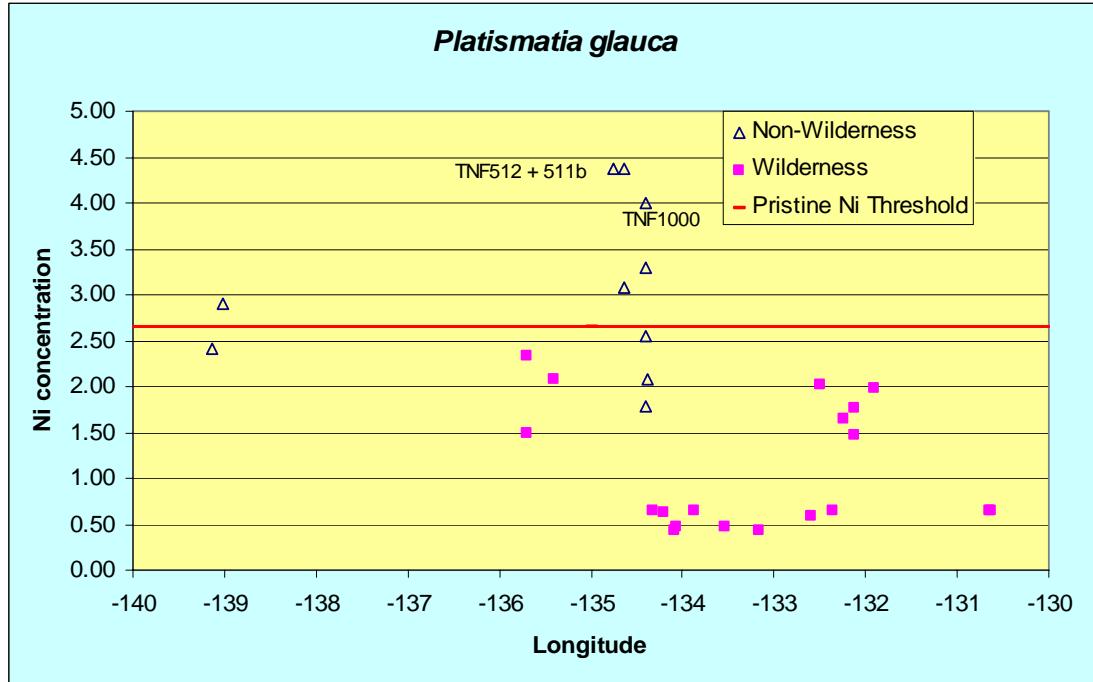


Figure XXIII-24. Wilderness and Non-Wilderness plot means of Ni ppm in *Platismatia glauca* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ni ppm

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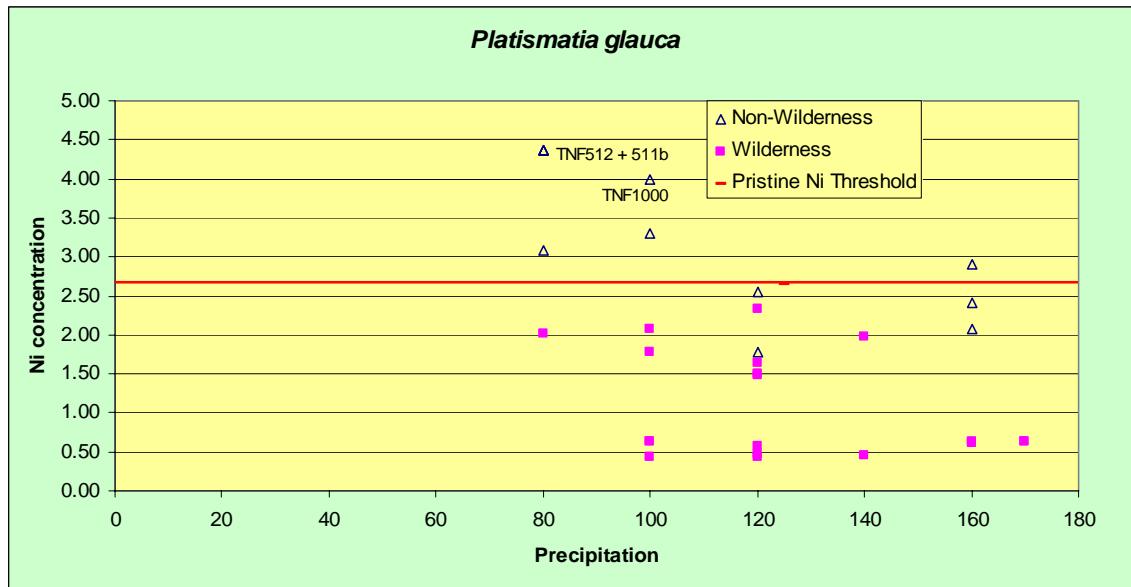


Figure XXIII-25. Wilderness and Non-Wilderness plot means of Ni ppm in *Platismatia glauca* vs. plot Precipitation.

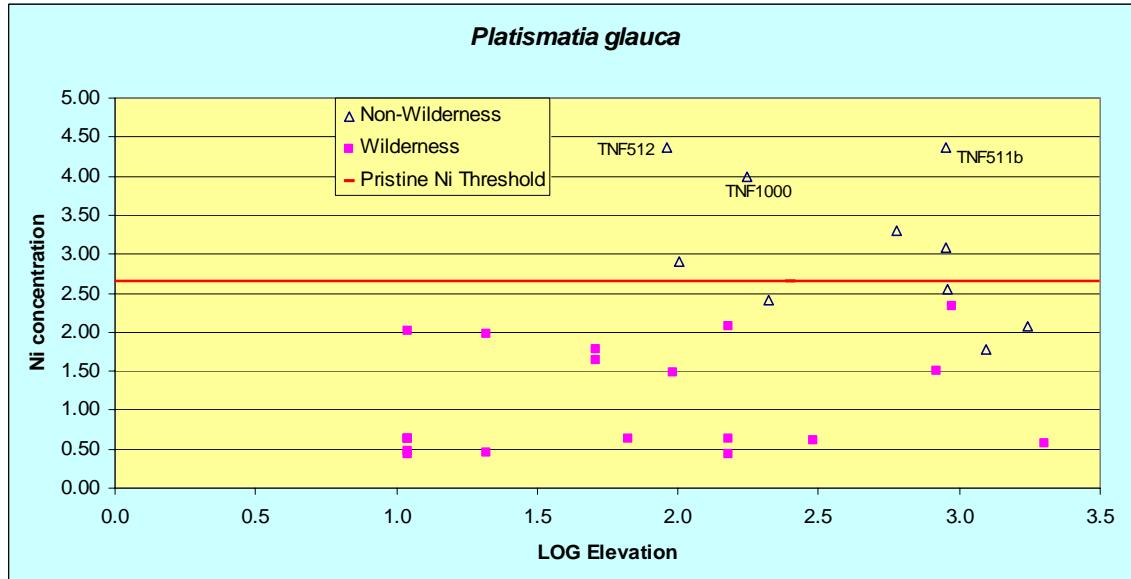


Figure XXIII-26. Wilderness and Non-Wilderness plot means of Ni ppm in *Platismatia glauca* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

P ppm

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XXIV. SUMMARY OF P PPM DATA ANALYSIS

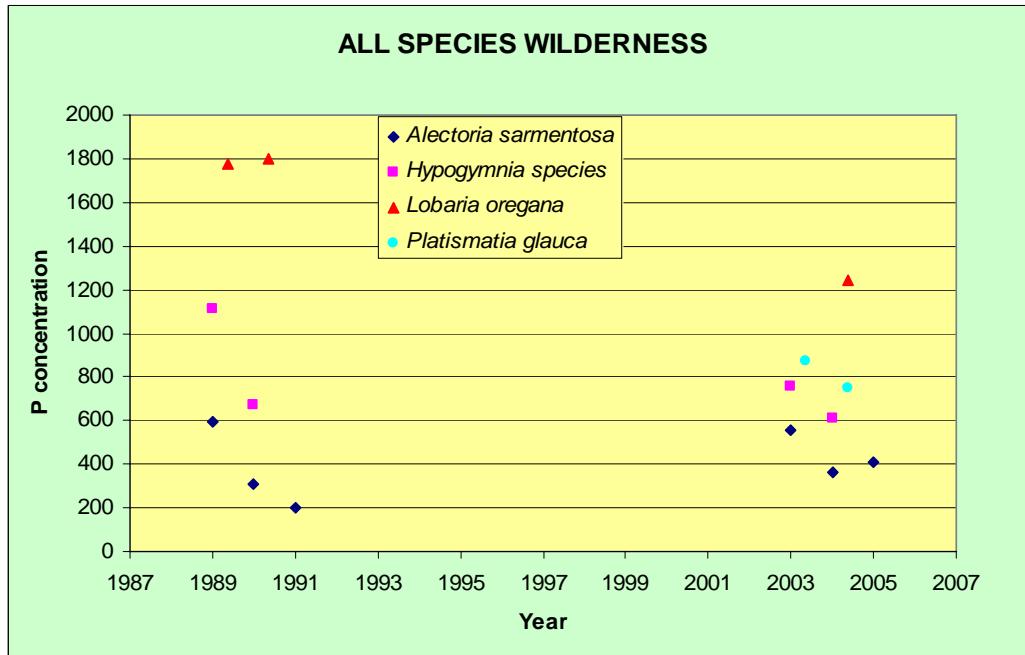


Figure XXIV-27. Wilderness plot means of P ppm
in All Species per year.

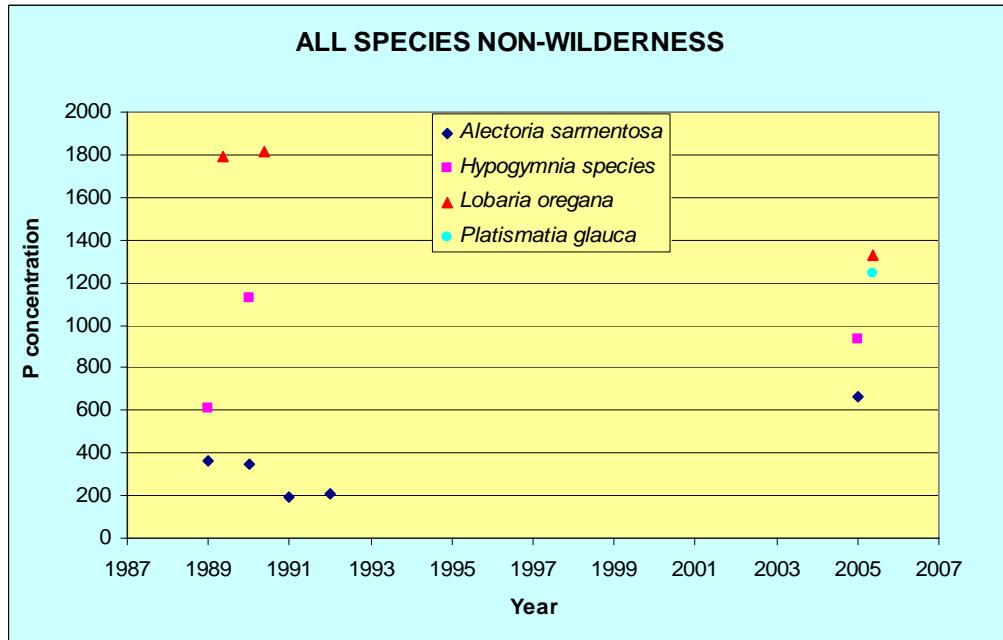


Figure XXIV-28. Non-Wilderness plot means of P ppm
in All Species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

P ppm

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Alectoria sarmentosa

Summary Statistics:

Table XXIV-2. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the P ppm content of *Alectoria sarmentosa* per year.

P ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	362.74	76.1446	151.3287	574.1513
1989	Wilderness	591.78	75.3888	397.9846	785.5710
1990	Non-Wilderness	347.73	54.0382	236.6527	458.8071
1990	Wilderness	310.38	78.9222	117.2687	503.4999
1991	Non-Wilderness	193.6281	8.3143	176.1603	211.0958
1991	Wilderness	201.61	7.6276	180.4274	222.7826
1992	Non-Wilderness	205.66	10.3293	181.2375	230.0873
2003	Wilderness	557.05	125.3892	1036.1663	2150.2746
2004	Wilderness	360.82	85.1815	184.6071	537.0299
2005	Non-Wilderness	663.69	125.3194	341.5496	985.8371
2005	Wilderness	408.23	60.3982	271.5982	544.8588

Summary of Statistical Tests:

$$t = -1.1626, df = 8, p\text{-value} = 0.2785$$

There is no evidence of a difference in P ppm content in *Alectoria sarmentosa* from pre-2000 and post 2000 samples (p-value = 0.2785).

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

P ppm

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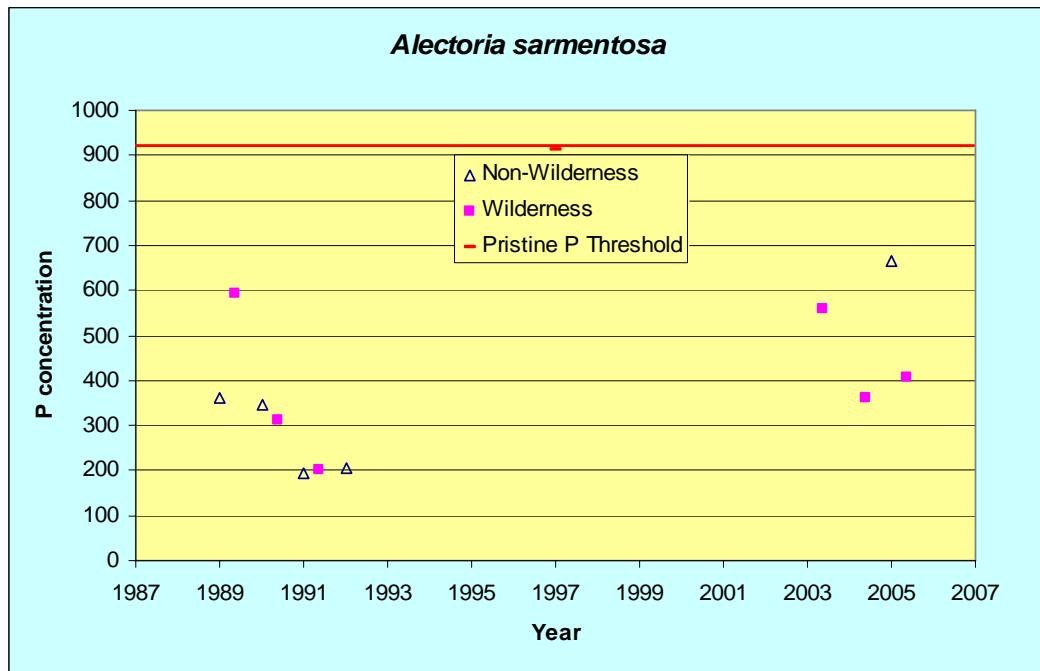


Figure XXIV-3. Wilderness and Non-Wilderness yearly means of P ppm in *Alectoria sarmentosa* per year.

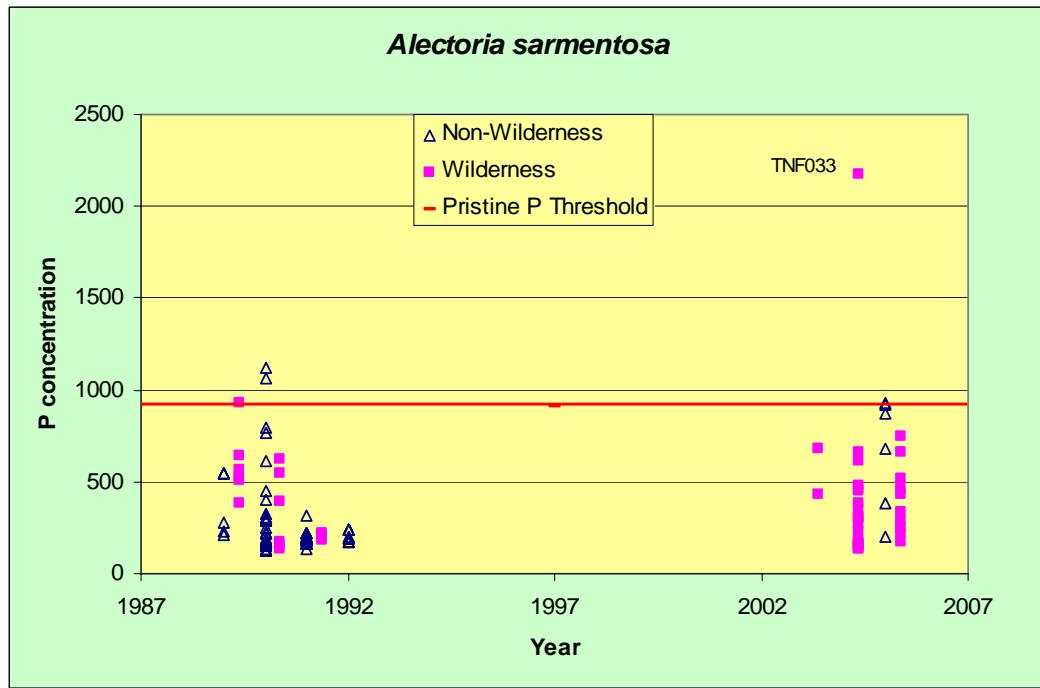


Figure XXIV-4. Wilderness and Non-Wilderness plot means of P ppm in *Alectoria sarmentosa* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

P ppm

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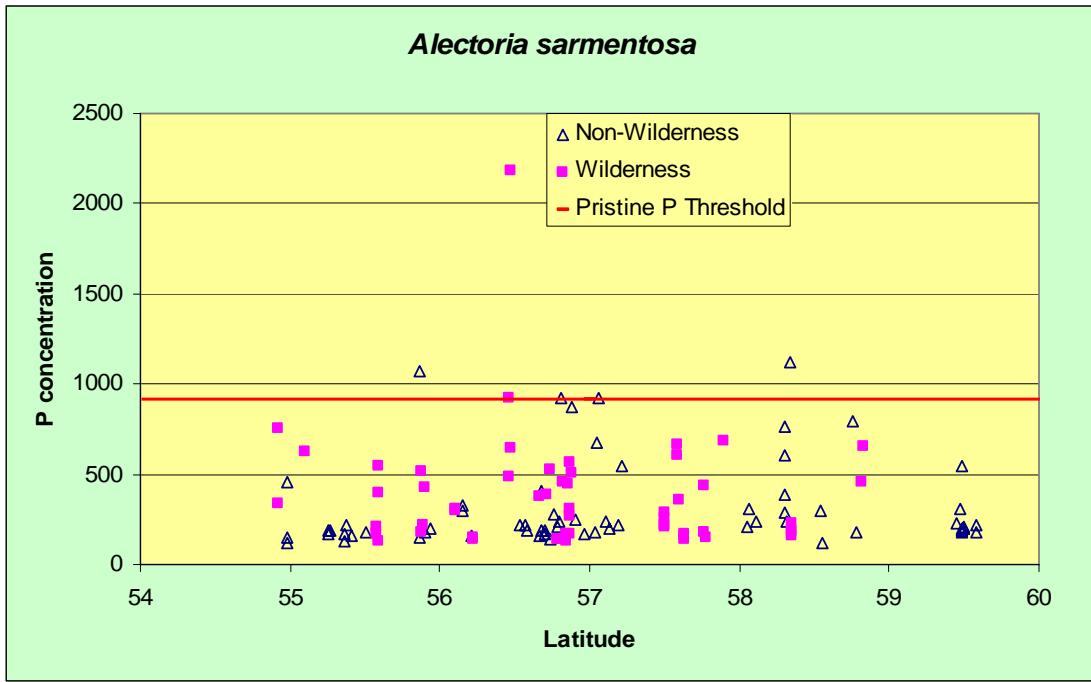


Figure XXIV-5. Wilderness and Non-Wilderness plot means of P ppm in *Alectoria sarmentosa* vs. plot Latitude.

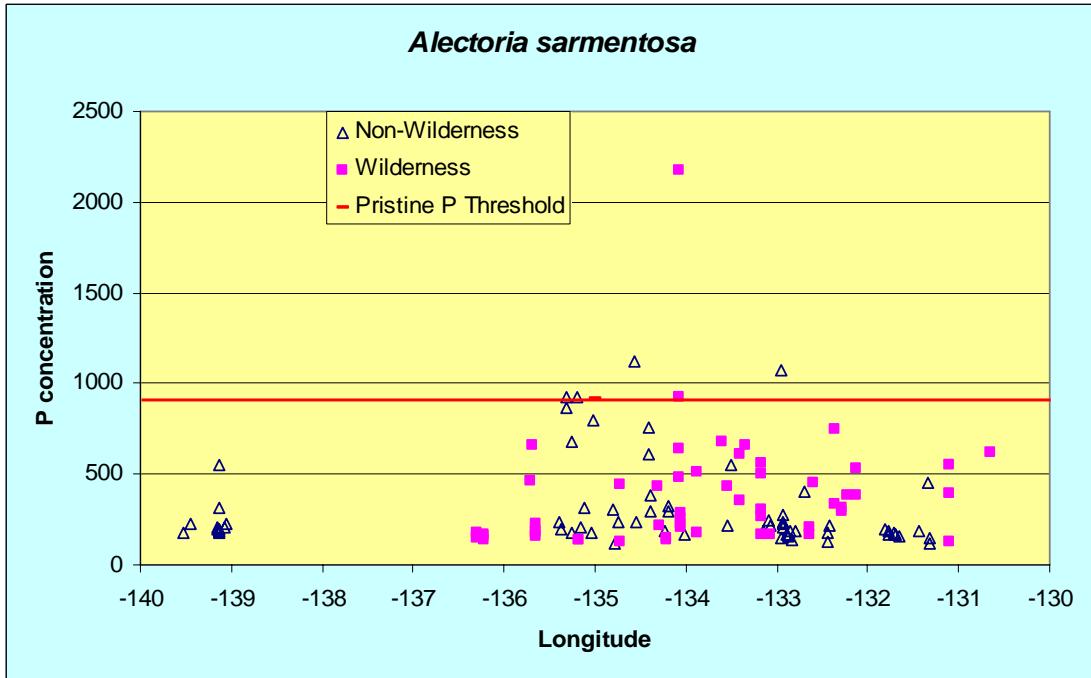


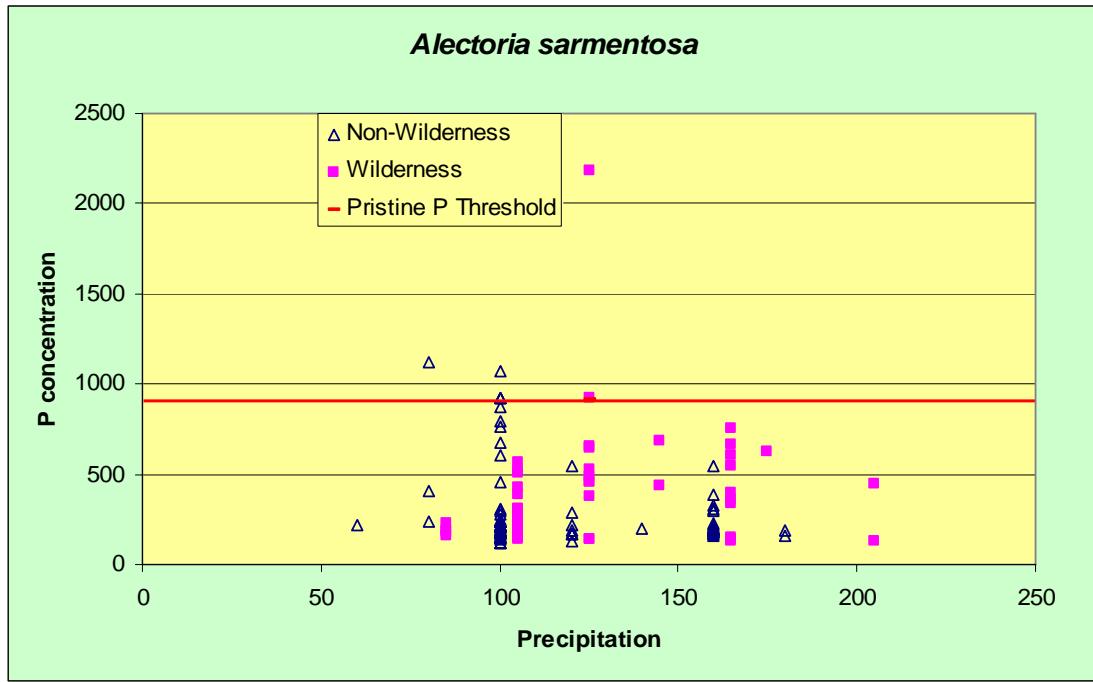
Figure XXIV-6. Wilderness and Non-Wilderness plot means of P ppm in *Alectoria sarmentosa* vs. plot Longitude.

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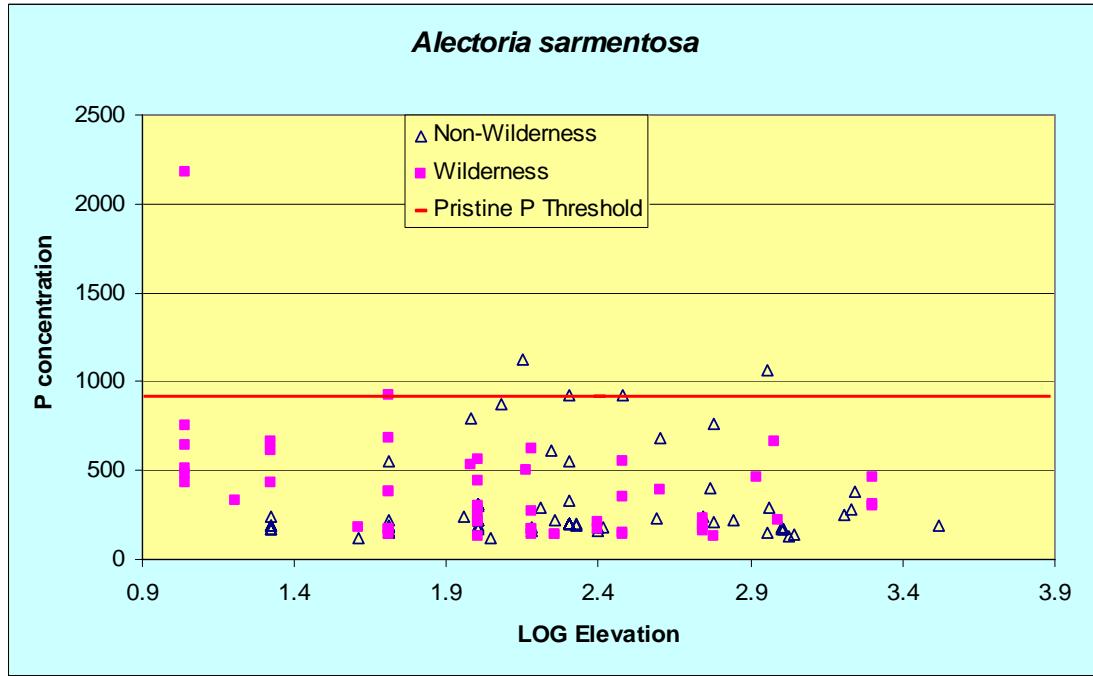
ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

P ppm

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**Figure XXIV-7. Wilderness and Non-Wilderness plot means of P ppm
in *Alectoria sarmentosa* vs. plot Precipitation.**



**Figure XXIV-8. Wilderness and Non-Wilderness plot means of P ppm
in *Alectoria sarmentosa* vs. plot Log-Elevation.**

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

P ppm

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Hypogymnia species

In this series, all of the *Hypogymnia* species were included as a group.

Table XXIV-3. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the P ppm content of *Hypogymnia species* per year.

P ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	612.50	196.5000	1884.2690	3109.2690
1989	Wilderness	1113.47	93.3430	854.3049	1372.6284
1990	Non-Wilderness	1128.13	115.4113	885.6615	1370.6017
1990	Wilderness	675.38	128.8464	360.1051	990.6568
2003	Wilderness	758.09	NA	NA	NA
2004	Wilderness	613.87	108.4177	335.1760	892.5690
2005	Non-Wilderness	931.34	176.3951	172.3731	1690.3069
2005	Wilderness	909.76	123.1564	625.7609	1193.7591

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

P ppm

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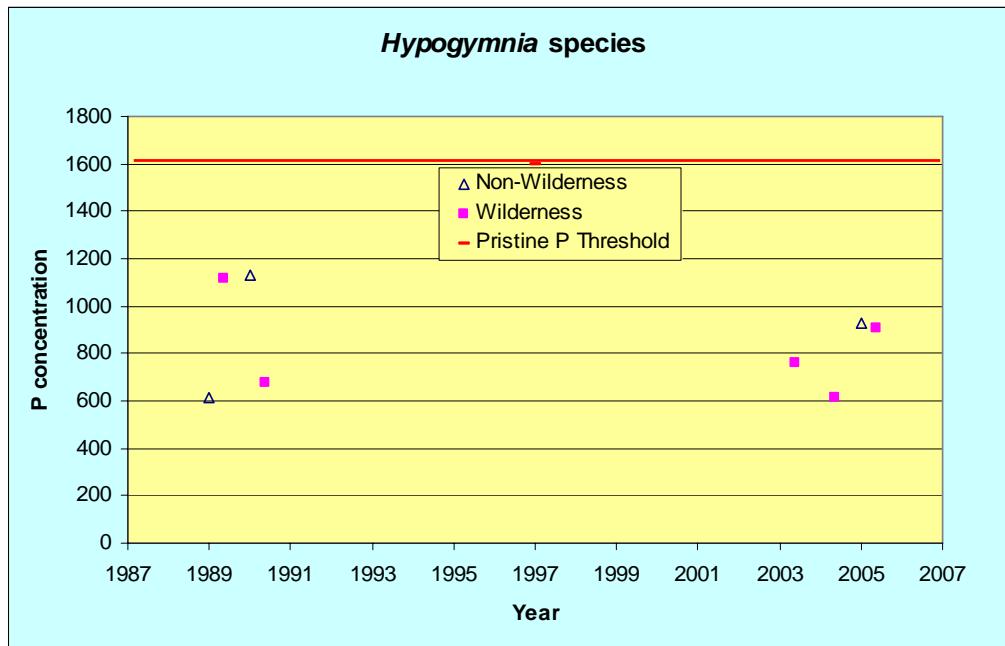


Figure XXIV-9. Wilderness and Non-Wilderness yearly means of P ppm in *Hypogymnia* species per year.

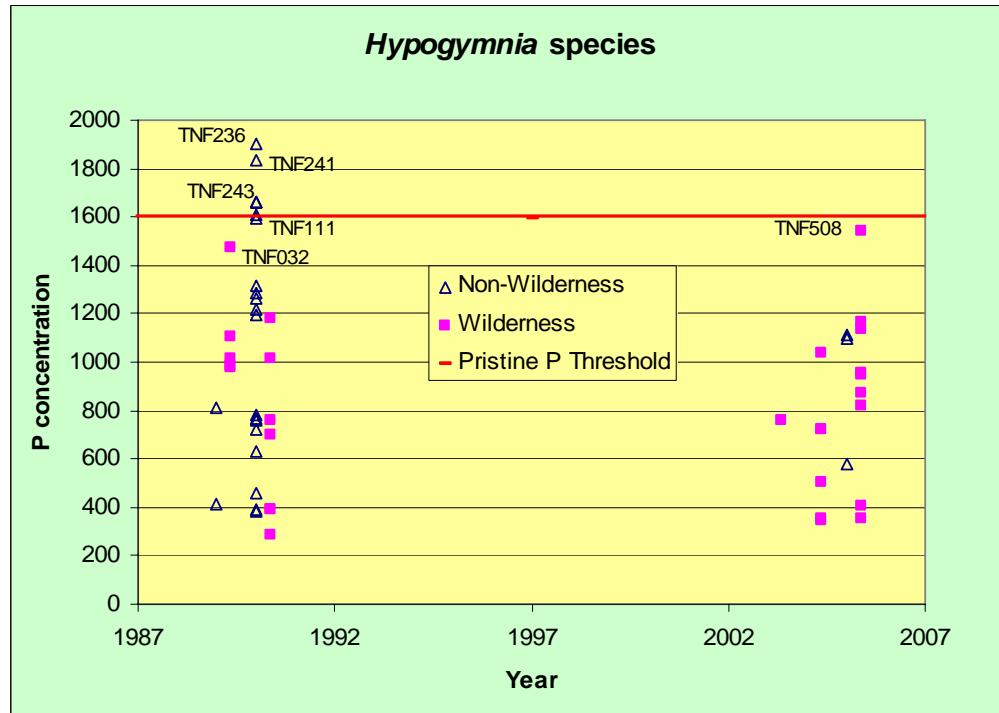


Figure XXIV-10. Wilderness and Non-Wilderness plot means of P ppm in *Hypogymnia* species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

P ppm

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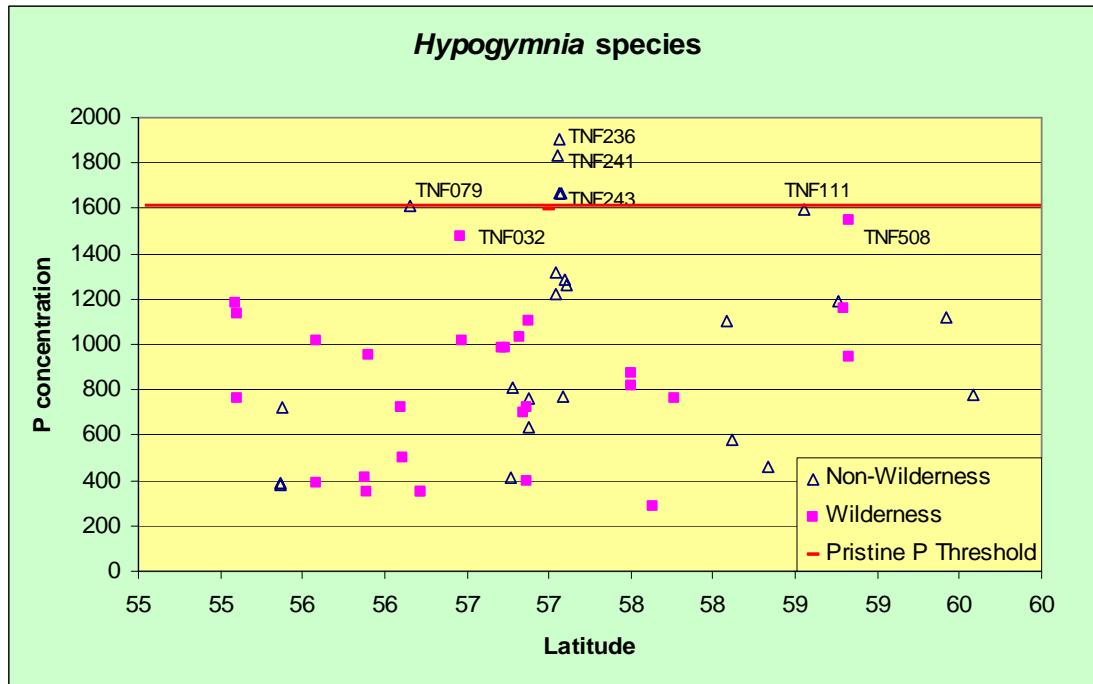


Figure XXIV-11. Wilderness and Non-Wilderness plot means of P ppm in *Hypogymnia* species vs. plot Latitude.

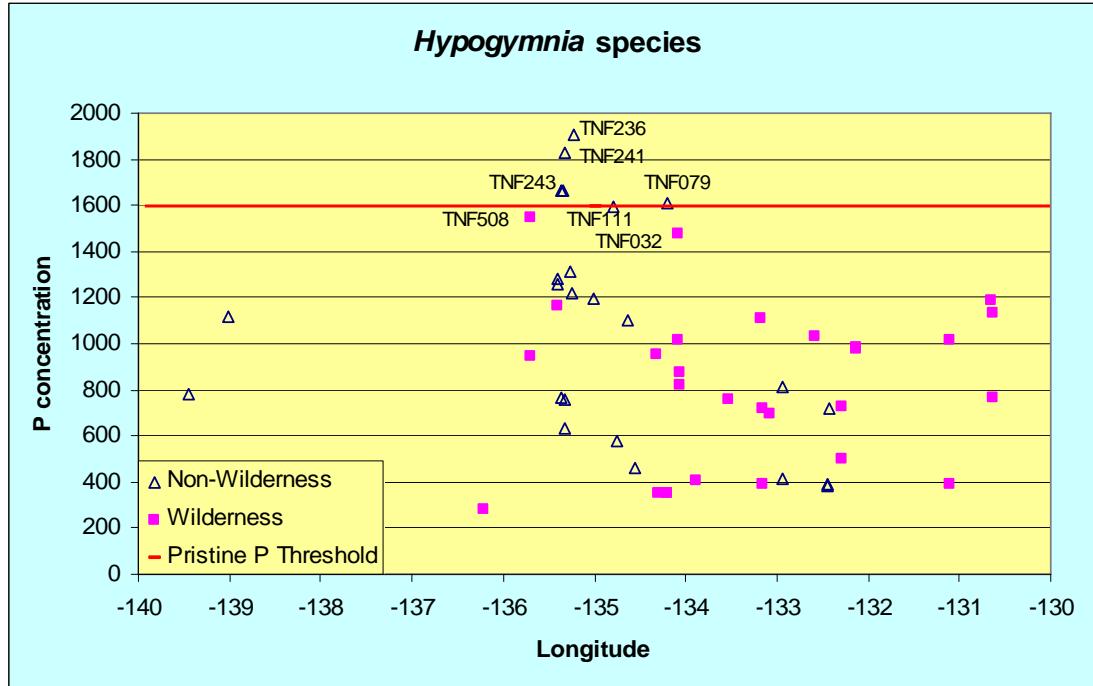


Figure XXIV-12. Wilderness and Non-Wilderness plot means of P ppm in *Hypogymnia* species vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

P ppm

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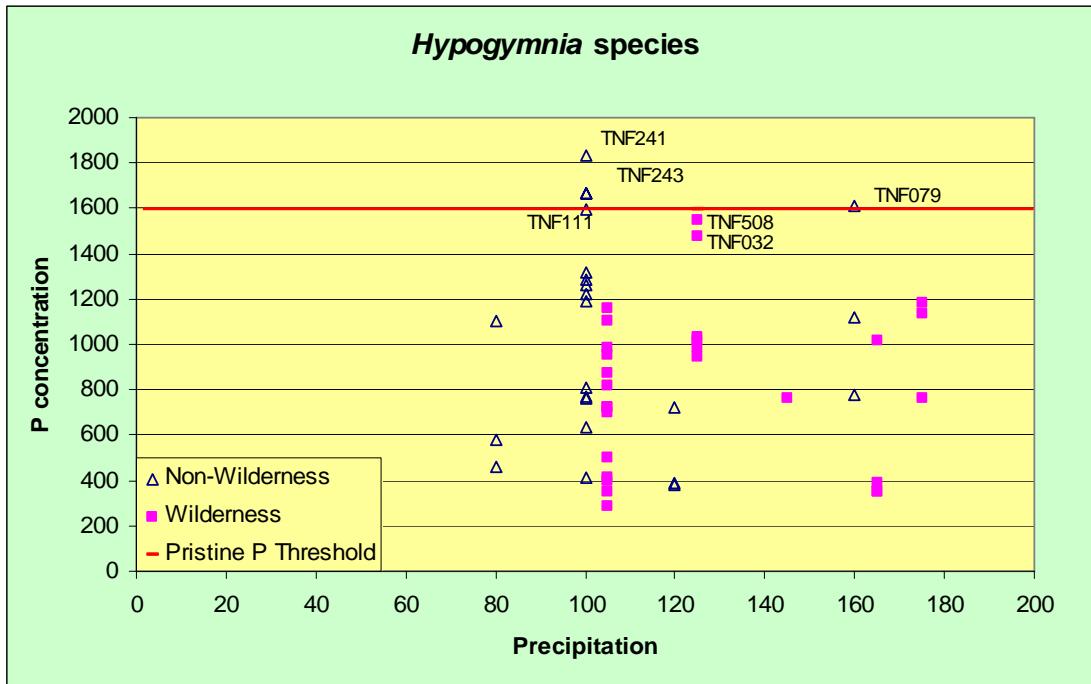


Figure XXIV-13. Wilderness and Non-Wilderness plot means of P ppm in *Hypogymnia* species vs. plot Precipitation.

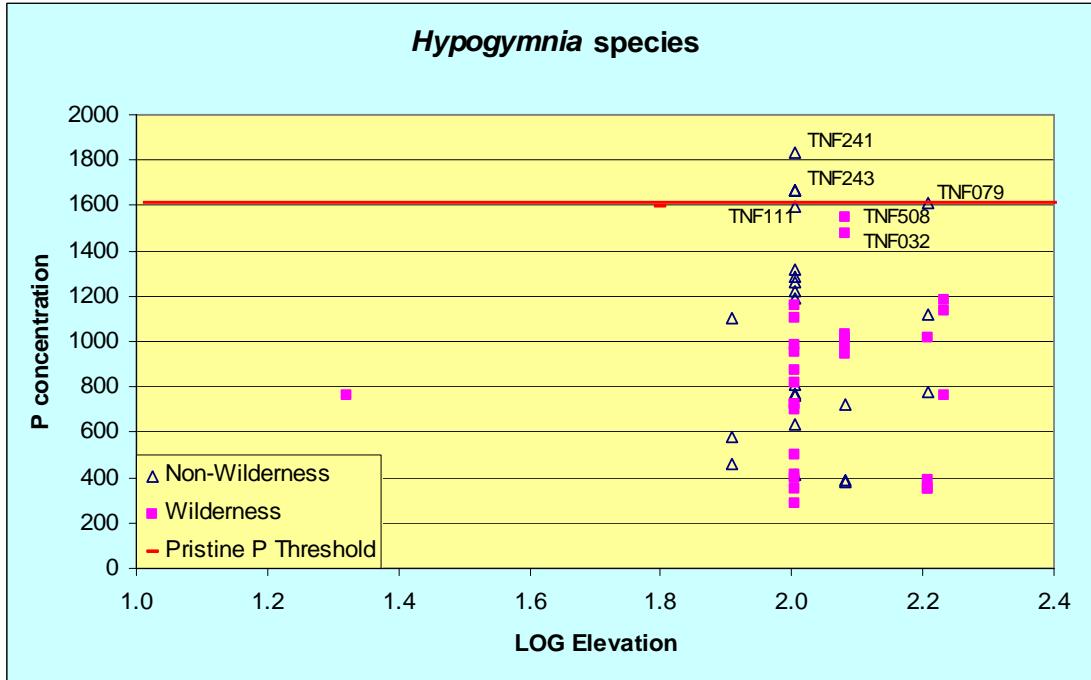


Figure XXIV-14. Wilderness and Non-Wilderness plot means of P ppm in *Hypogymnia* species vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

P ppm

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Lobaria oregana

Table XXIV-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the P ppm content of *Lobaria oregana* per year.

P ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	1792.25	155.4934	1297.4005	2287.0995
1989	Wilderness	1778.58	279.1520	1003.5260	2553.6270
1990	Non-Wilderness	1811.46	90.0948	1615.1554	2007.7549
1990	Wilderness	1801.65	236.4482	1193.8434	2409.4621
2004	Wilderness	1246.71	118.4279	956.9247	1536.4898
2005	Non-Wilderness	1328.60	NA	NA	NA
2005	Wilderness	1902.3562	154.3054	1411.2875	2393.4250

Summary of Statistical Tests:

$$t = -0.4222, \text{ df} = 4, \text{ p-value} = 0.6946$$

There is no evidence of a difference in P ppm content in *Lobaria oregana* from pre-2000 and post 2000 samples (p-value = 0.6946).

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

P ppm

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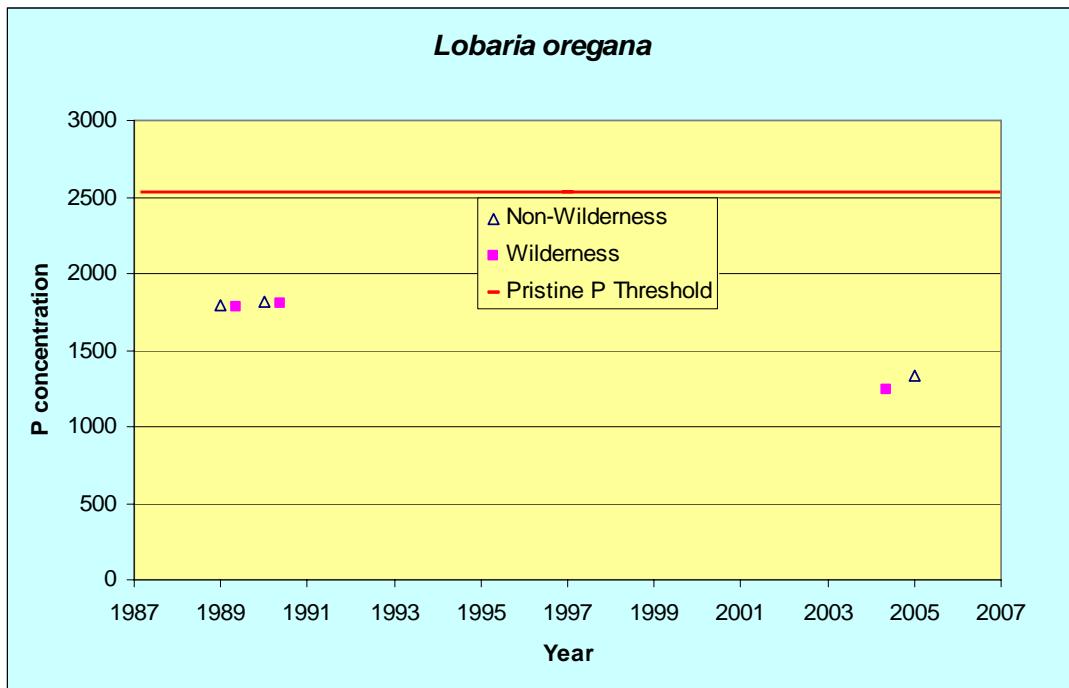


Figure XXIV-15. Wilderness and Non-Wilderness yearly means of P ppm in *Lobaria oregana* per year.

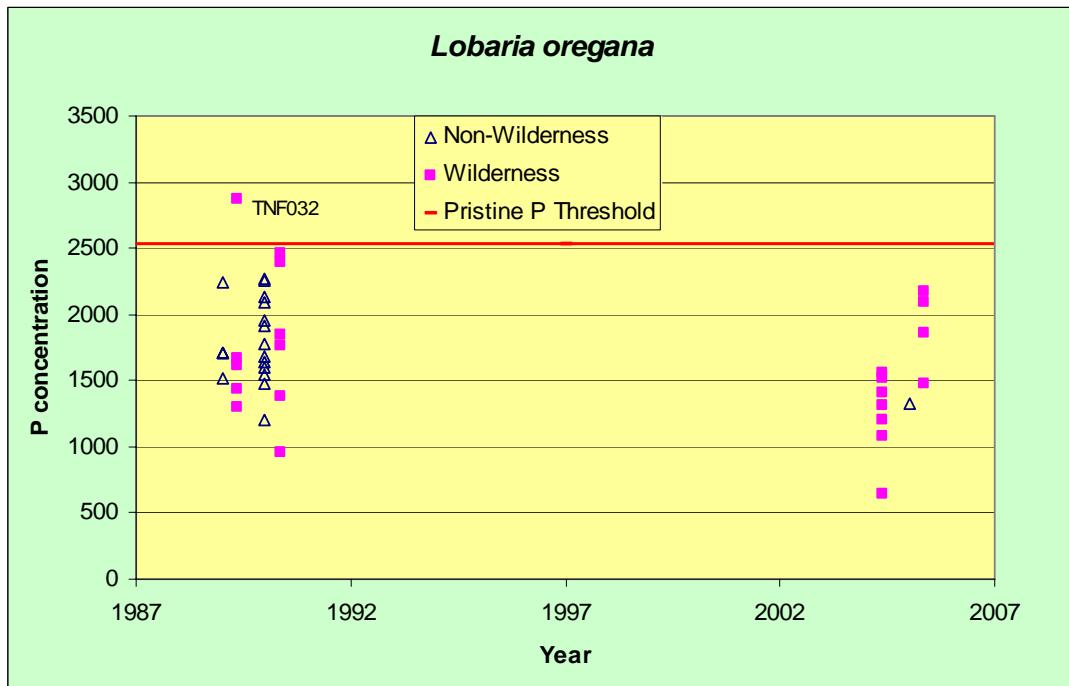


Figure XXIV-16. Wilderness and Non-Wilderness plot means of P ppm in *Lobaria oregana* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

P ppm

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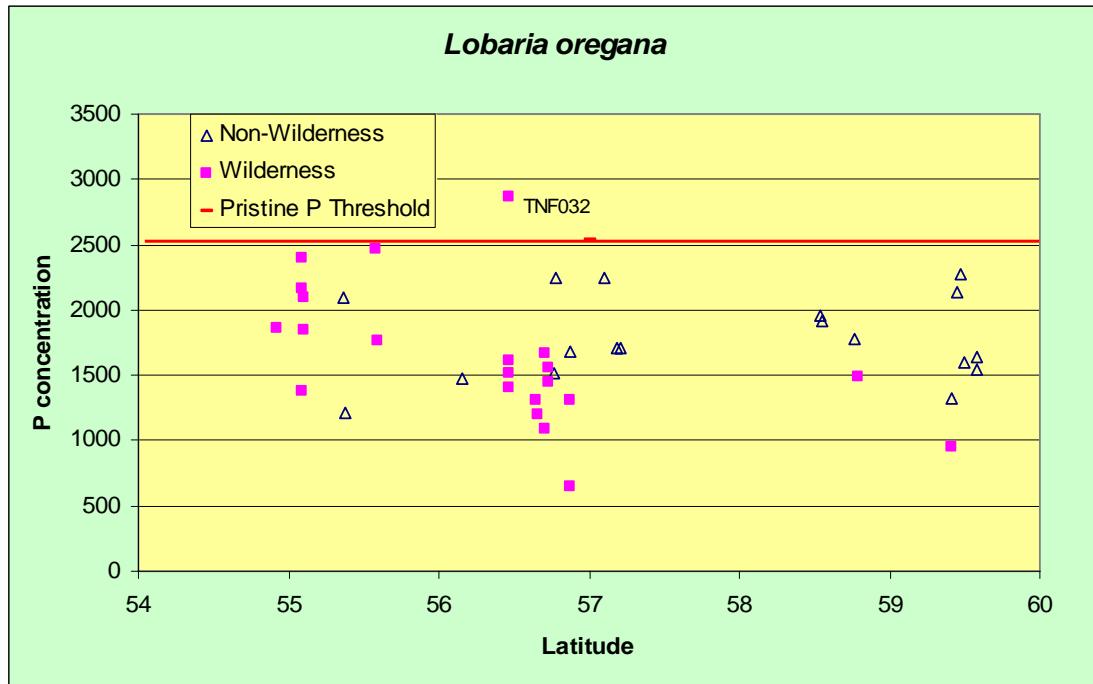


Figure XXIV-17. Wilderness and Non-Wilderness plot means of P ppm in *Lobaria oregana* vs. plot Latitude.

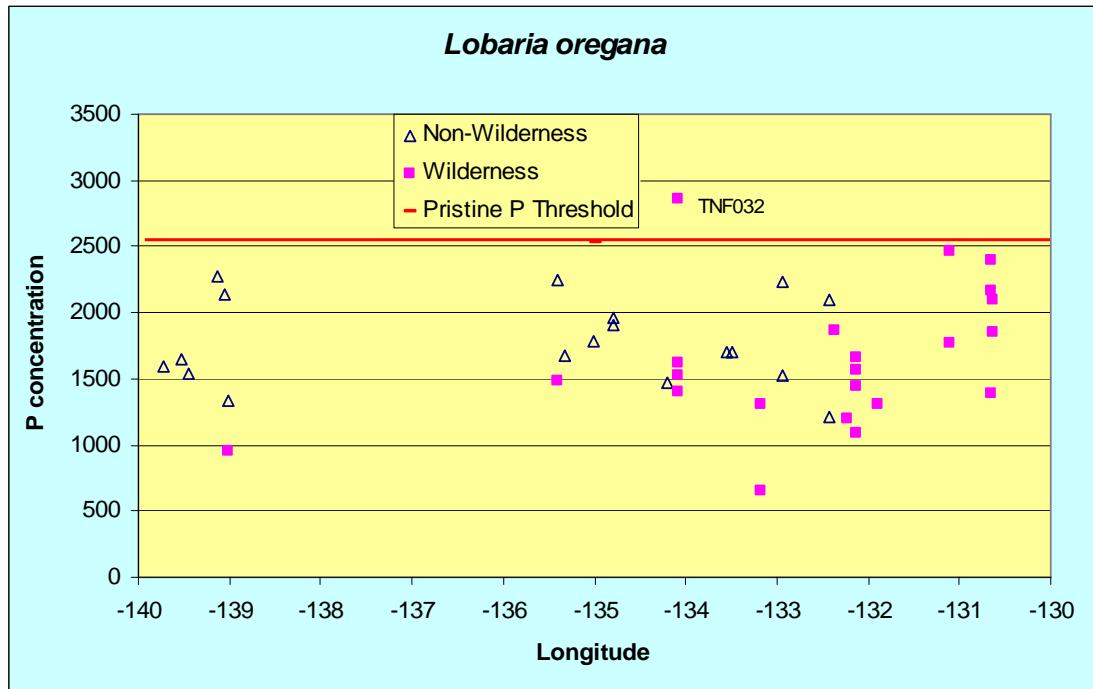


Figure XXIV-18. Wilderness and Non-Wilderness plot means of P ppm in *Lobaria oregana* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

P ppm

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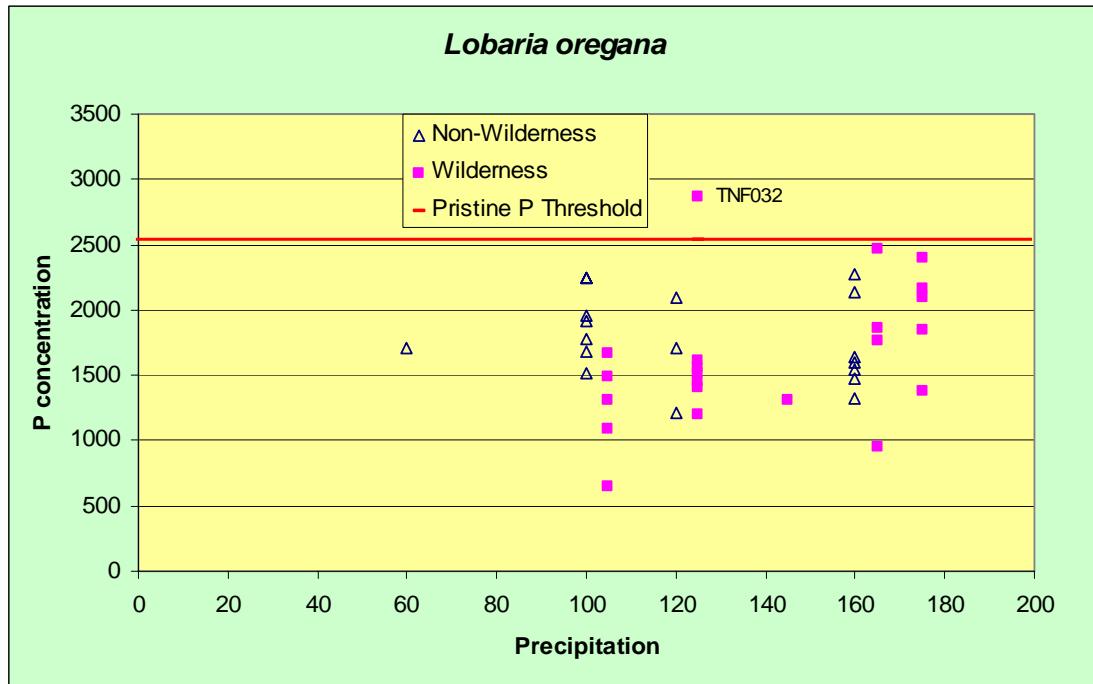


Figure XXIV-19. Wilderness and Non-Wilderness plot means of P ppm in *Lobaria oregana* vs. plot Precipitation.

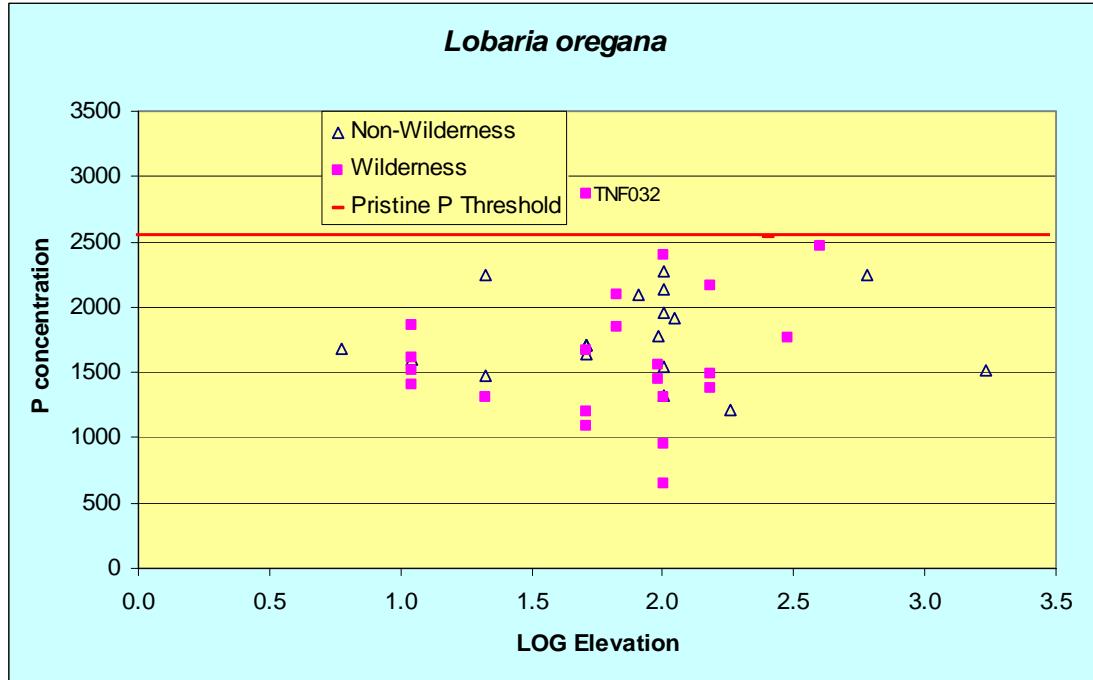


Figure XXIV-20. Wilderness and Non-Wilderness plot means of P ppm in *Lobaria oregana* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

P ppm

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Platismatia glauca

Table XXIV-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the P ppm content of *Platismatia glauca* per year.

P ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2003	Wilderness	876.00	NA	NA	NA
2004	Wilderness	745.43	53.9139	623.4636	867.3868
2005	Non-Wilderness	1104.47	124.6367	822.5221	1386.4179
2005	Wilderness	889.42	71.8006	719.6347	1059.1978

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

P ppm

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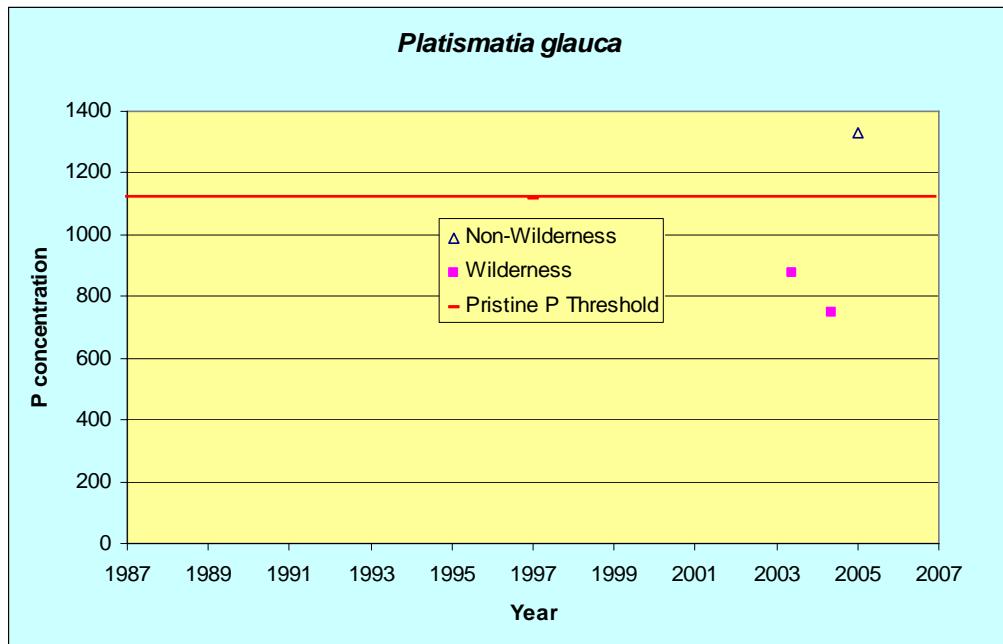


Figure XXIV-21. Wilderness and Non-Wilderness yearly means of P ppm in *Platismatia glauca* per year.

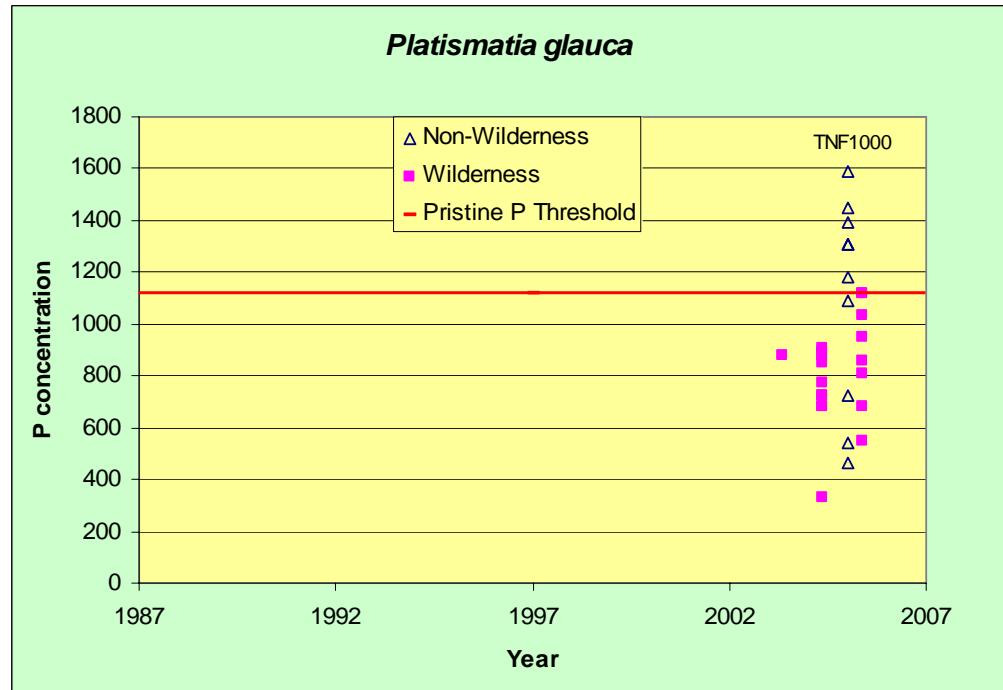


Figure XXIV-22. Wilderness and Non-Wilderness plot means of P ppm in *Platismatia glauca* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

P ppm

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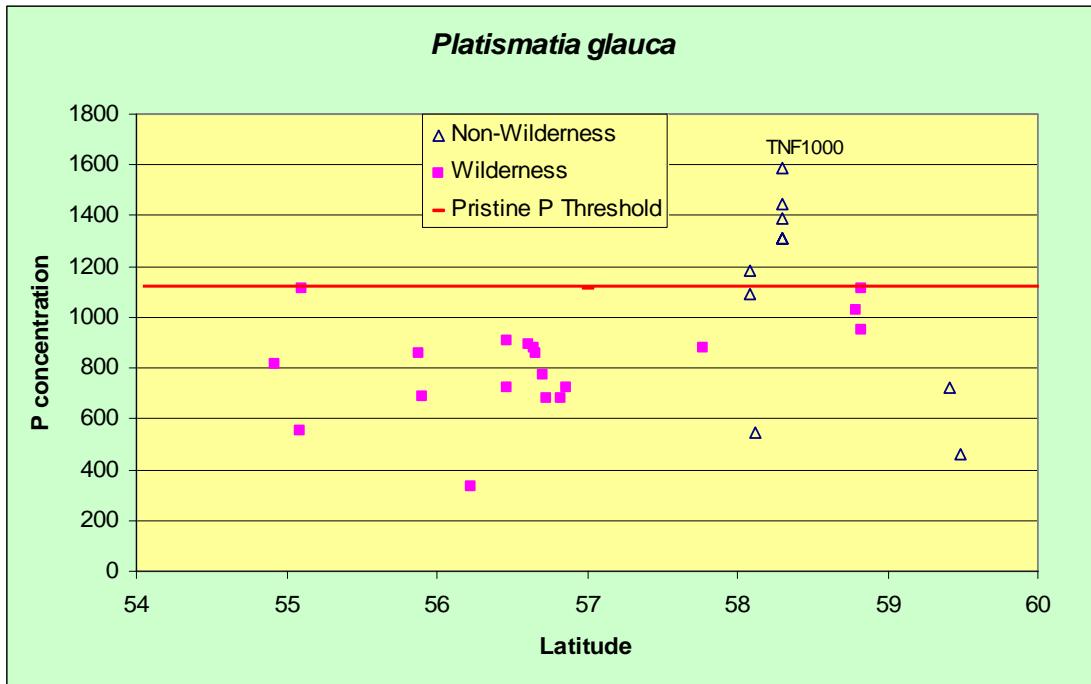


Figure XXIV-23. Wilderness and Non-Wilderness plot means of P ppm in *Platismatia glauca* vs. plot Latitude.

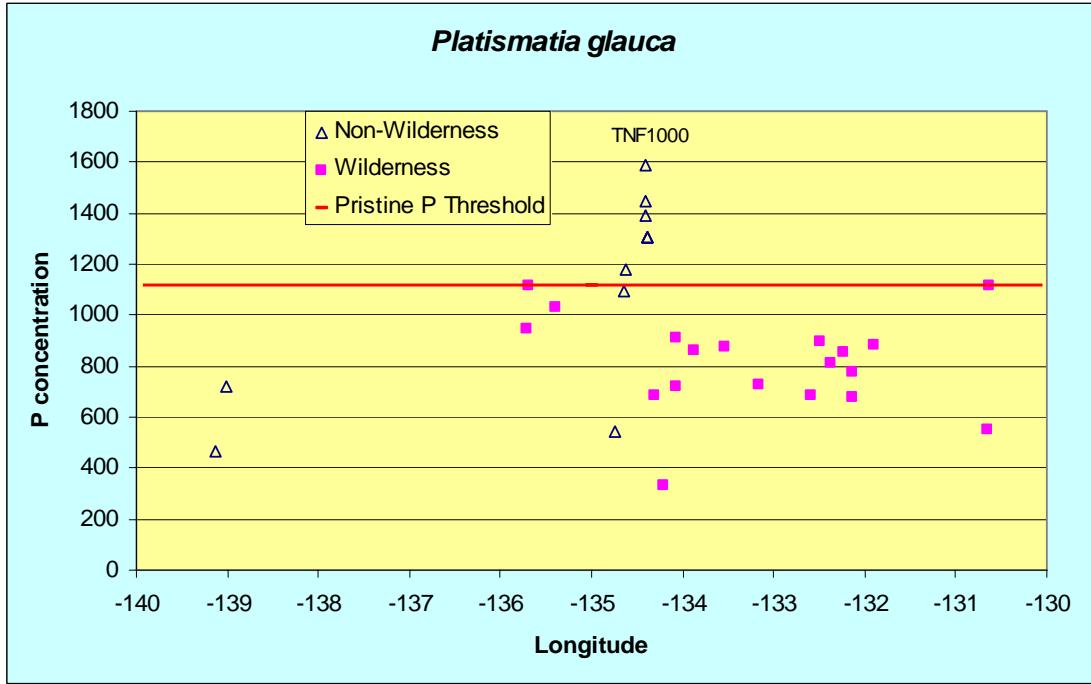


Figure XXIV-24. Wilderness and Non-Wilderness plot means of P ppm in *Platismatia glauca* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

P ppm

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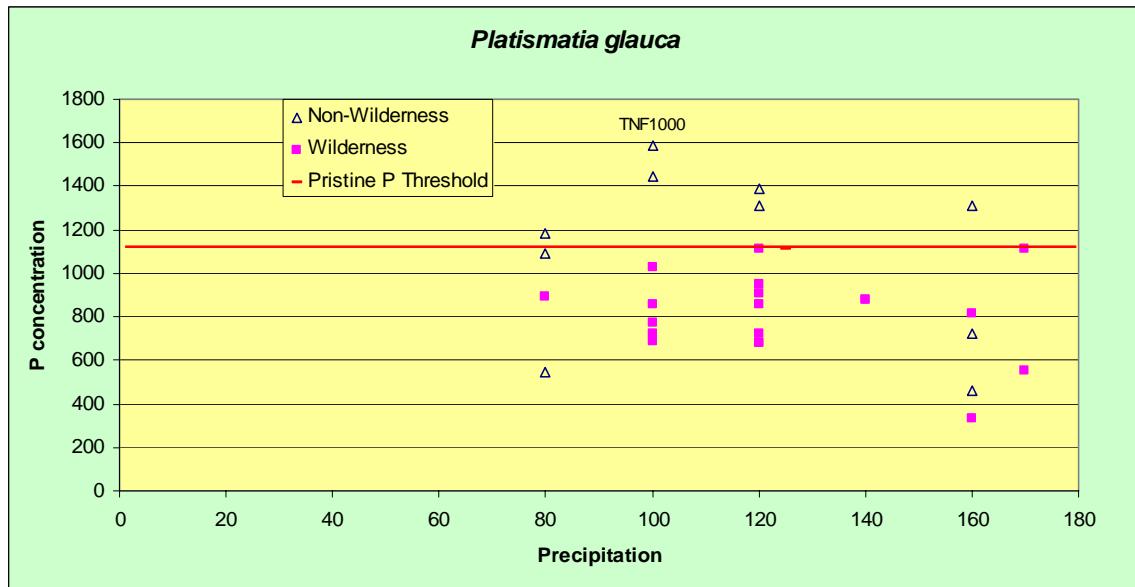


Figure XXIV-25. Wilderness and Non-Wilderness plot means of P ppm in *Platismatia glauca* vs. plot Precipitation.

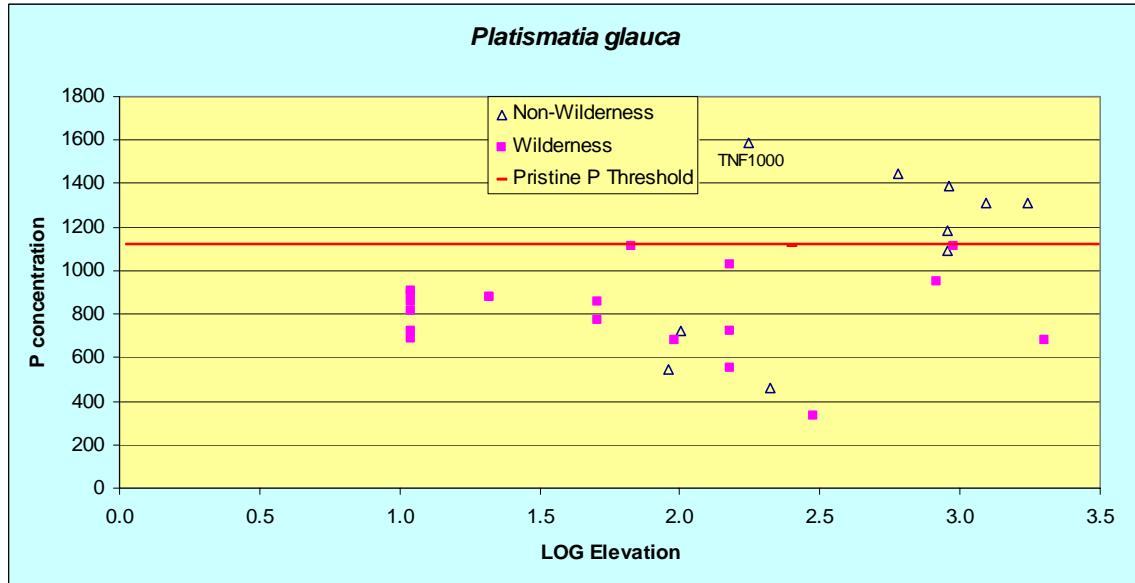


Figure XXIV-26. Wilderness and Non-Wilderness plot means of P ppm in *Platismatia glauca* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Pb ppm

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XXV. SUMMARY OF Pb PPM DATA ANALYSIS

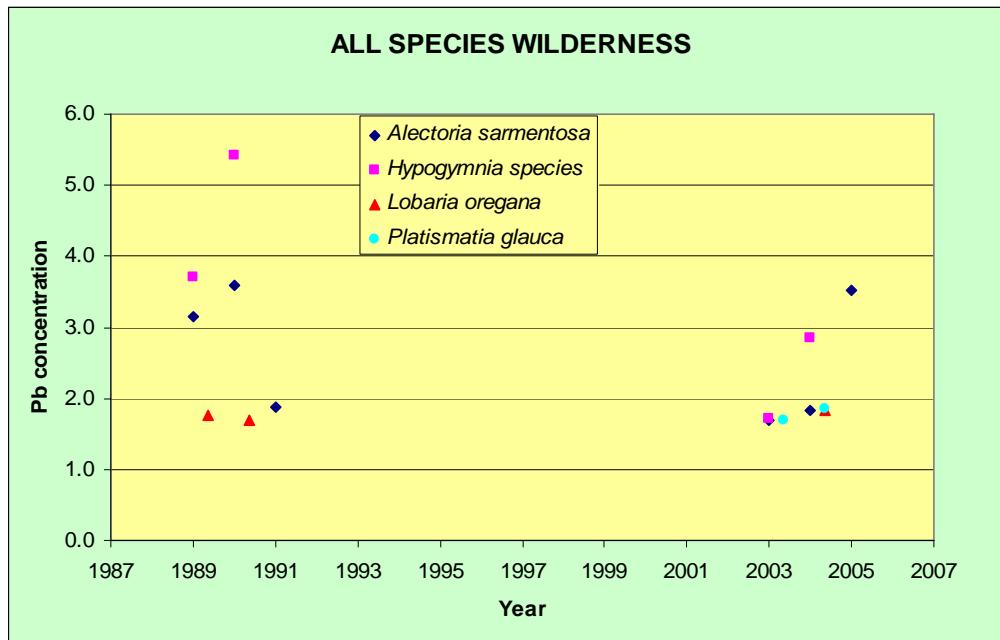


Figure XXV-27. Wilderness plot means of Pb ppm
in All Species per year.

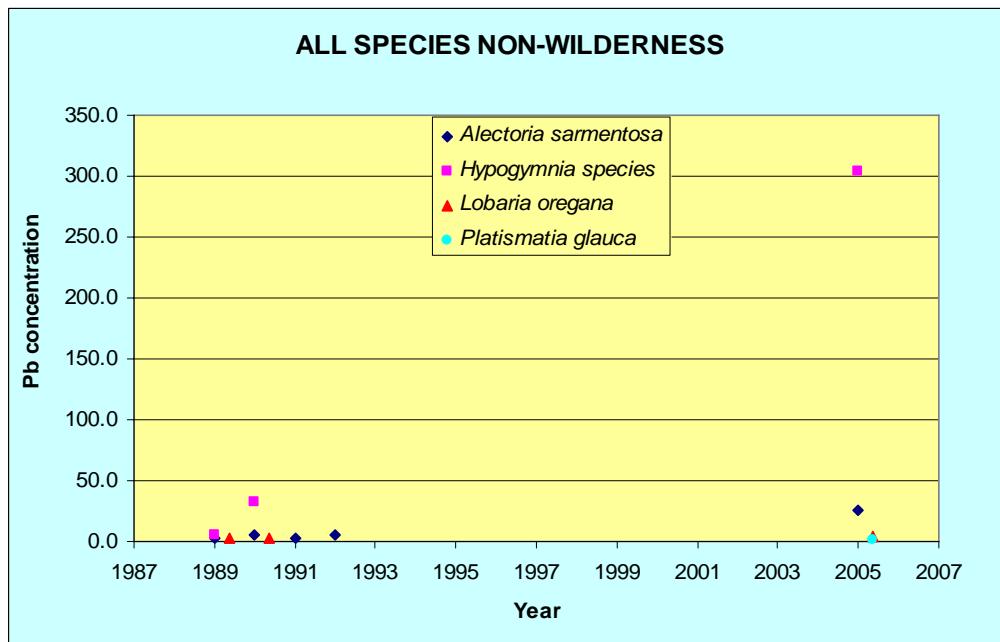


Figure XXV-28. Non-Wilderness plot means of Pb ppm
in All Species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Pb ppm

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Alectoria sarmentosa

Summary Statistics:

Table XXV-2. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Pb ppm content of *Alectoria sarmentosa* per year.

Pb ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	2.61	0.2909	1.8024	3.4176
1989	Wilderness	3.15	0.6994	1.3521	4.9479
1990	Non-Wilderness	4.90	2.0678	0.6526	9.1534
1990	Wilderness	3.59	0.7418	1.7698	5.4002
1991	Non-Wilderness	2.8615	0.4264	1.9658	3.7572
1991	Wilderness	1.89	0.0626	1.7122	2.0595
1992	Non-Wilderness	5.83	4.1444	3.9717	15.6282
2003	Wilderness	1.68	0.0000	1.6800	1.6800
2004	Wilderness	1.83	0.0669	1.6959	1.9728
2005	Non-Wilderness	25.90	22.1260	30.9809	82.7722
2005	Wilderness	3.52	0.0000	3.5200	3.5200

Summary of Statistical Tests:

$$t = -0.2358, df = 8, p\text{-value} = 0.8195$$

There is no evidence of a difference in Pb ppm content in *Alectoria sarmentosa* from pre-2000 and post 2000 samples (p-value = 0.8195).

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Pb ppm

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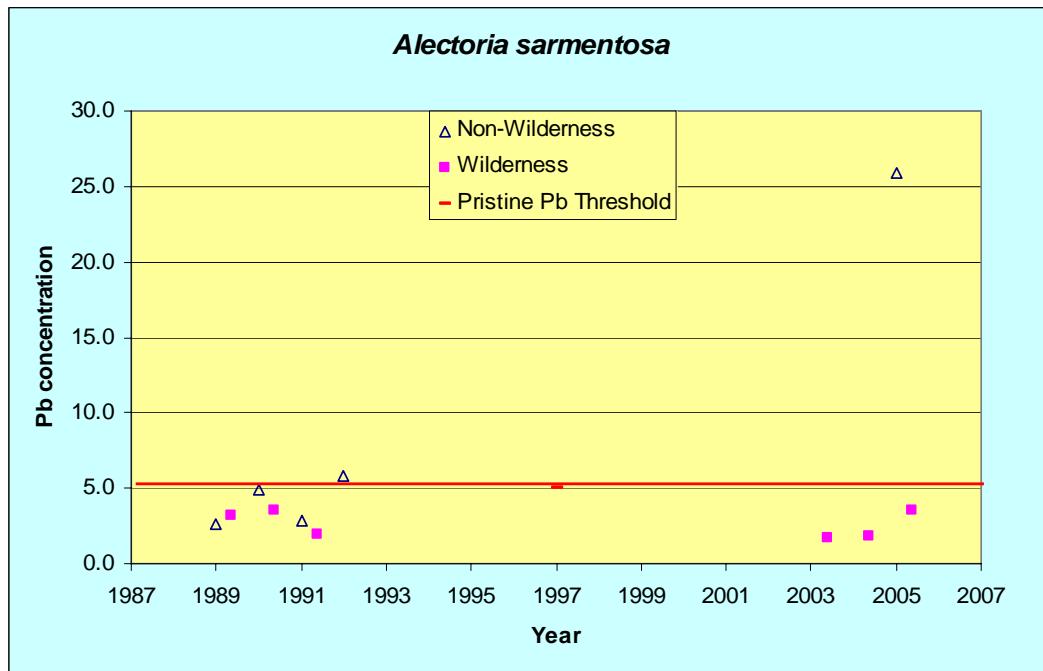


Figure XXV-3. Wilderness and Non-Wilderness yearly means of Pb ppm in *Alectoria sarmentosa* per year.

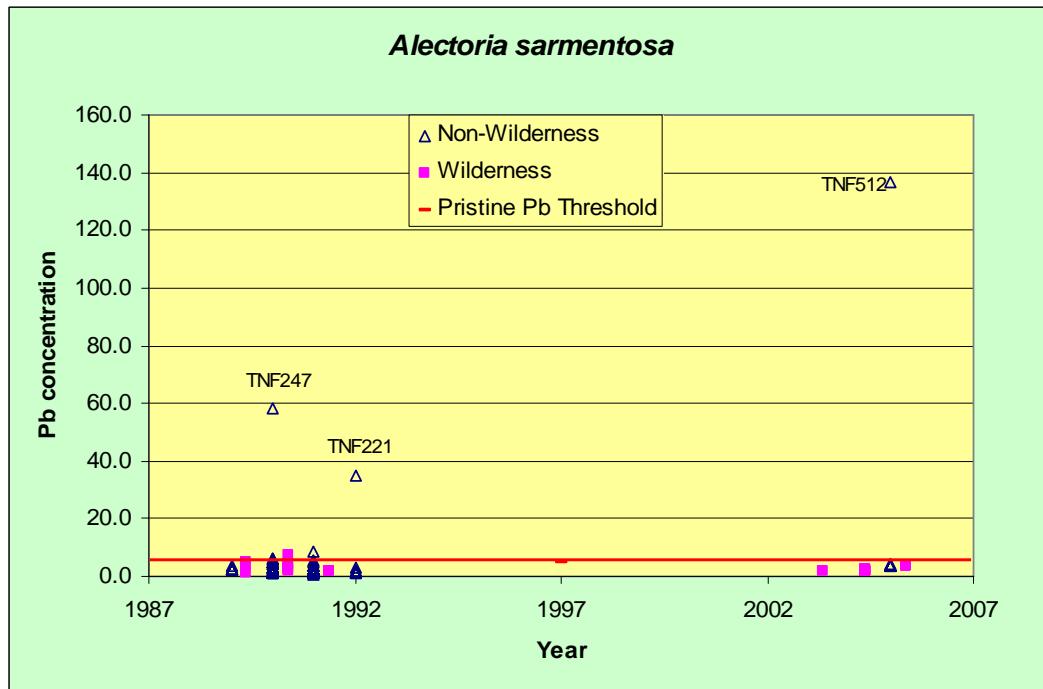


Figure XXV-4. Wilderness and Non-Wilderness plot means of Pb ppm in *Alectoria sarmentosa* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Pb ppm

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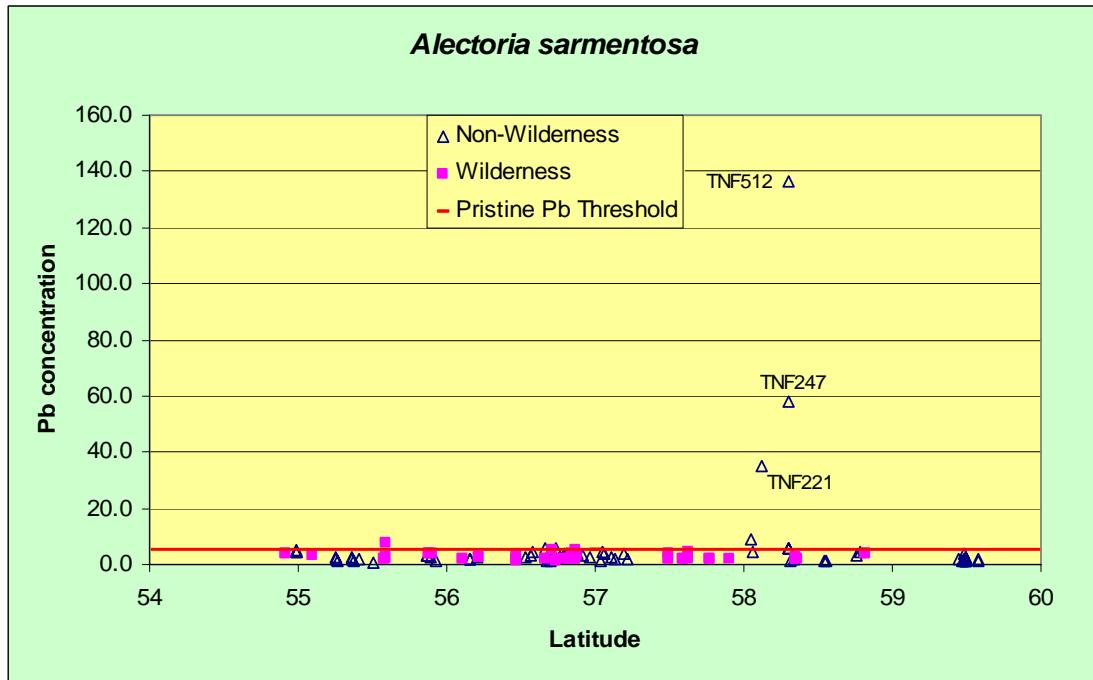


Figure XXV-5. Wilderness and Non-Wilderness plot means of Pb ppm in *Alectoria sarmentosa* vs. plot Latitude.

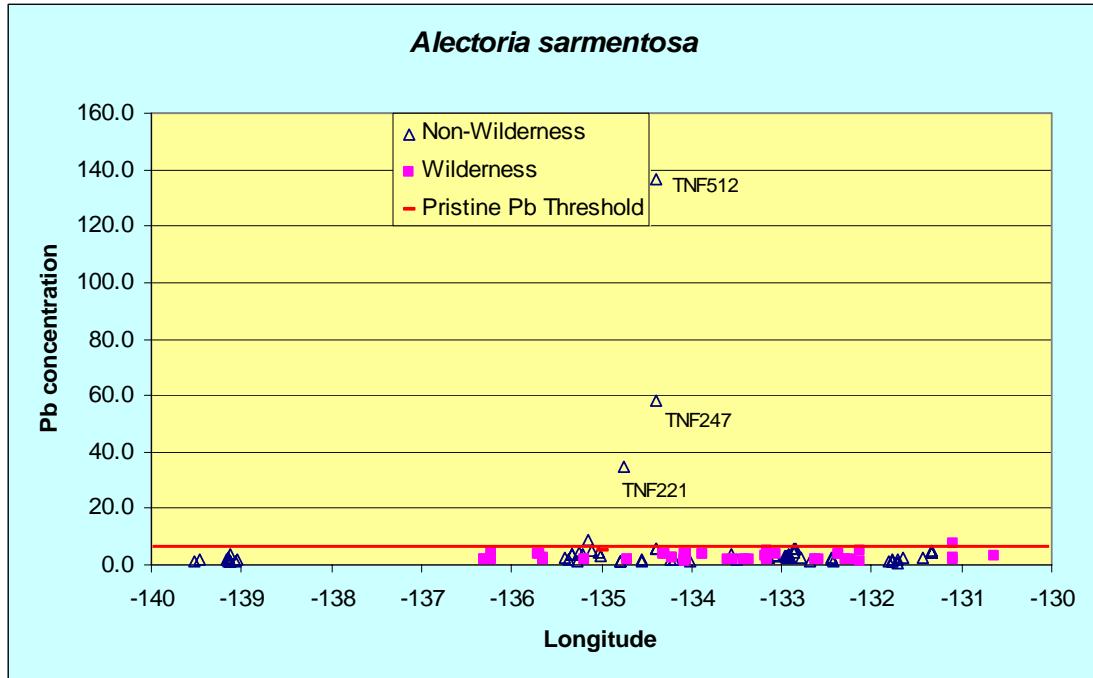


Figure XXV-6. Wilderness and Non-Wilderness plot means of Pb ppm in *Alectoria sarmentosa* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Pb ppm

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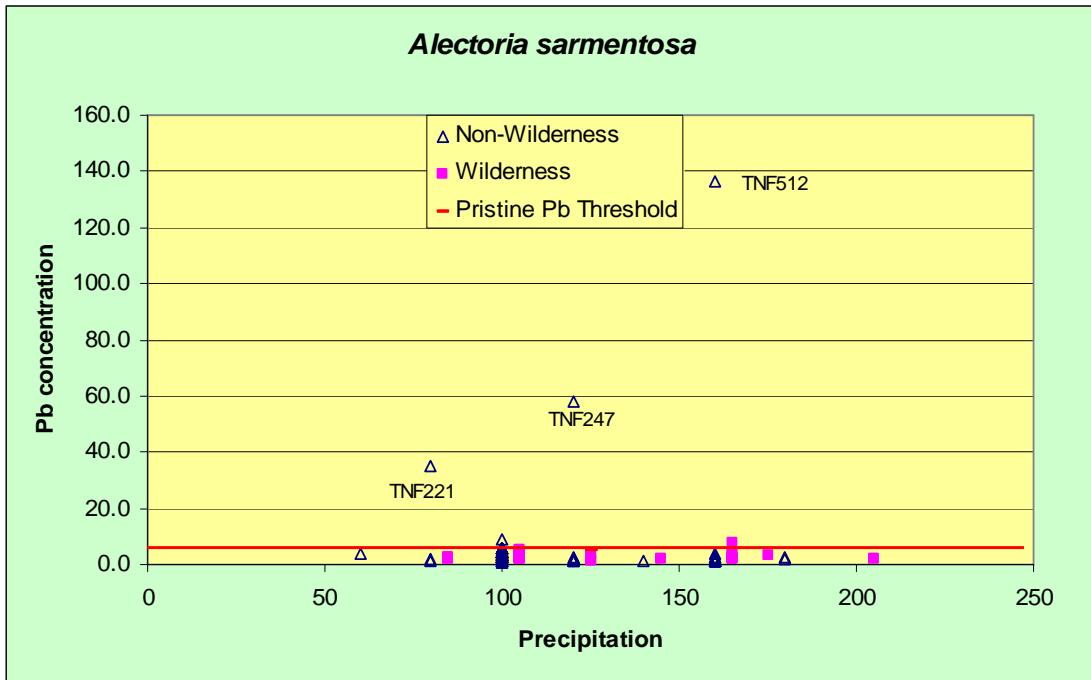


Figure XXV-7. Wilderness and Non-Wilderness plot means of Pb ppm in *Alectoria sarmentosa* vs. plot Precipitation.

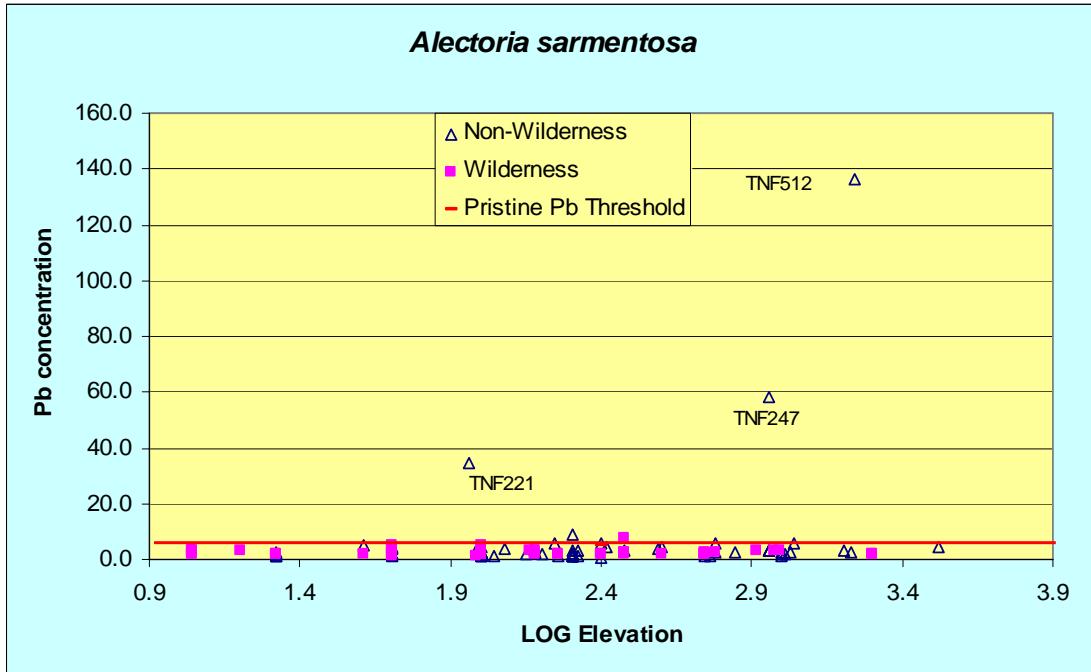


Figure XXV-8. Wilderness and Non-Wilderness plot means of Pb ppm in *Alectoria sarmentosa* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Pb ppm

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Hypogymnia species

In this series, all of the *Hypogymnia* species were included as a group.

Table XXV-3. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Pb ppm content of *Hypogymnia species* per year.

Pb ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	5.50	2.5000	26.2655	37.2655
1989	Wilderness	3.70	0.3000	2.8671	4.5329
1990	Non-Wilderness	33.05	10.9320	10.0853	56.0200
1990	Wilderness	5.43	1.3087	2.2262	8.6309
2003	Wilderness	1.72	NA	NA	NA
2004	Wilderness	2.86	0.2110	2.3131	3.3980
2005	Non-Wilderness	303.60	150.2443	342.8472	950.0506
2005	Wilderness	3.52	0.0000	3.5200	3.5200

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Pb ppm

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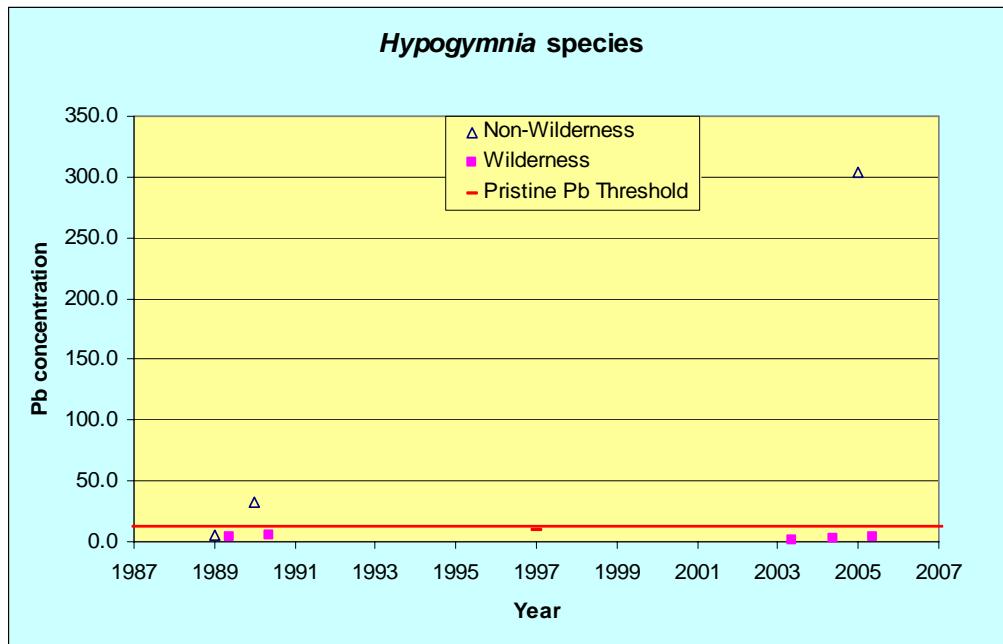


Figure XXV-9. Wilderness and Non-Wilderness yearly means of Pb ppm in *Hypogymnia* species per year.

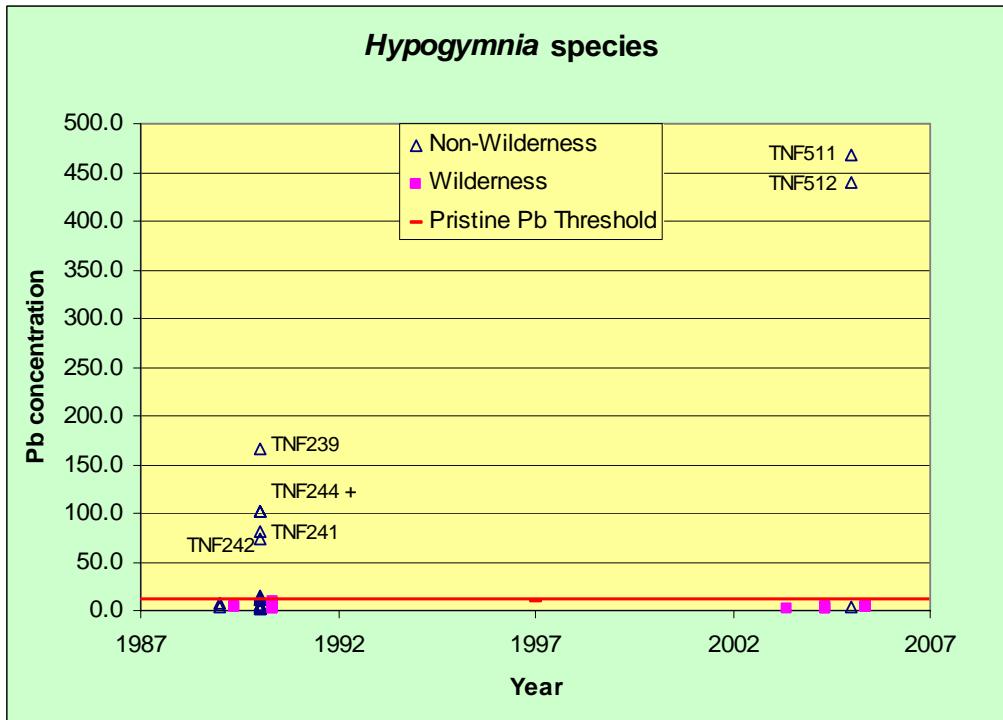


Figure XXV-10. Wilderness and Non-Wilderness plot means of Pb ppm in *Hypogymnia* species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Pb ppm

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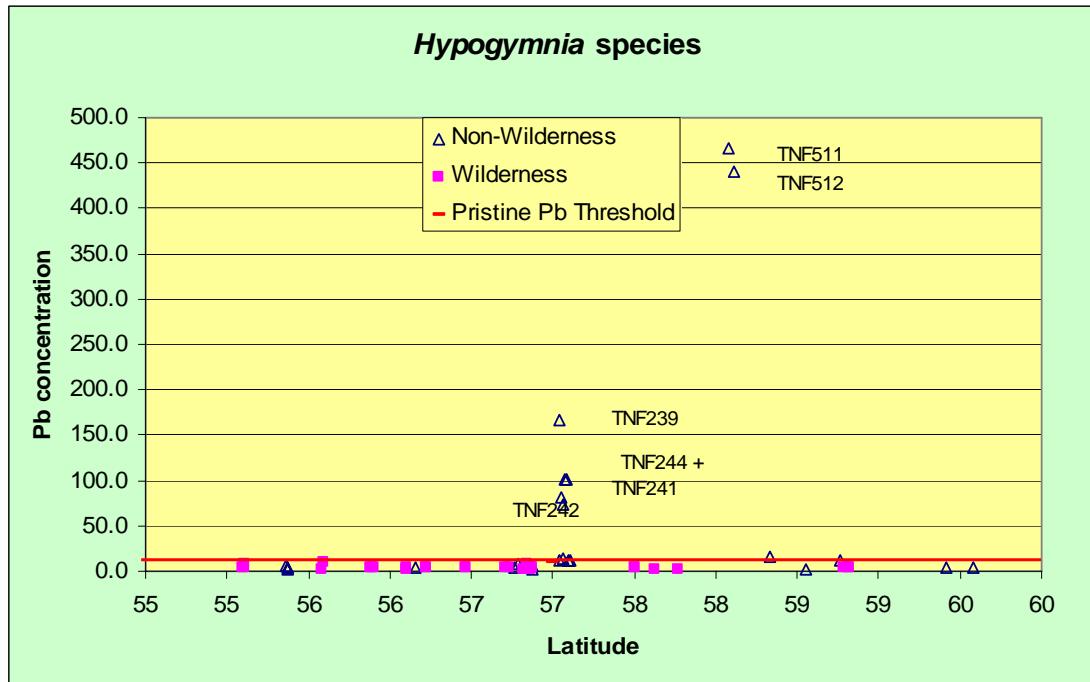


Figure XXV-11. Wilderness and Non-Wilderness plot means of Pb ppm in *Hypogymnia* species vs. plot Latitude.

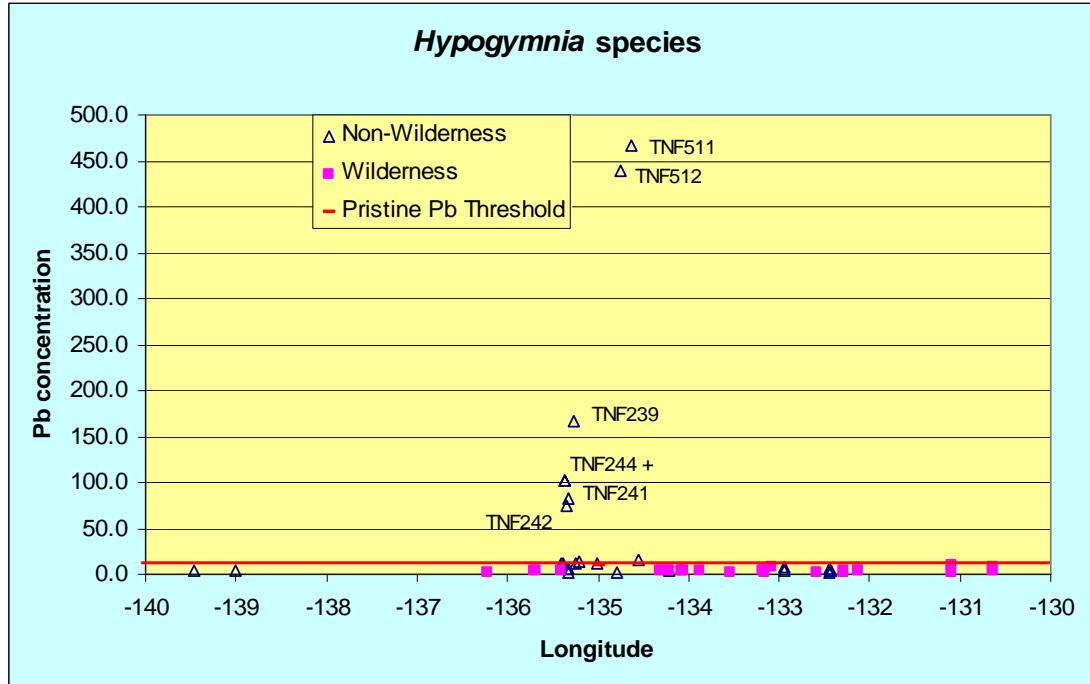


Figure XXV-12. Wilderness and Non-Wilderness plot means of Pb ppm in *Hypogymnia* species vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Pb ppm

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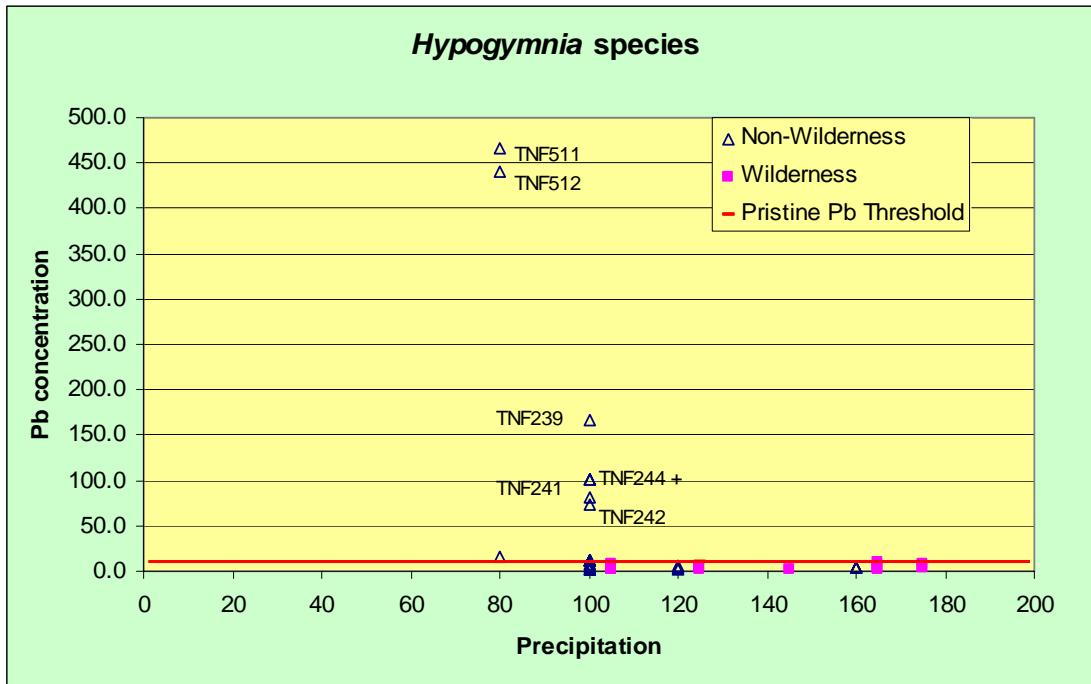


Figure XXV-13. Wilderness and Non-Wilderness plot means of Pb ppm in *Hypogymnia* species vs. plot Precipitation.

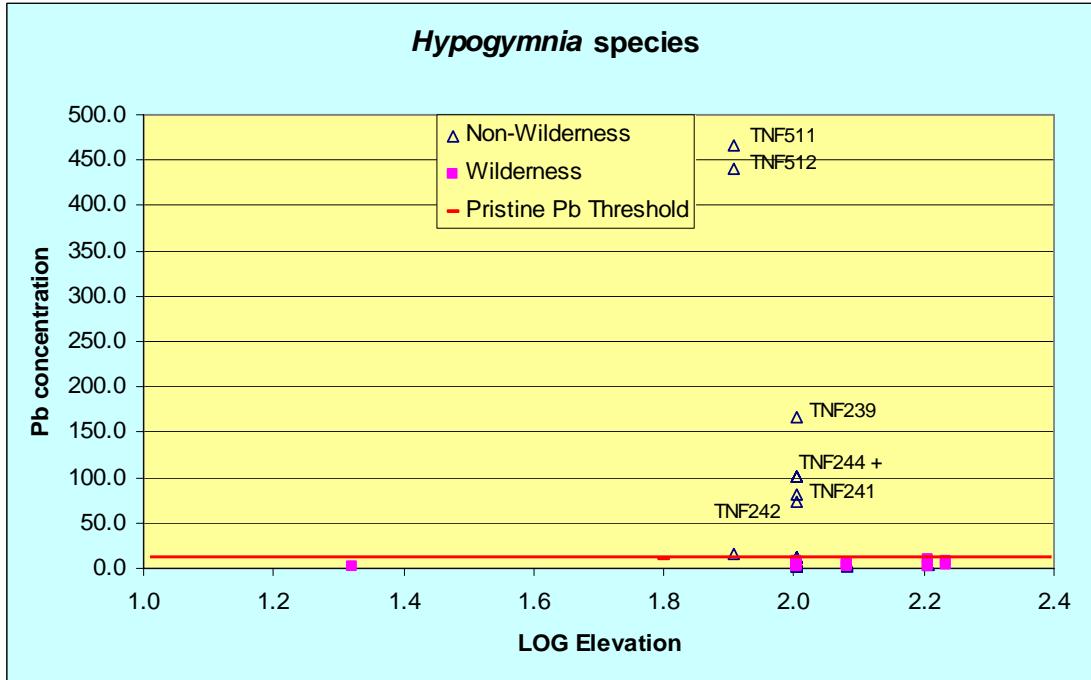


Figure XXV-14. Wilderness and Non-Wilderness plot means of Pb ppm in *Hypogymnia* species vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Pb ppm

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Lobaria oregana

Table XXV-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Pb ppm content of *Lobaria oregana* per year.

Pb ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	2.42	0.1596	1.9088	2.9245
1989	Wilderness	1.76	0.1939	1.2216	2.2984
1990	Non-Wilderness	2.52	1.3759	-0.4785	5.5170
1990	Wilderness	1.70	0.2546	1.0434	2.3522
2004	Wilderness	1.82	0.1388	1.4792	2.1583
2005	Non-Wilderness	3.52	NA	NA	NA
2005	Wilderness	3.5200	0.0000	3.5200	3.5200

Summary of Statistical Tests:

$$t = -2.189, \text{ df} = 4, \text{ p-value} = 0.0938$$

There is suggestive evidence of a difference in Pb ppm content in *Lobaria oregana* from pre-2000 and post 2000 samples (p-value = 0.0938).

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Pb ppm

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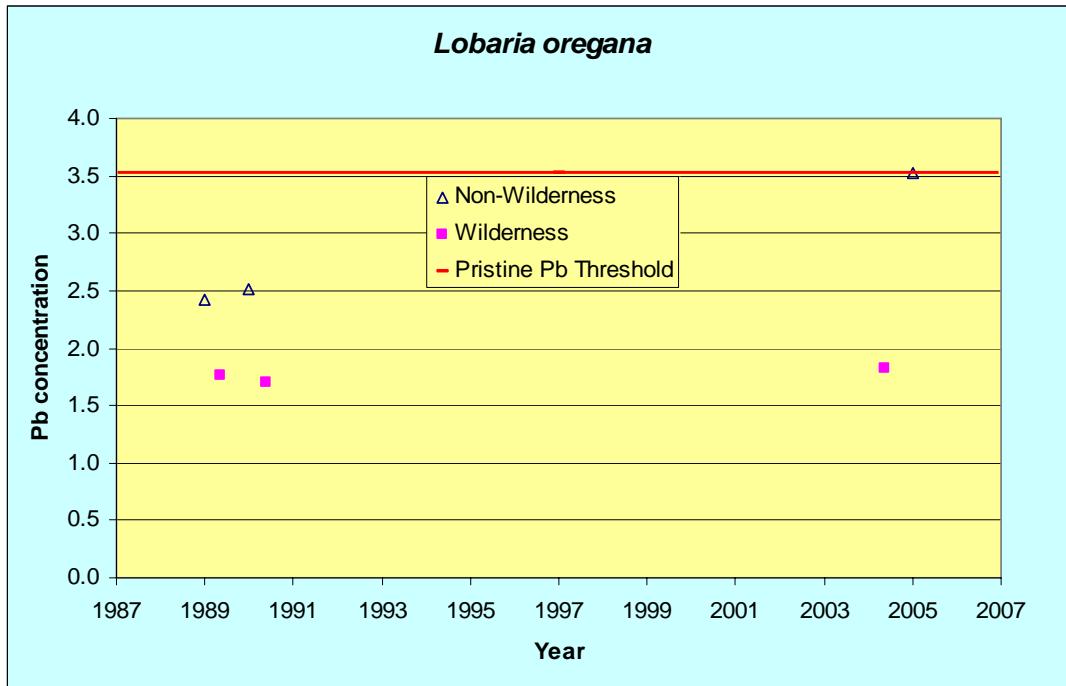


Figure XXV-15. Wilderness and Non-Wilderness yearly means of Pb ppm in *Lobaria oregana* per year.

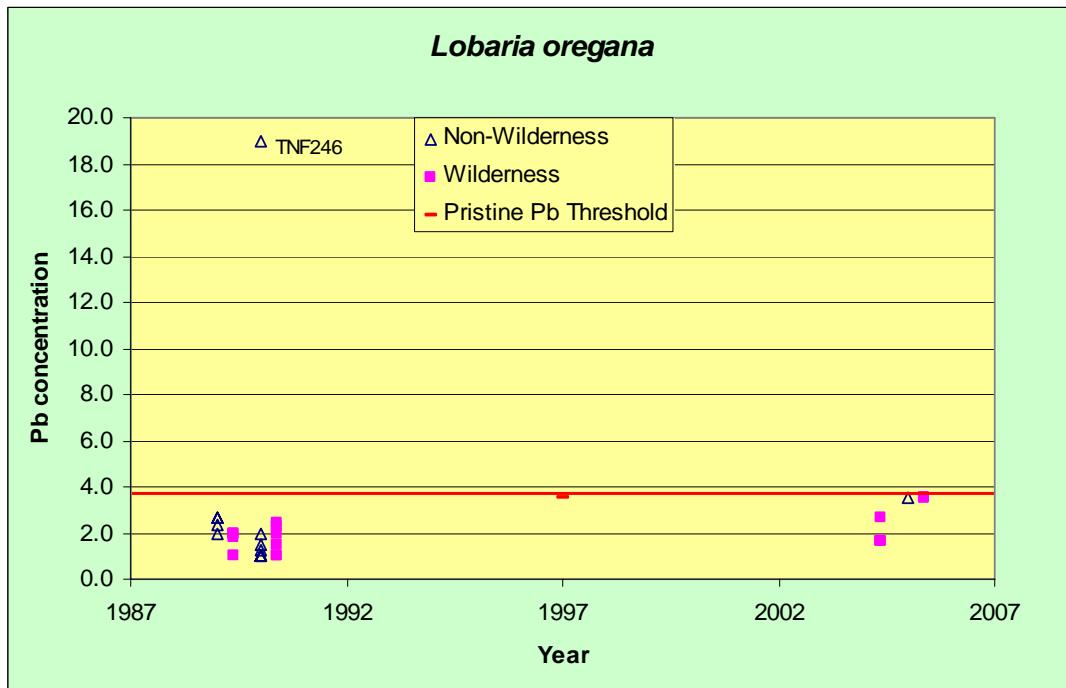


Figure XXV-16. Wilderness and Non-Wilderness plot means of Pb ppm in *Lobaria oregana* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Pb ppm

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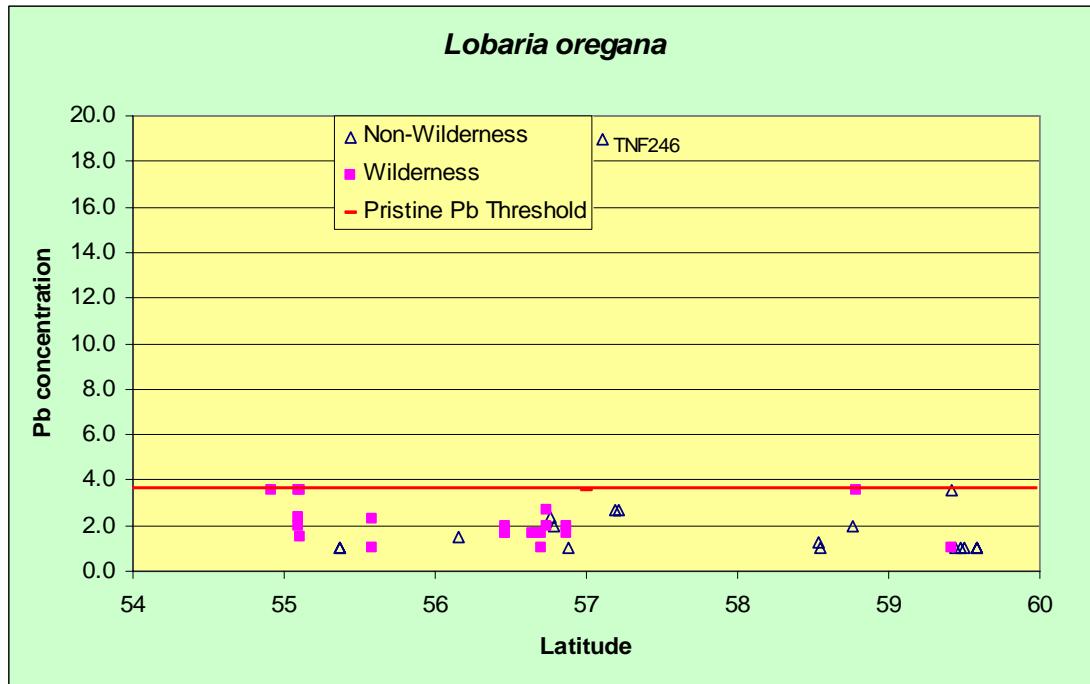


Figure XXV-17. Wilderness and Non-Wilderness plot means of Pb ppm in *Lobaria oregana* vs. plot Latitude.

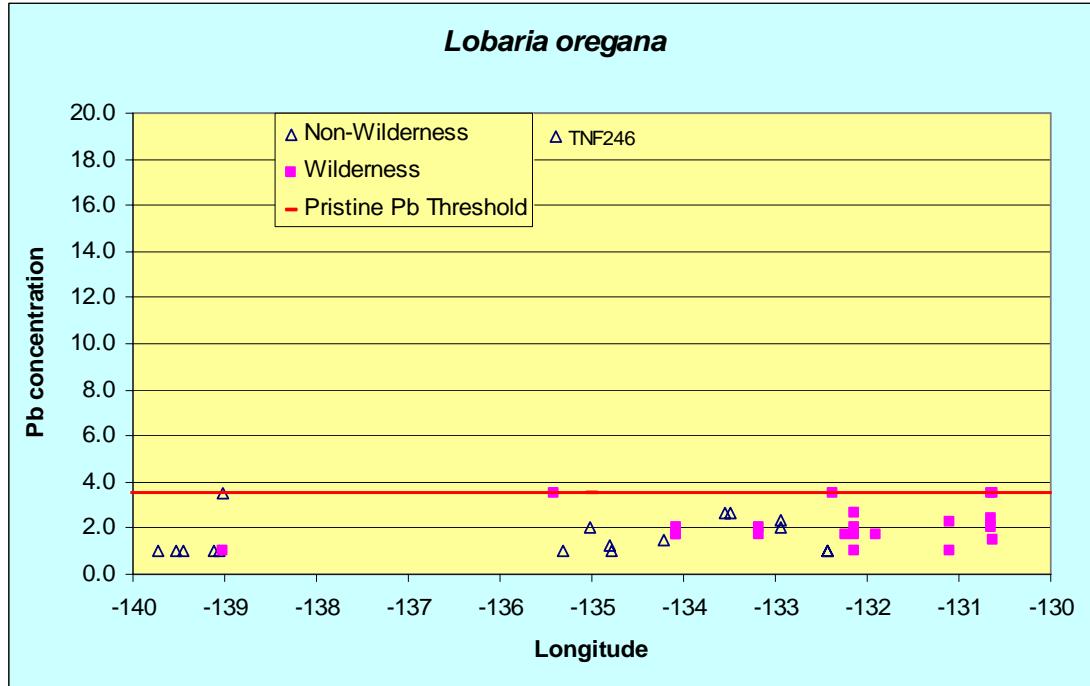


Figure XXV-18. Wilderness and Non-Wilderness plot means of Pb ppm in *Lobaria oregana* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Pb ppm

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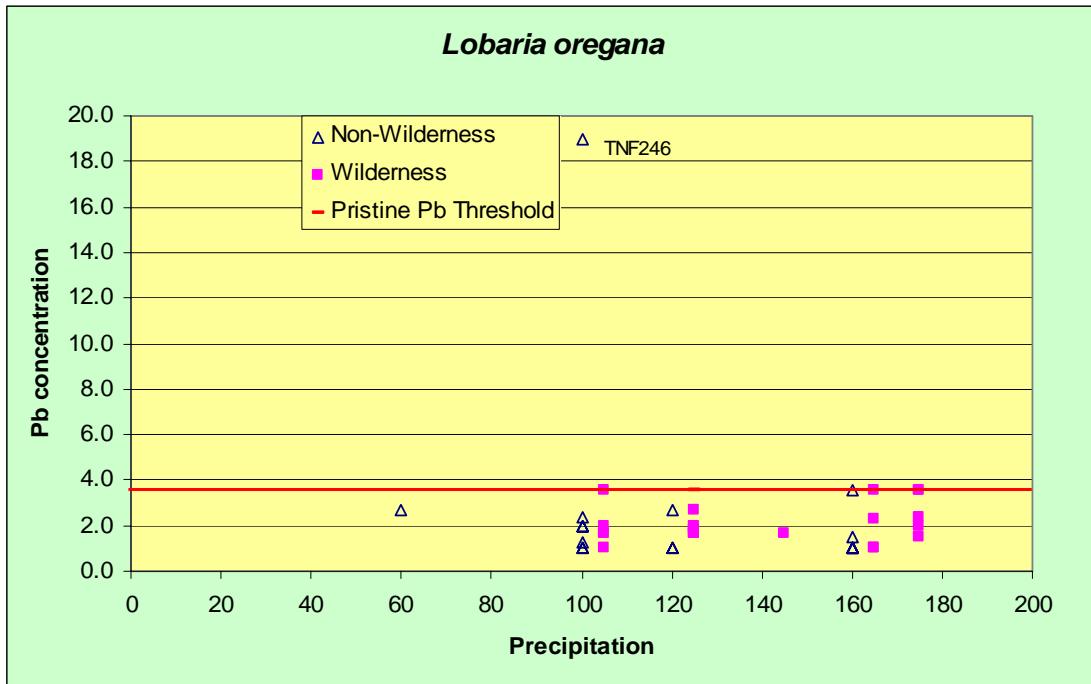


Figure XXV-19. Wilderness and Non-Wilderness plot means of Pb ppm in *Lobaria oregana* vs. plot Precipitation.

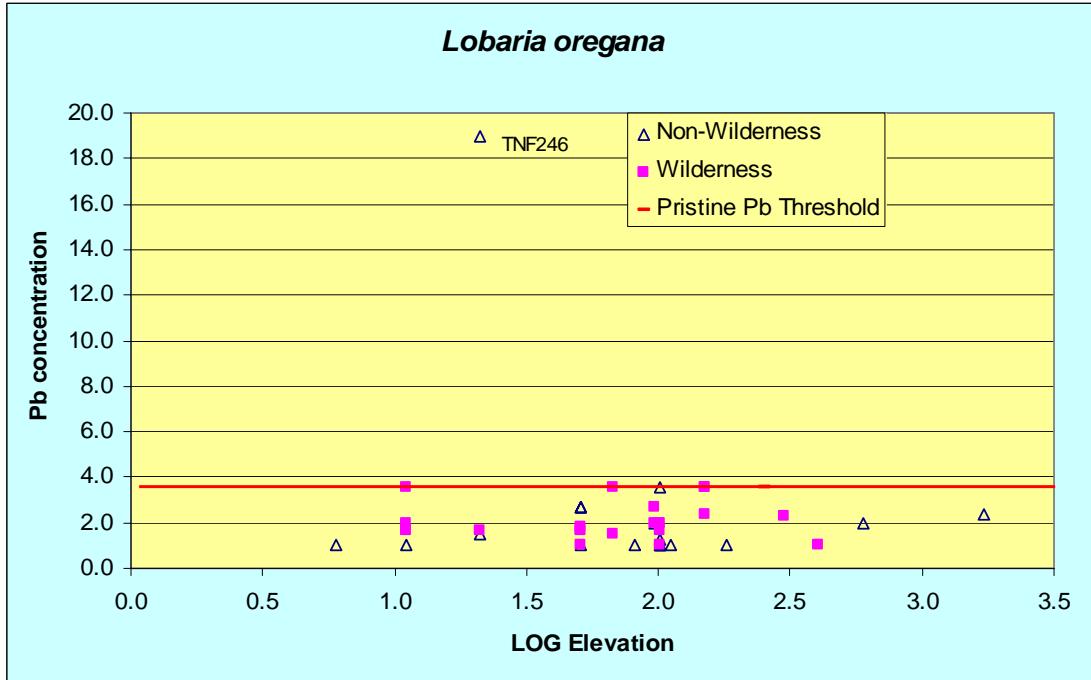


Figure XXV-20. Wilderness and Non-Wilderness plot means of Pb ppm in *Lobaria oregana* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Pb ppm

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Platismatia glauca

Table XXV-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Pb ppm content of *Platismatia glauca* per year.

Pb ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2003	Wilderness	1.68	NA	NA	NA
2004	Wilderness	1.86	0.1405	1.5452	2.1809
2005	Non-Wilderness	155.62	85.2947	37.3316	348.5685
2005	Wilderness	3.52	0.0000	3.5200	3.5200

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Pb ppm

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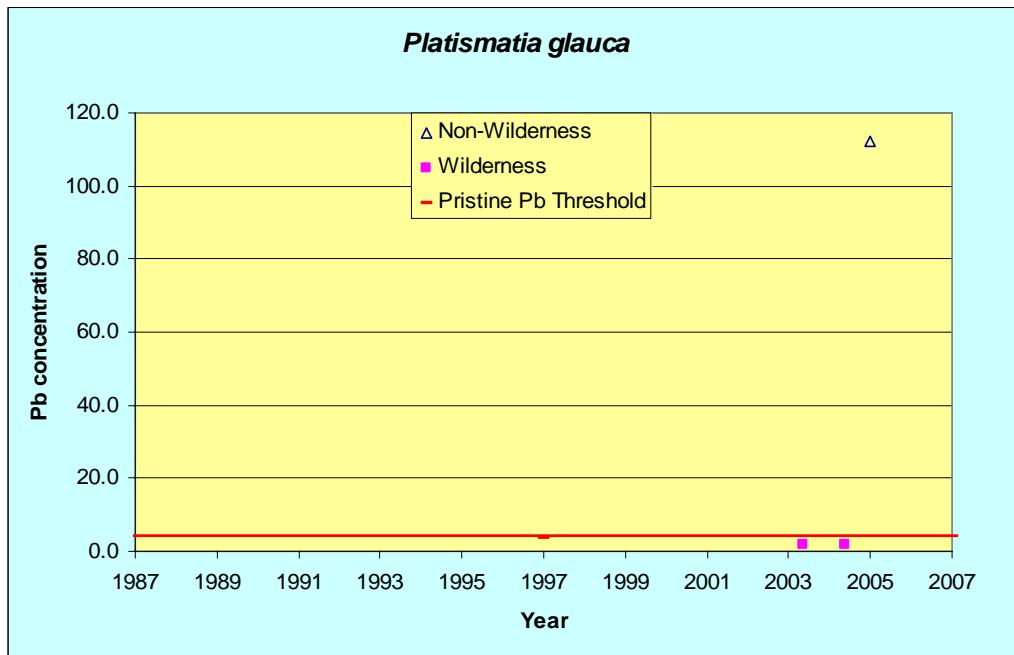


Figure XXV-21. Wilderness and Non-Wilderness yearly means of Pb ppm in *Platismatia glauca* per year.

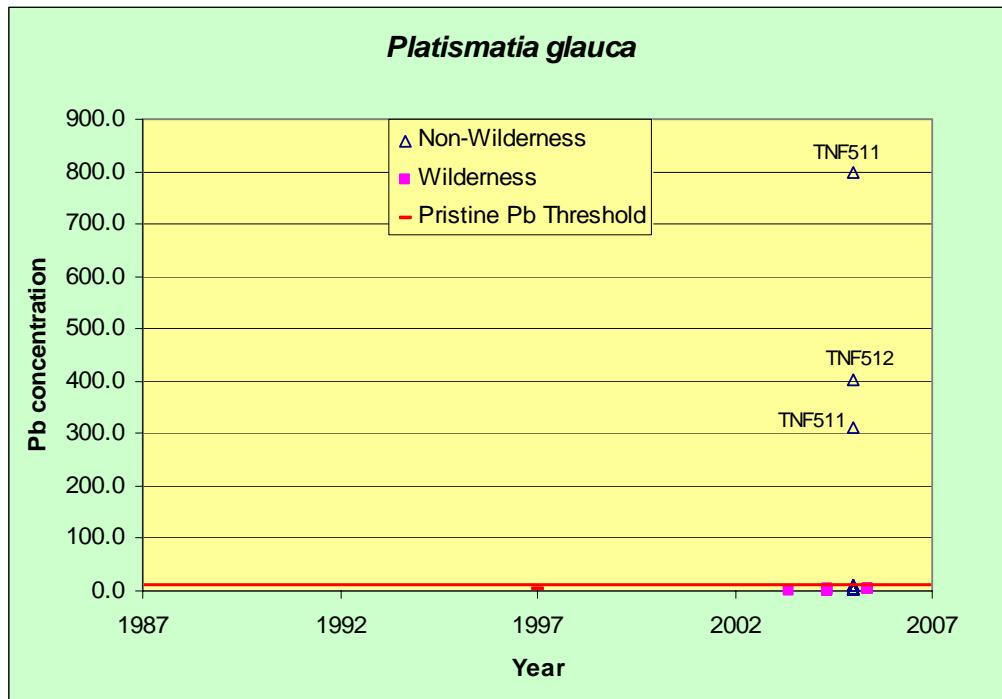


Figure XXV-22. Wilderness and Non-Wilderness plot means of Pb ppm in *Platismatia glauca* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Pb ppm

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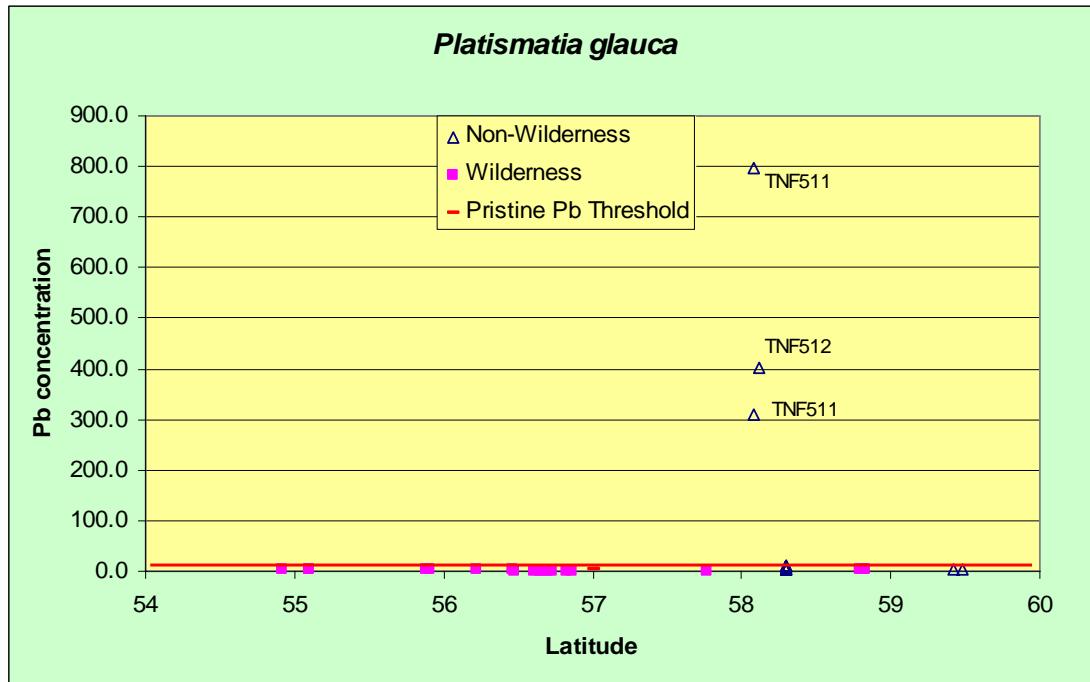


Figure XXV-23. Wilderness and Non-Wilderness plot means of Pb ppm in *Platismatia glauca* vs. plot Latitude.

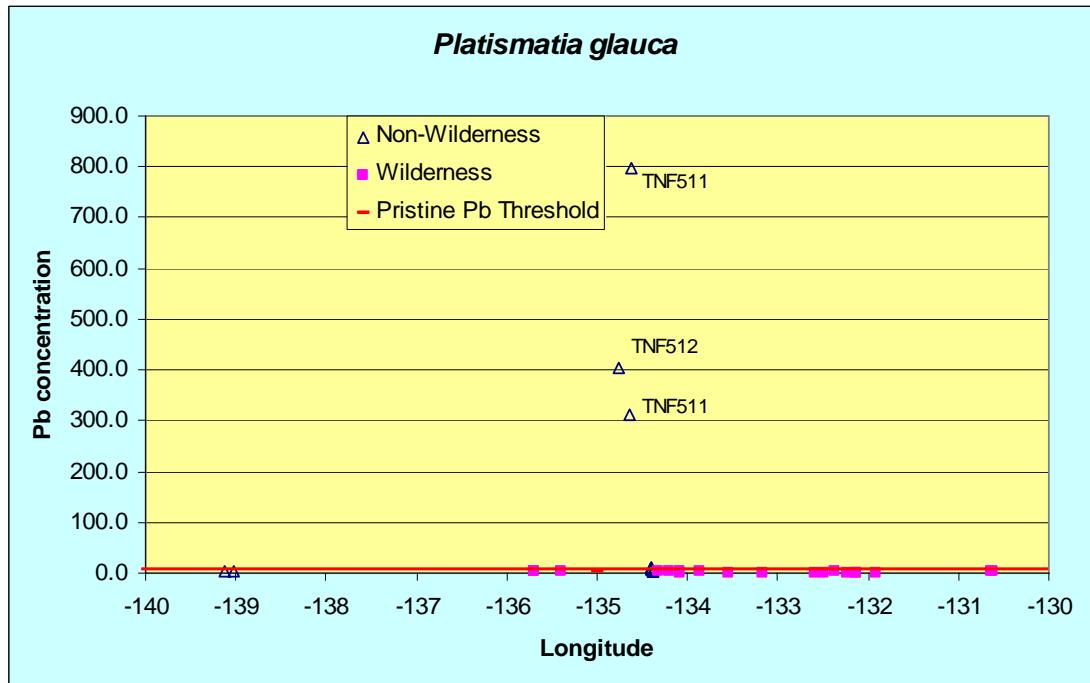


Figure XXV-24. Wilderness and Non-Wilderness plot means of Pb ppm in *Platismatia glauca* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Pb ppm

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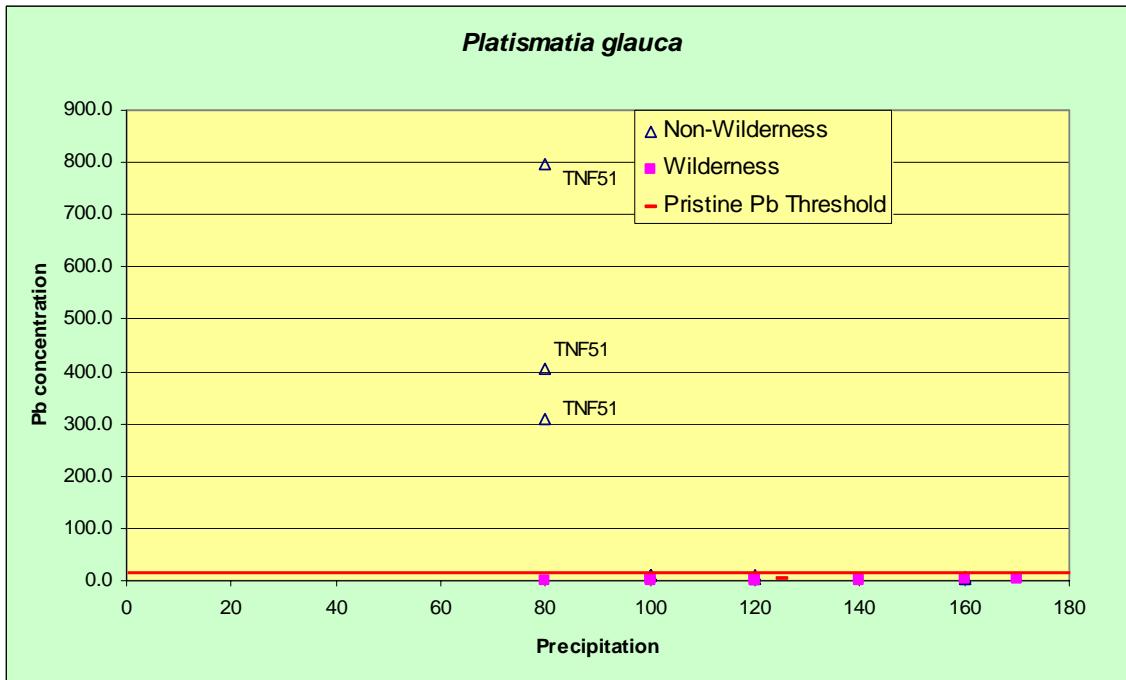


Figure XXV-25. Wilderness and Non-Wilderness plot means of Pb ppm
in *Platismatia glauca* vs. plot Precipitation.

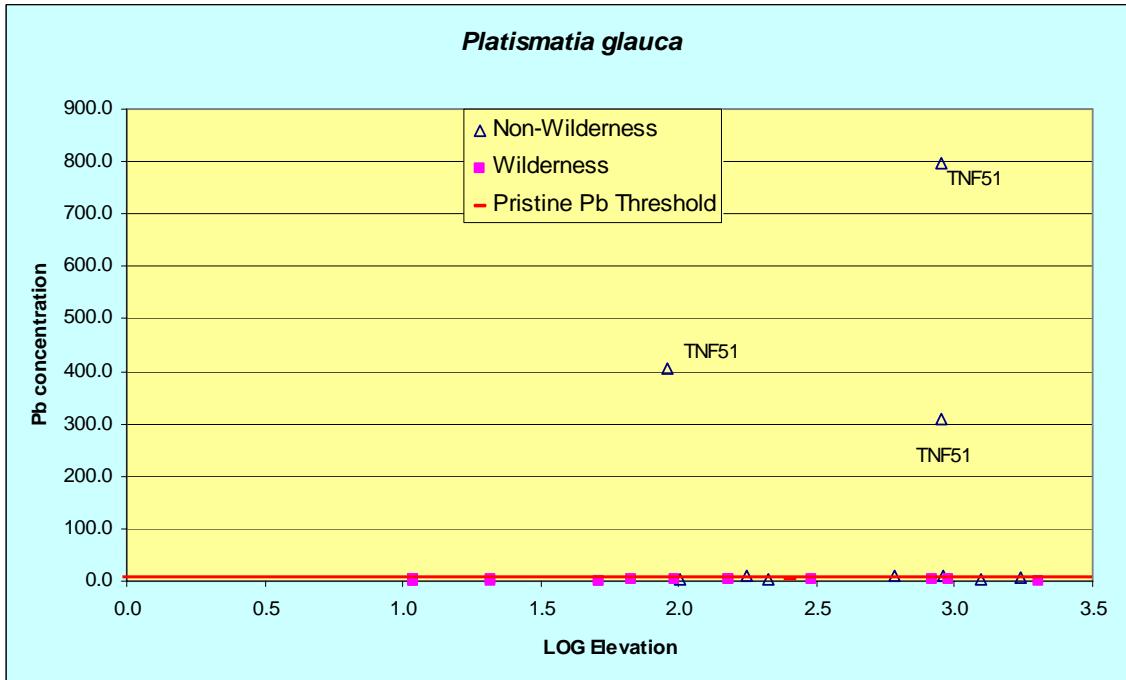


Figure XXV-26. Wilderness and Non-Wilderness plot means of Pb ppm
in *Platismatia glauca* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Rb ppm

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XXVI. SUMMARY OF Rb PPM DATA ANALYSIS

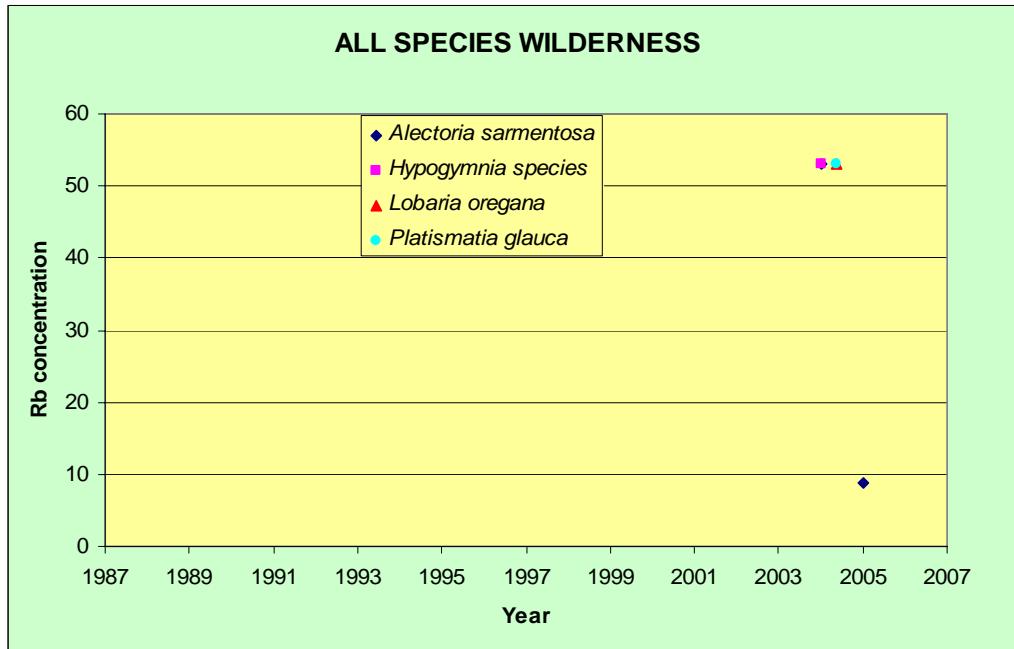


Figure XXVI-27. Wilderness plot means of Rb ppm
in *All Species* per year.

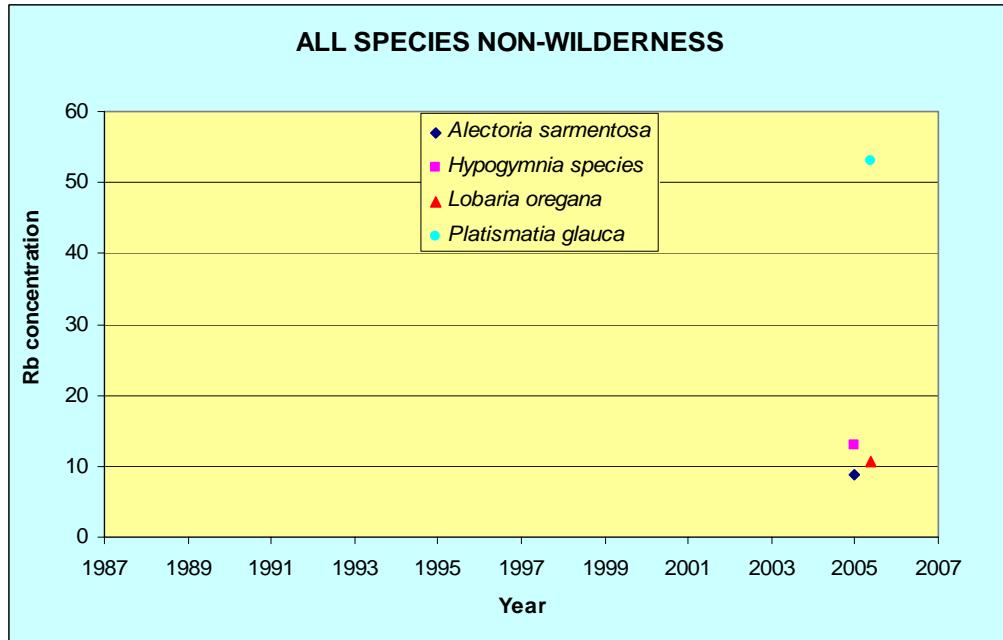


Figure XXVI-28. Non-Wilderness plot means of Rb ppm
in *All Species* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Rb ppm

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Alectoria sarmentosa

Summary Statistics:

Table XXVI-2. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Rb ppm content of *Alectoria sarmentosa* per year.

Rb ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	53.00	0.0000	53.0000	53.0000
2005	Non-Wilderness	8.86	0.0000	8.8600	8.8600
2005	Wilderness	8.88	0.0219	8.8324	8.9313

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Rb ppm

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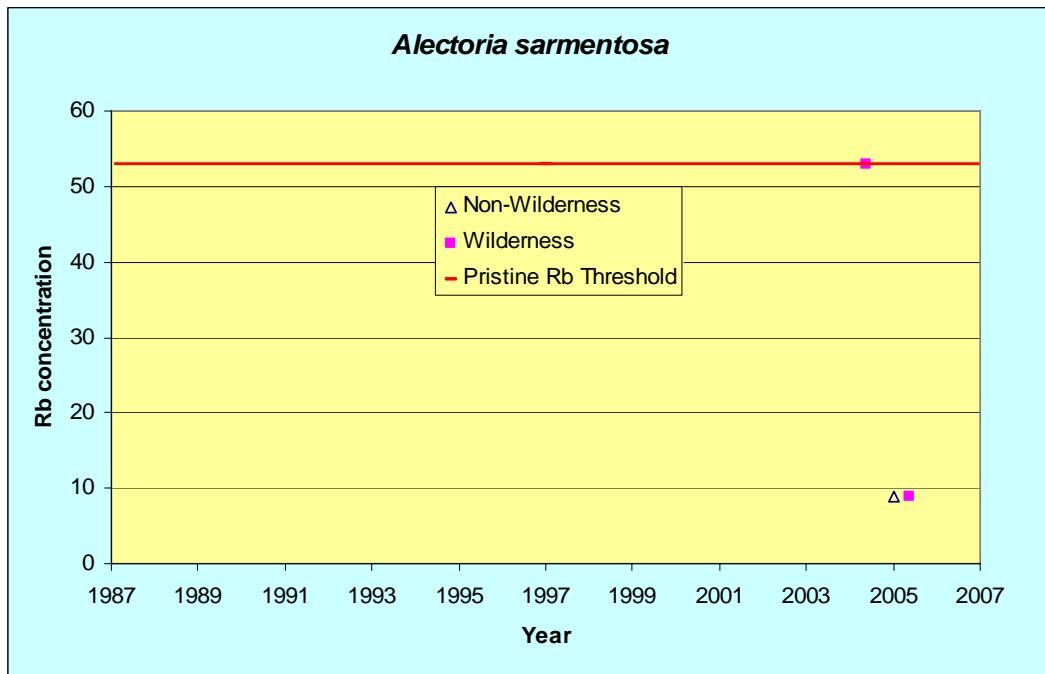


Figure XXVI-3. Wilderness and Non-Wilderness yearly means of Rb ppm in *Alectoria sarmentosa* per year.

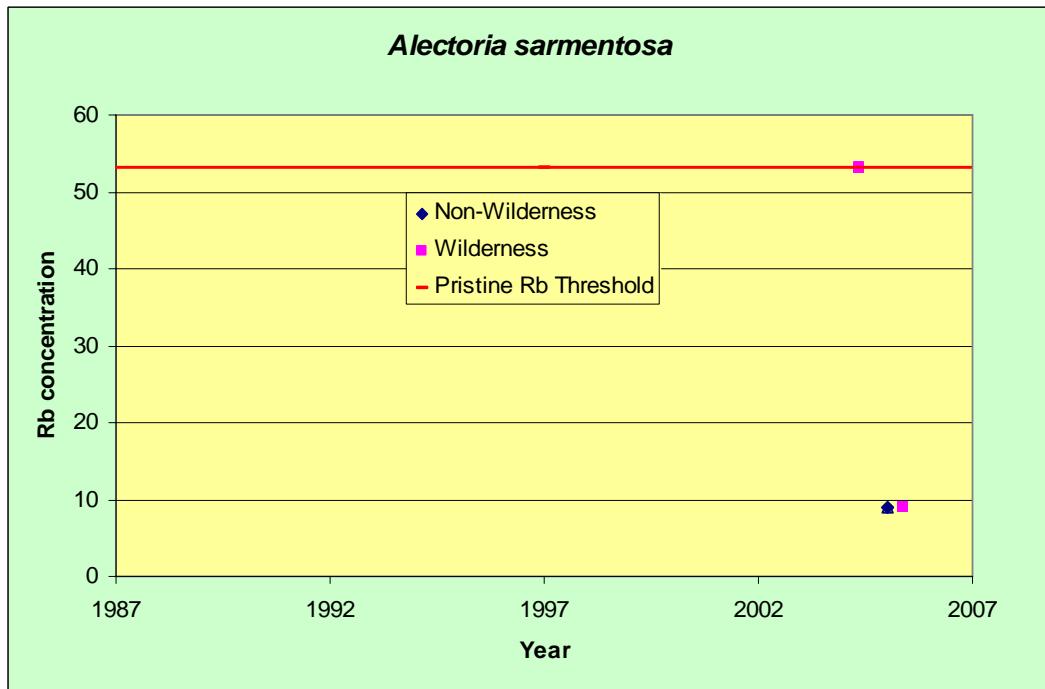


Figure XXVI-4. Wilderness and Non-Wilderness plot means of Rb ppm in *Alectoria sarmentosa* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Rb ppm

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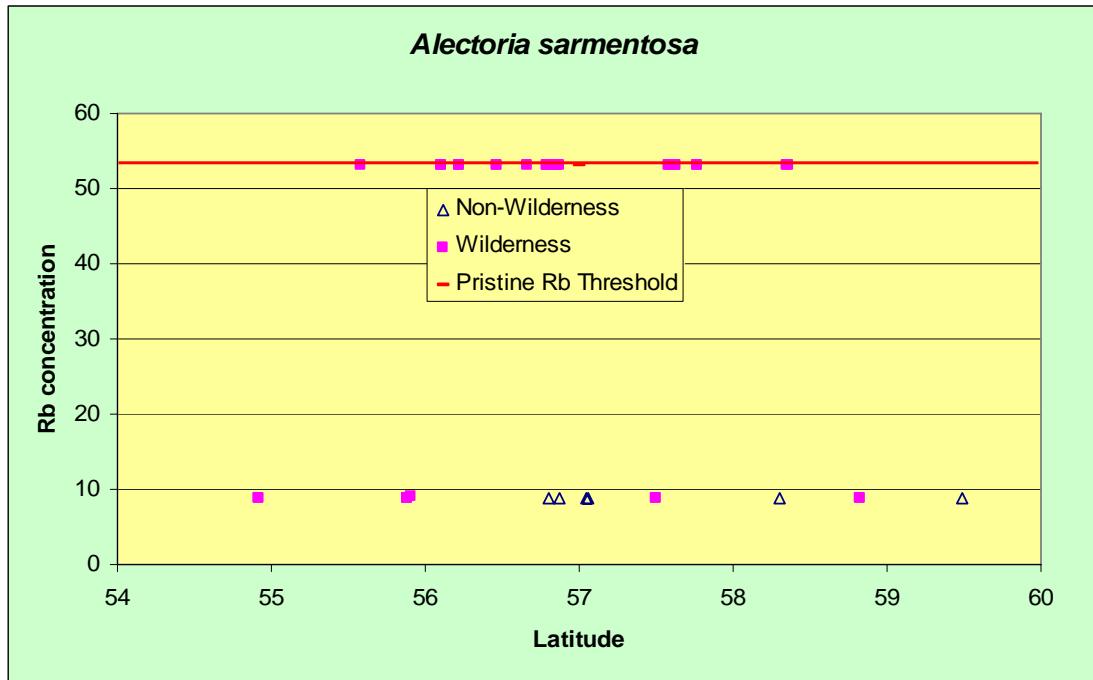


Figure XXVI-5. Wilderness and Non-Wilderness plot means of Rb ppm in *Alectoria sarmentosa* vs. plot Latitude.

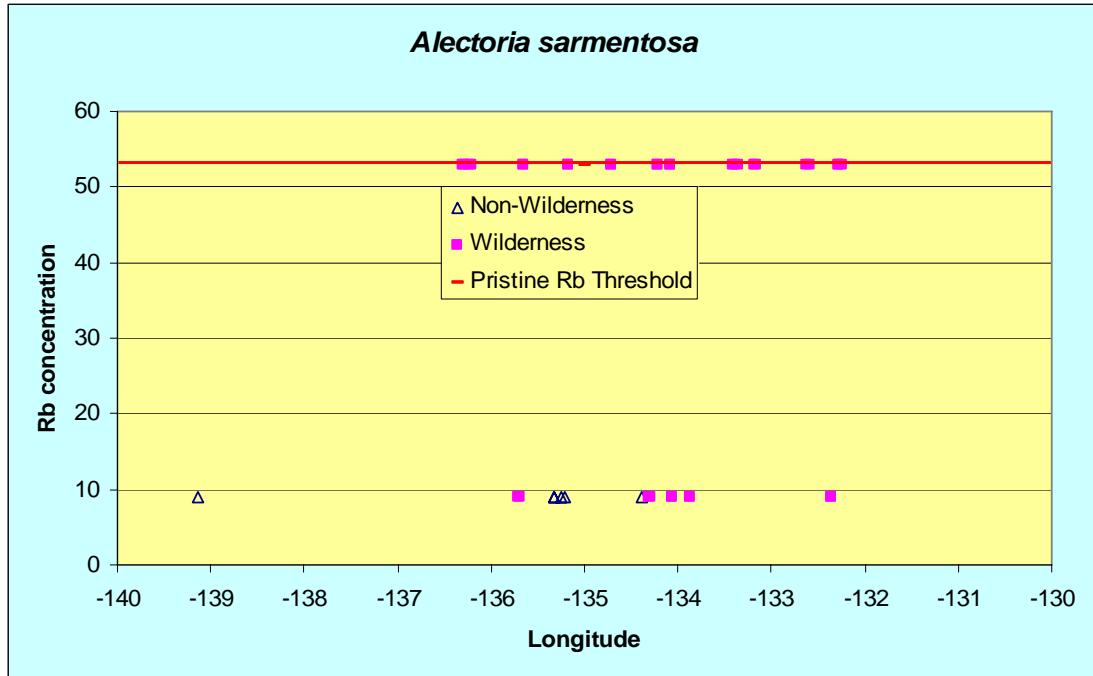


Figure XXVI-6. Wilderness and Non-Wilderness plot means of Rb ppm in *Alectoria sarmentosa* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Rb ppm

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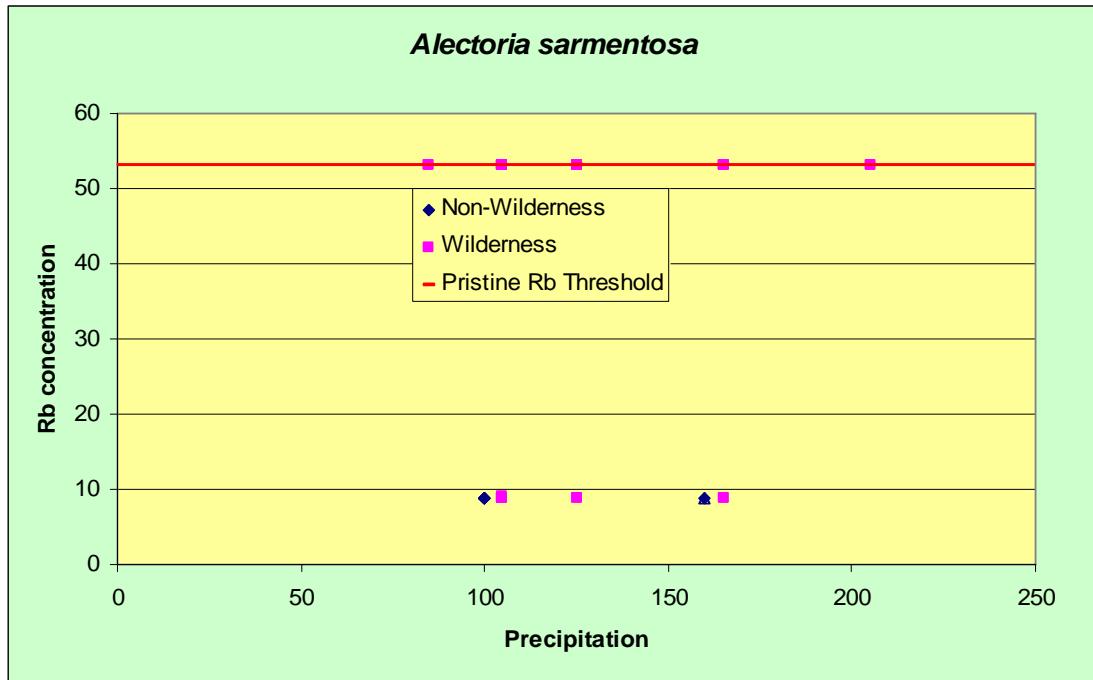


Figure XXVI-7. Wilderness and Non-Wilderness plot means of Rb ppm in *Alectoria sarmentosa* vs. plot Precipitation.

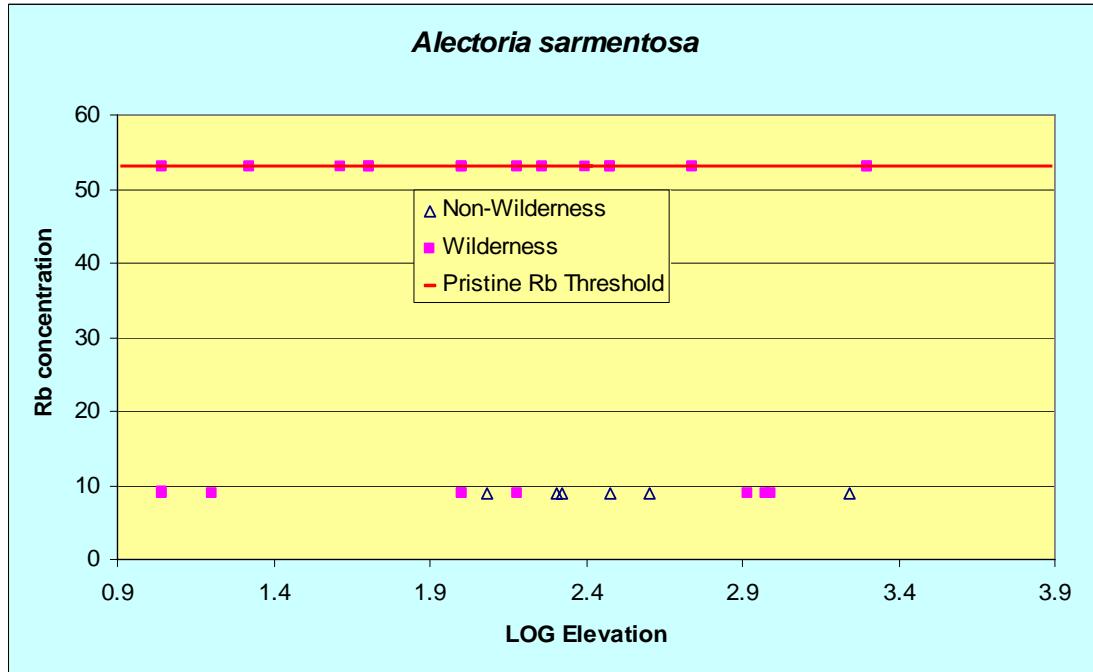


Figure XXVI-8. Wilderness and Non-Wilderness plot means of Rb ppm in *Alectoria sarmentosa* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Rb ppm

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Hypogymnia species

In this series, all of the *Hypogymnia* species were included as a group.

Table XXVI-3. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Rb ppm content of *Hypogymnia species* per year.

Pb ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	53.00	0.0000	53.0000	53.0000
2005	Non-Wilderness	12.87	1.9857	4.3278	21.4155
2005	Wilderness	12.15	1.3559	9.0233	15.2765

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Rb ppm

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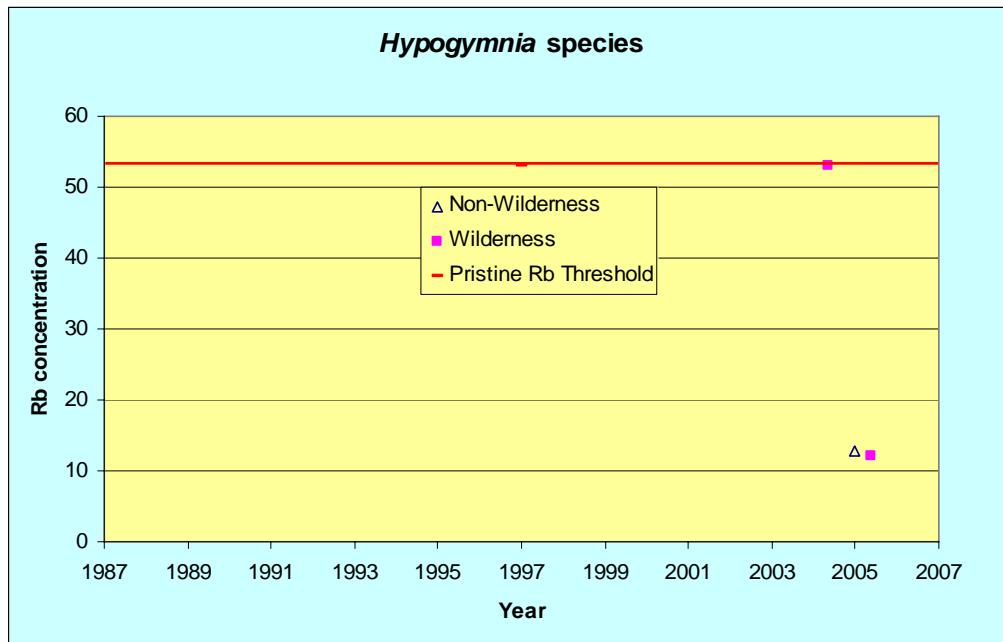


Figure XXVI-9. Wilderness and Non-Wilderness yearly means of Rb ppm in *Hypogymnia* species per year.

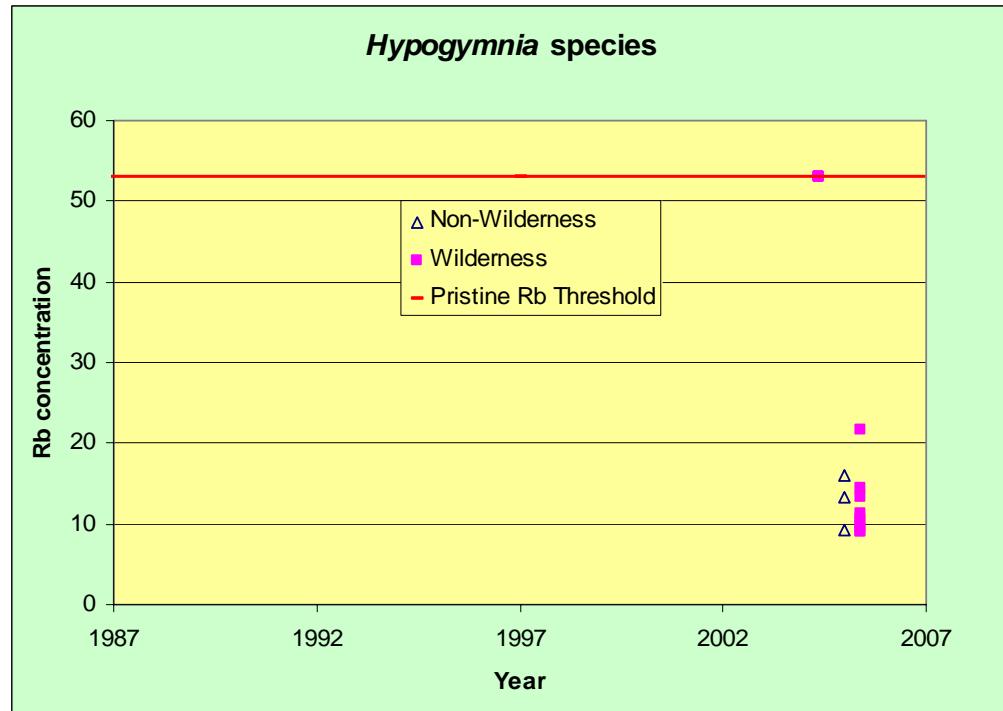


Figure XXVI-10. Wilderness and Non-Wilderness plot means of Rb ppm in *Hypogymnia* species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Rb ppm

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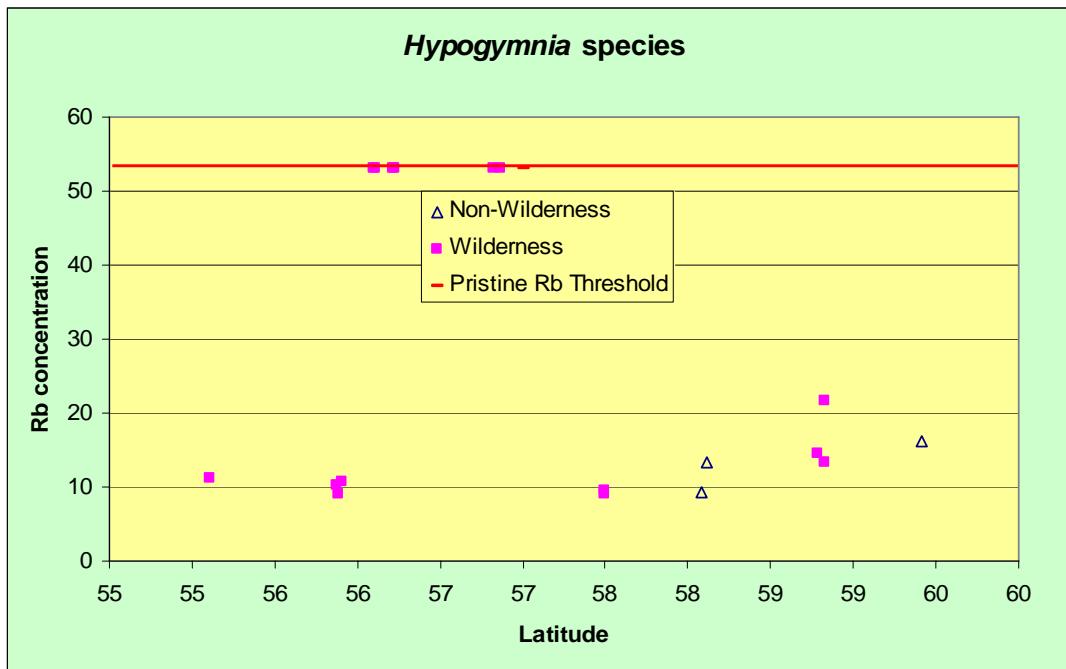


Figure XXVI-11. Wilderness and Non-Wilderness plot means of Rb ppm in *Hypogymnia species* vs. plot Latitude.

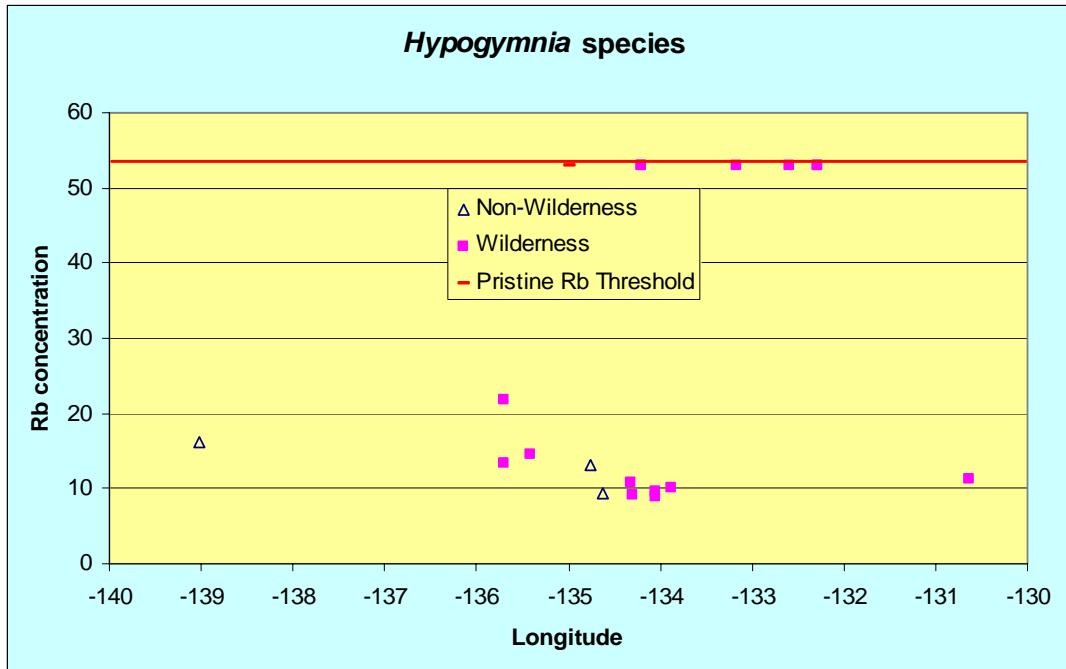


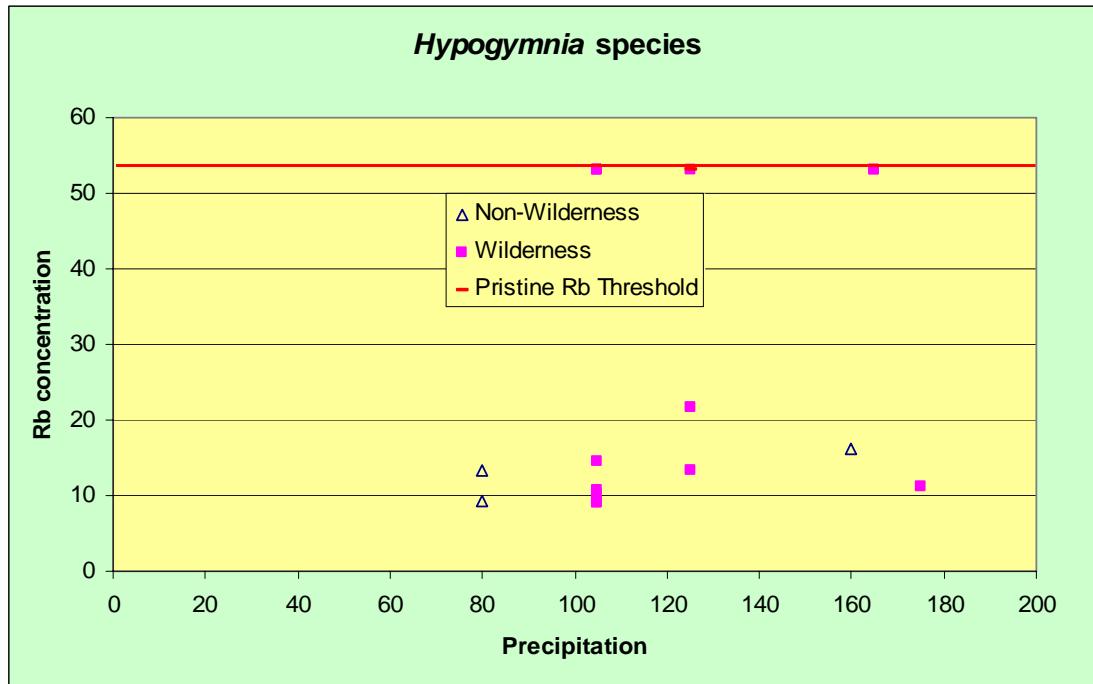
Figure XXVI-12. Wilderness and Non-Wilderness plot means of Rb ppm in *Hypogymnia species* vs. plot Longitude.

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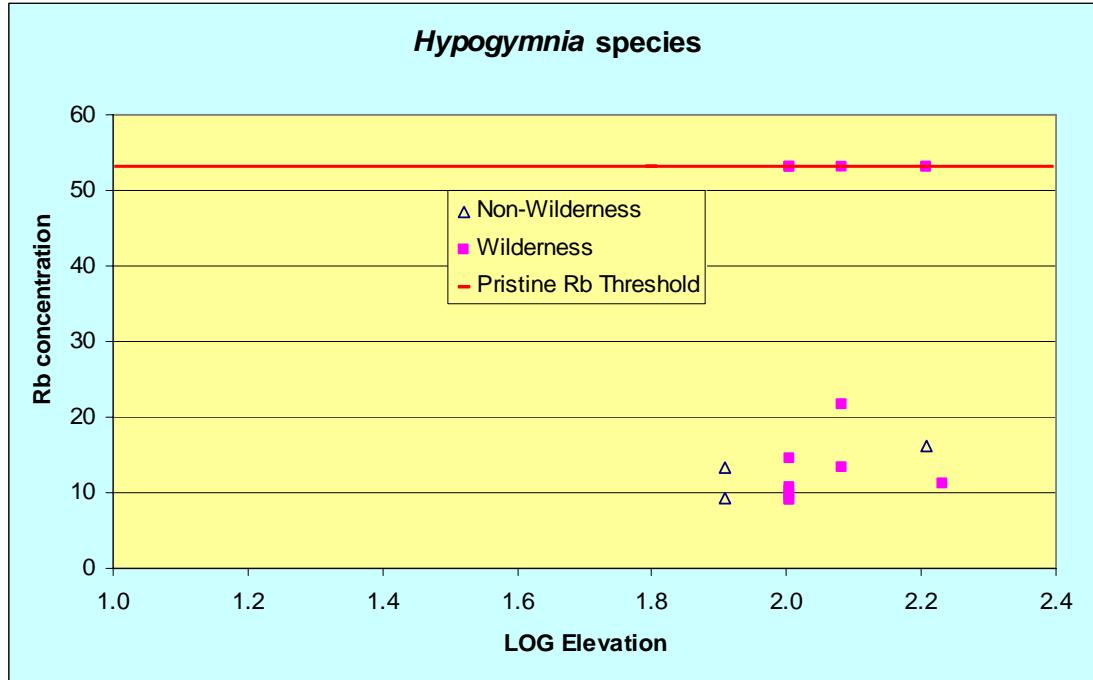
ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Rb ppm

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**Figure XXVI-13. Wilderness and Non-Wilderness plot means of Rb ppm
in *Hypogymnia* species vs. plot Precipitation.**



**Figure XXVI-14. Wilderness and Non-Wilderness plot means of Rb ppm
in *Hypogymnia* species vs. plot Log-Elevation.**

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Rb ppm

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Lobaria oregana

Table XXVI-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Rb ppm content of *Lobaria oregana* per year.

Rb ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	53.00	0.0000	53.0000	53.0000
2005	Non-Wilderness	10.74	NA	NA	NA
2005	Wilderness	11.6783	2.0160	5.2625	18.0940

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Rb ppm

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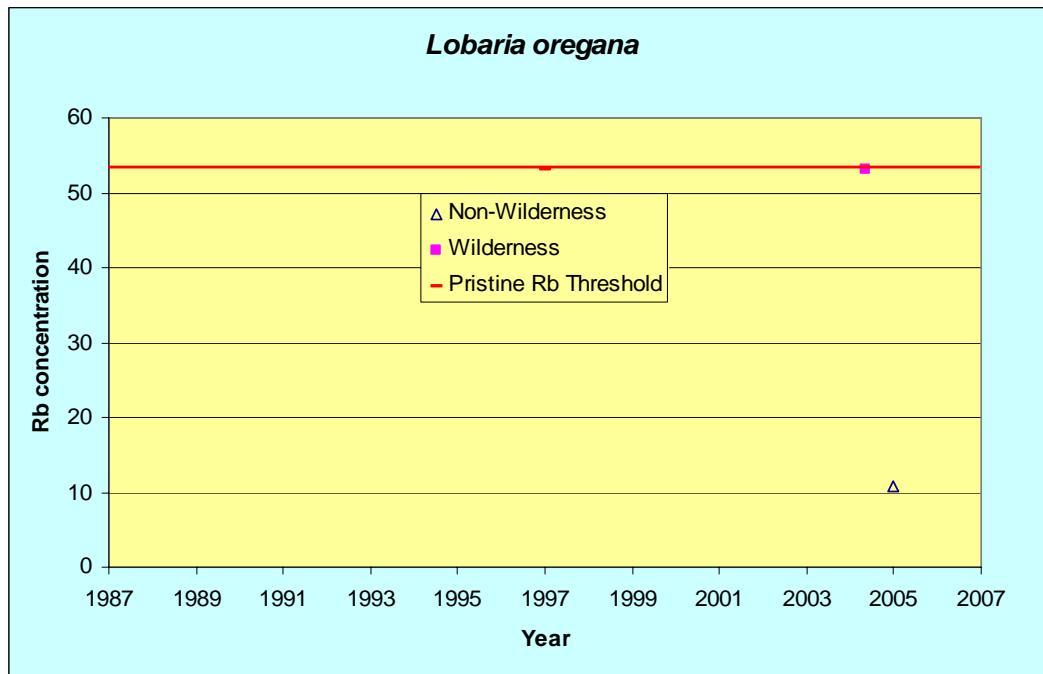


Figure XXVI-15. Wilderness and Non-Wilderness yearly means of Rb ppm in *Lobaria oregana* per year.

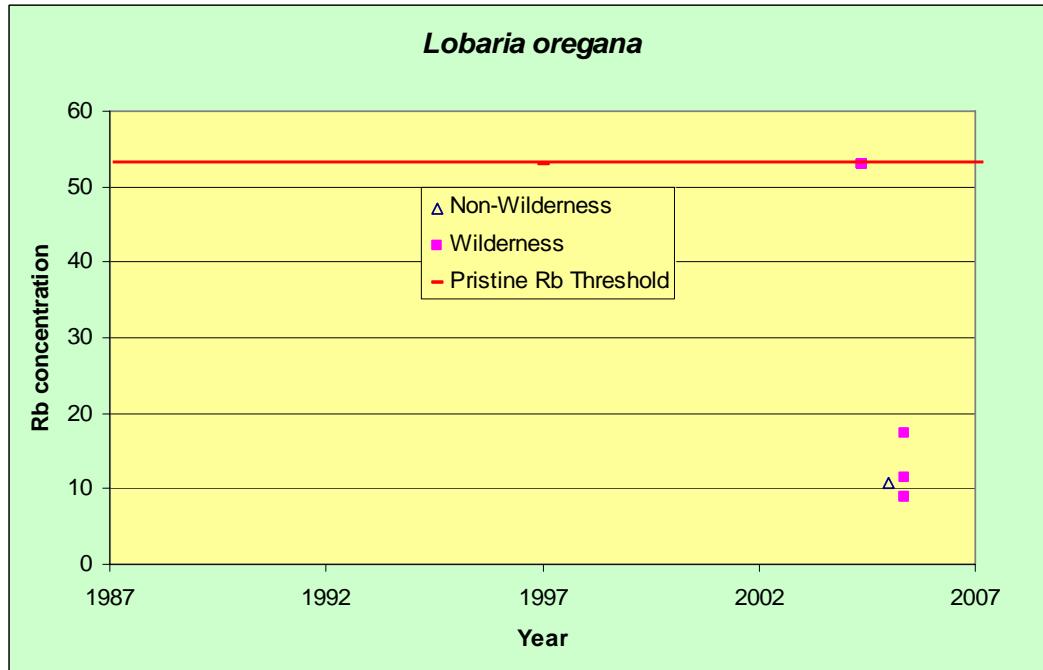


Figure XXVI-16. Wilderness and Non-Wilderness plot means of Rb ppm in *Lobaria oregana* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Rb ppm

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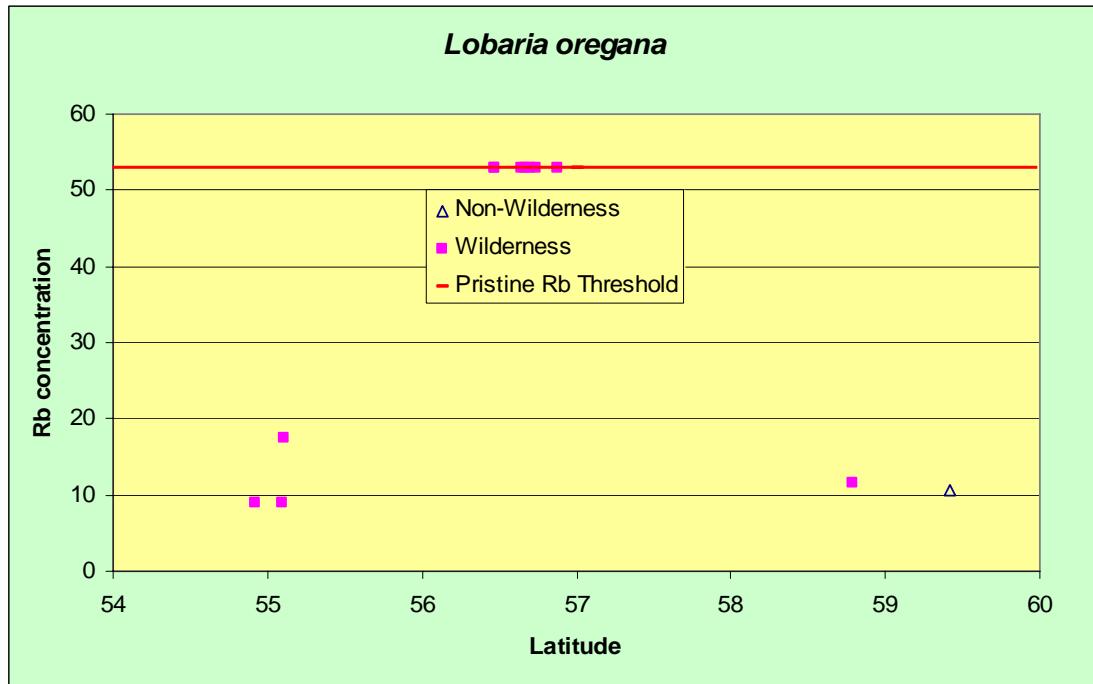


Figure XXVI-17. Wilderness and Non-Wilderness plot means of Rb ppm in *Lobaria oregana* vs. plot Latitude.

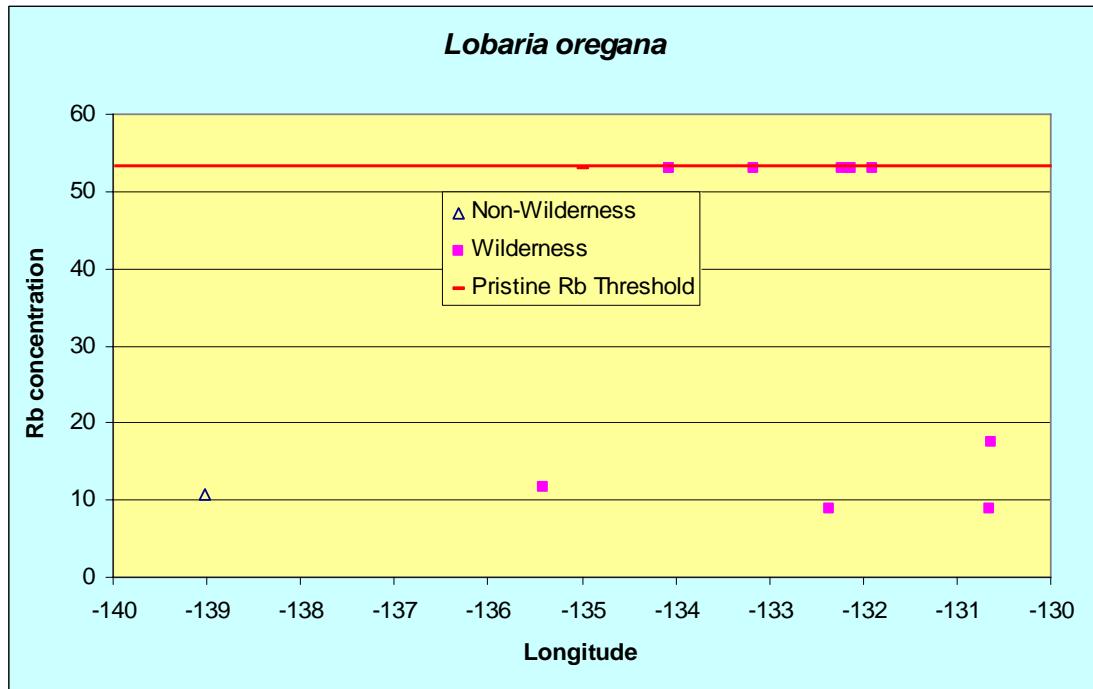


Figure XXVI-18. Wilderness and Non-Wilderness plot means of Rb ppm in *Lobaria oregana* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Rb ppm

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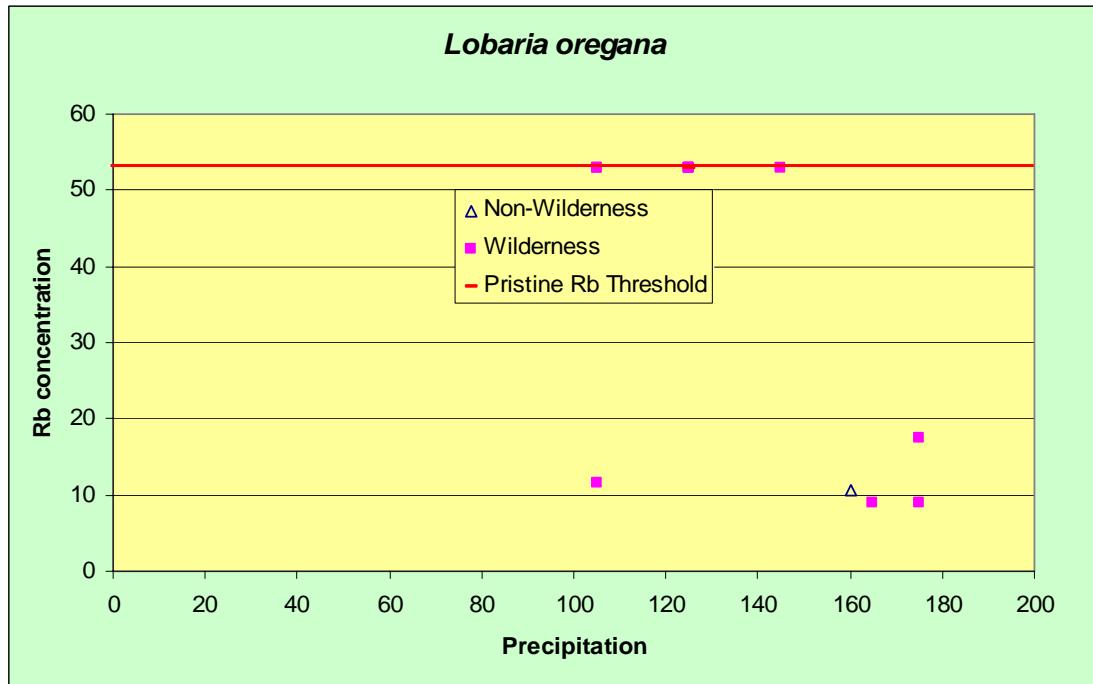


Figure XXVI-19. Wilderness and Non-Wilderness plot means of Rb ppm in *Lobaria oregana* vs. plot Precipitation.

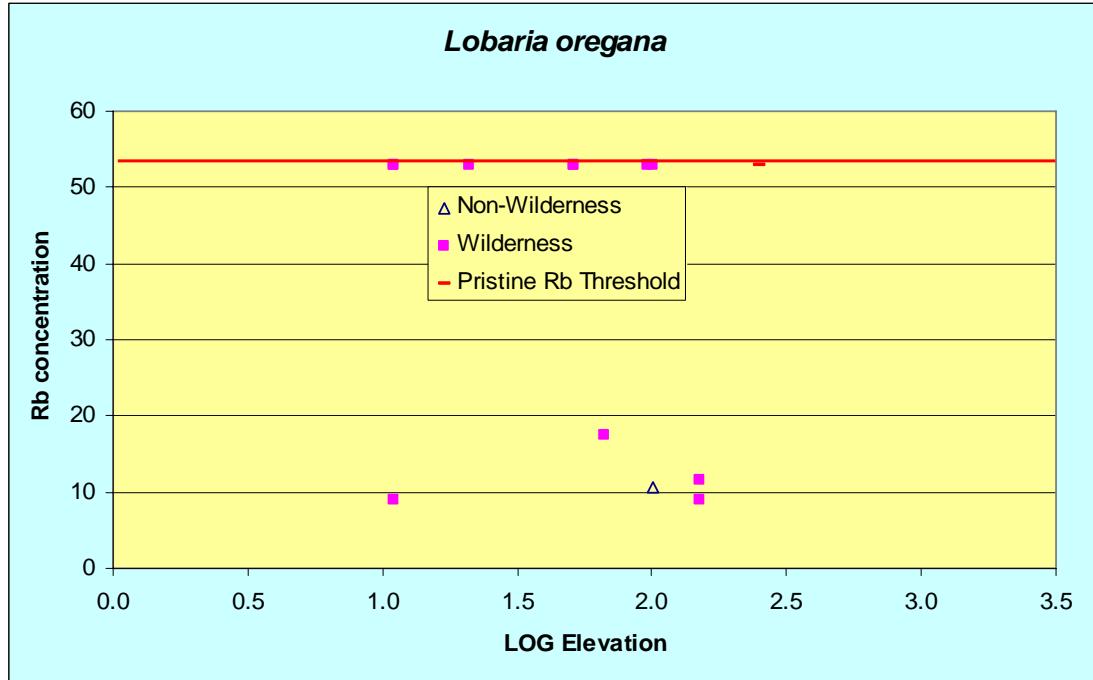


Figure XXVI-20. Wilderness and Non-Wilderness plot means of Rb ppm in *Lobaria oregana* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Rb ppm

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Platismatia glauca

Table XXVI-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Rb ppm content of *Platismatia glauca* per year.

Rb ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	53.00	0.0000	53.0000	53.0000
2005	Non-Wilderness	9.32	0.4550	8.2857	10.3443
2005	Wilderness	9.93	0.9101	7.7804	12.0845

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Rb ppm

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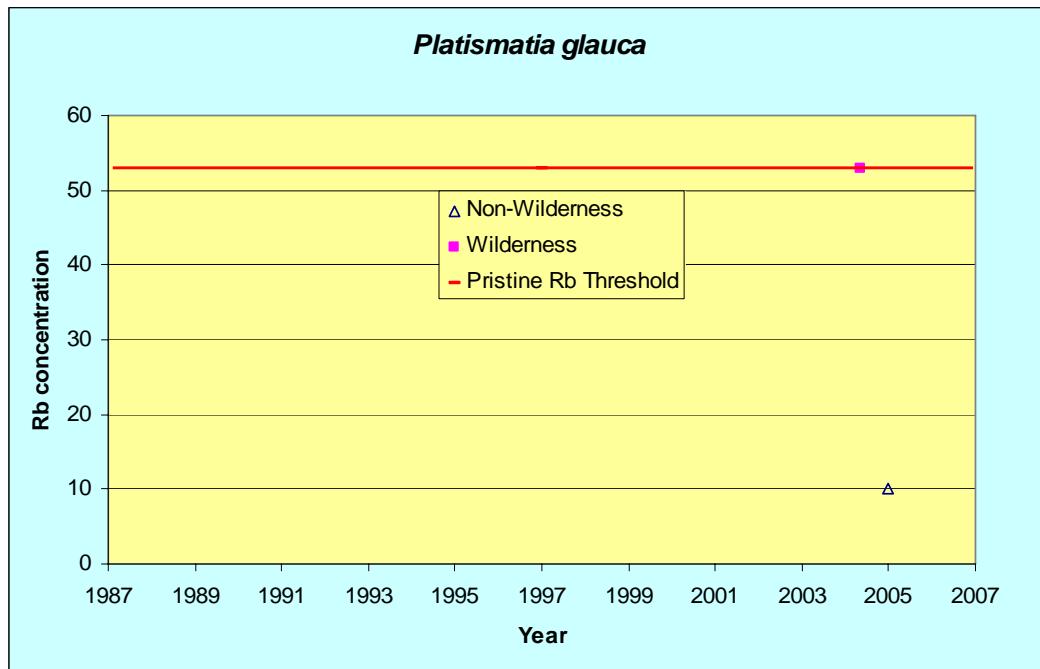


Figure XXVI-21. Wilderness and Non-Wilderness yearly means of Rb ppm in *Platismatia glauca* per year.

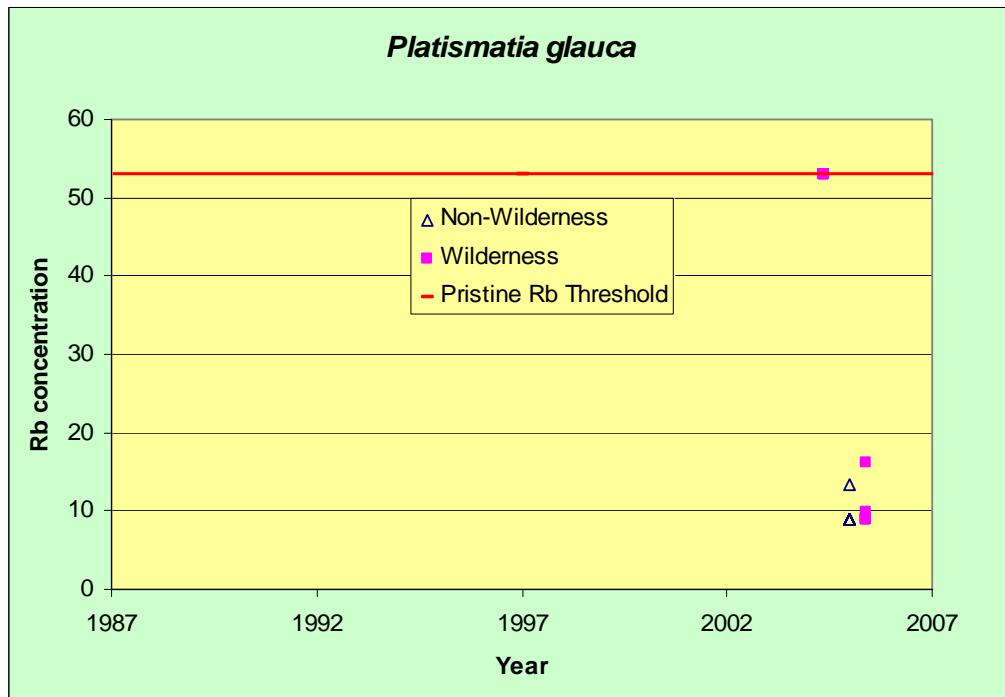


Figure XXVI-22. Wilderness and Non-Wilderness plot means of Rb ppm in *Platismatia glauca* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Rb ppm

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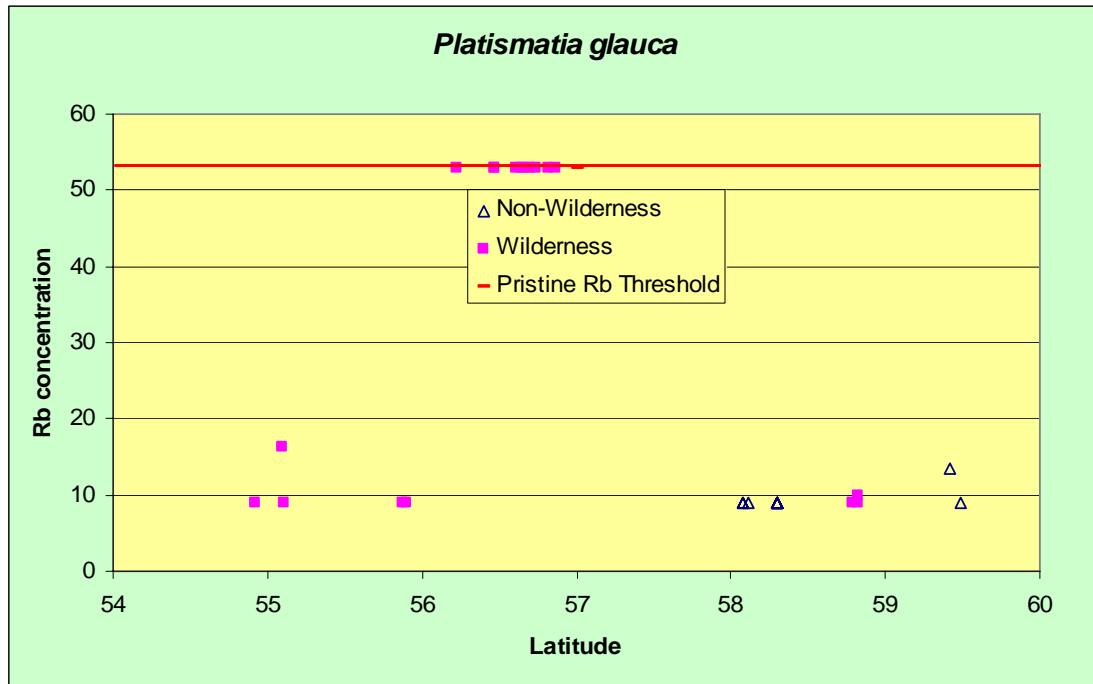


Figure XXVI-23. Wilderness and Non-Wilderness plot means of Rb ppm in *Platismatia glauca* vs. plot Latitude.

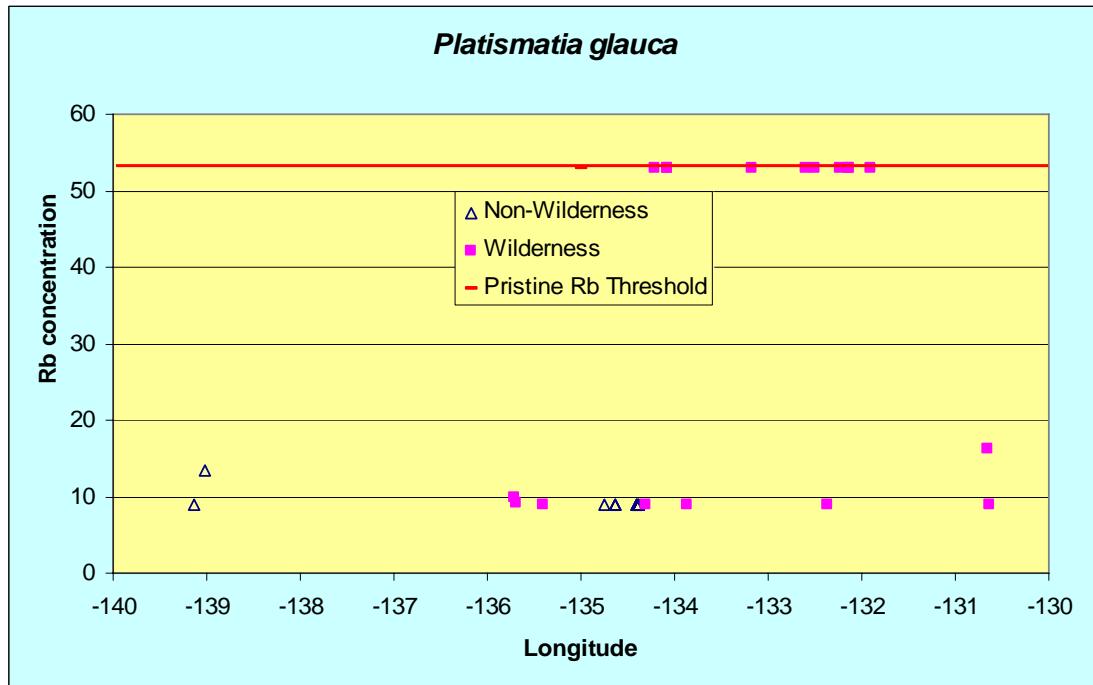


Figure XXVI-24. Wilderness and Non-Wilderness plot means of Rb ppm in *Platismatia glauca* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Rb ppm

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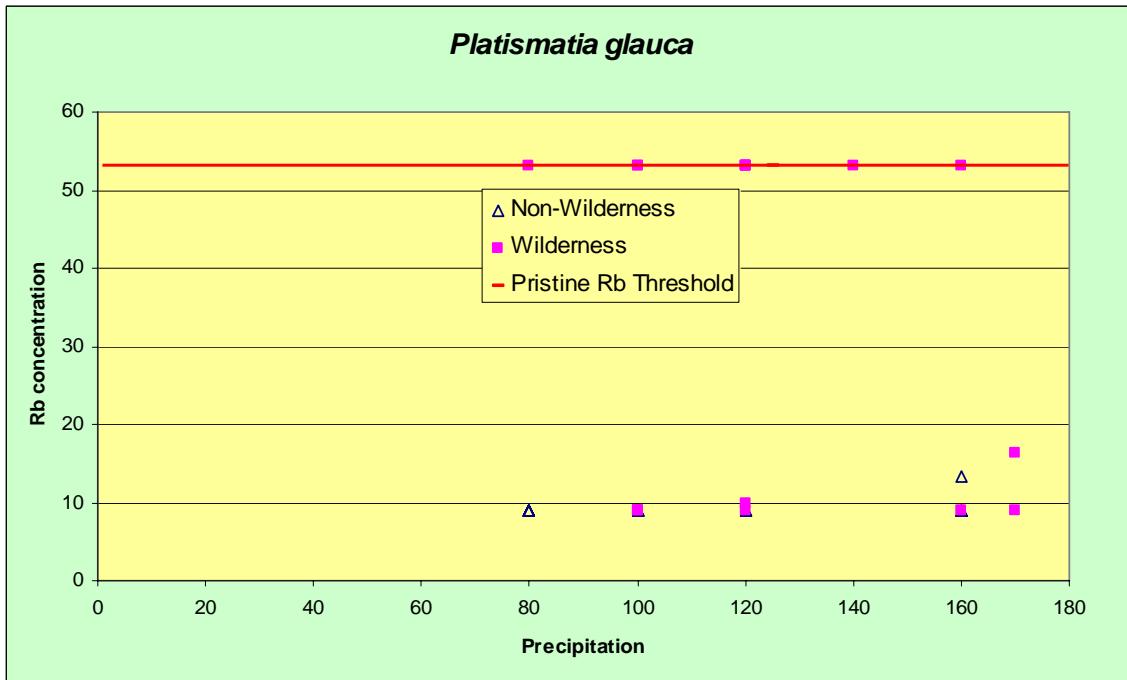


Figure XXVI-25. Wilderness and Non-Wilderness plot means of Rb ppm in *Platismatia glauca* vs. plot Precipitation.

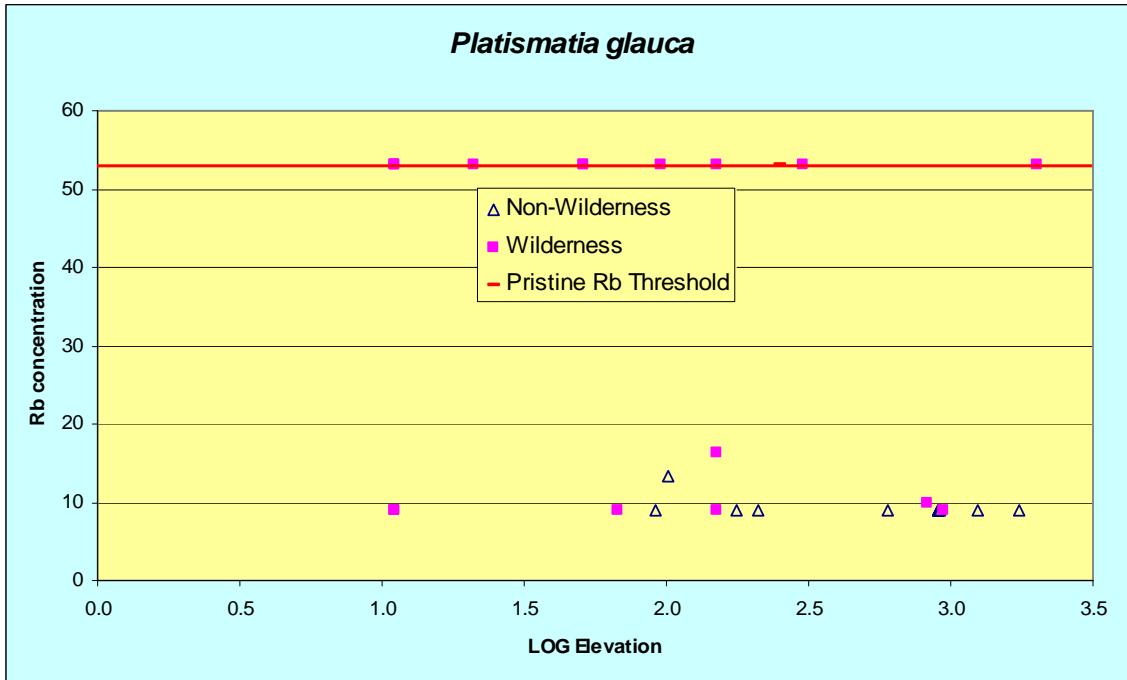


Figure XXVI-26. Wilderness and Non-Wilderness plot means of Rb ppm in *Platismatia glauca* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Si ppm

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XXVII. SUMMARY OF Si PPM DATA ANALYSIS

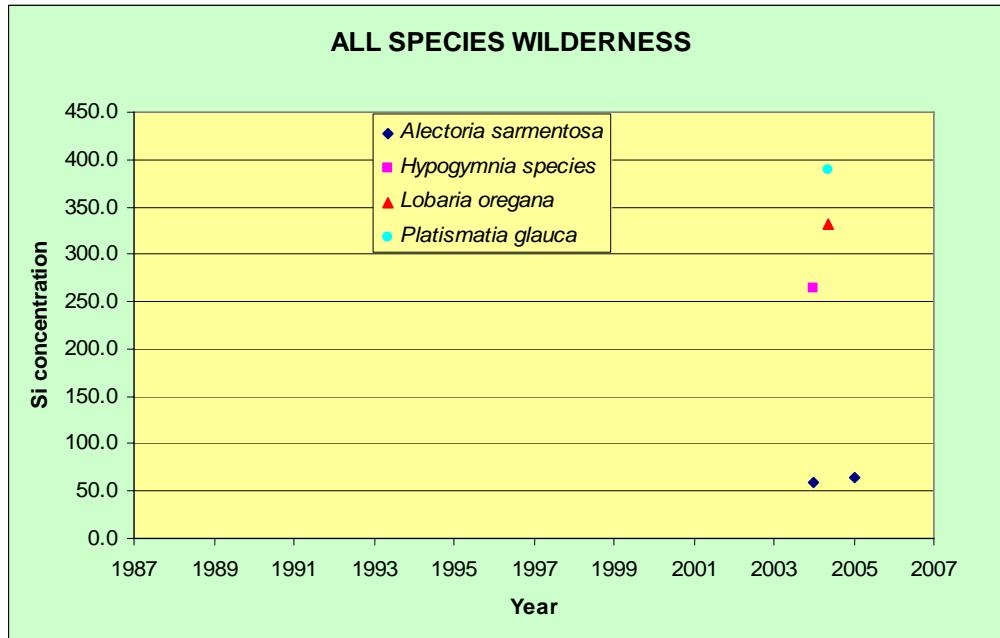


Figure XXVII-27. Wilderness plot means of Si ppm in All Species per year.

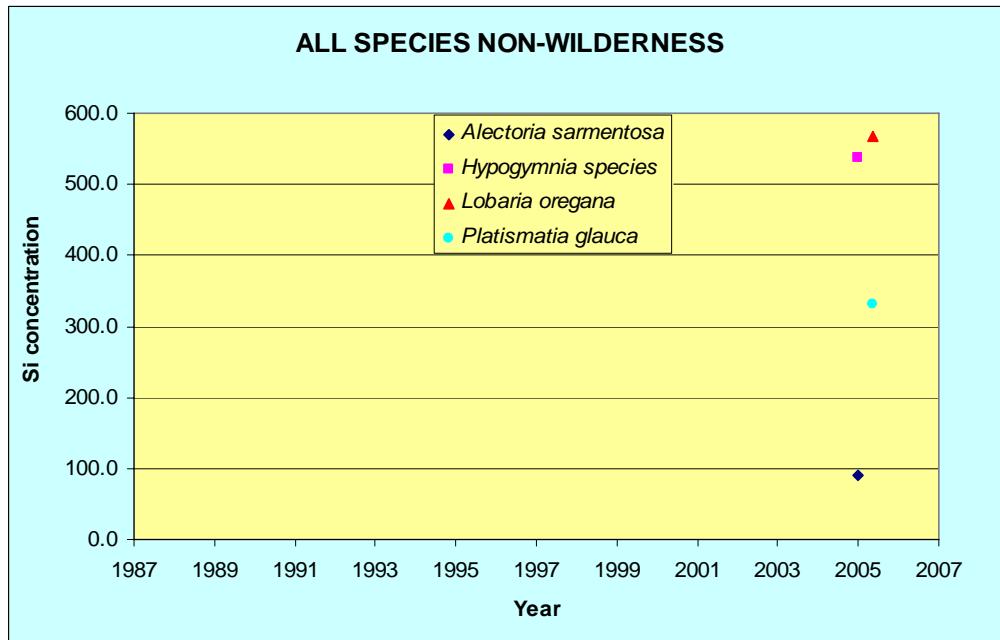


Figure XXVII-28. Non-Wilderness plot means of Si ppm in All Species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Si ppm

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Alectoria sarmentosa

Summary Statistics:

Table XXVII-2. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Si ppm content of *Alectoria sarmentosa* per year.

Si ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	59.88	4.6889	50.1827	69.5822
2005	Non-Wilderness	91.17	24.4854	28.2296	154.1131
2005	Wilderness	64.13	13.1451	34.3891	93.8617

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Si ppm

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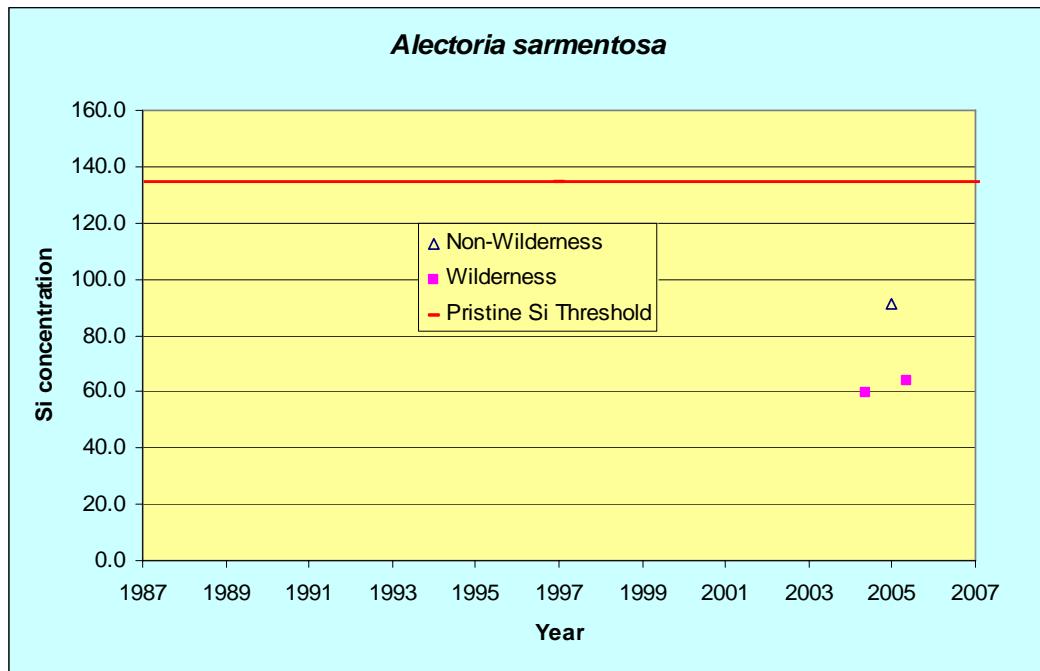


Figure XXVII-3. Wilderness and Non-Wilderness yearly means of Si ppm in *Alectoria sarmentosa* per year.

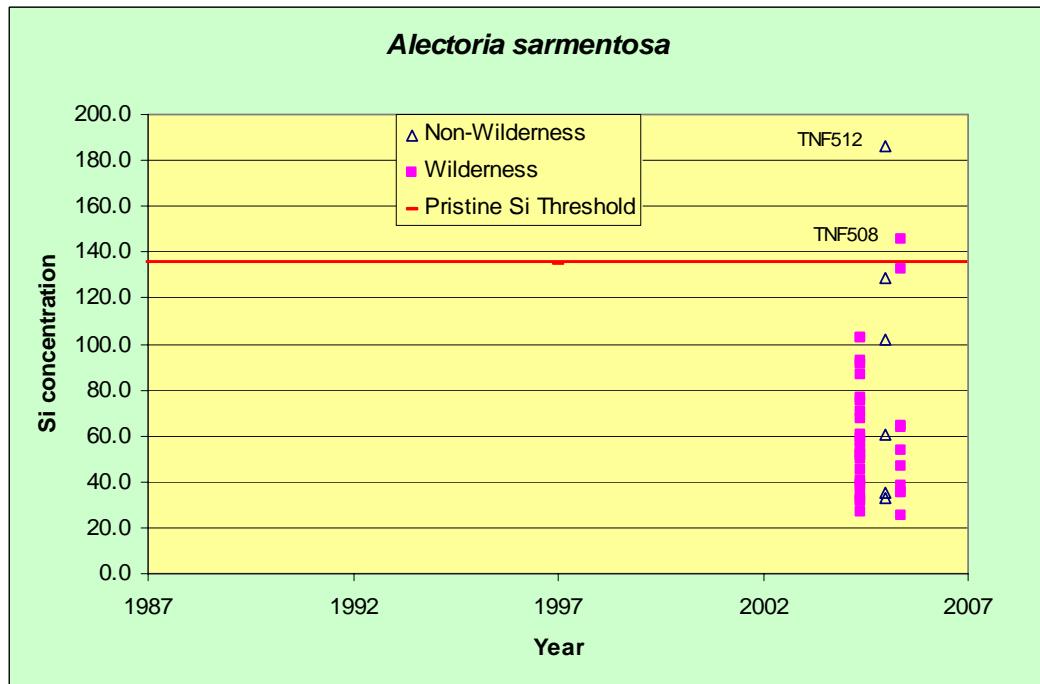


Figure XXVII-4. Wilderness and Non-Wilderness plot means of Si ppm in *Alectoria sarmentosa* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Si ppm

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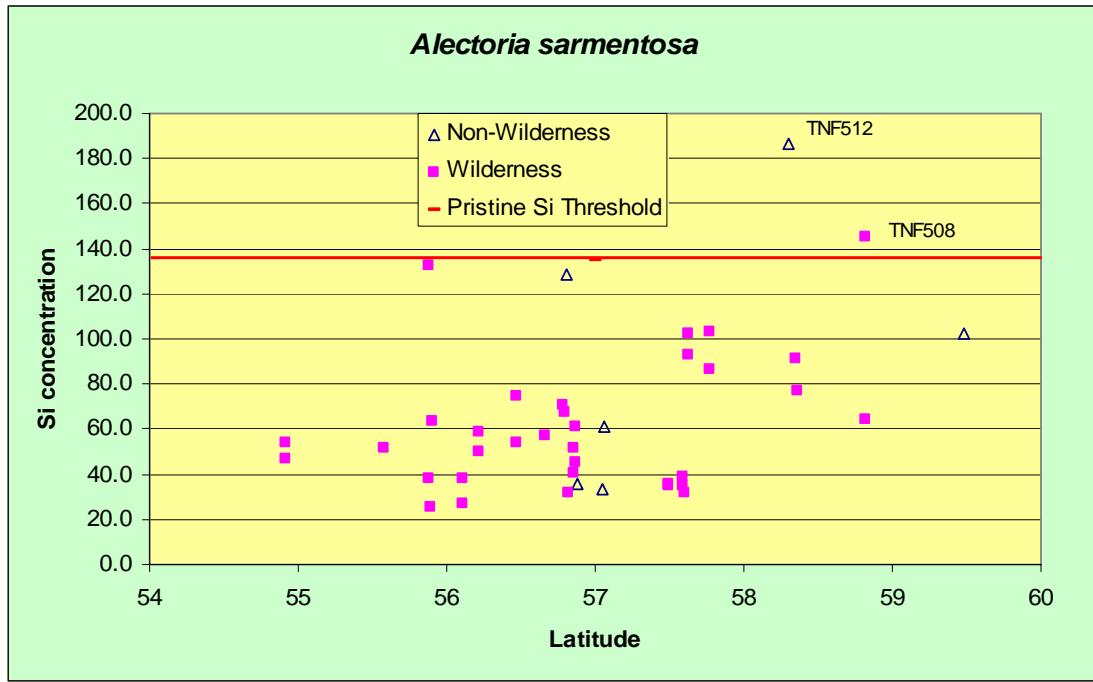


Figure XXVII-5. Wilderness and Non-Wilderness plot means of Si ppm in *Alectoria sarmentosa* vs. plot Latitude.

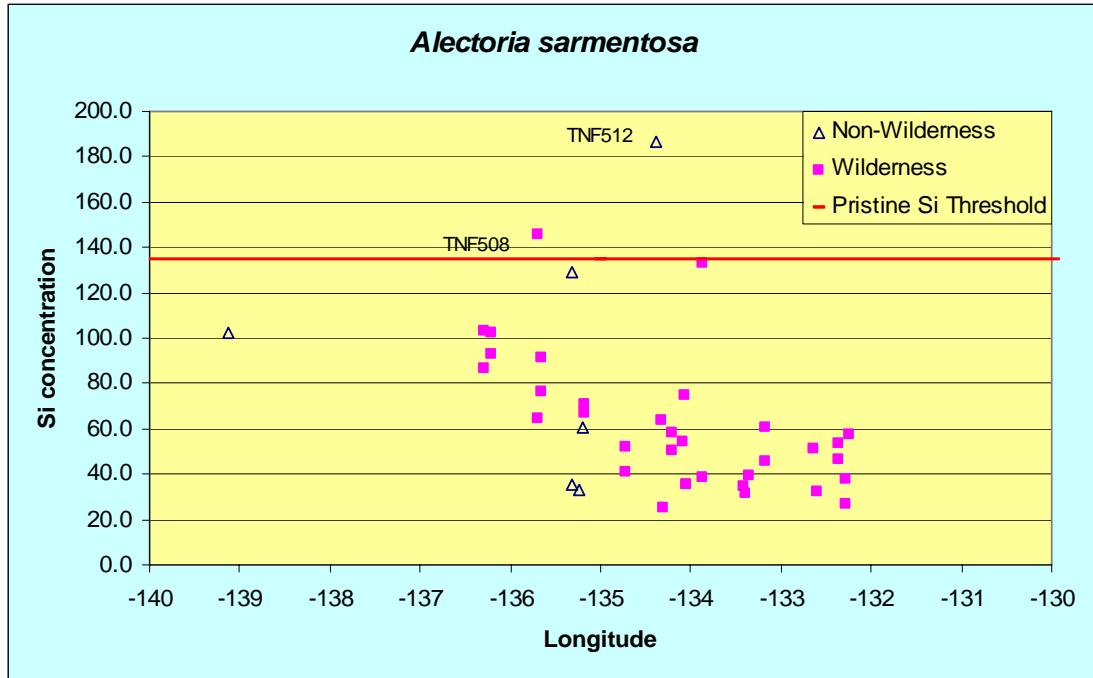


Figure XXVII-6. Wilderness and Non-Wilderness plot means of Si ppm in *Alectoria sarmentosa* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Si ppm

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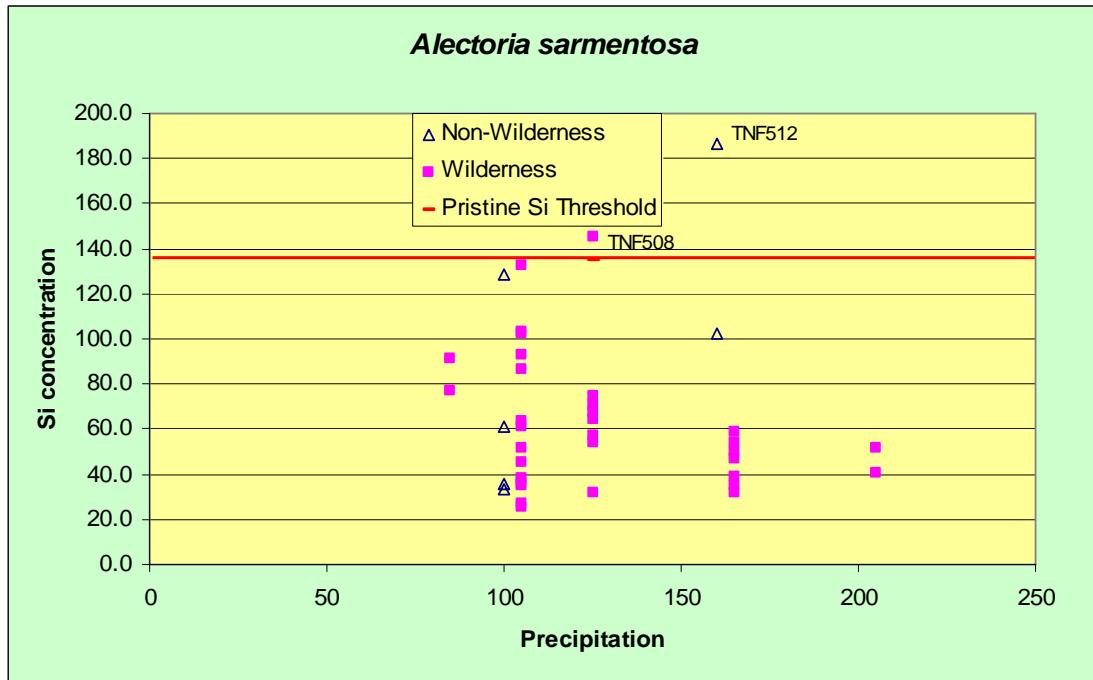


Figure XXVII-7. Wilderness and Non-Wilderness plot means of Si ppm
in *Alectoria sarmentosa* vs. plot Precipitation.

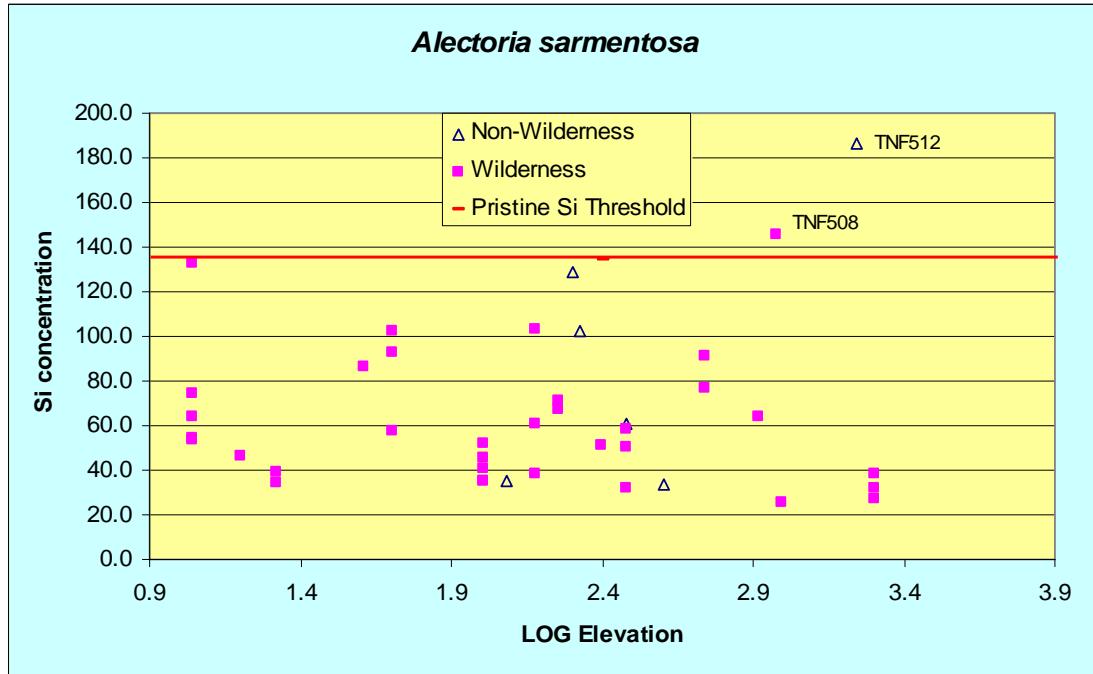


Figure XXVII-8. Wilderness and Non-Wilderness plot means of Si ppm
in *Alectoria sarmentosa* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Si ppm

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Hypogymnia species

In this series, all of the *Hypogymnia* species were included as a group.

Table XXVII-3. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Si ppm content of *Hypogymnia species* per year.

Si ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	264.42	32.8639	179.9358	348.8947
2005	Non-Wilderness	537.33	97.8674	116.2390	958.4176
2005	Wilderness	309.10	46.4001	202.1028	416.1005

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Si ppm

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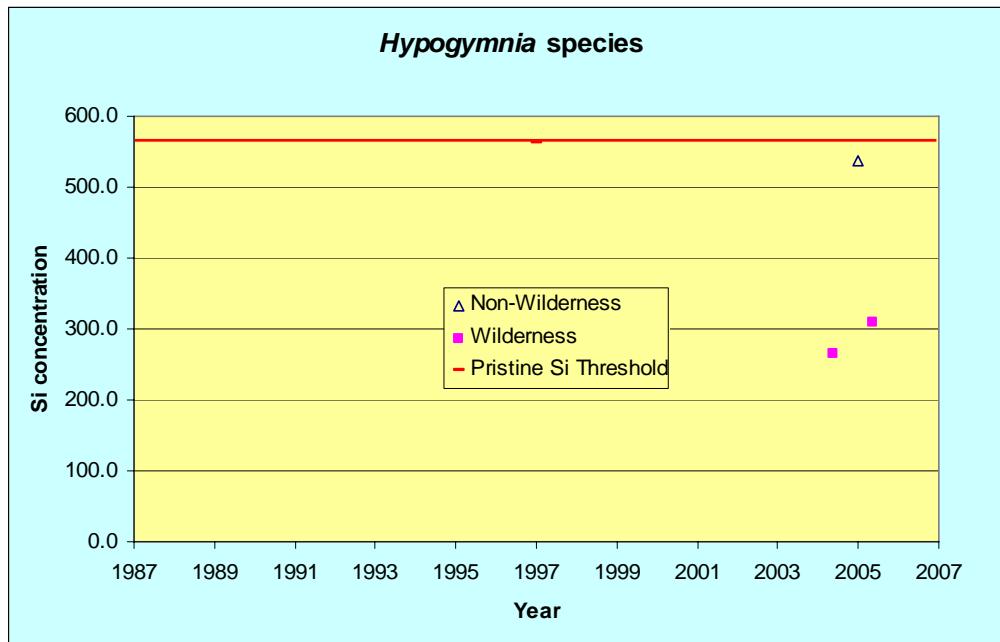


Figure XXVII-9. Wilderness and Non-Wilderness yearly means of Si ppm in *Hypogymnia* species per year.

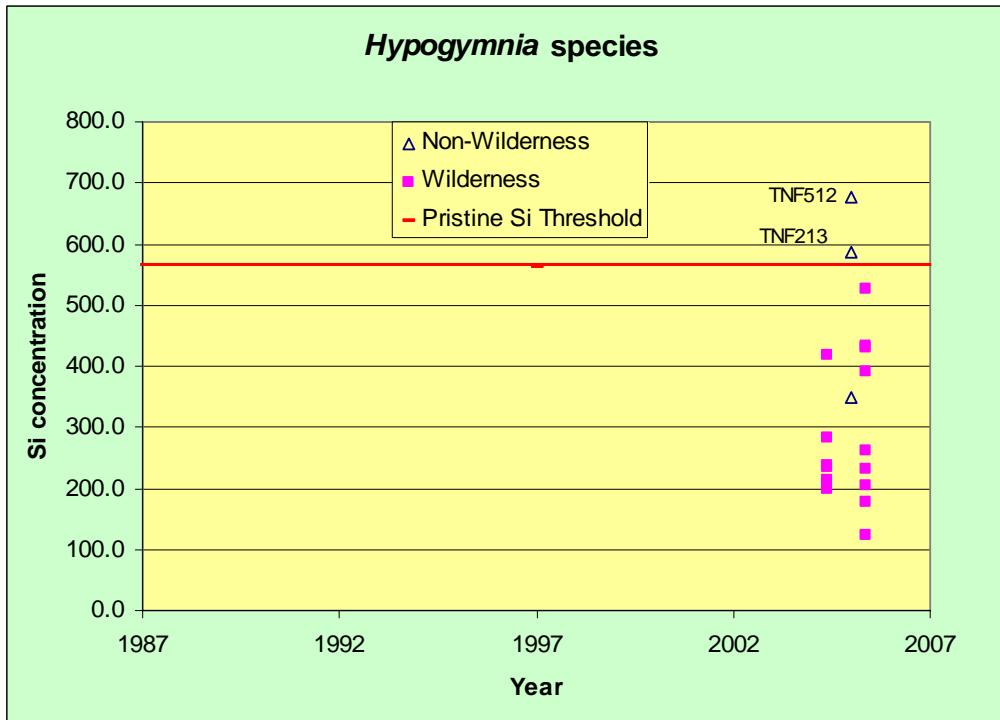


Figure XXVII-10. Wilderness and Non-Wilderness plot means of Si ppm in *Hypogymnia* species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Si ppm

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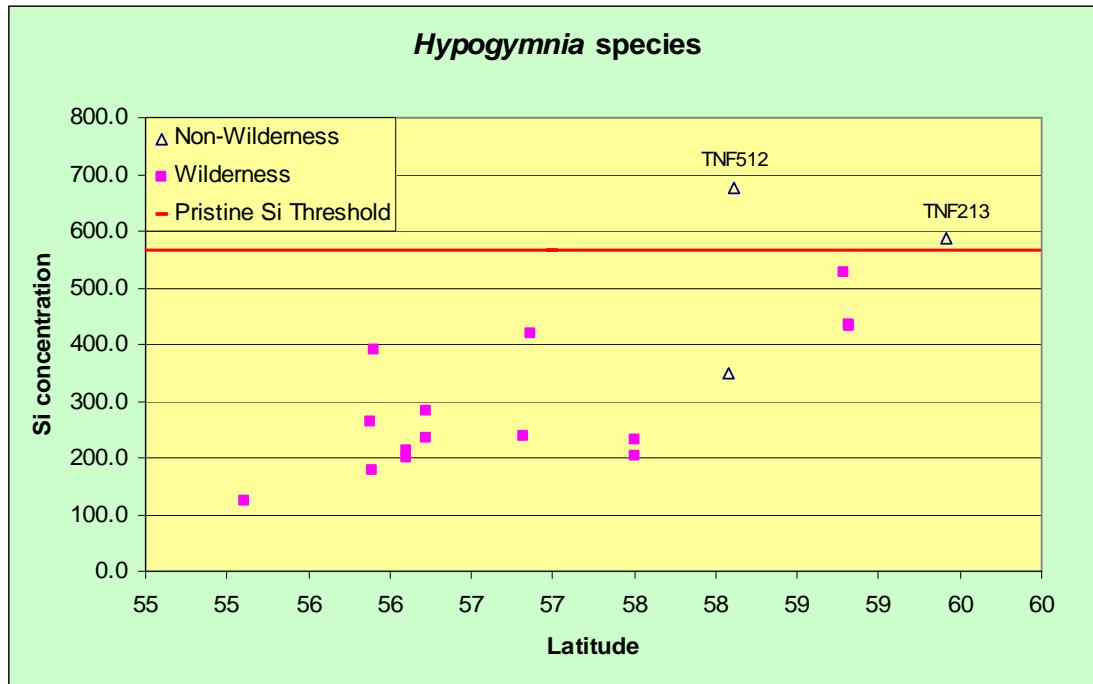


Figure XXVII-11. Wilderness and Non-Wilderness plot means of Si ppm in *Hypogymnia* species vs. plot Latitude.

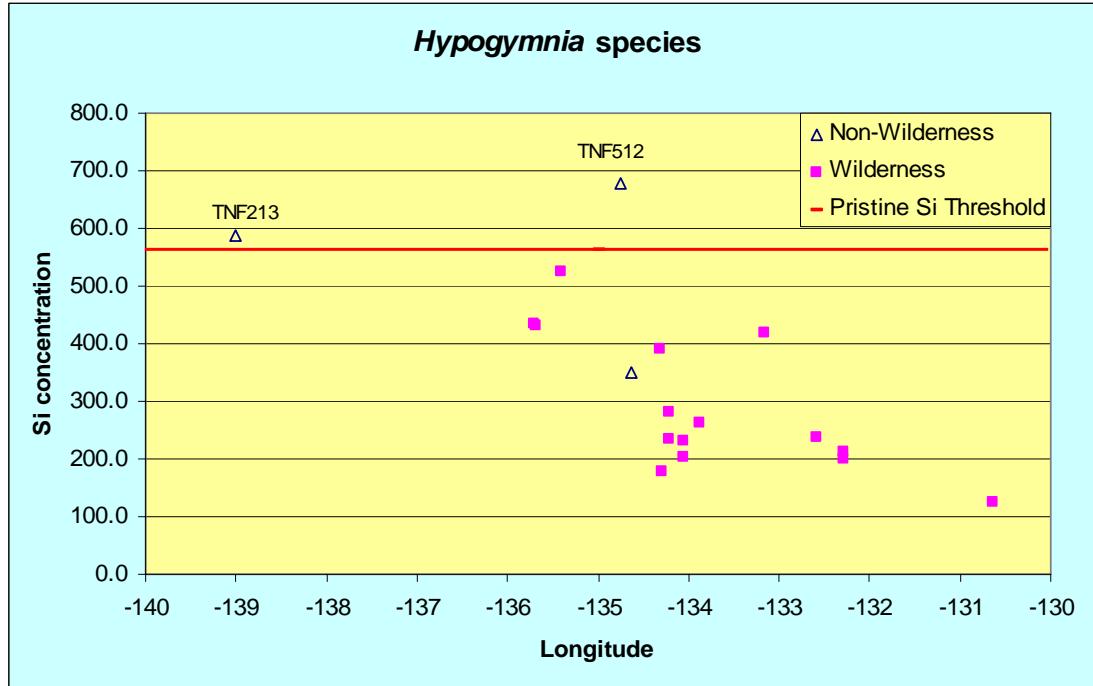


Figure XXVII-12. Wilderness and Non-Wilderness plot means of Si ppm in *Hypogymnia* species vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Si ppm

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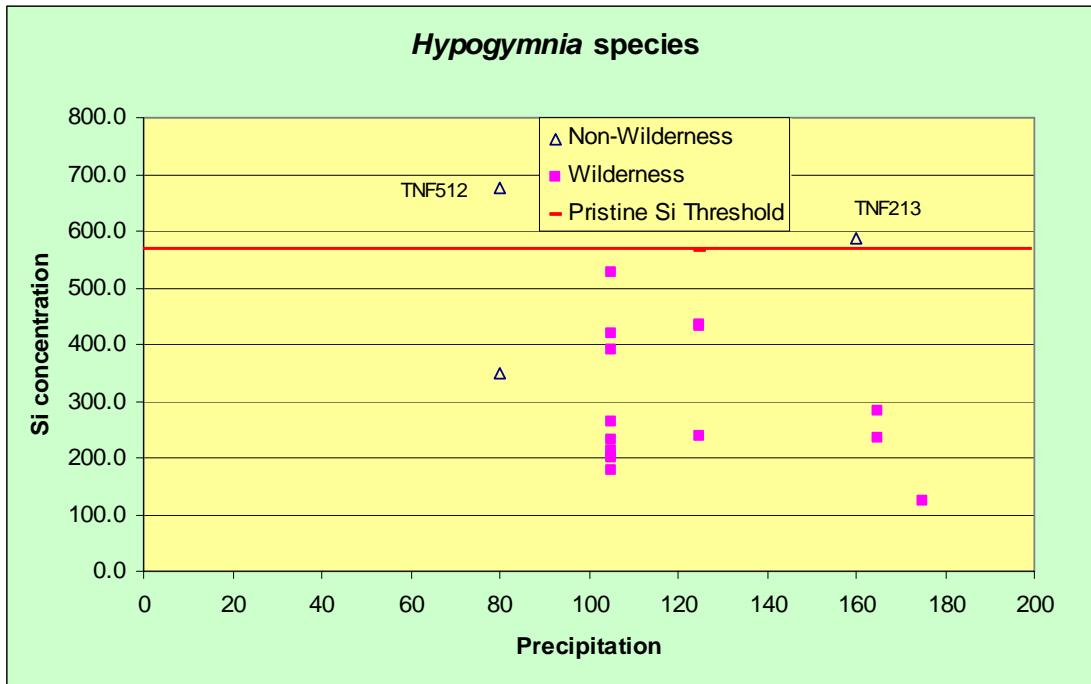


Figure XXVII-13. Wilderness and Non-Wilderness plot means of Si ppm in *Hypogymnia* species vs. plot Precipitation.

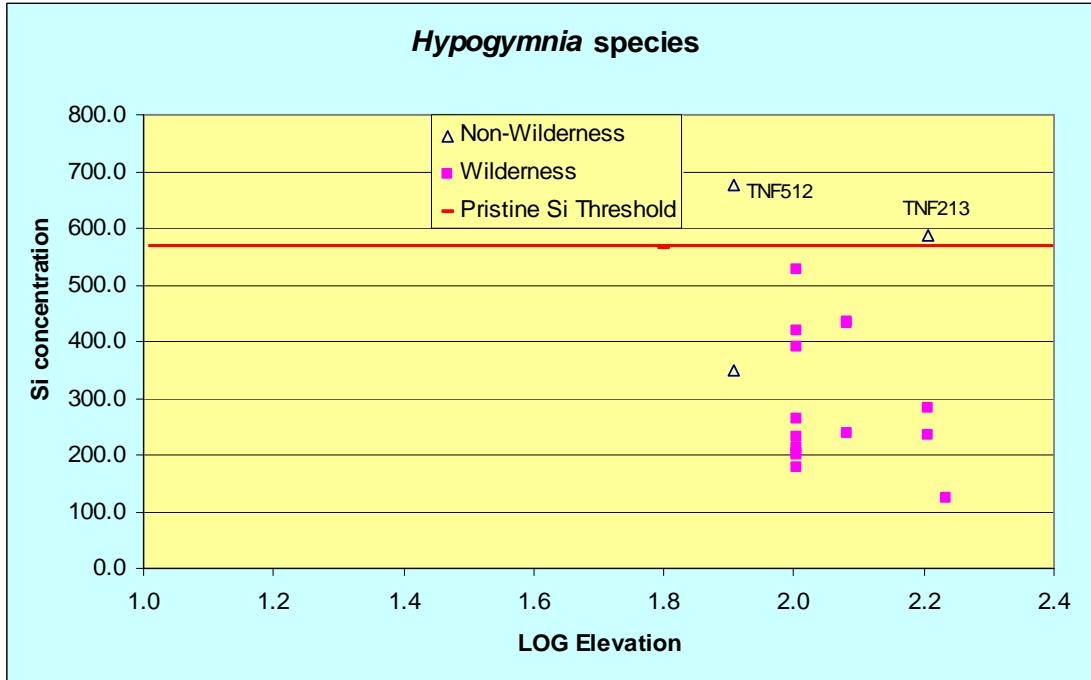


Figure XXVII-14. Wilderness and Non-Wilderness plot means of Si ppm in *Hypogymnia* species vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Si ppm

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Lobaria oregana

Table XXVII-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Si ppm content of *Lobaria oregana* per year.

Si ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	332.41	96.8681	95.3837	569.4390
2005	Non-Wilderness	567.28	NA	NA	NA
2005	Wilderness	117.7676	60.9940	NA	311.8777

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Si ppm

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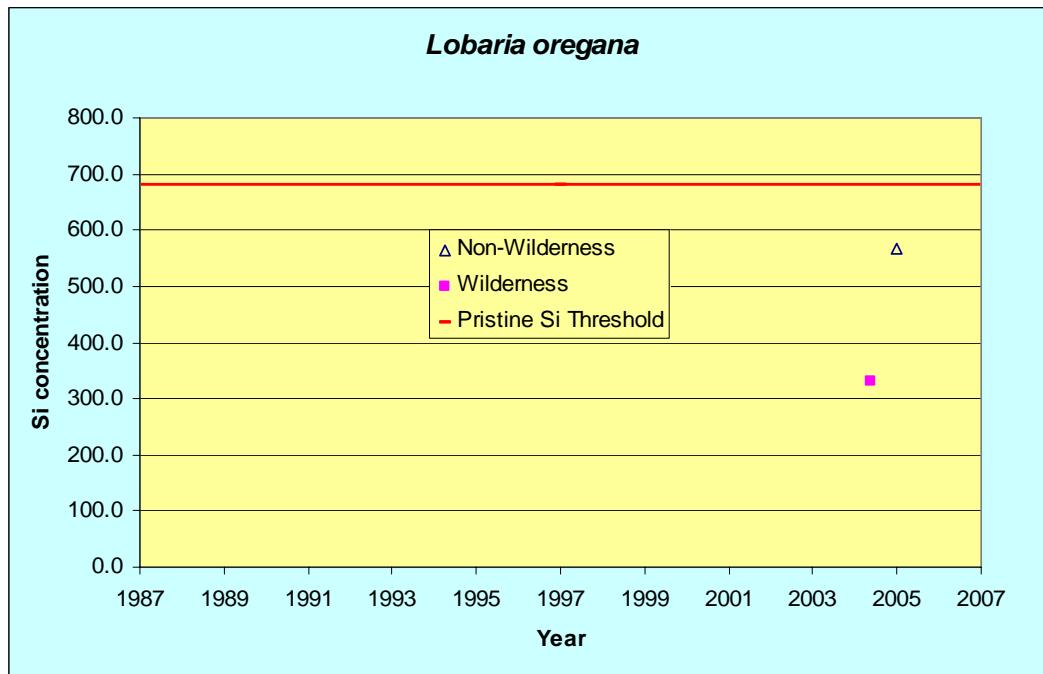


Figure XXVII-15. Wilderness and Non-Wilderness yearly means of Si ppm in *Lobaria oregana* per year.

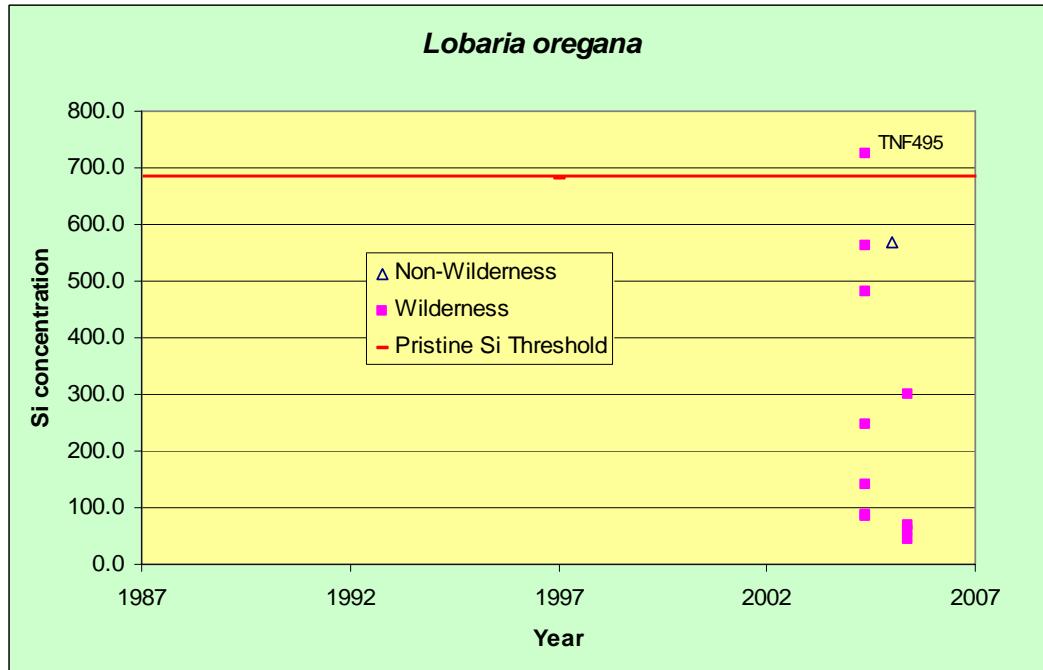


Figure XXVII-16. Wilderness and Non-Wilderness plot means of Si ppm in *Lobaria oregana* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Si ppm

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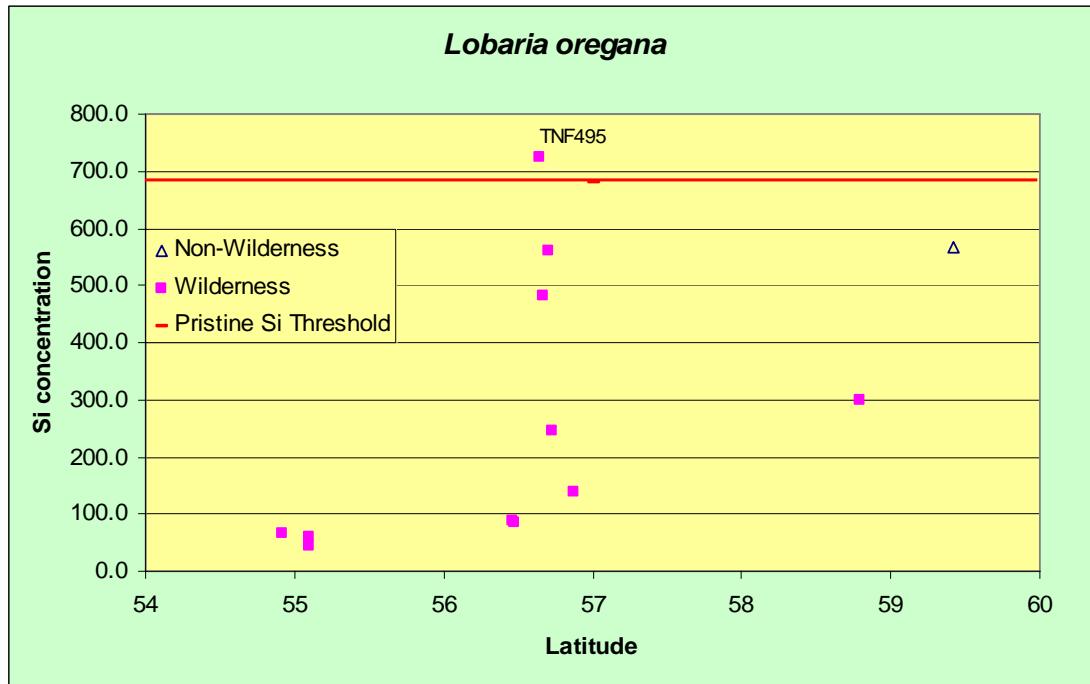


Figure XXVII-17. Wilderness and Non-Wilderness plot means of Si ppm in *Lobaria oregana* vs. plot Latitude.

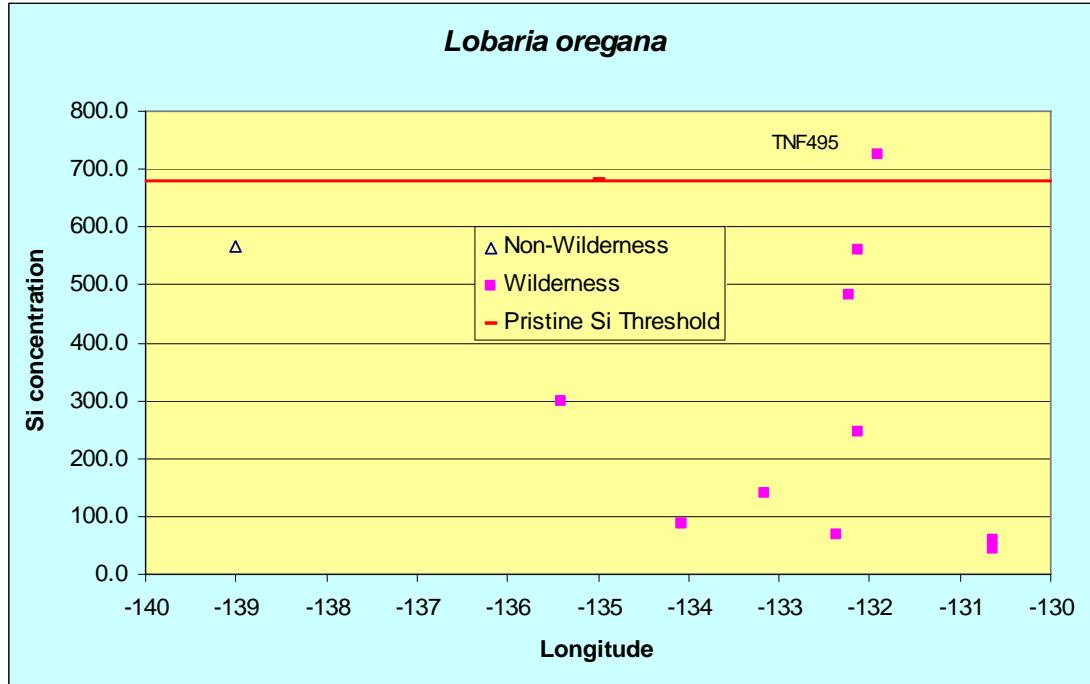


Figure XXVII-18. Wilderness and Non-Wilderness plot means of Si ppm in *Lobaria oregana* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Si ppm

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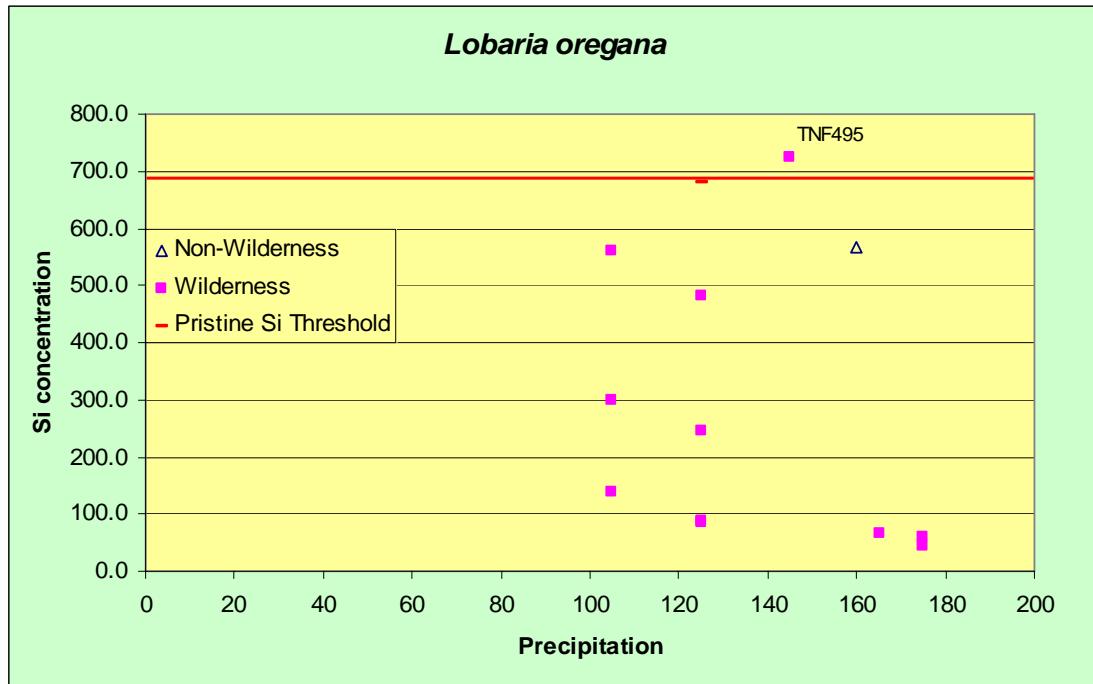


Figure XXVII-19. Wilderness and Non-Wilderness plot means of Si ppm in *Lobaria oregana* vs. plot Precipitation.

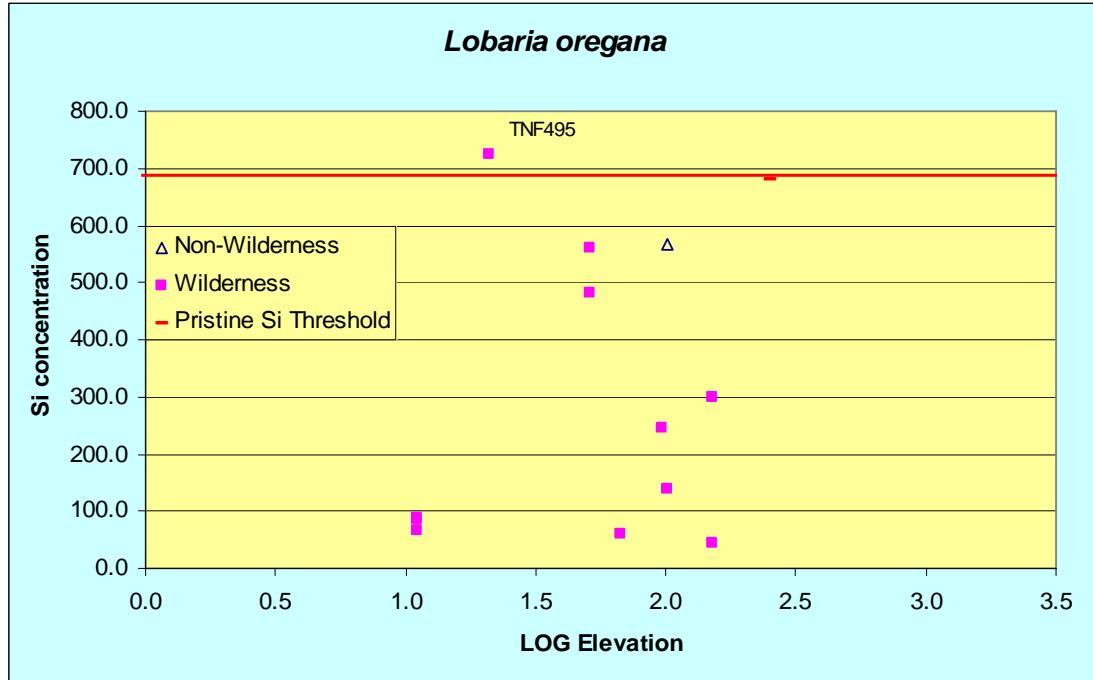


Figure XXVII-20. Wilderness and Non-Wilderness plot means of Si ppm in *Lobaria oregana* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Si ppm

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Platismatia glauca

Table XXVII-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Si ppm content of *Platismatia glauca* per year.

Si ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	389.73	63.0716	247.0559	532.4114
2005	Non-Wilderness	524.88	22.3015	474.4295	575.3285
2005	Wilderness	352.75	58.0100	215.5789	489.9224

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA Si ppm

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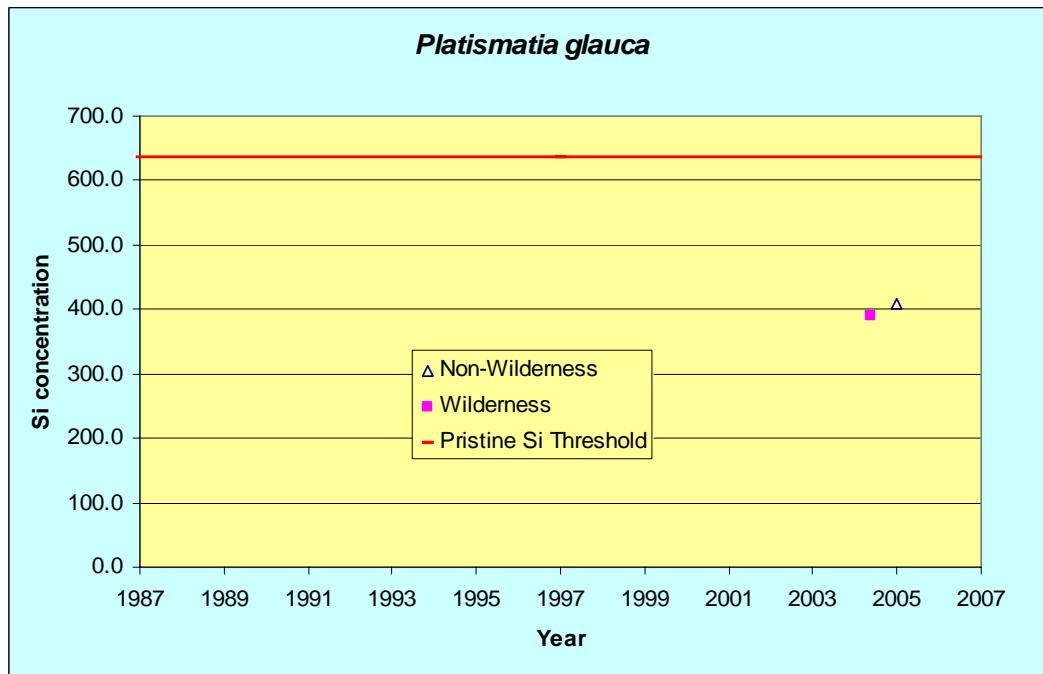


Figure XXVII-21. Wilderness and Non-Wilderness yearly means of Si ppm in *Platismatia glauca* per year.

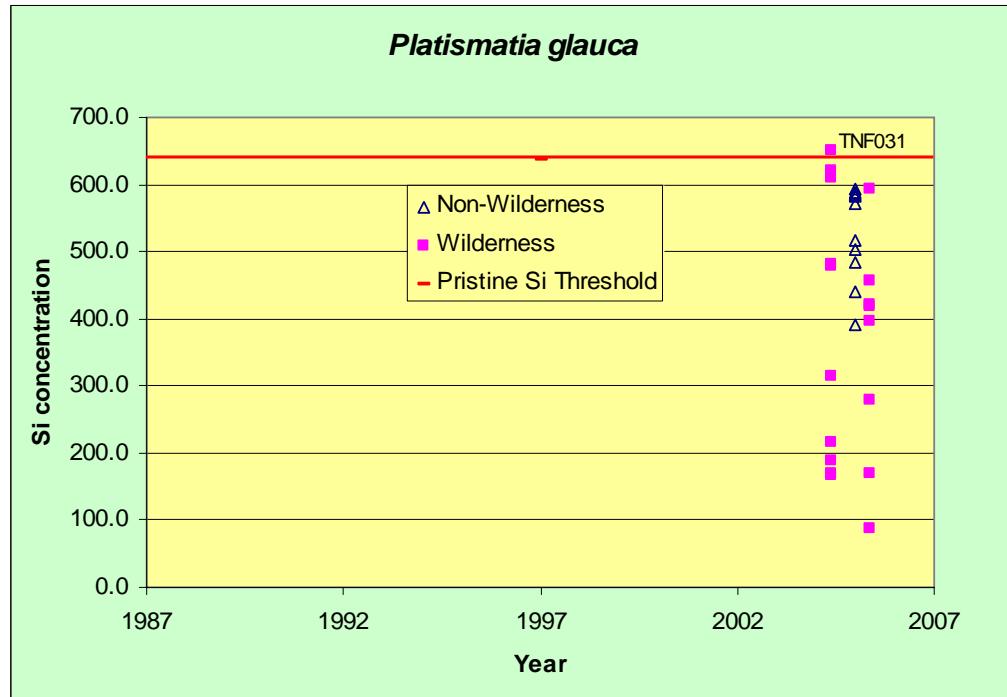


Figure XXVII-22. Wilderness and Non-Wilderness plot means of Si ppm in *Platismatia glauca* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Si ppm

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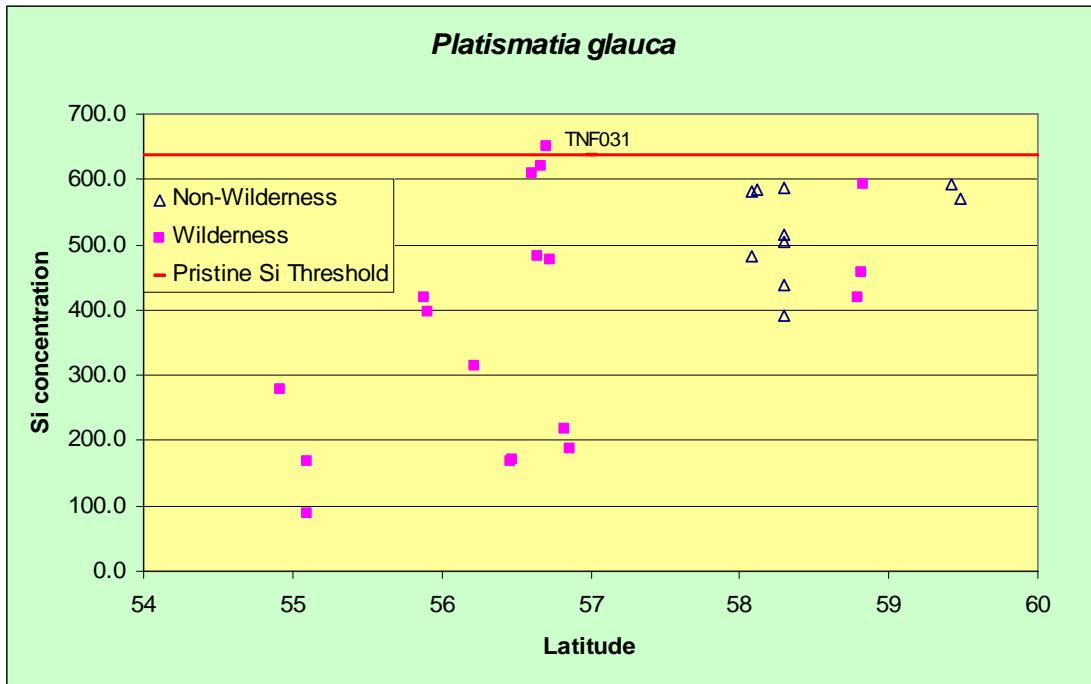


Figure XXVII-23. Wilderness and Non-Wilderness plot means of Si ppm in *Platismatia glauca* vs. plot Latitude.

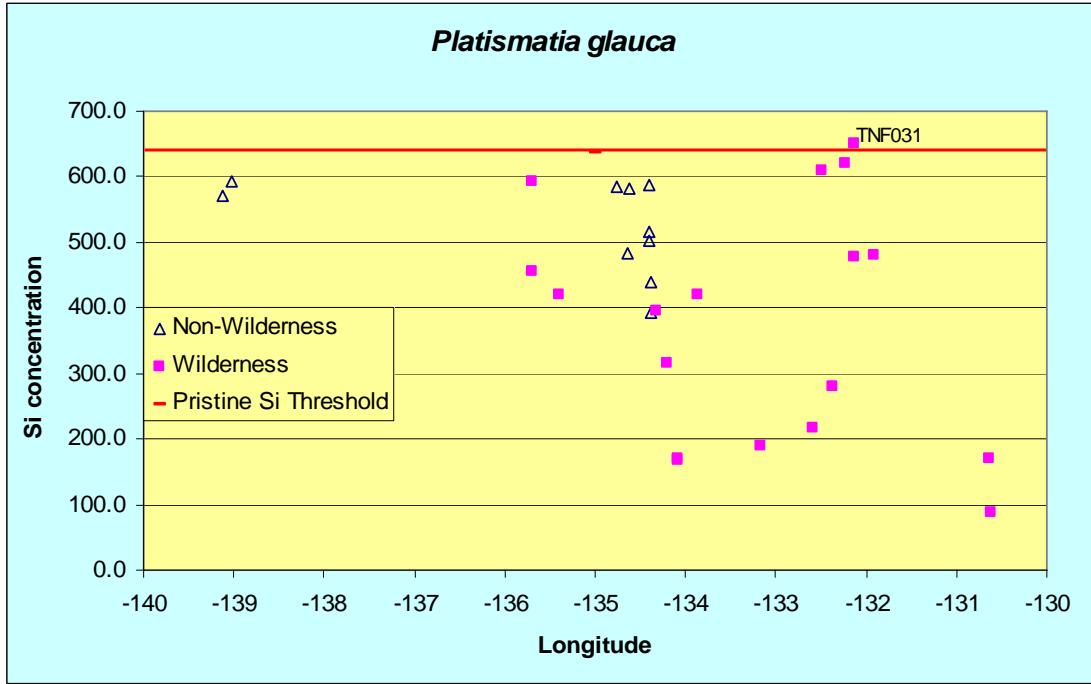


Figure XXVII-24. Wilderness and Non-Wilderness plot means of Si ppm in *Platismatia glauca* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Si ppm

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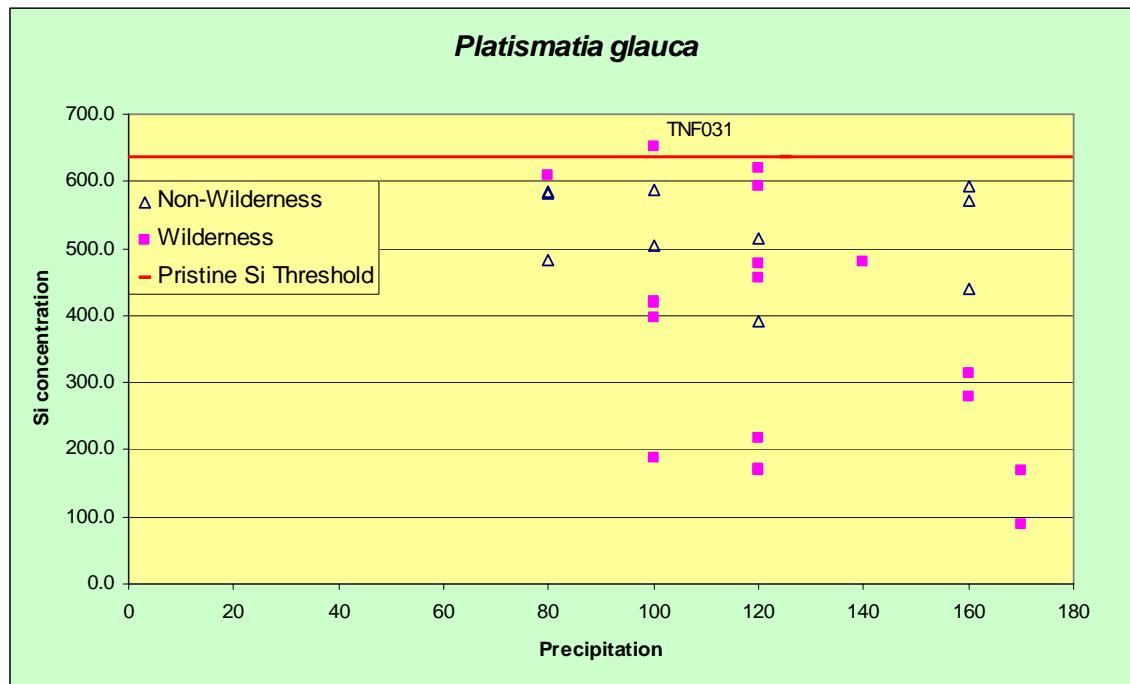


Figure XXVII-25. Wilderness and Non-Wilderness plot means of Si ppm in *Platismatia glauca* vs. plot Precipitation.

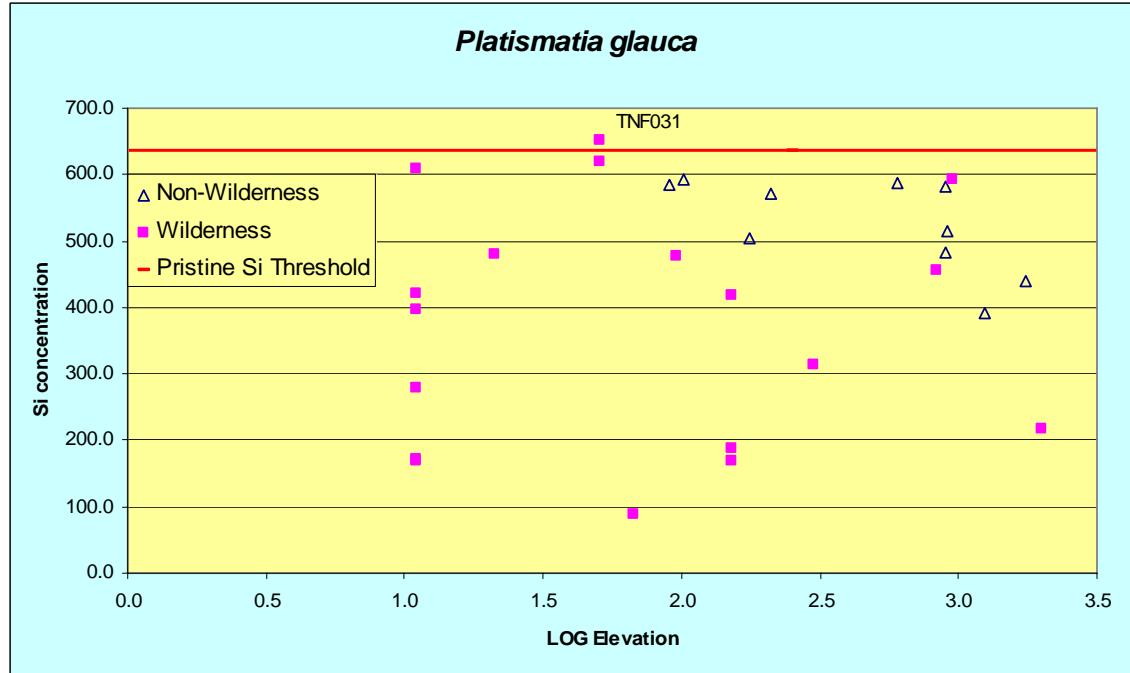


Figure XXVII-26. Wilderness and Non-Wilderness plot means of Si ppm in *Platismatia glauca* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Sr ppm

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XXVIII. SUMMARY OF Sr PPM DATA ANALYSIS

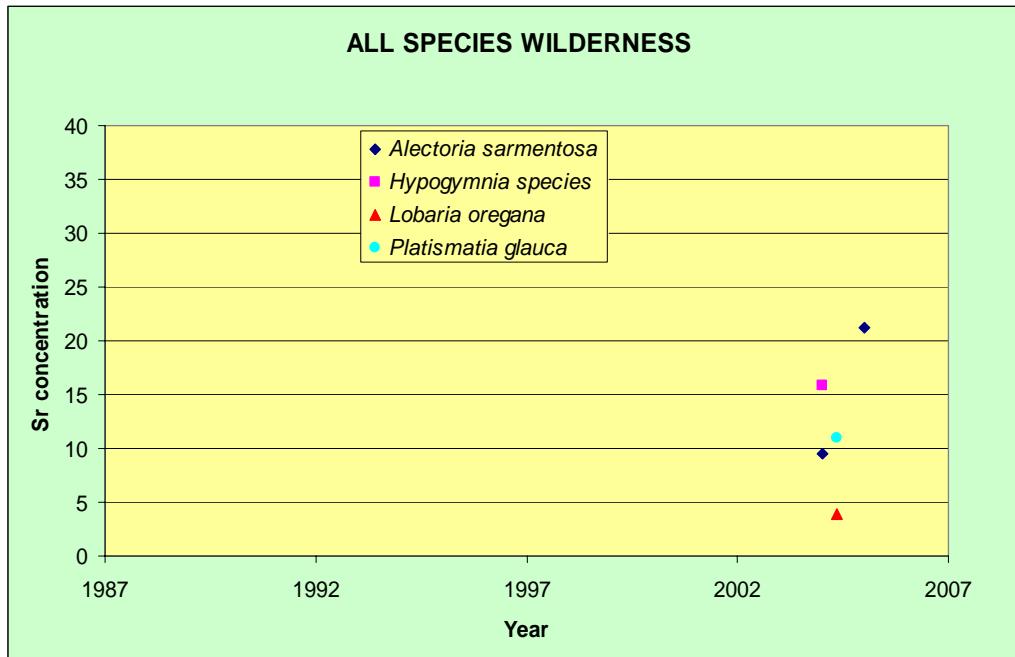


Figure XXVIII-27. Wilderness plot means of Sr ppm in All Species per year.

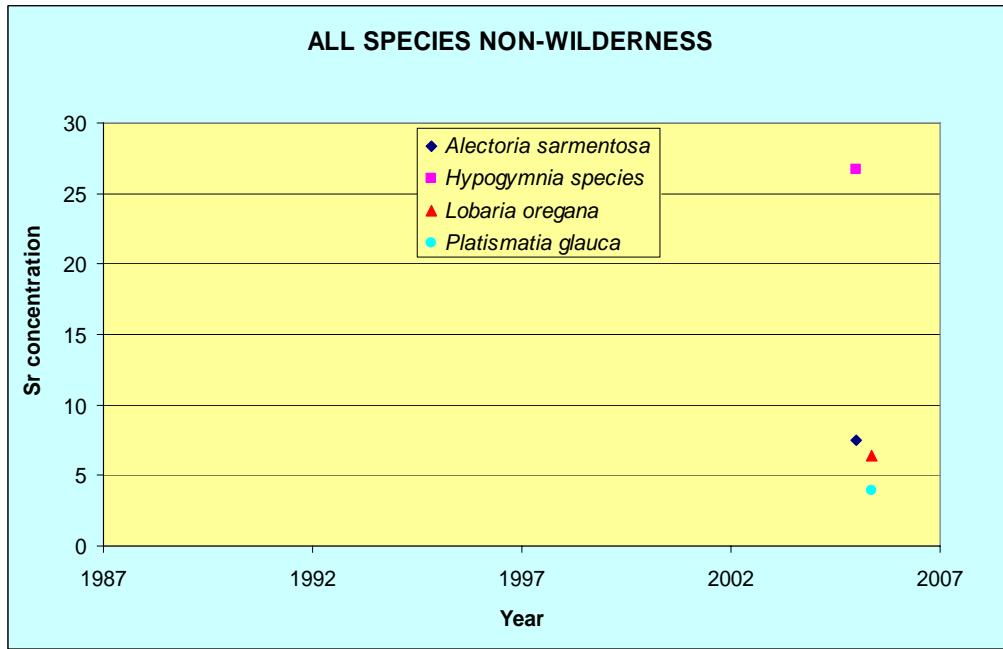


Figure XXVIII-28. Non-Wilderness plot means of Sr ppm in All Species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Sr ppm

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Alectoria sarmentosa

Summary Statistics:

Table XXVIII-2. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Sr ppm content of *Alectoria sarmentosa* per year.

Sr ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	9.46	1.3757	6.6153	12.3071
2005	Non-Wilderness	7.50	1.7813	2.9224	12.0803
2005	Wilderness	21.26	2.8934	14.7117	27.8023

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Sr ppm

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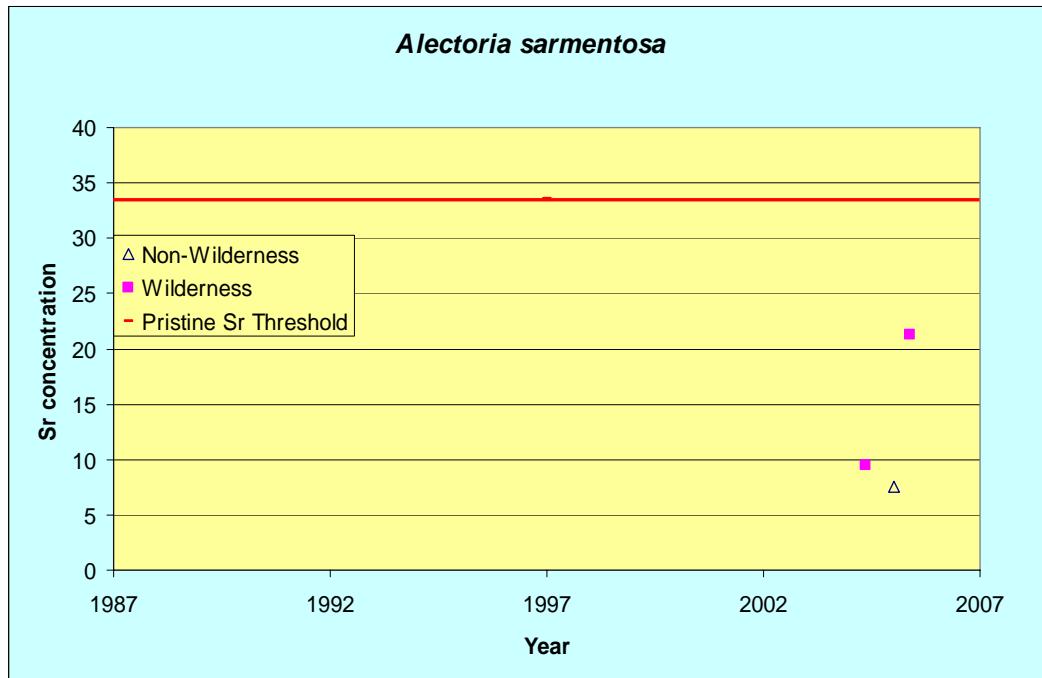


Figure XXVIII-3. Wilderness and Non-Wilderness yearly means of Sr ppm in *Alectoria sarmentosa* per year.

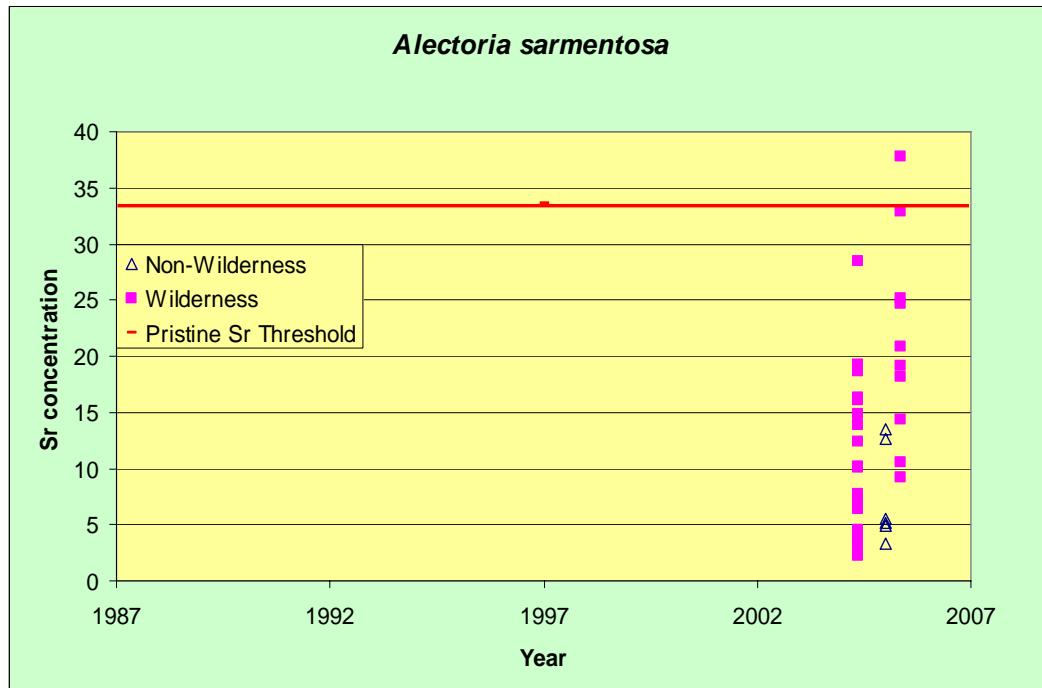


Figure XXVIII-4. Wilderness and Non-Wilderness plot means of Sr ppm in *Alectoria sarmentosa* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Sr ppm

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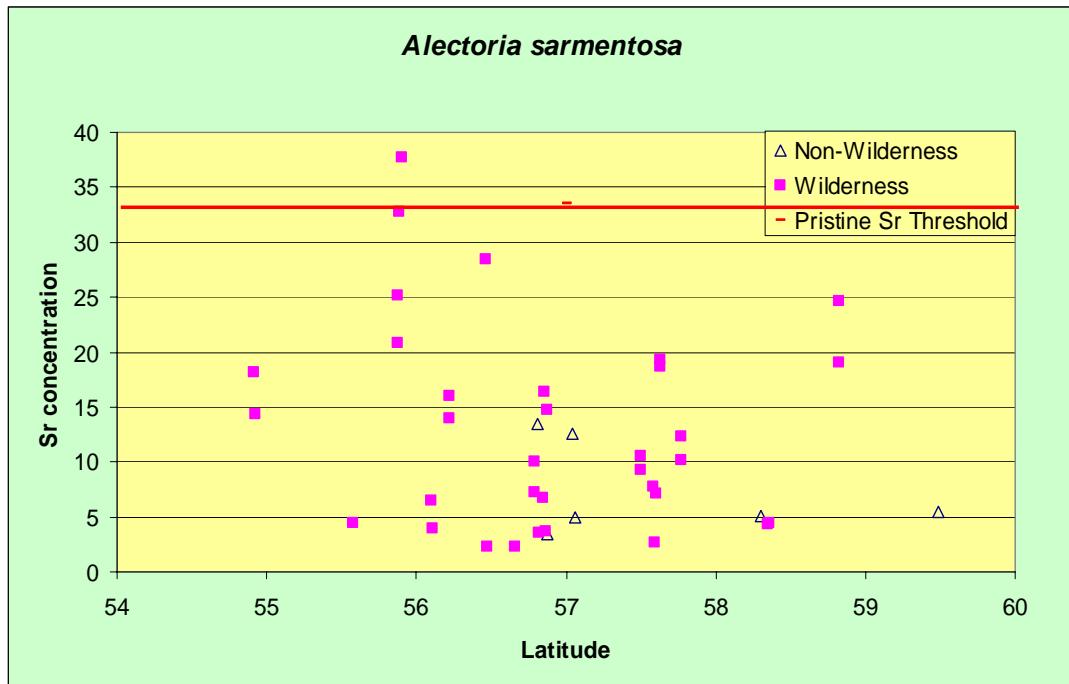


Figure XXVIII-5. Wilderness and Non-Wilderness plot means of Sr ppm in *Alectoria sarmentosa* vs. plot Latitude.

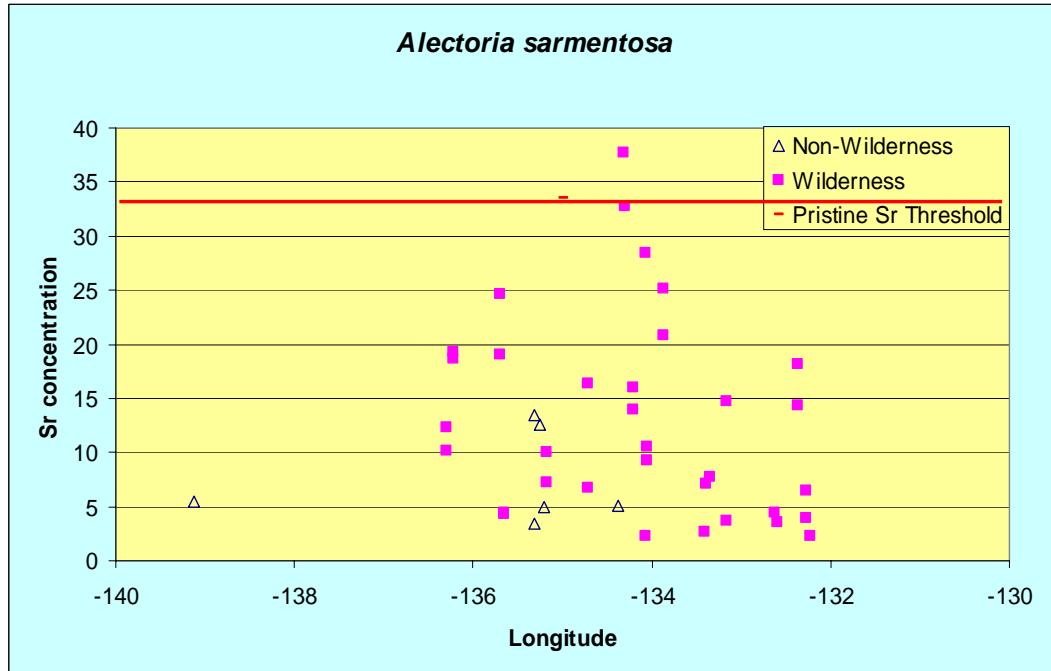


Figure XXVIII-6. Wilderness and Non-Wilderness plot means of Sr ppm in *Alectoria sarmentosa* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Sr ppm

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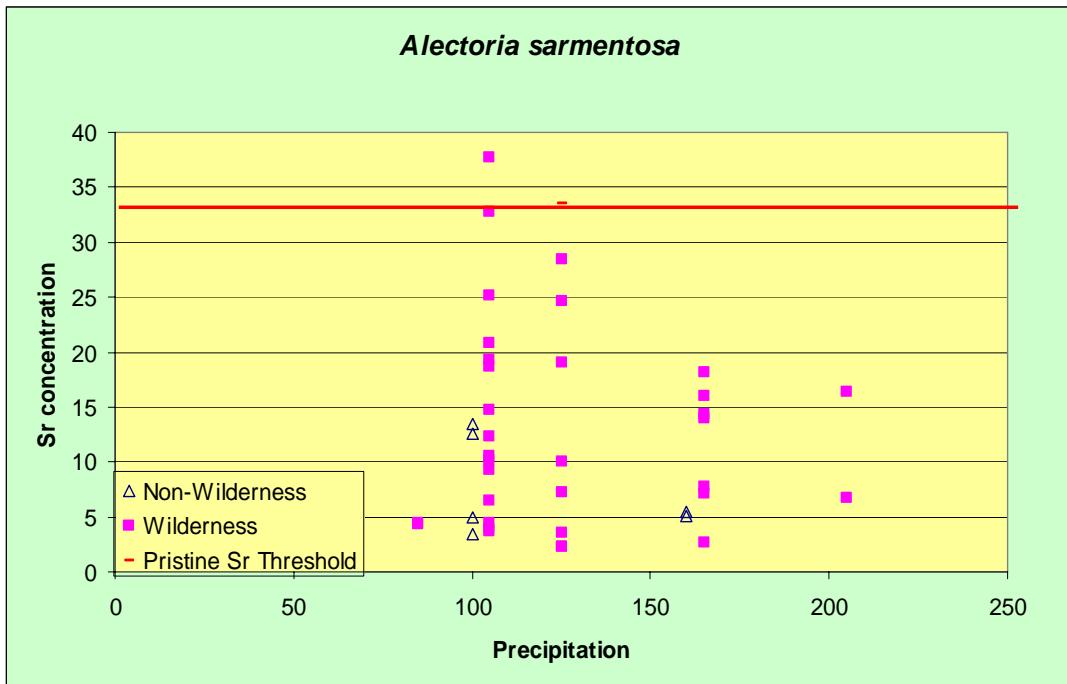


Figure XXVIII-7. Wilderness and Non-Wilderness plot means of Sr ppm in *Alectoria sarmentosa* vs. plot Precipitation.

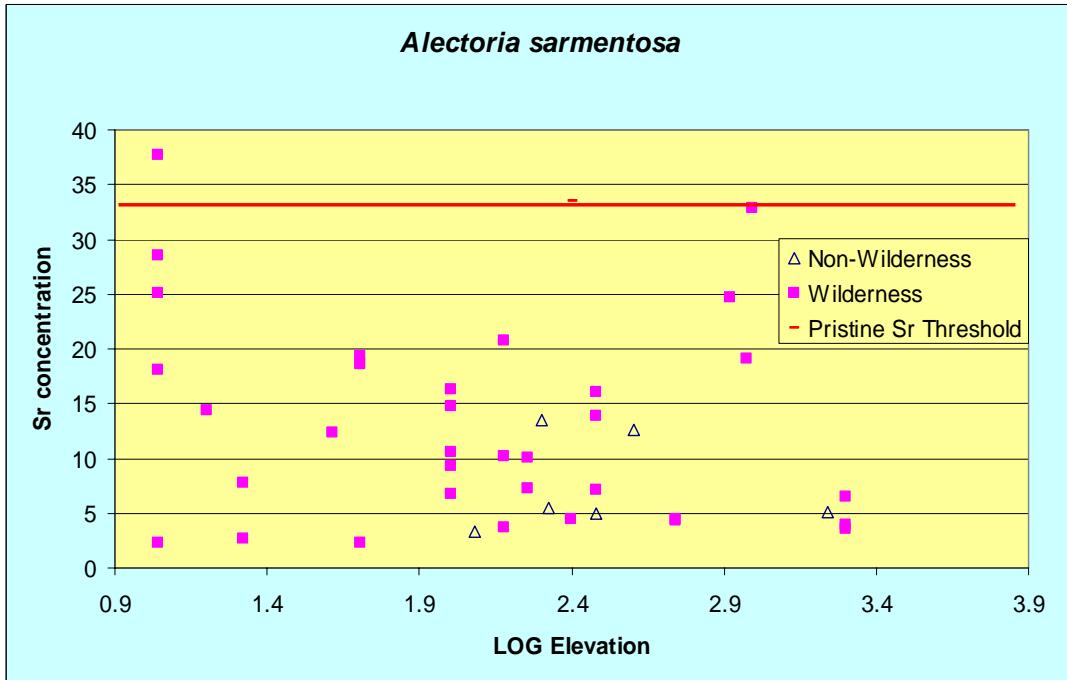


Figure XXVIII-8. Wilderness and Non-Wilderness plot means of Sr ppm in *Alectoria sarmentosa* vs. plot Log-Elevation.

ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Sr ppm

Hypogymnia species

In this series, all of the *Hypogymnia* species were included as a group.

Table XXVIII-3. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Sr ppm content of *Hypogymnia* species per year.

Sr ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	15.90	3.3499	7.2877	24.5099
2005	Non-Wilderness	26.71	9.6389	14.7653	68.1803
2005	Wilderness	37.38	5.7698	24.0721	50.6823

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Sr ppm

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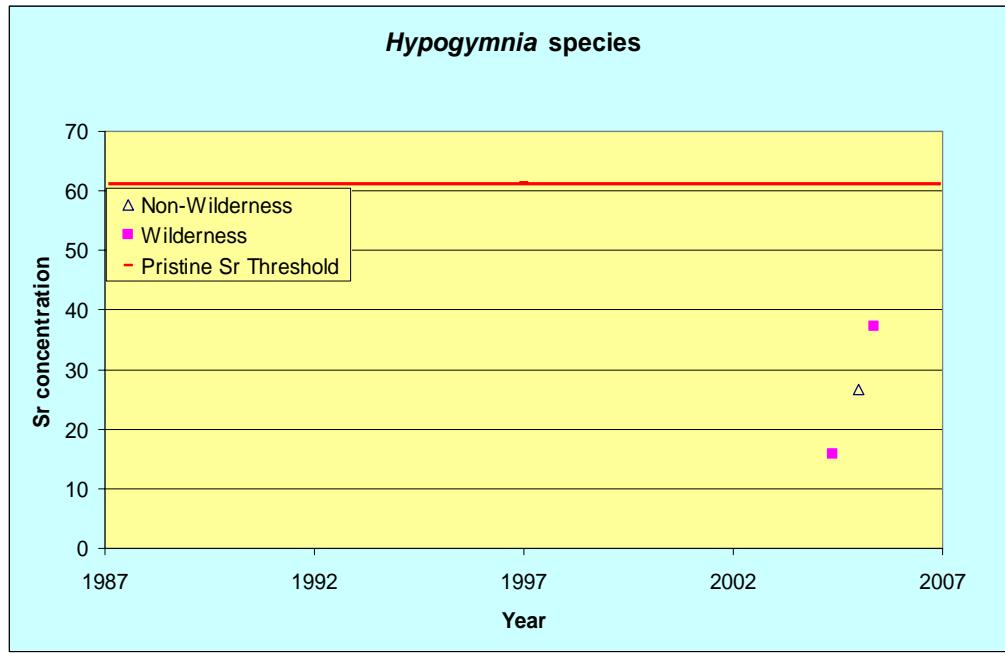


Figure XXVIII-9. Wilderness and Non-Wilderness yearly means of Sr ppm in *Hypogymnia* species per year.

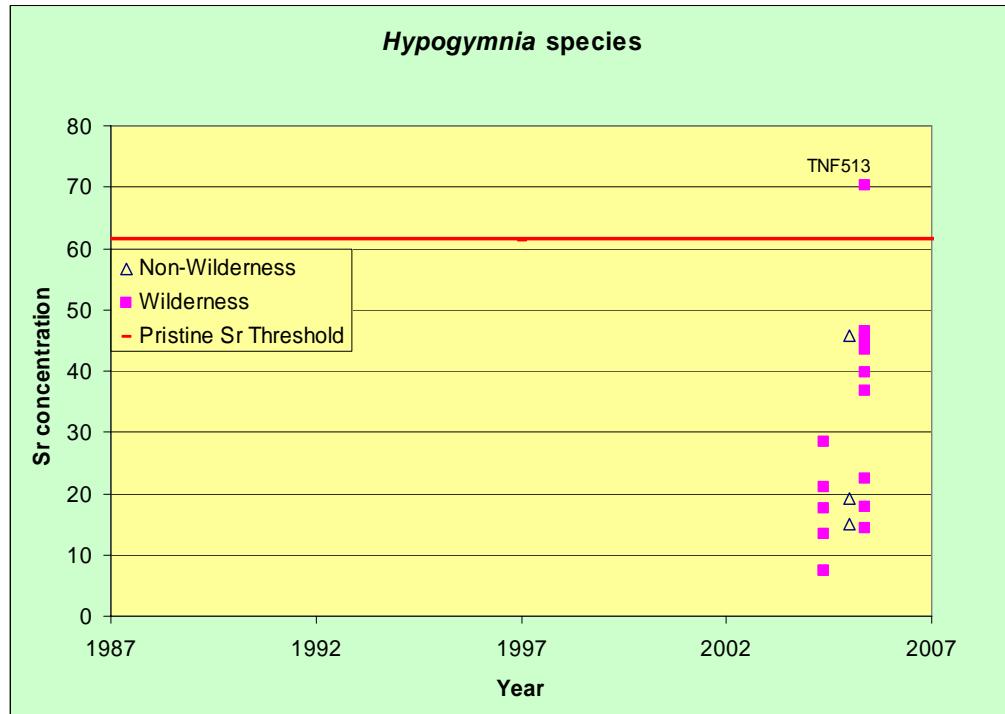


Figure XXVIII-10. Wilderness and Non-Wilderness plot means of Sr ppm in *Hypogymnia* species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Sr ppm

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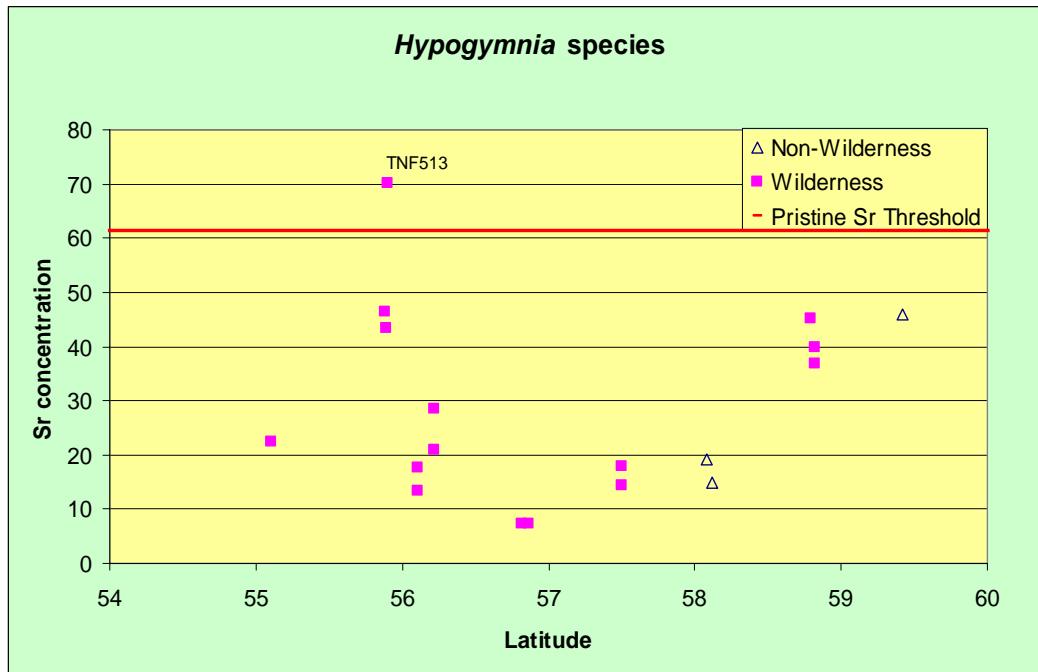


Figure XXVIII-11. Wilderness and Non-Wilderness plot means of Sr ppm in *Hypogymnia* species vs. plot Latitude.

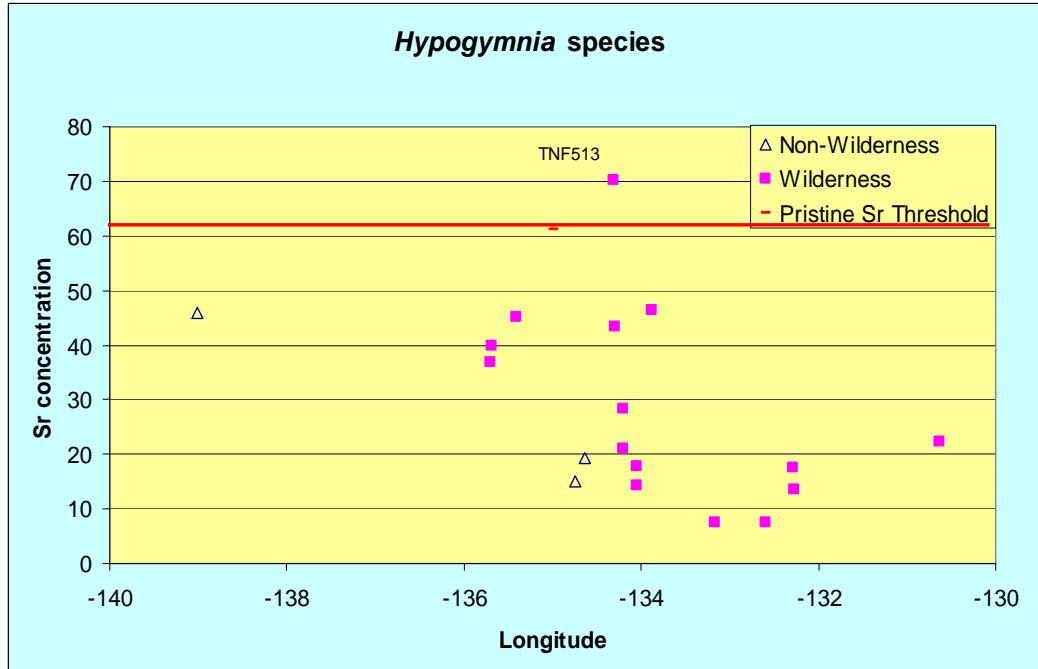


Figure XXVIII-12. Wilderness and Non-Wilderness plot means of Sr ppm in *Hypogymnia* species vs. plot Longitude.

ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Sr ppm

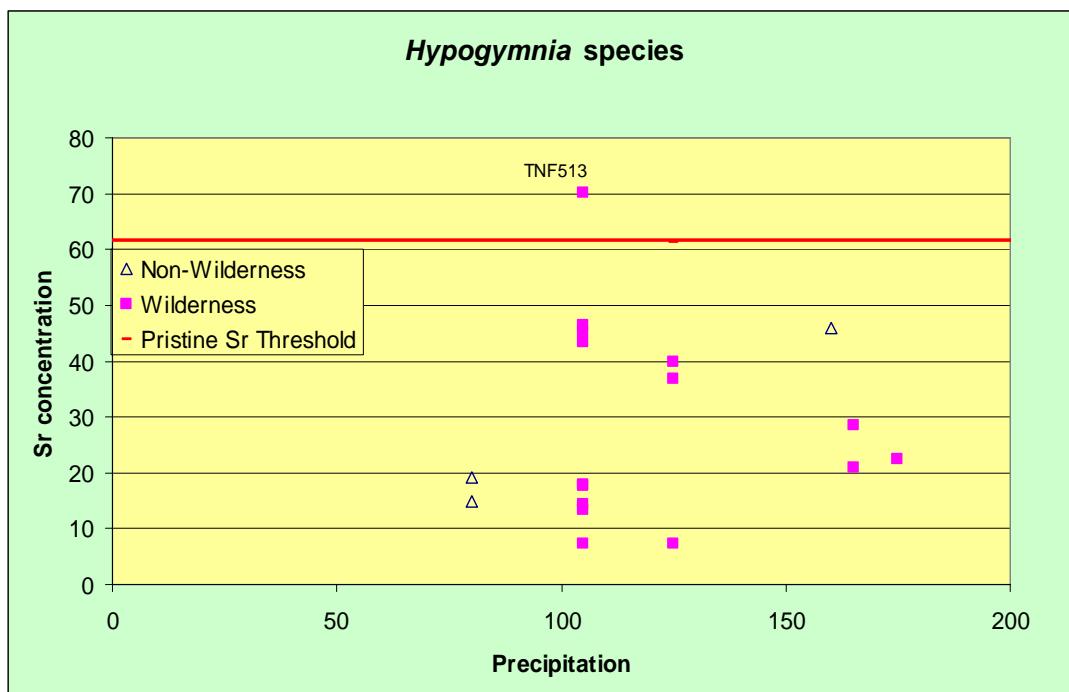


Figure XXVIII-13. Wilderness and Non-Wilderness plot means of Sr ppm in *Hypogymnia* species vs. plot Precipitation.

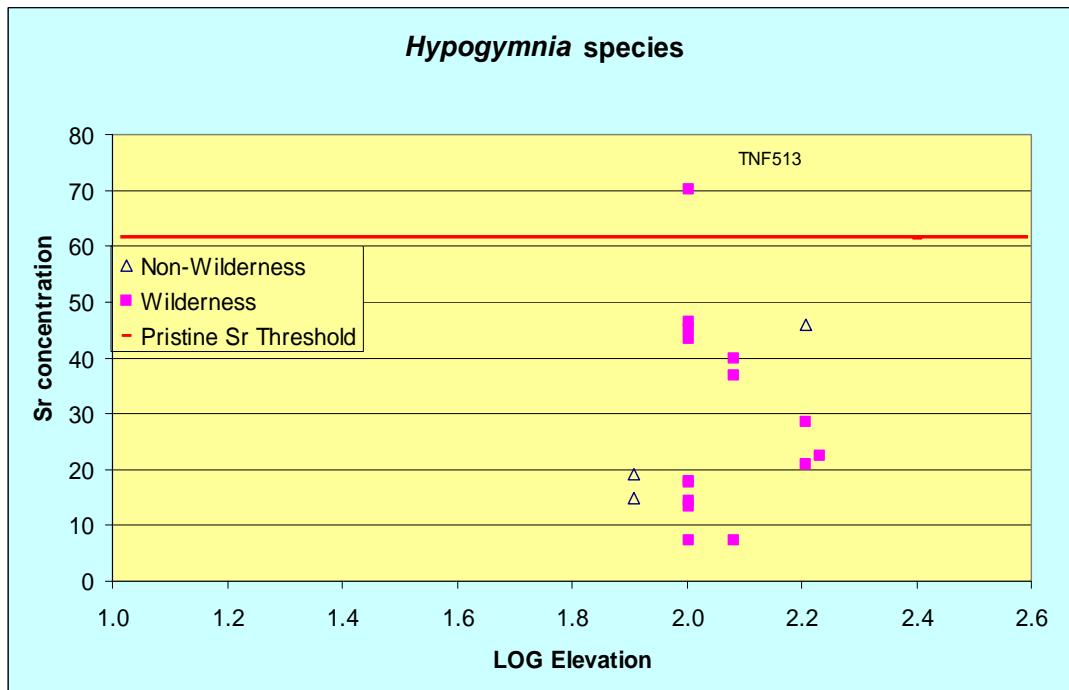


Figure XXVIII-14. Wilderness and Non-Wilderness plot means of Sr ppm in *Hypogymnia* species vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Sr ppm

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Lobaria oregana

Table XXVIII-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Sr ppm content of *Lobaria oregana* per year.

Sr ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	3.93	0.5206	2.6519	5.1995
2005	Non-Wilderness	6.37	NA	NA	NA
2005	Wilderness	3.1641	1.2125	-0.6946	7.0229

ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Sr ppm

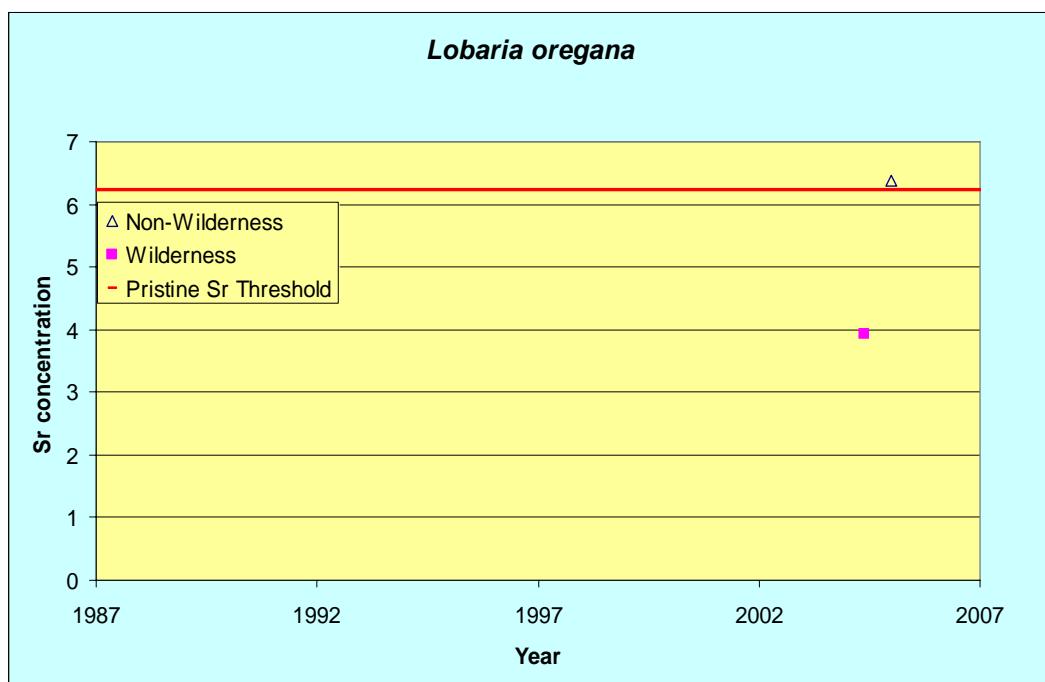


Figure XXVIII-15. Wilderness and Non-Wilderness yearly means of Sr ppm in *Lobaria oregana* per year.

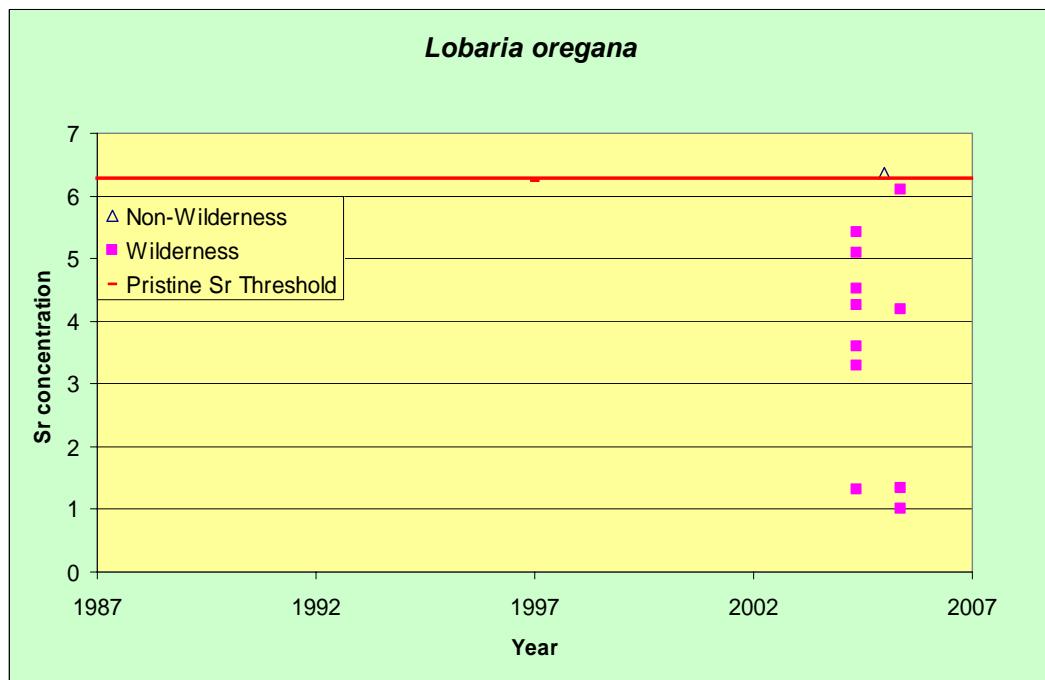


Figure XXVIII-16. Wilderness and Non-Wilderness plot means of Sr ppm in *Lobaria oregana* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Sr ppm

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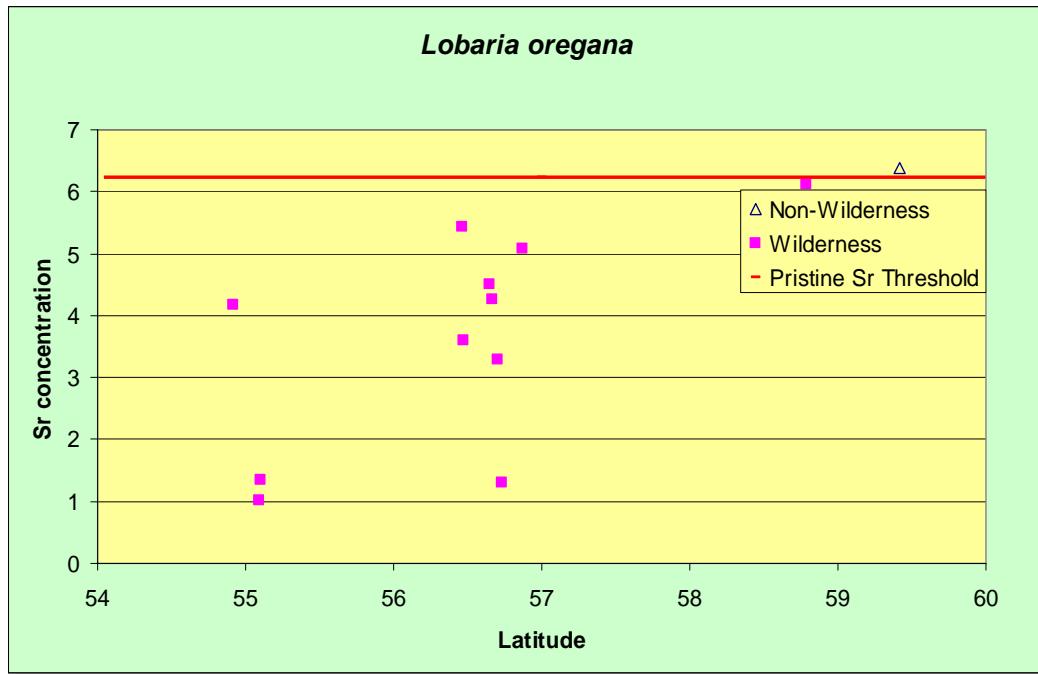


Figure XXVIII-17. Wilderness and Non-Wilderness plot means of Sr ppm in *Lobaria oregana* vs. plot Latitude.

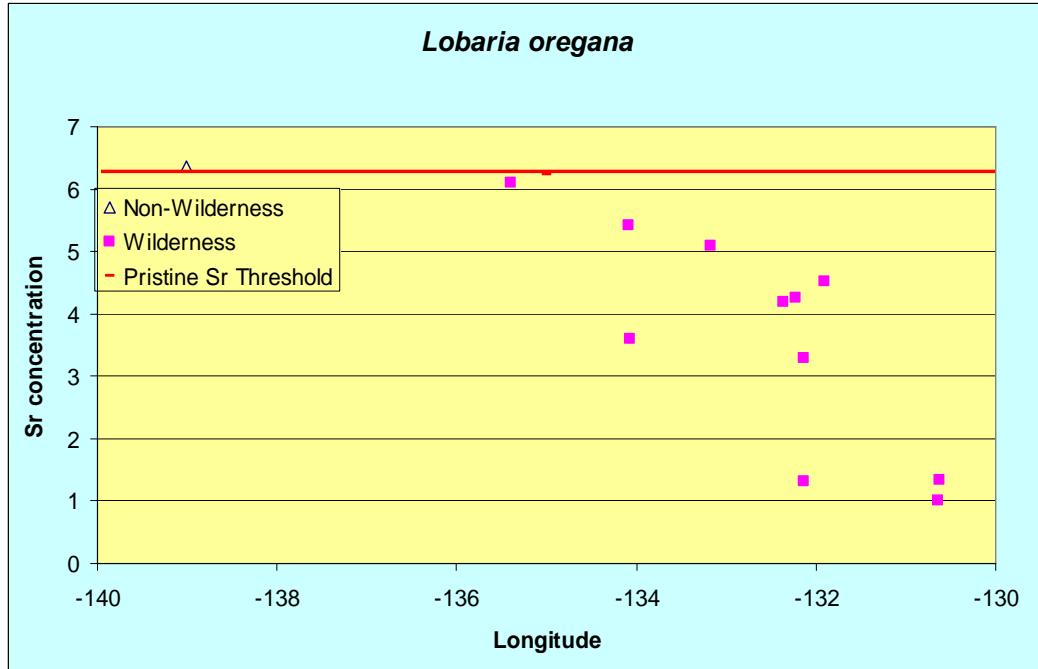


Figure XXVIII-18. Wilderness and Non-Wilderness plot means of Sr ppm in *Lobaria oregana* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Sr ppm

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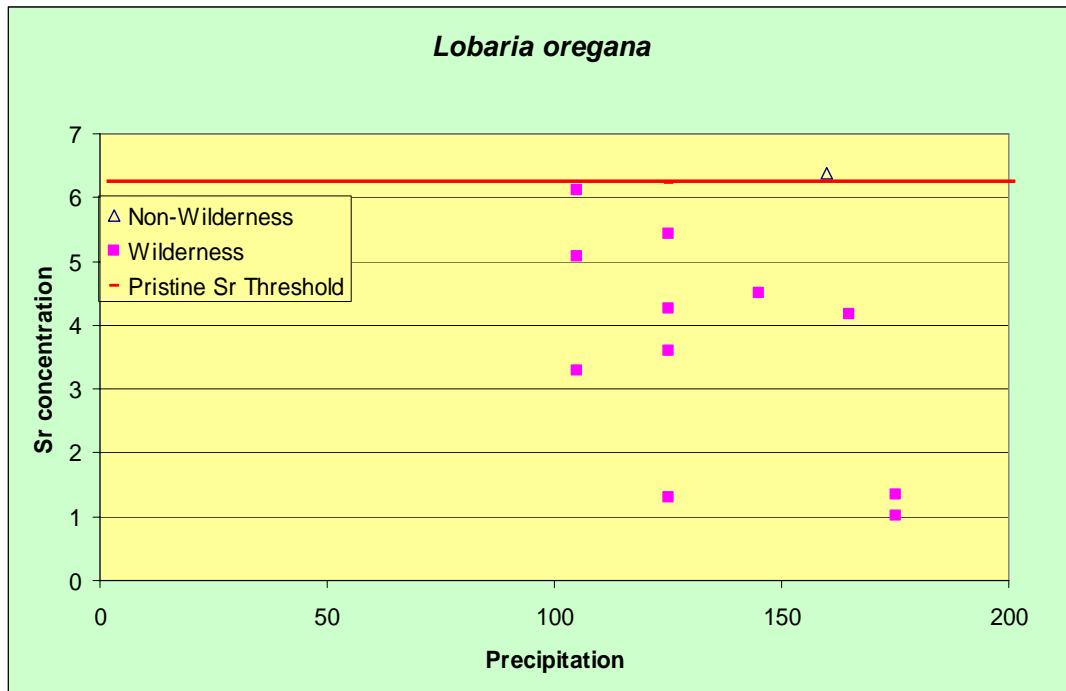


Figure XXVIII-19. Wilderness and Non-Wilderness plot means of Sr ppm in *Lobaria oregana* vs. plot Precipitation.

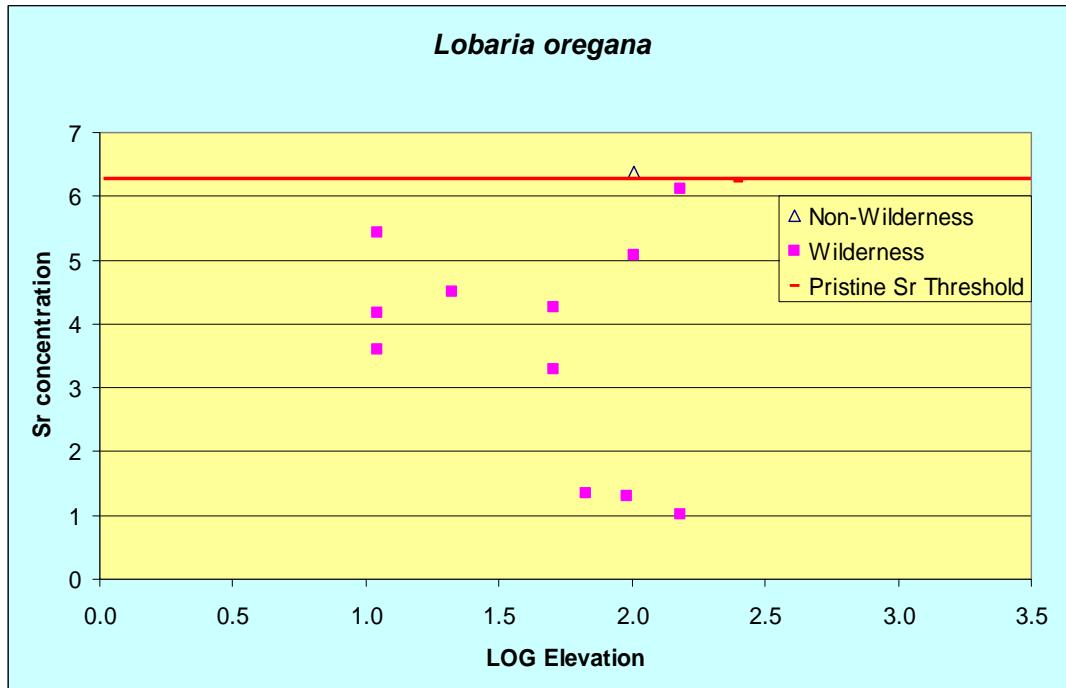


Figure XXVIII-20. Wilderness and Non-Wilderness plot means of Sr ppm in *Lobaria oregana* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Sr ppm

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Platismatia glauca

Table XXVIII-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Sr ppm content of *Platismatia glauca* per year.

Sr ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	10.96	2.5239	5.2512	16.6700
2005	Non-Wilderness	12.36	1.4866	8.9956	15.7215
2005	Wilderness	19.93	2.3339	14.4071	25.4449

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Sr ppm

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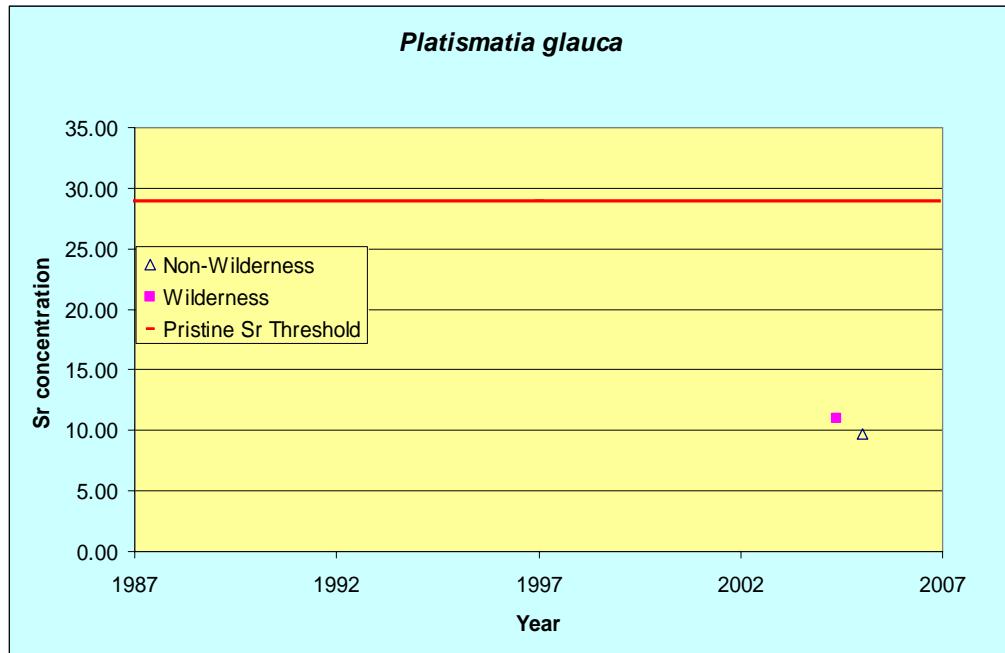


Figure XXVIII-21. Wilderness and Non-Wilderness yearly means of Sr ppm in *Platismatia glauca* per year.

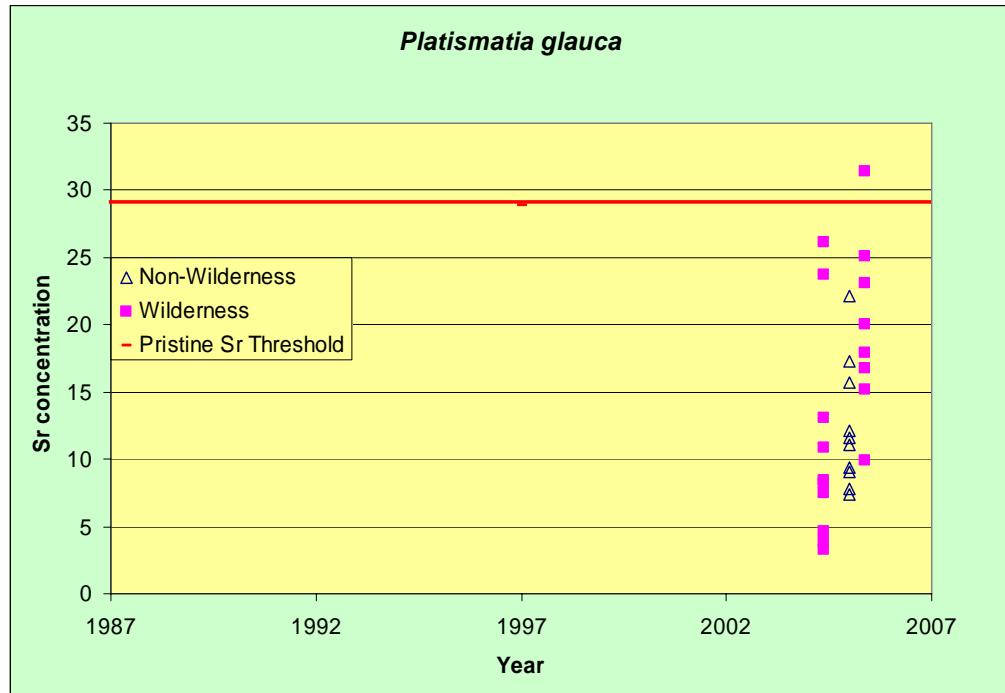


Figure XXVIII-22. Wilderness and Non-Wilderness plot means of Sr ppm in *Platismatia glauca* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Sr ppm

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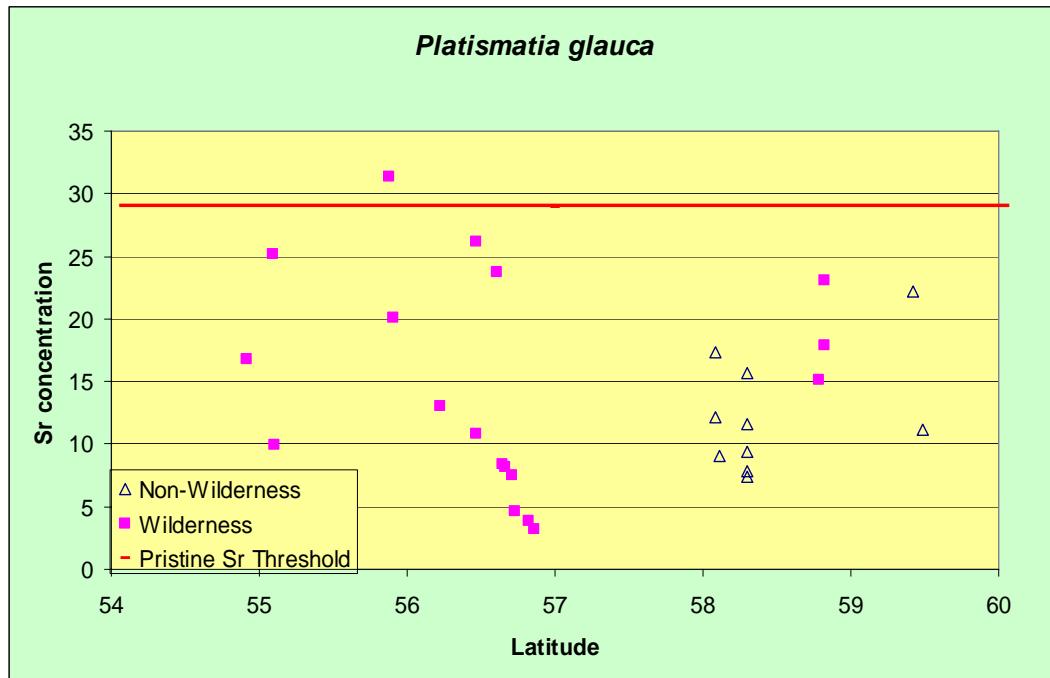


Figure XXVIII-23. Wilderness and Non-Wilderness plot means of Sr ppm in *Platismatia glauca* vs. plot Latitude.

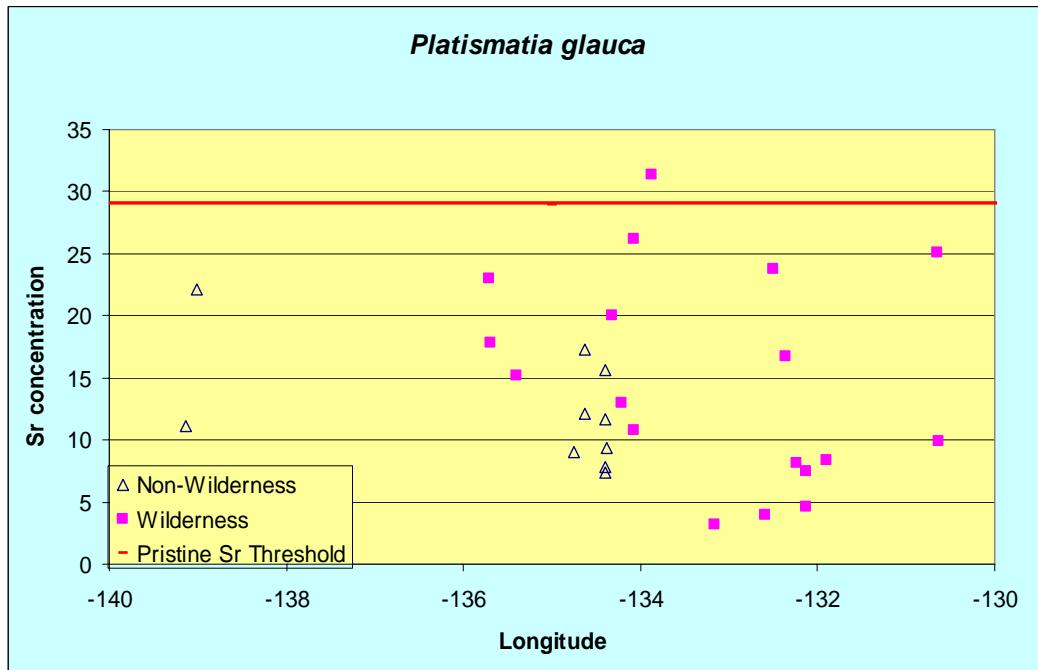


Figure XXVIII-24. Wilderness and Non-Wilderness plot means of Sr ppm in *Platismatia glauca* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Sr ppm

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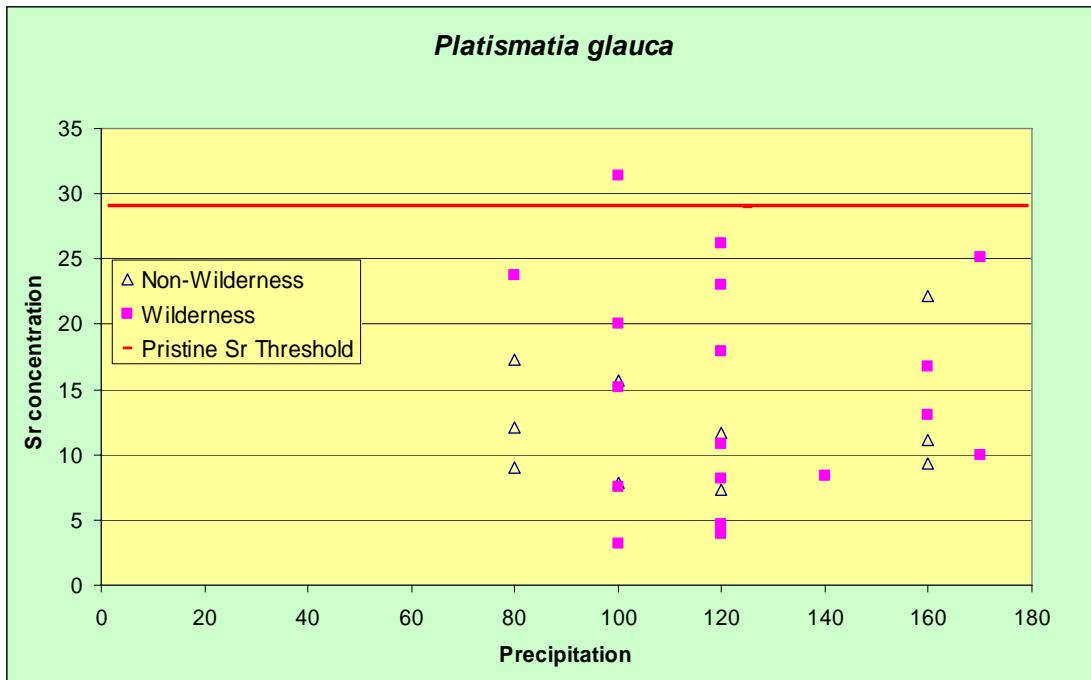


Figure XXVIII-25. Wilderness and Non-Wilderness plot means of Sr ppm
in *Platismatia glauca* vs. plot Precipitation.

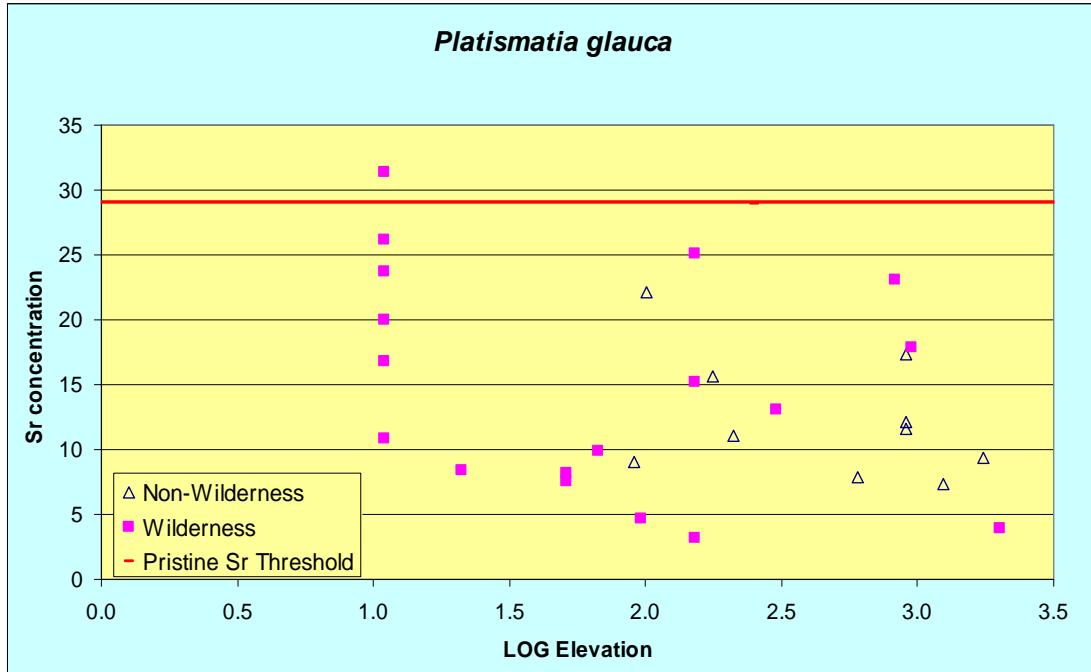


Figure XXVIII-26. Wilderness and Non-Wilderness plot means of Sr ppm
in *Platismatia glauca* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ti ppm

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XXXIX. SUMMARY OF Ti PPM DATA ANALYSIS

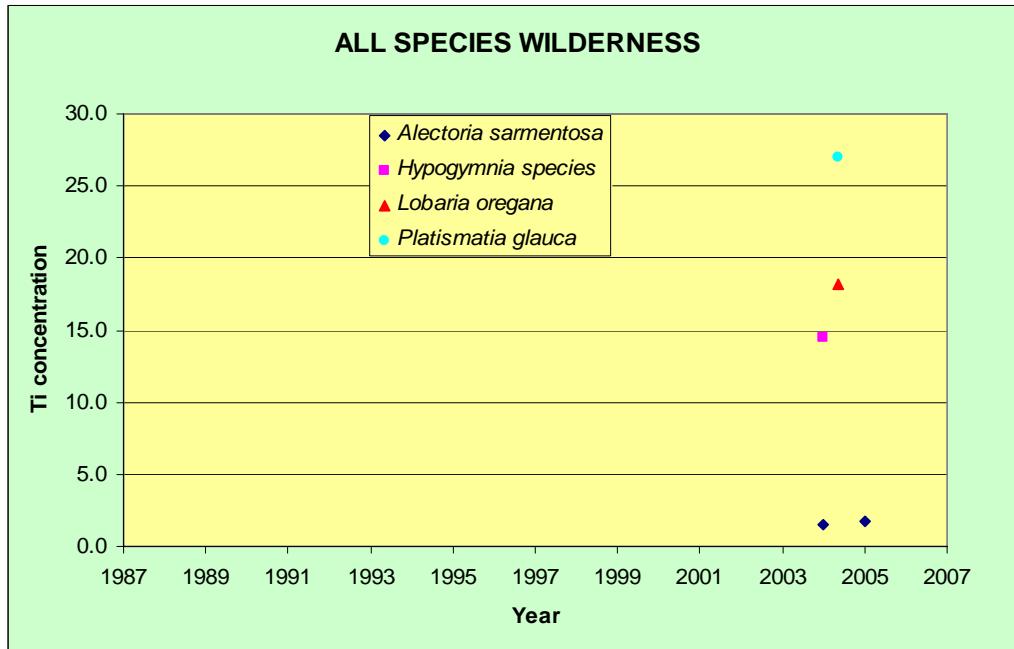


Figure XXIX-27. Wilderness plot means of Ti ppm
in *All Species* per year.

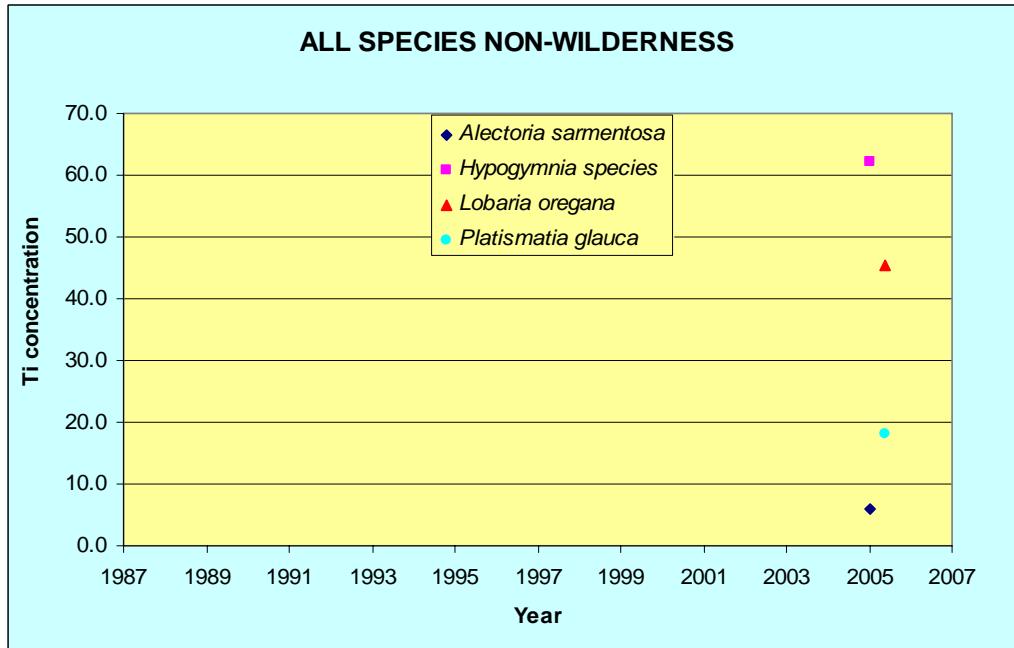


Figure XXIX-28. Non-Wilderness plot means of Ti ppm
in *All Species* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ti ppm

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Alectoria sarmentosa

Summary Statistics:

Table XXIX-2. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Ti ppm content of *Alectoria sarmentosa* per year.

Ti ppmr				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	1.54	0.1631	1.2042	1.8790
2005	Non-Wilderness	5.92	2.0308	0.7029	11.1438
2005	Wilderness	1.73	0.5346	0.5238	2.9426

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ti ppm

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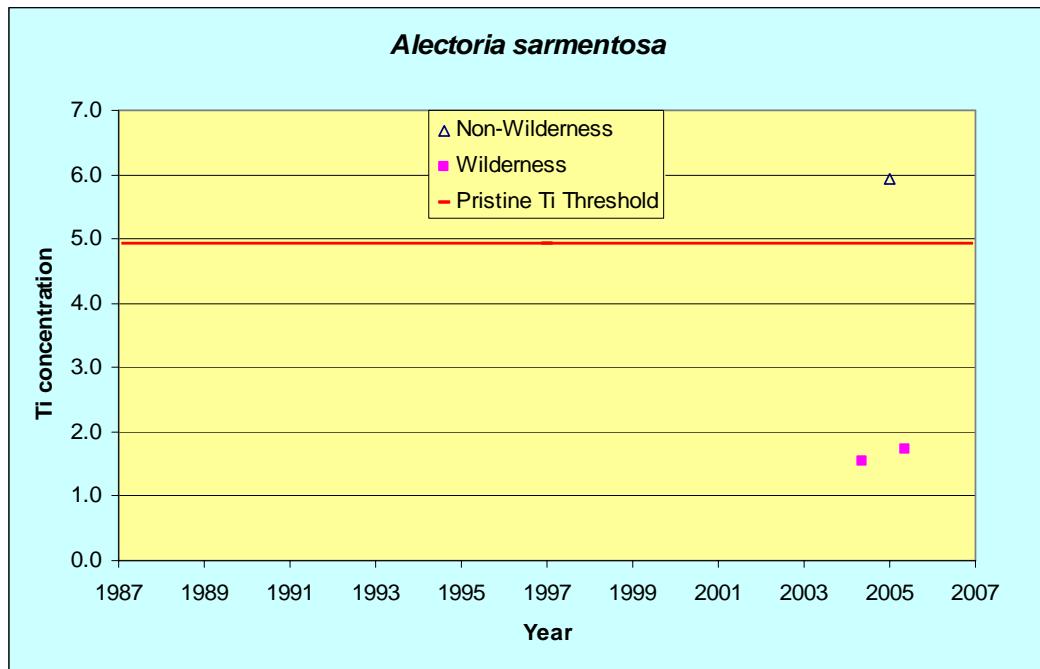


Figure XXIX-3. Wilderness and Non-Wilderness yearly means of Ti ppm in *Alectoria sarmentosa* per year.

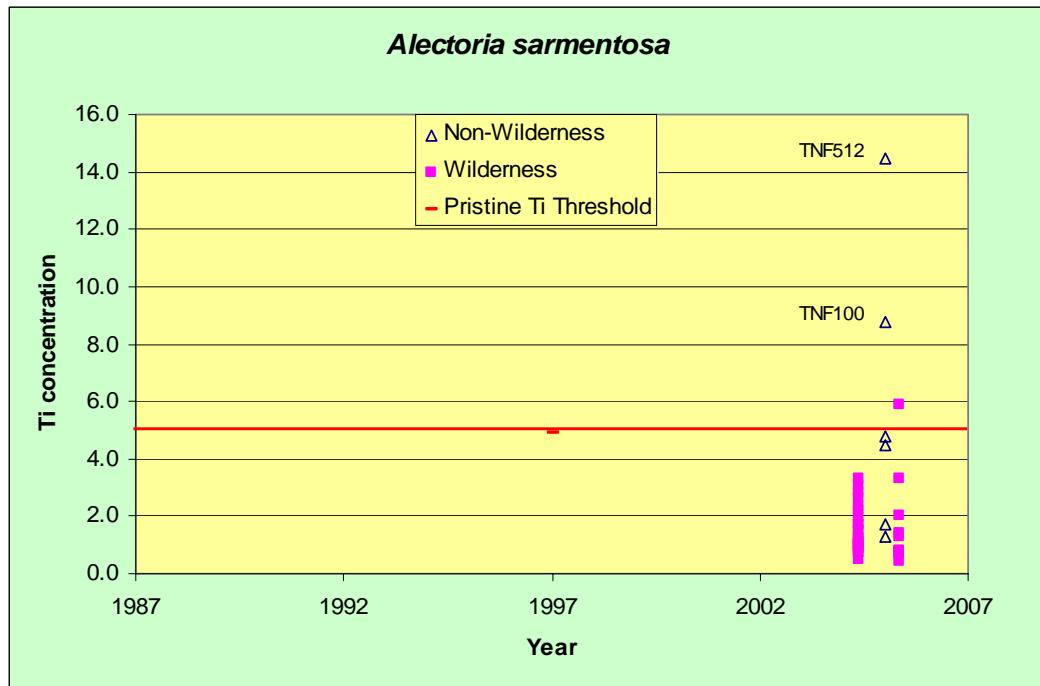


Figure XXIX-4. Wilderness and Non-Wilderness plot means of Ti ppm in *Alectoria sarmentosa* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ti ppm

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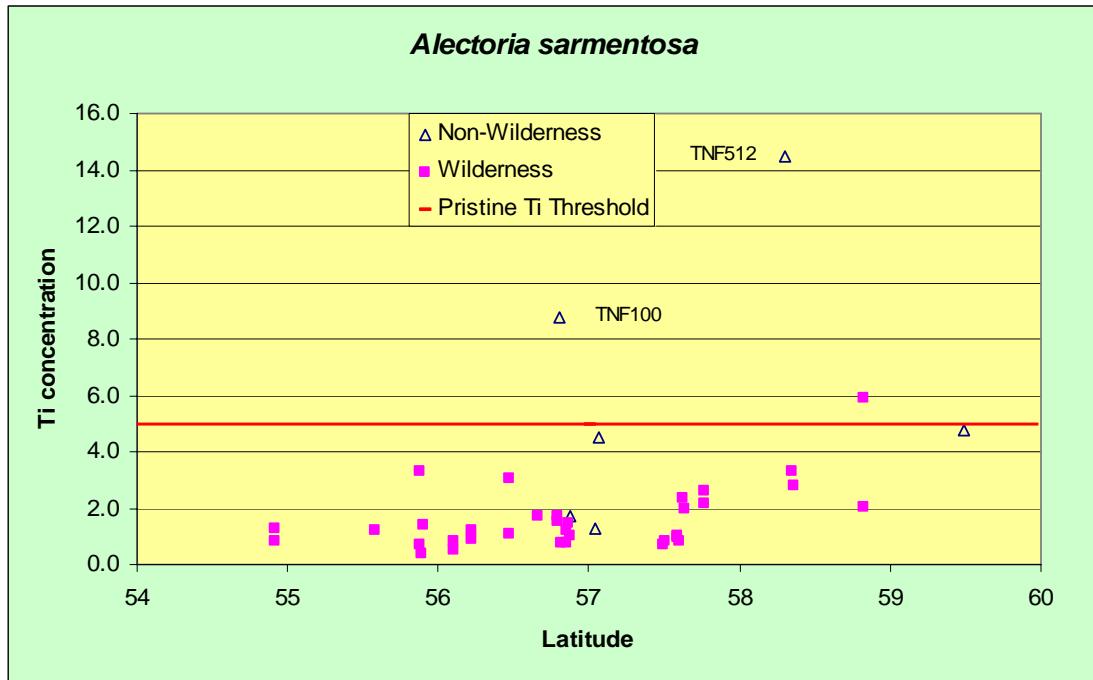


Figure XXIX-5. Wilderness and Non-Wilderness plot means of Ti ppm in *Alectoria sarmentosa* vs. plot Latitude.

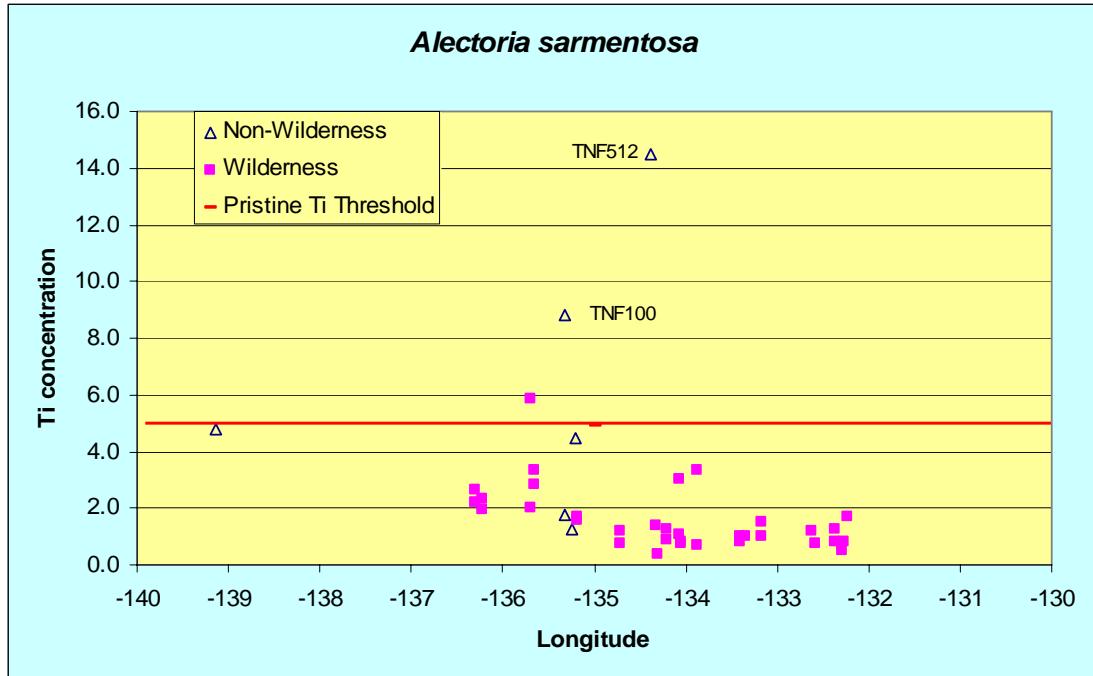


Figure XXIX-6. Wilderness and Non-Wilderness plot means of Ti ppm in *Alectoria sarmentosa* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ti ppm

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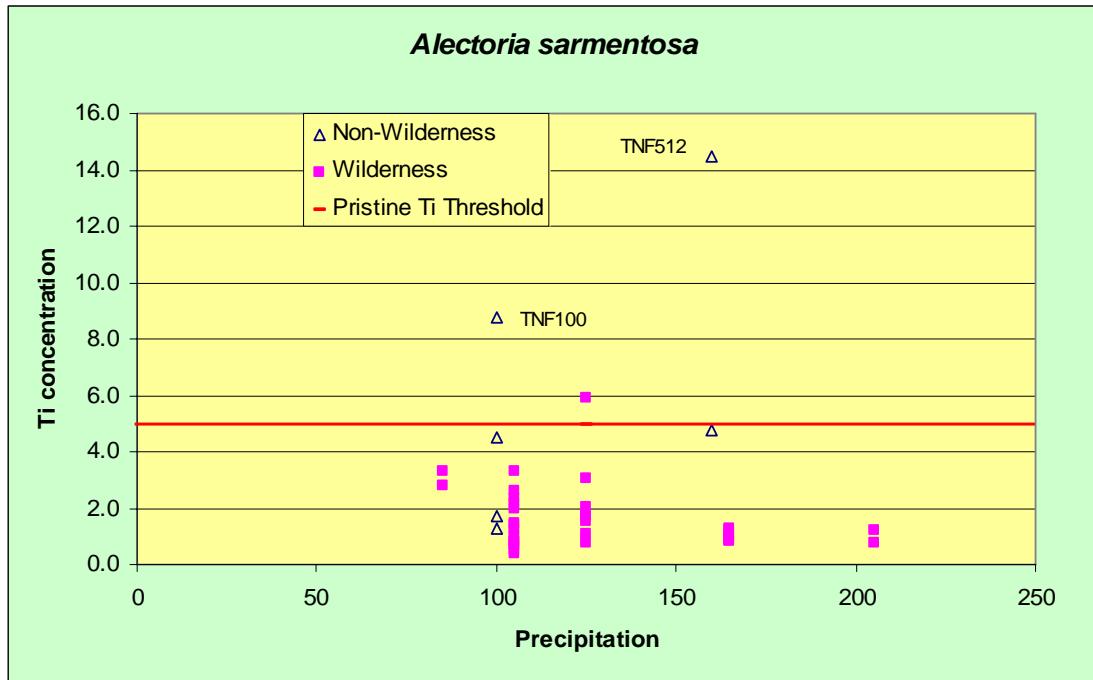


Figure XXIX-7. Wilderness and Non-Wilderness plot means of Ti ppm in *Alectoria sarmentosa* vs. plot Precipitation.

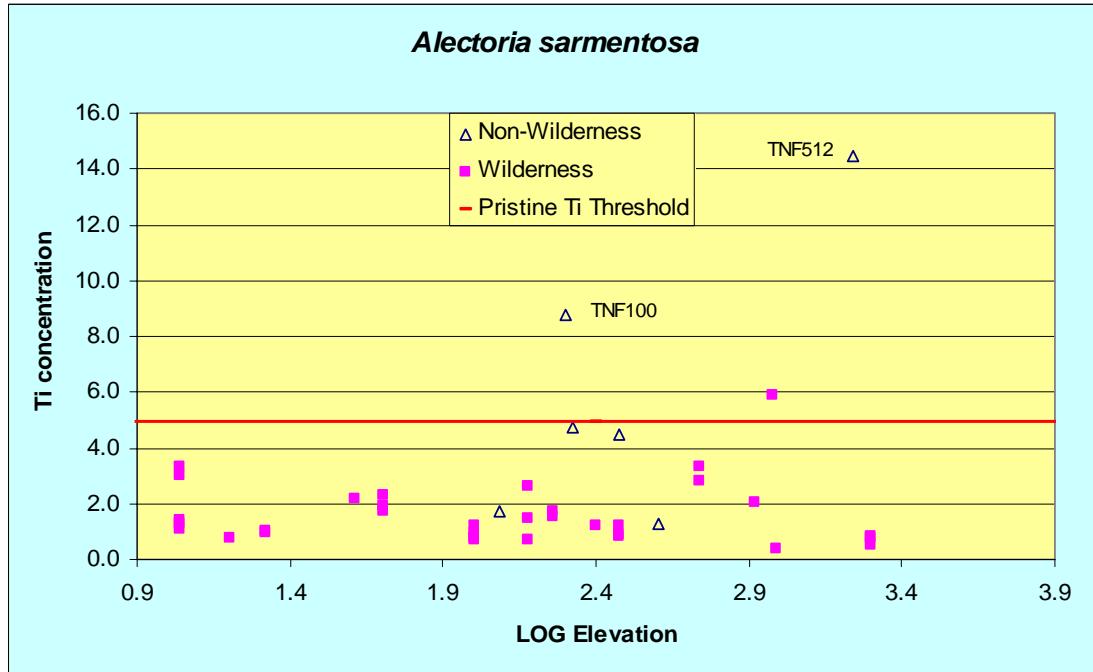


Figure XXIX-8. Wilderness and Non-Wilderness plot means of Ti ppm in *Alectoria sarmentosa* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ti ppm

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Hypogymnia species

In this series, all of the *Hypogymnia* species were included as a group.

Table XXIX-3. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Ti ppm content of *Hypogymnia species* per year.

Ti ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	14.52	5.0042	1.6582	27.3855
2005	Non-Wilderness	62.14	20.9610	28.0471	152.3288
2005	Wilderness	18.86	5.2284	6.8037	30.9170

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ti ppm

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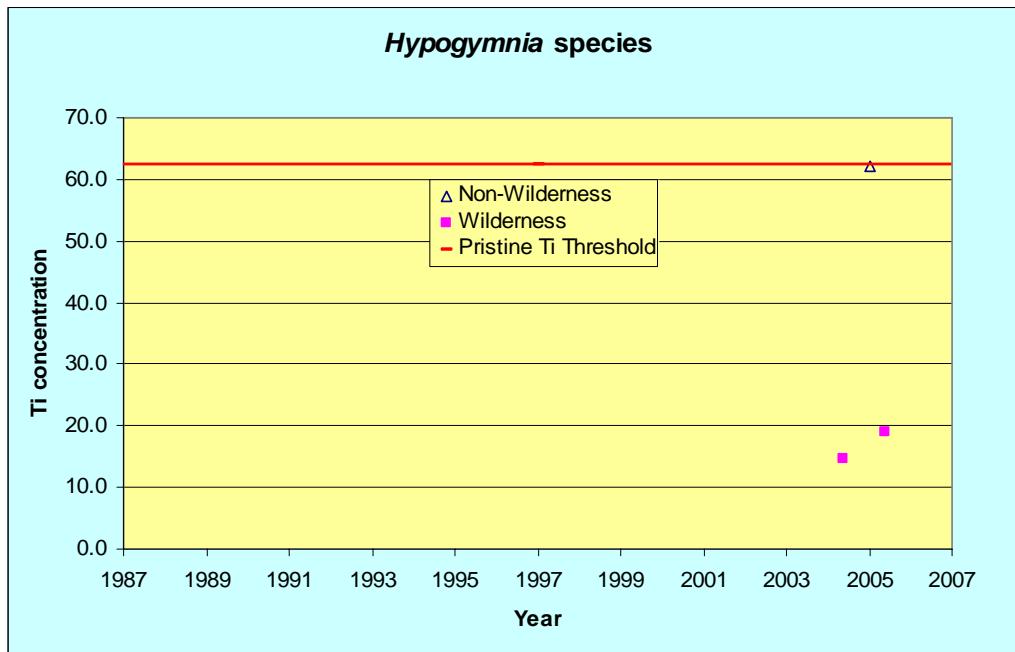


Figure XXIX-9. Wilderness and Non-Wilderness yearly means of Ti ppm in *Hypogymnia* species per year.

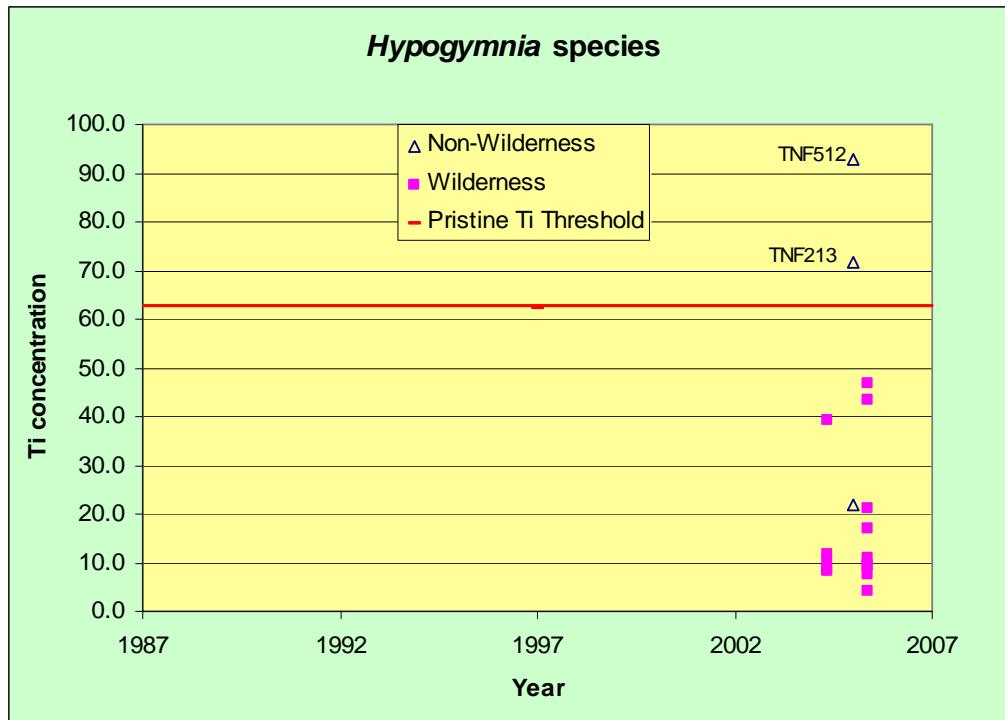


Figure XXIX-10. Wilderness and Non-Wilderness plot means of Ti ppm in *Hypogymnia* species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ti ppm

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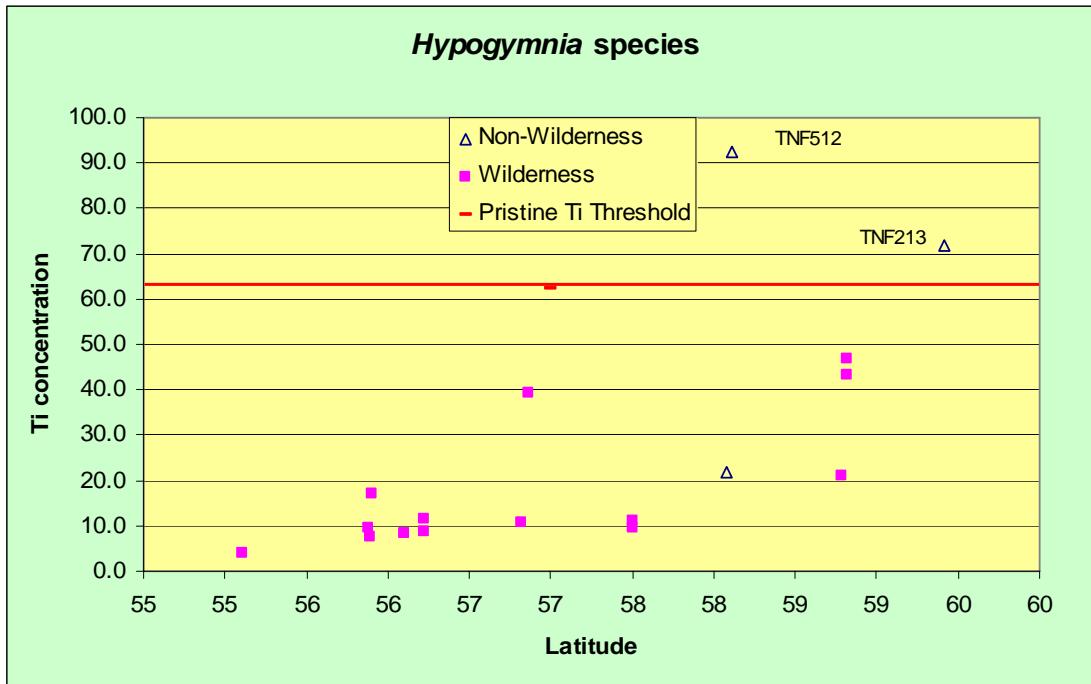


Figure XXIX-11. Wilderness and Non-Wilderness plot means of Ti ppm in *Hypogymnia* species vs. plot Latitude.

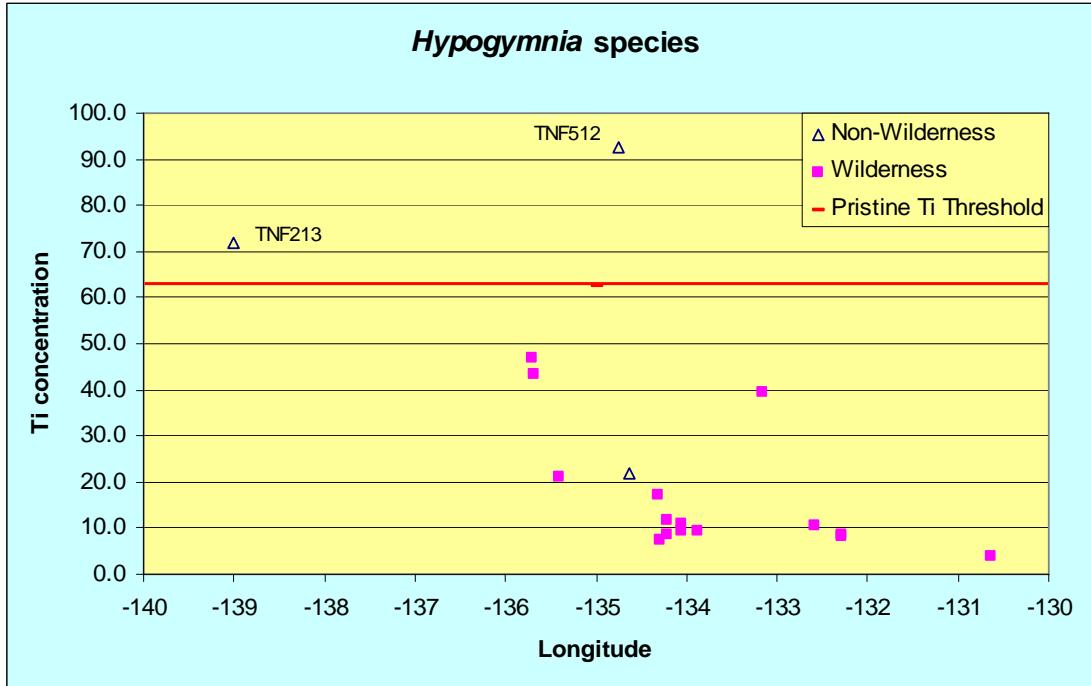


Figure XXIX-12. Wilderness and Non-Wilderness plot means of Ti ppm in *Hypogymnia* species vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ti ppm

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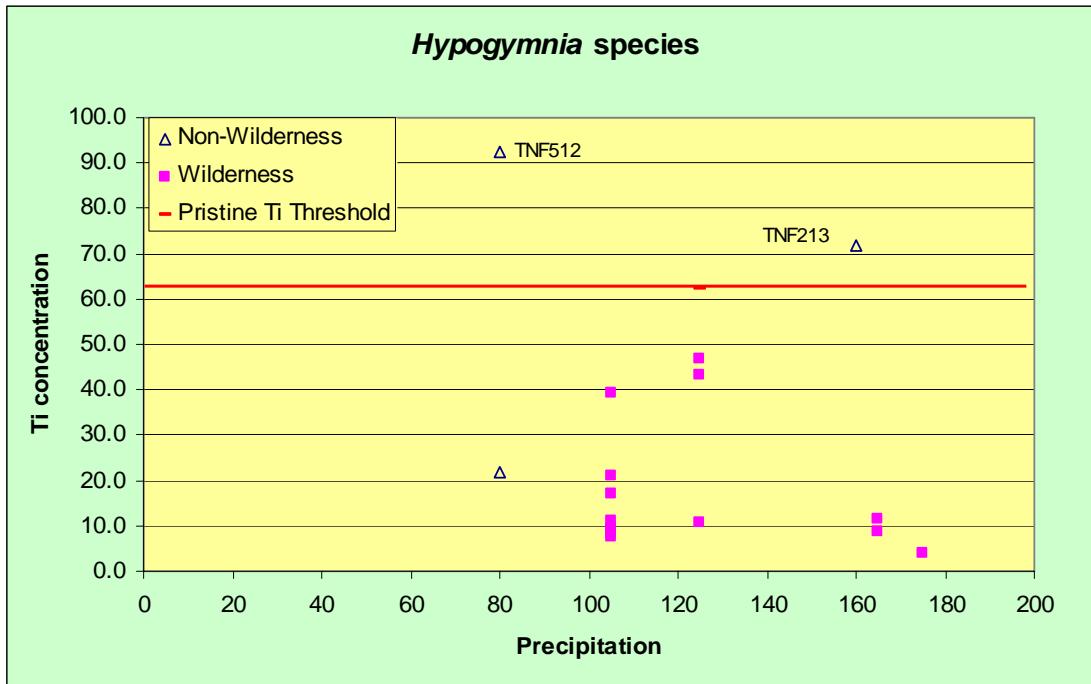


Figure XXIX-13. Wilderness and Non-Wilderness plot means of Ti ppm in *Hypogymnia* species vs. plot Precipitation.

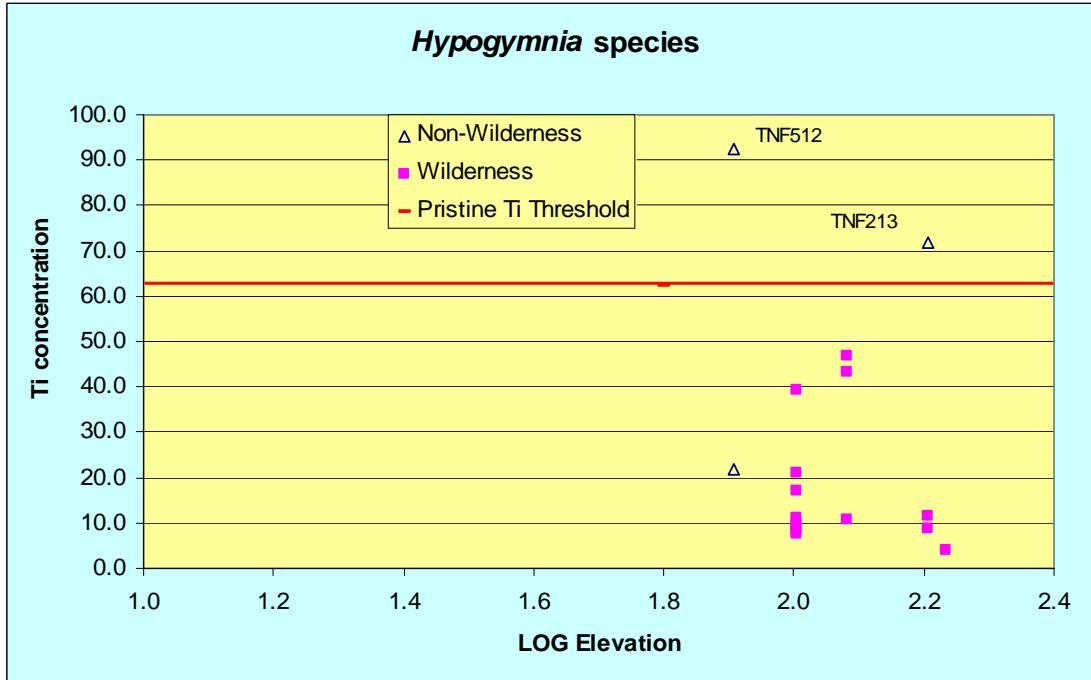


Figure XXIX-14. Wilderness and Non-Wilderness plot means of Ti ppm in *Hypogymnia* species vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ti ppm

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Lobaria oregana

Table XXIX-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Ti ppm content of *Lobaria oregana* per year.

Ti ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	18.14	6.0711	3.2848	32.9958
2005	Non-Wilderness	45.49	NA	NA	NA
2005	Wilderness	5.19	2.1008	-1.4908	11.8807

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ti ppm

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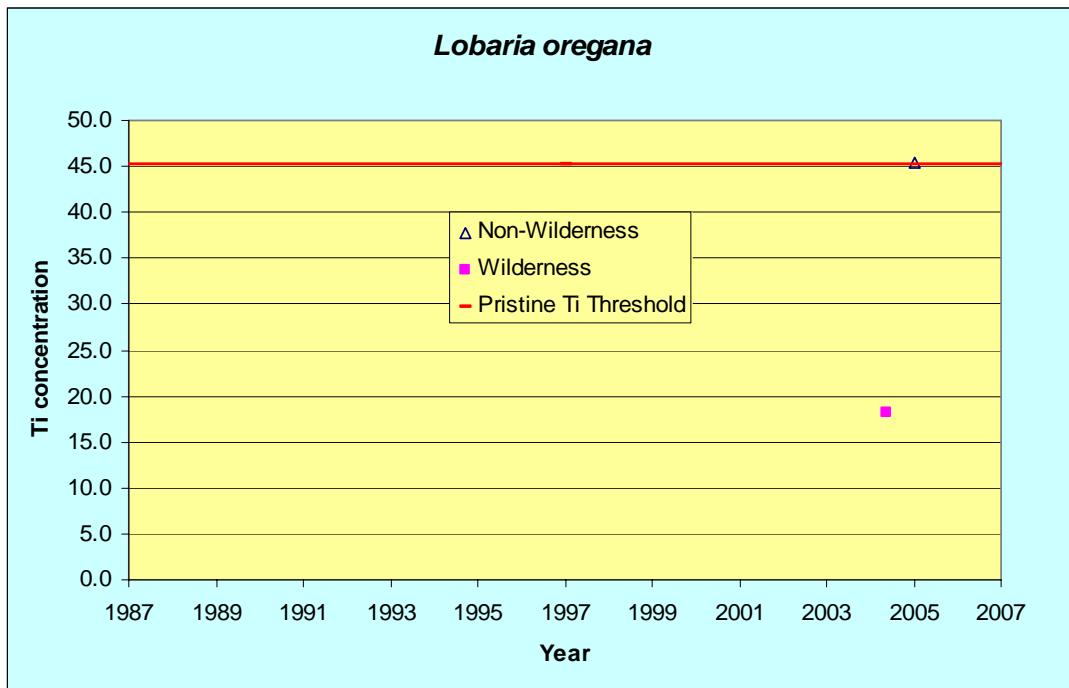


Figure XXIX-15. Wilderness and Non-Wilderness yearly means of Ti ppm in *Lobaria oregana* per year.

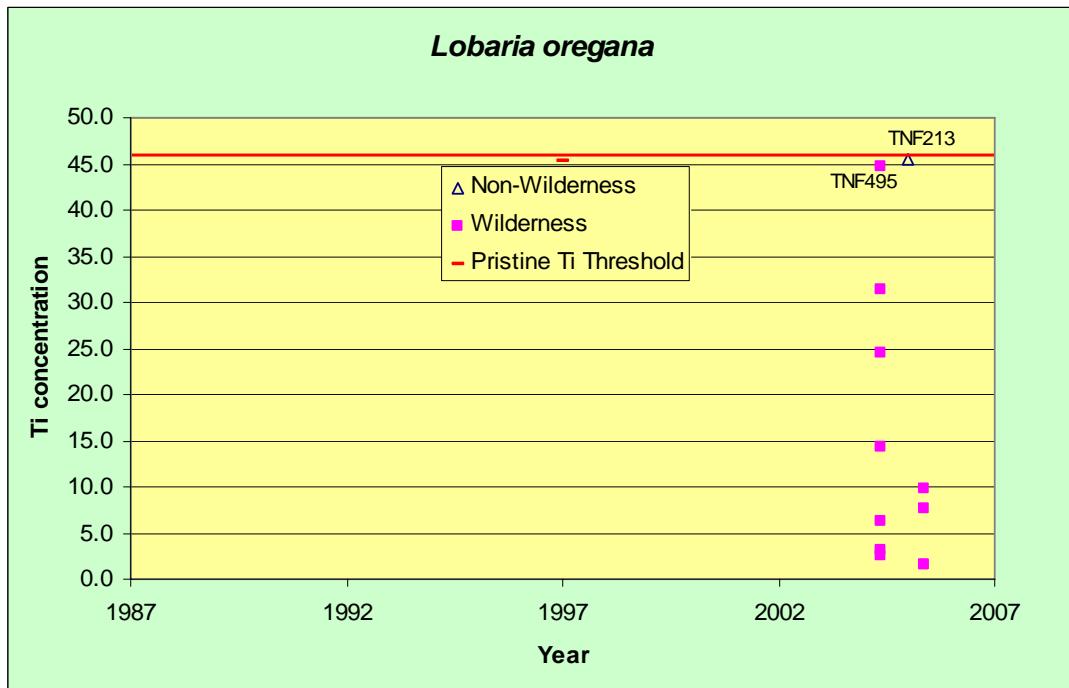


Figure XXIX-16. Wilderness and Non-Wilderness plot means of Ti ppm in *Lobaria oregana* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ti ppm

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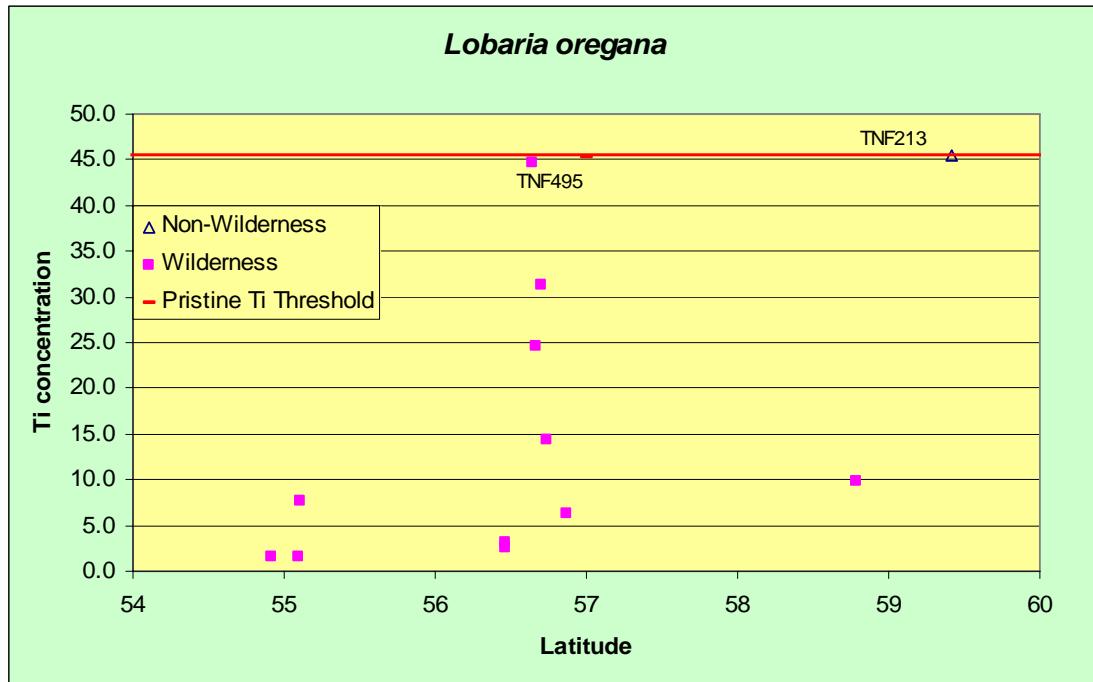


Figure XXIX-17. Wilderness and Non-Wilderness plot means of Ti ppm in *Lobaria oregana* vs. plot Latitude.

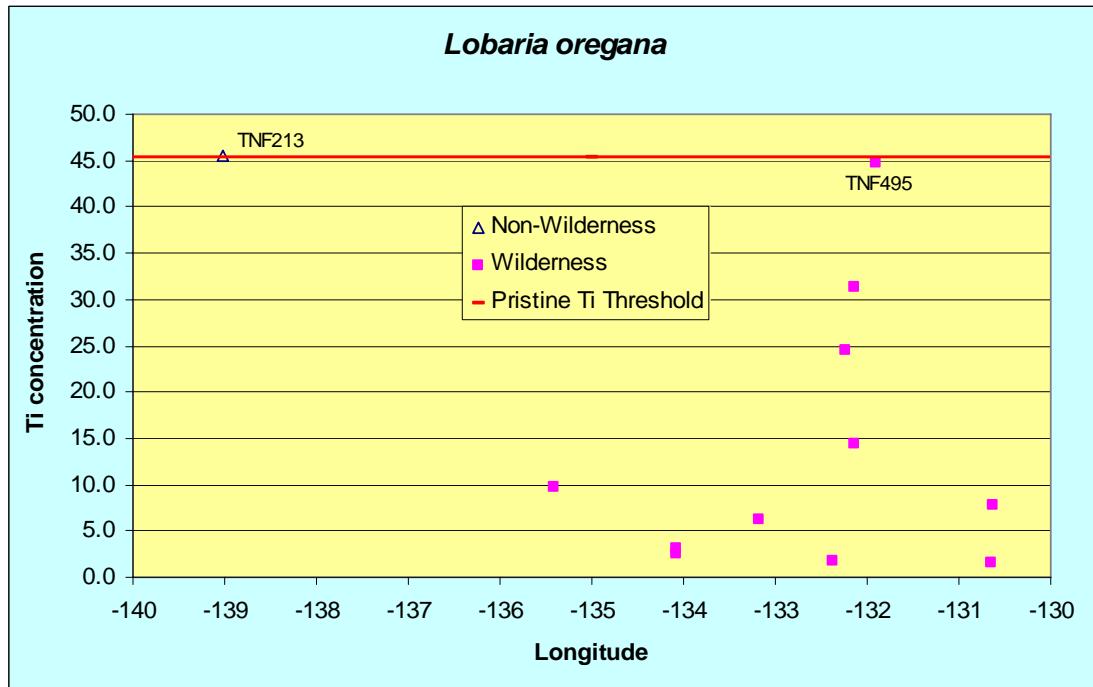


Figure XXIX-18. Wilderness and Non-Wilderness plot means of Ti ppm in *Lobaria oregana* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ti ppm

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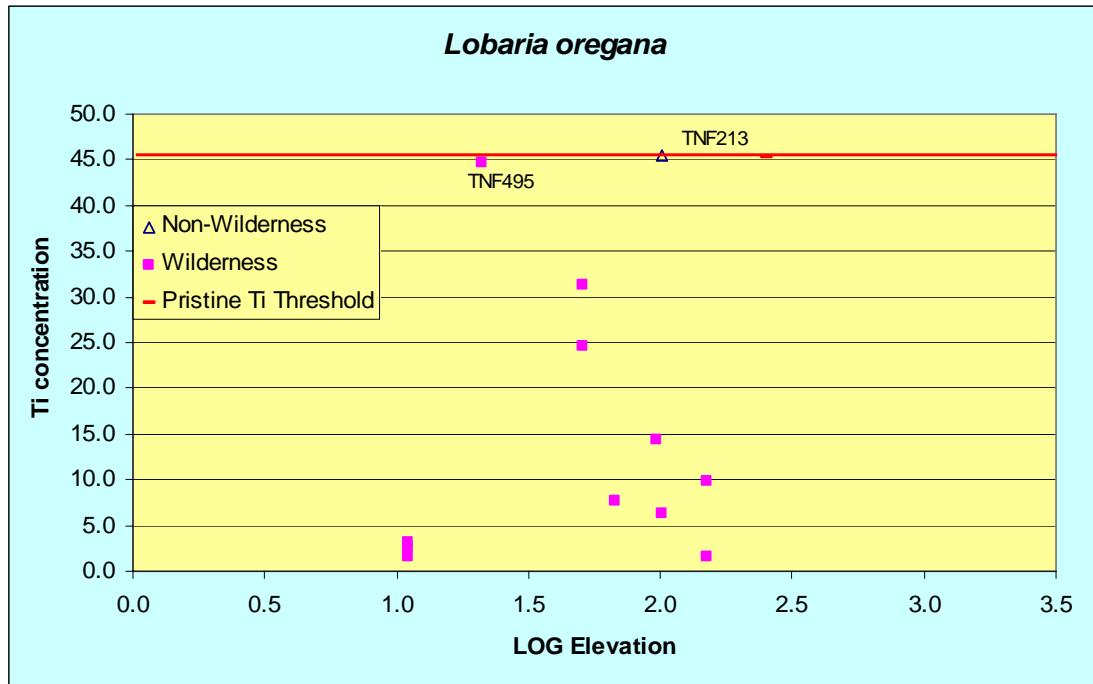


Figure XXIX-19. Wilderness and Non-Wilderness plot means of Ti ppm in *Lobaria oregana* vs. plot Precipitation.

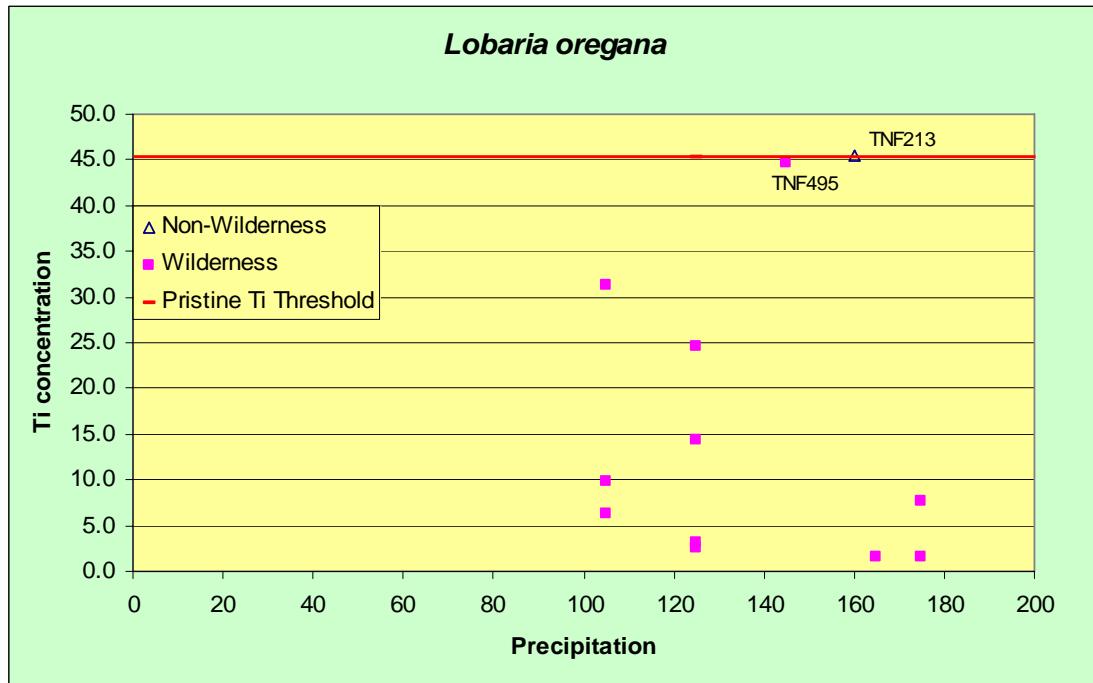


Figure XXIX-20. Wilderness and Non-Wilderness plot means of Ti ppm in *Lobaria oregana* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ti ppm

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Platismatia glauca

Table XXIX-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Ti ppm content of *Platismatia glauca* per year.

Ti ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	26.94	6.2880	12.7109	41.1599
2005	Non-Wilderness	59.38	10.1738	36.3656	82.3953
2005	Wilderness	24.28	6.6642	8.5198	40.0363

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ti ppm

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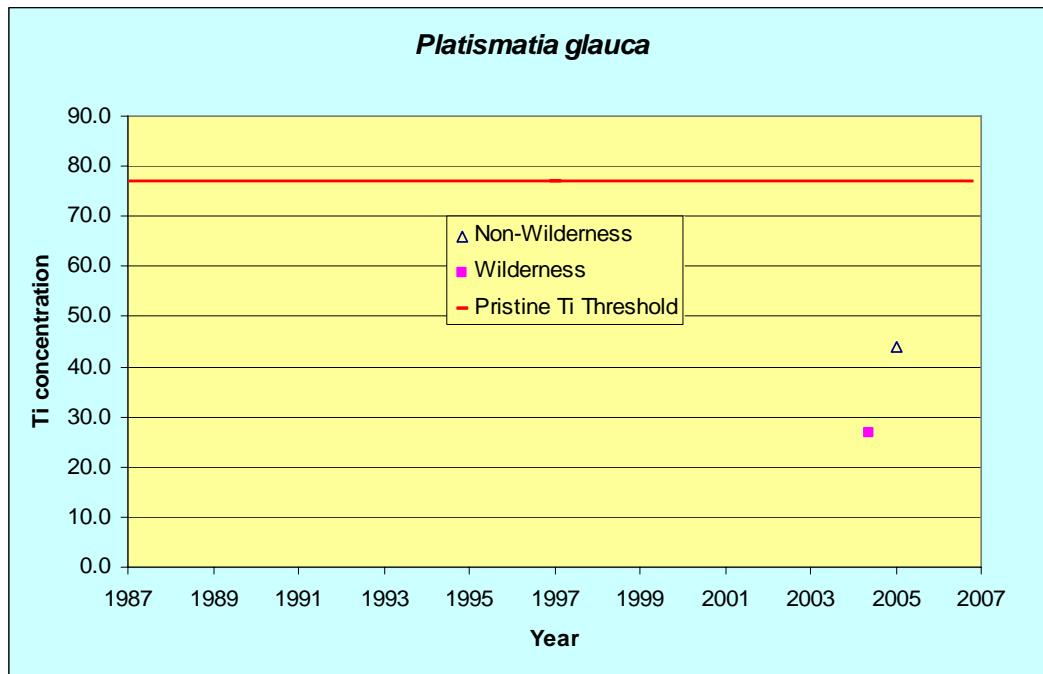


Figure XXIX-21. Wilderness and Non-Wilderness yearly means of Ti ppm in *Platismatia glauca* per year.

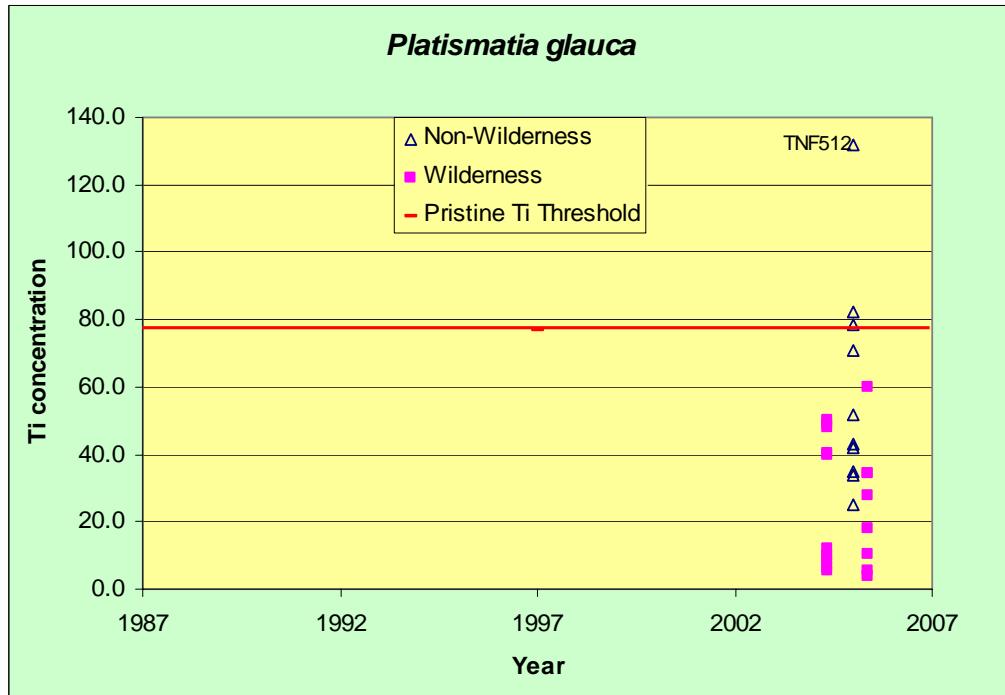


Figure XXIX-22. Wilderness and Non-Wilderness plot means of Ti ppm in *Platismatia glauca* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ti ppm

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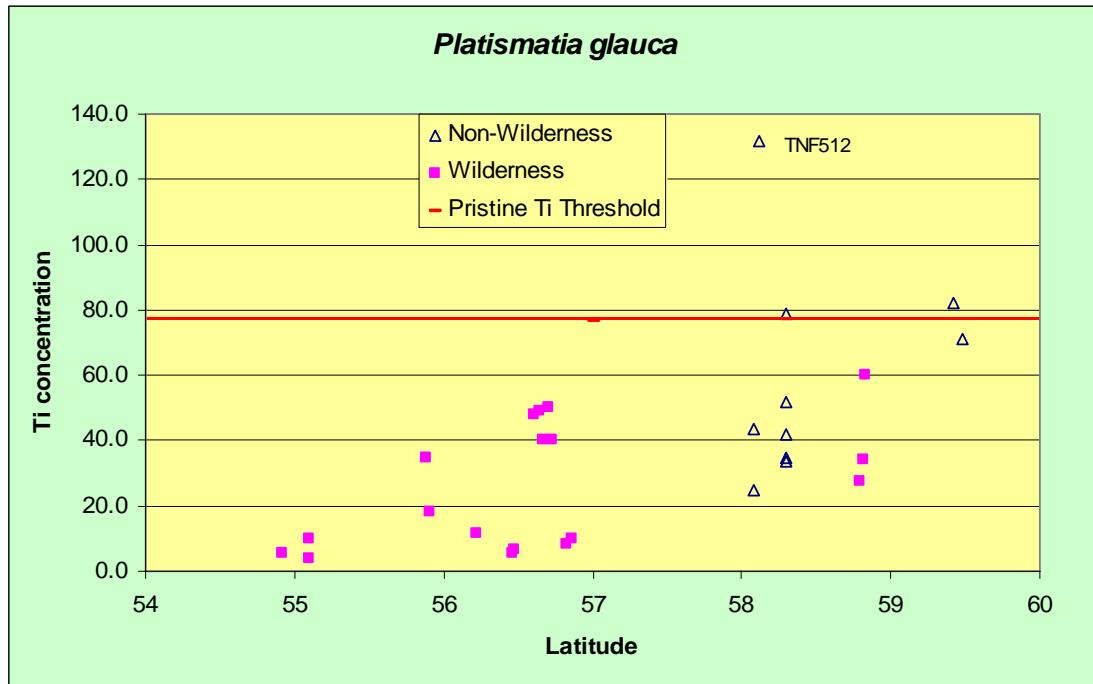


Figure XXIX-23. Wilderness and Non-Wilderness plot means of Ti ppm in *Platismatia glauca* vs. plot Latitude.

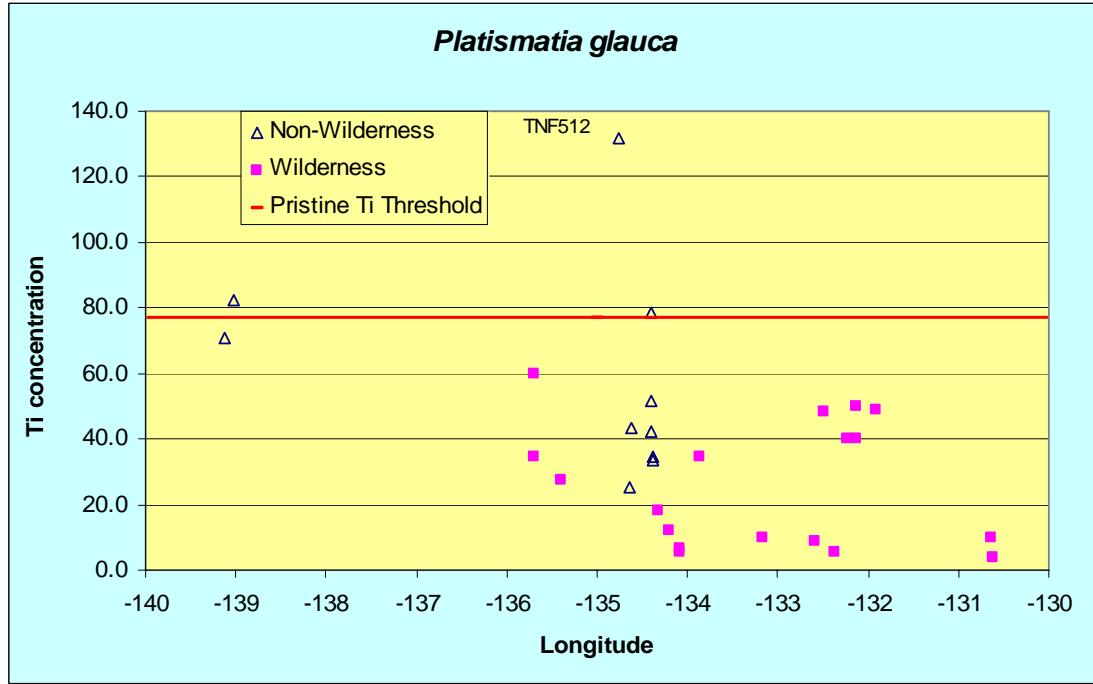


Figure XXIX-24. Wilderness and Non-Wilderness plot means of Ti ppm in *Platismatia glauca* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Ti ppm

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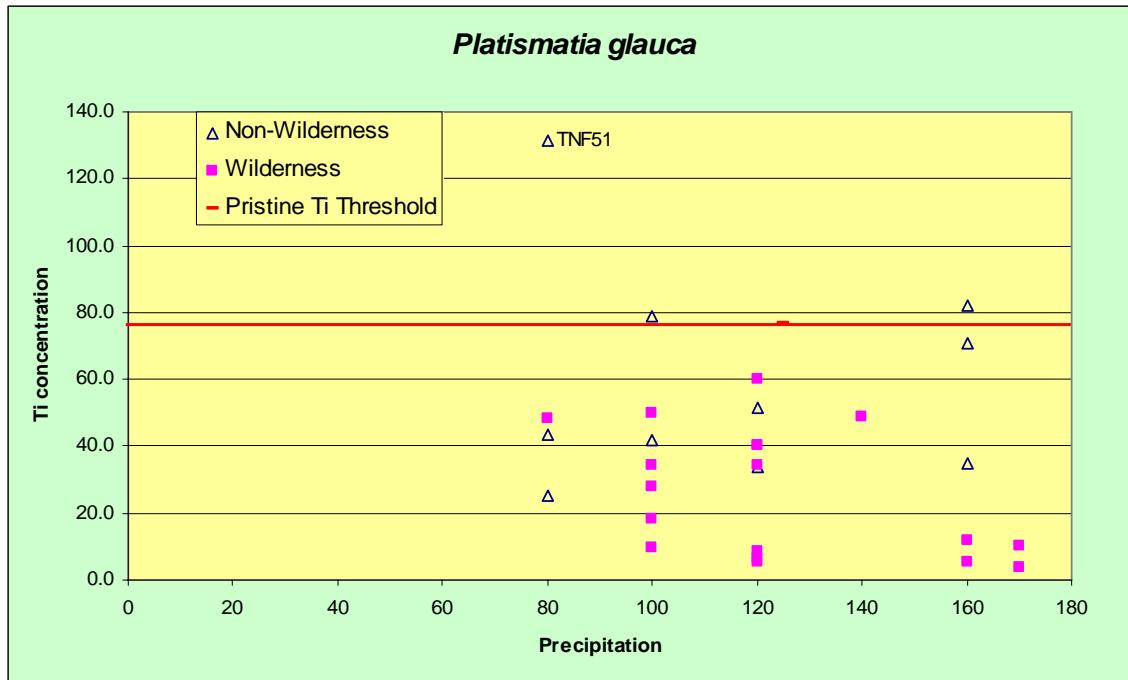


Figure XXIX-25. Wilderness and Non-Wilderness plot means of Ti ppm in *Platismatia glauca* vs. plot Precipitation.

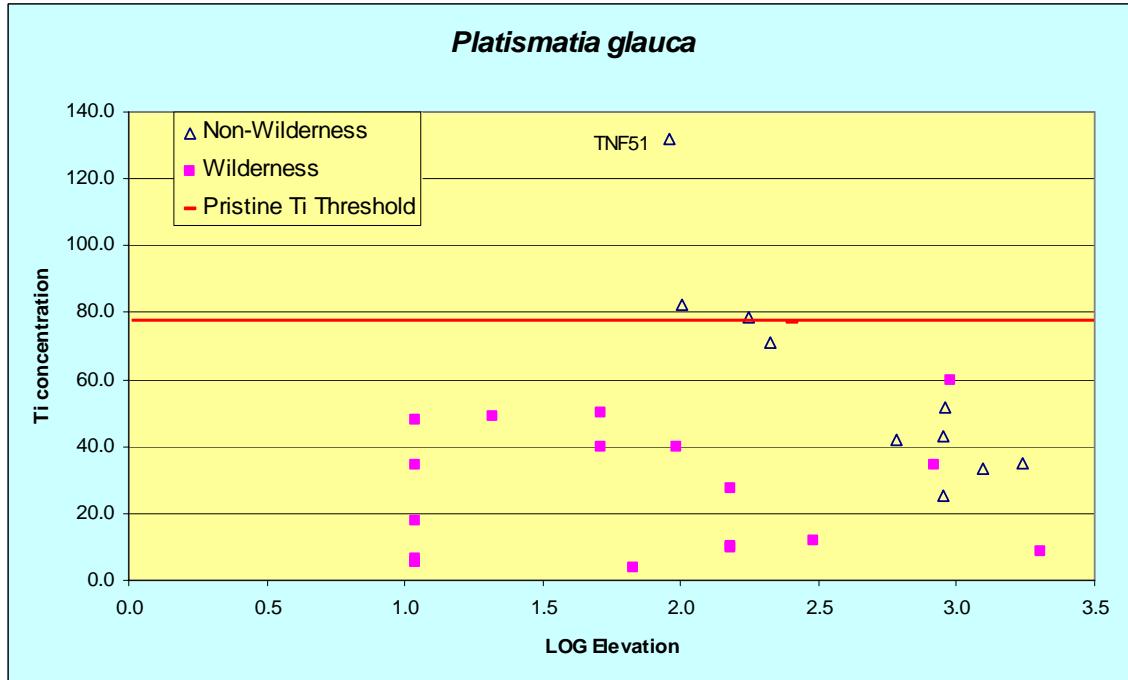


Figure XXIX-26. Wilderness and Non-Wilderness plot means of Ti ppm in *Platismatia glauca* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

V ppm

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XXX. SUMMARY OF V PPM DATA ANALYSIS

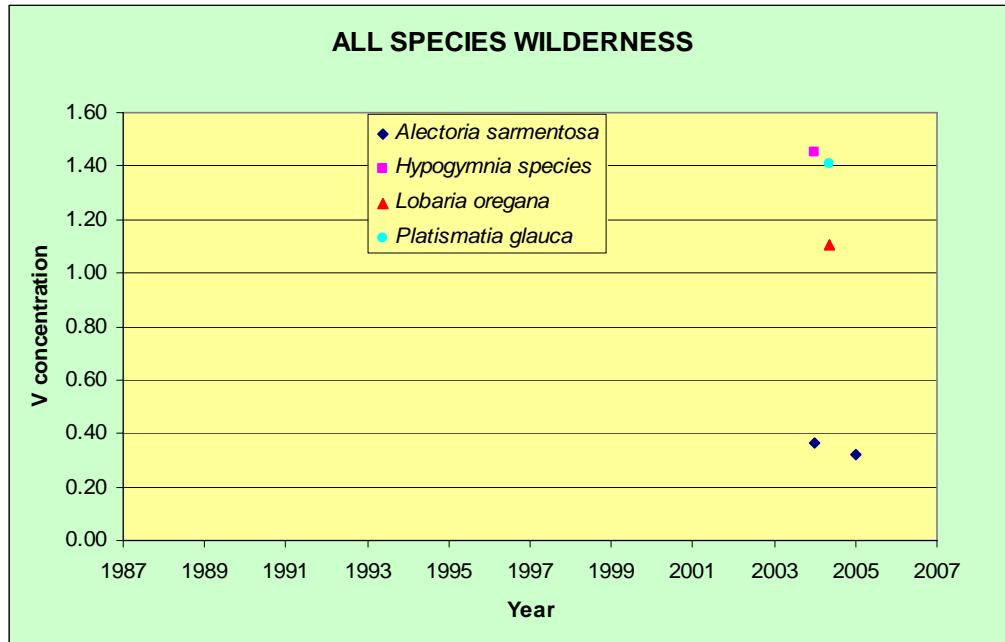


Figure XXX-27. Wilderness plot means of V ppm
in All Species per year.

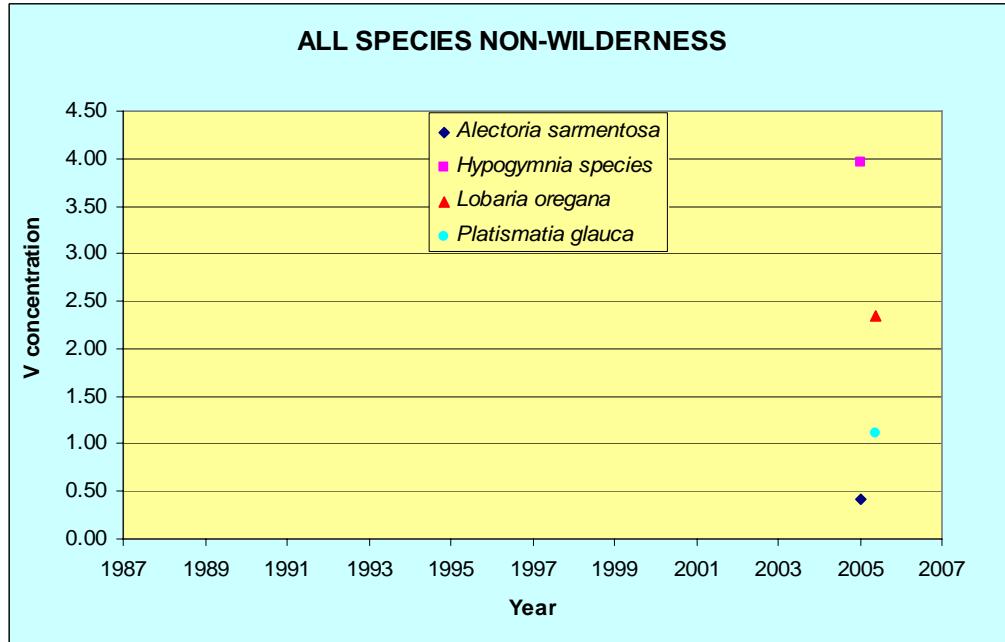


Figure XXX-28. Non-Wilderness plot means of V ppm
in All Species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

V ppm

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Alectoria sarmentosa

Summary Statistics:

Table XXX-2. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the V ppm content of *Alectoria sarmentosa* per year.

V ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	0.36	0.0010	0.3597	0.3639
2005	Non-Wilderness	0.42	0.0653	0.2522	0.5879
2005	Wilderness	0.32	0.0000	0.3200	0.3200

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

V ppm

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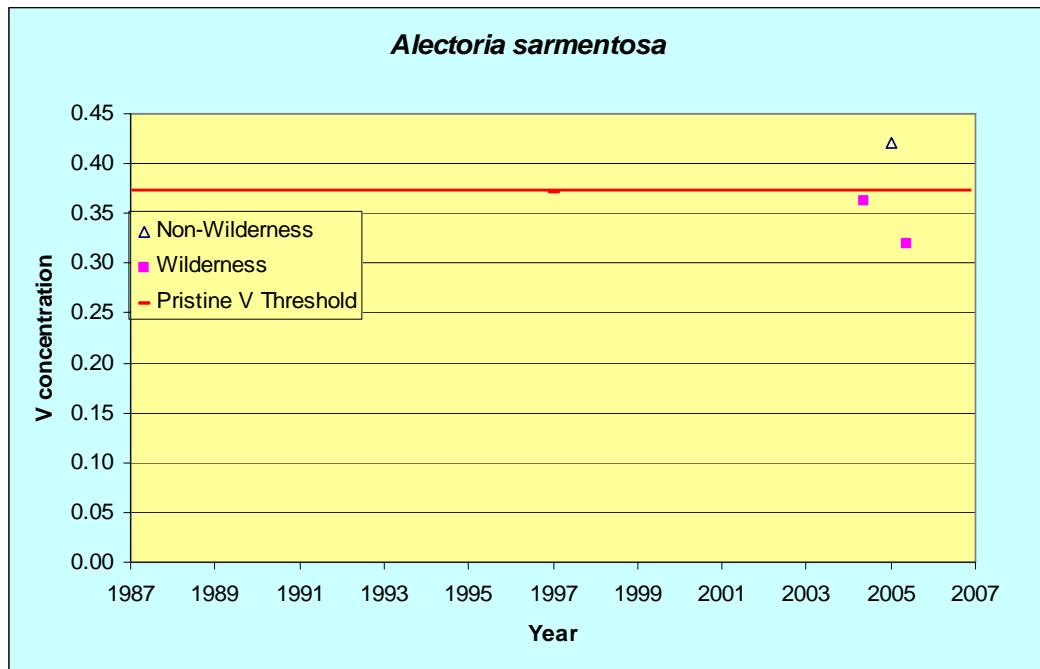


Figure XXX-3. Wilderness and Non-Wilderness yearly means of V ppm in *Alectoria sarmentosa* per year.

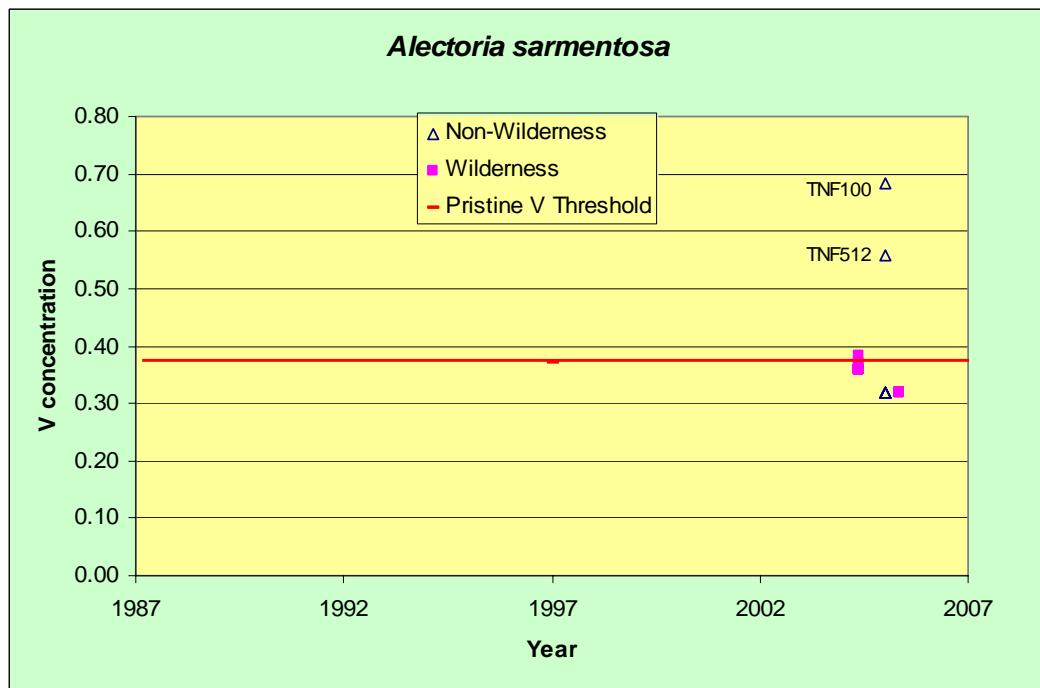


Figure XXX-4. Wilderness and Non-Wilderness plot means of V ppm in *Alectoria sarmentosa* per year.

ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

V ppm

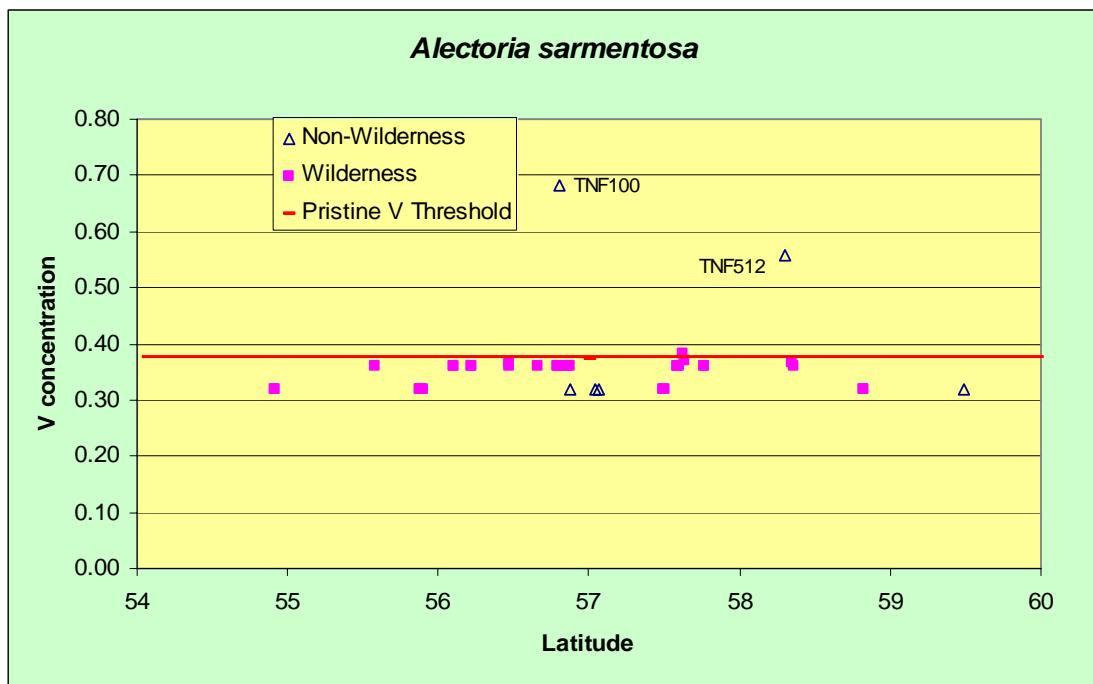


Figure XXX-5. Wilderness and Non-Wilderness plot means of V ppm in *Alectoria sarmentosa* vs. plot Latitude.

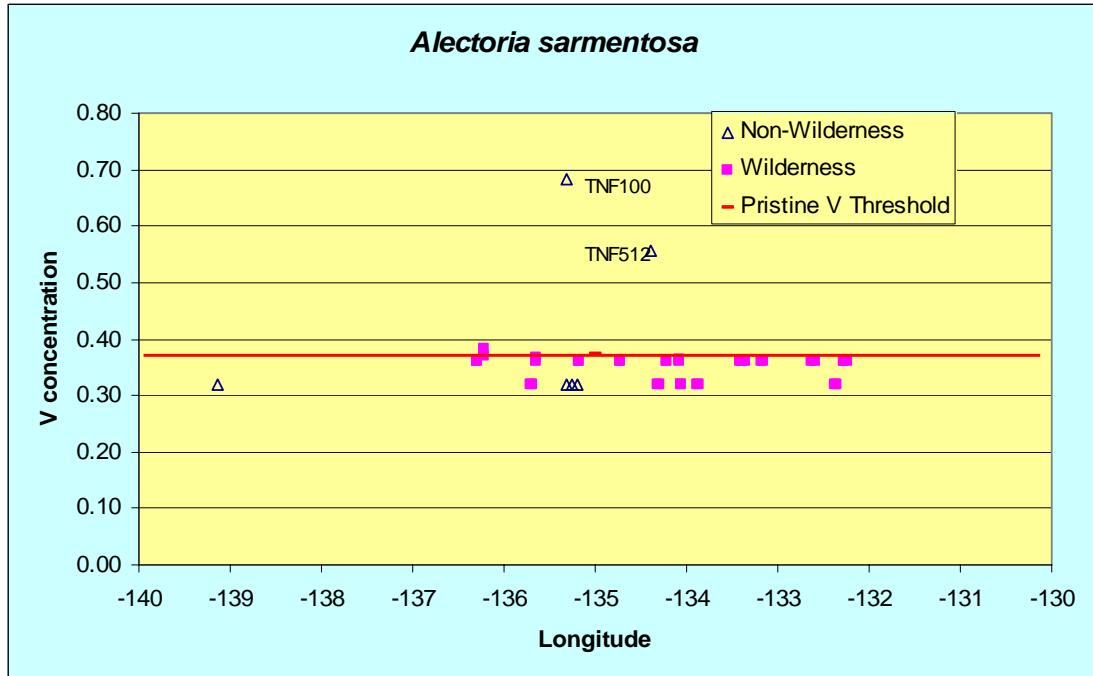


Figure XXX-6. Wilderness and Non-Wilderness plot means of V ppm in *Alectoria sarmentosa* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

V ppm

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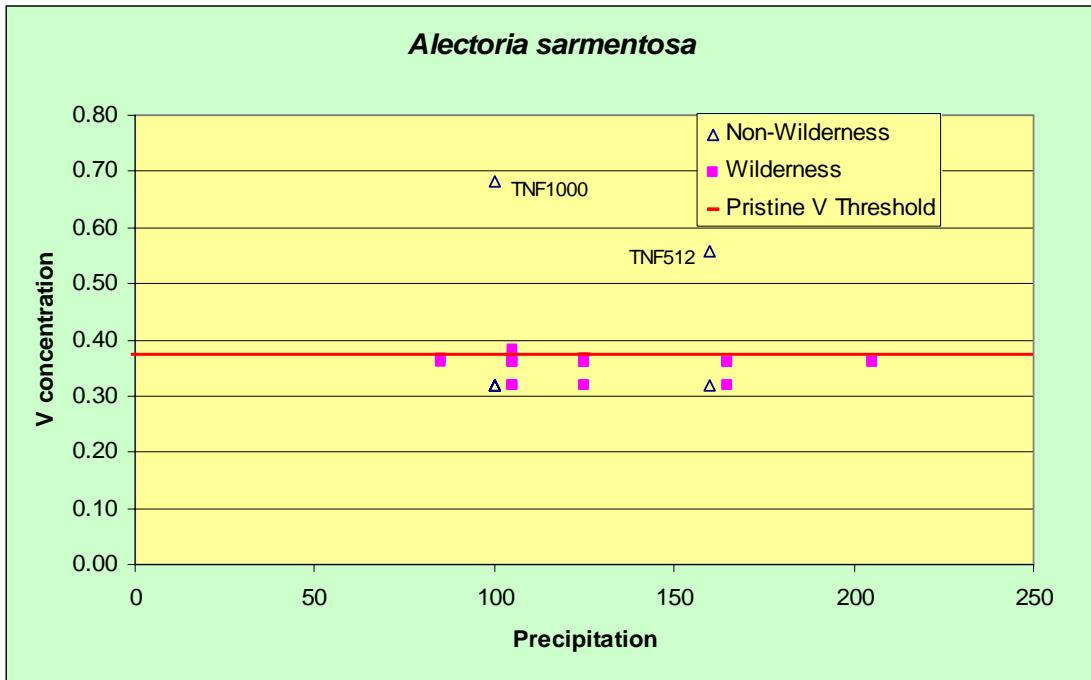


Figure XXX-7. Wilderness and Non-Wilderness plot means of V ppm
in *Alectoria sarmentosa* vs. plot Precipitation.

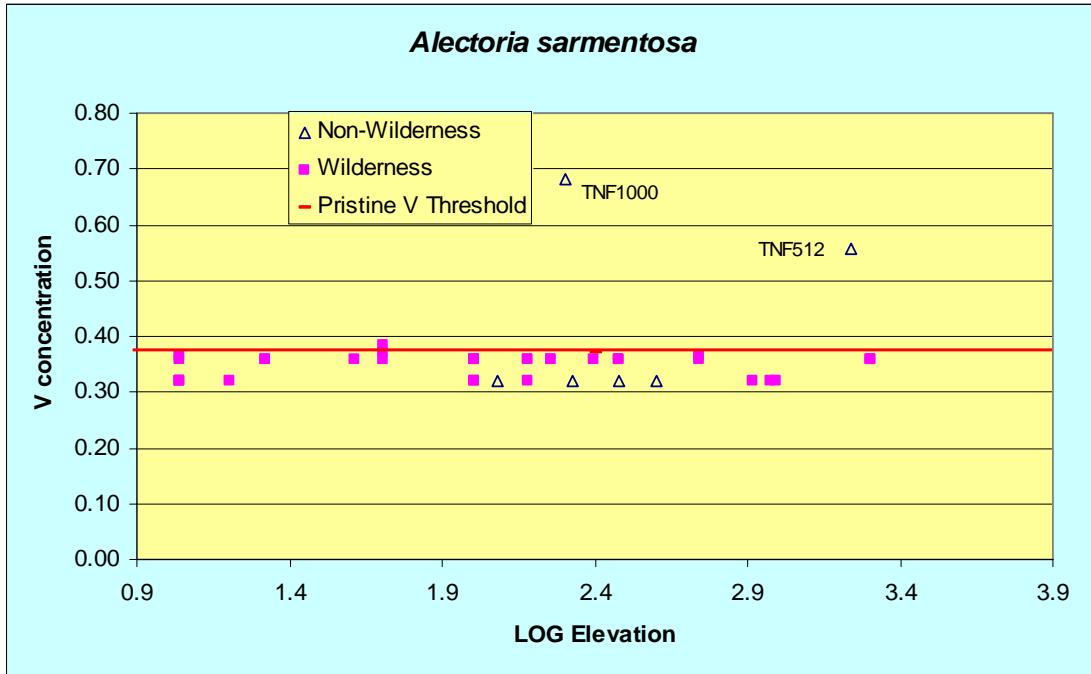


Figure XXX-8. Wilderness and Non-Wilderness plot means of V ppm
in *Alectoria sarmentosa* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

V ppm

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Hypogymnia species

In this series, all of the *Hypogymnia* species were included as a group.

Table XXX-3. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the V ppm content of *Hypogymnia species* per year.

V ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	1.45	0.1356	1.1056	1.8029
2005	Non-Wilderness	3.95	1.1721	1.0898	8.9962
2005	Wilderness	1.35	0.2744	0.7167	1.9821

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

V ppm

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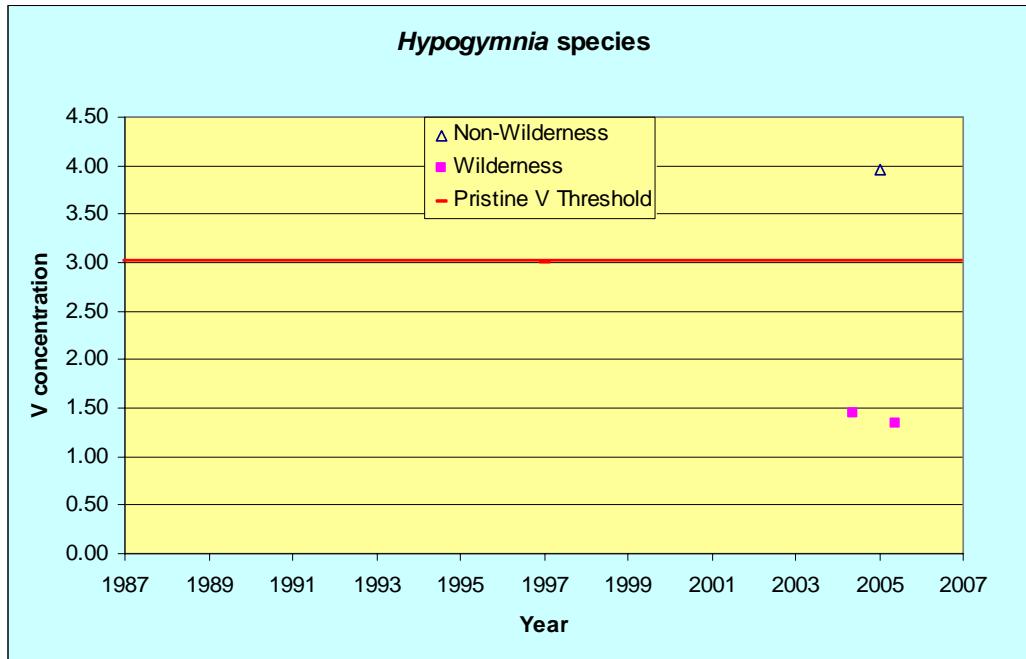


Figure XXX-9. Wilderness and Non-Wilderness yearly means of V ppm in *Hypogymnia species* per year.

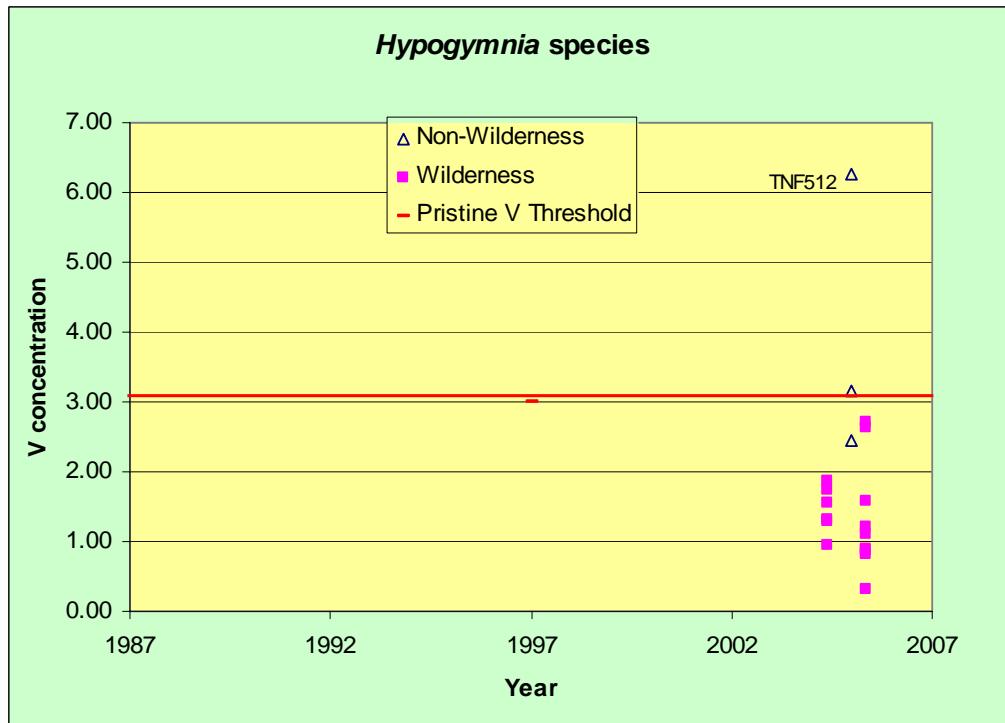


Figure XXX-10. Wilderness and Non-Wilderness plot means of V ppm in *Hypogymnia species* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

V ppm

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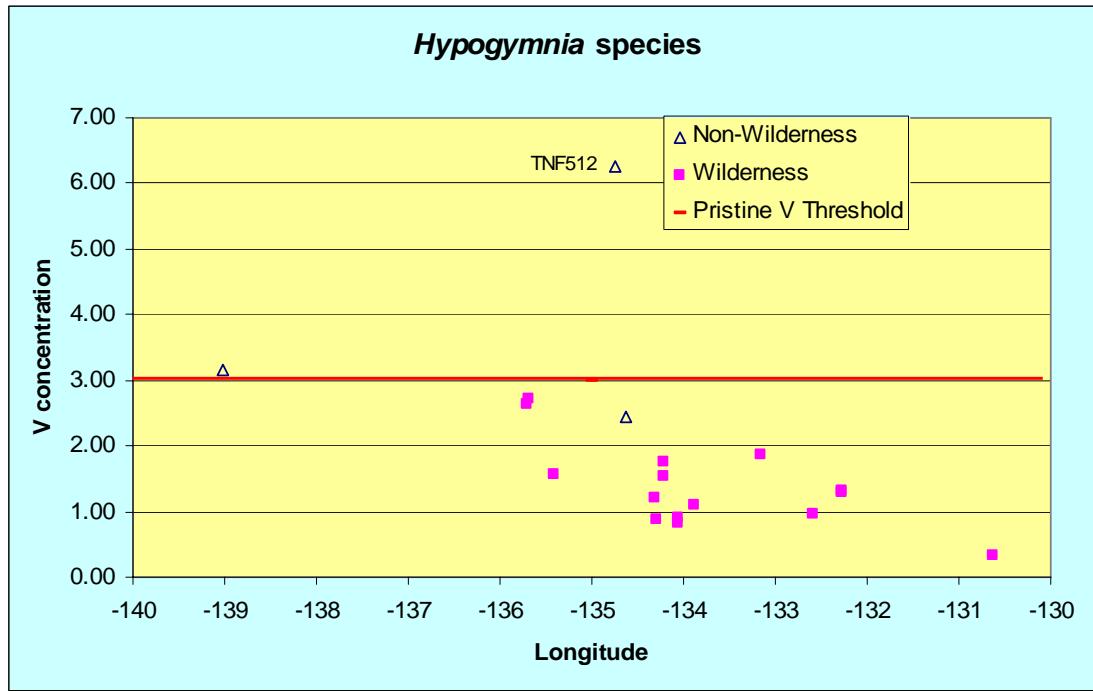


Figure XXX-11. Wilderness and Non-Wilderness plot means of V ppm in *Hypogymnia* species vs. plot Latitude.

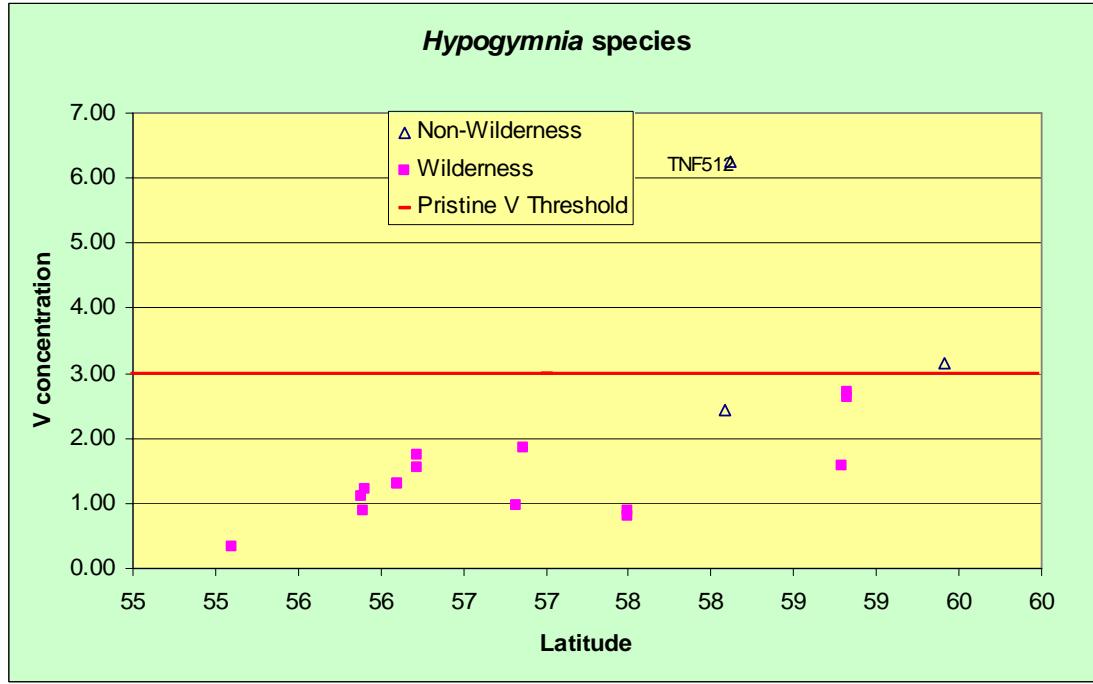


Figure XXX-12. Wilderness and Non-Wilderness plot means of V ppm in *Hypogymnia* species vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

V ppm

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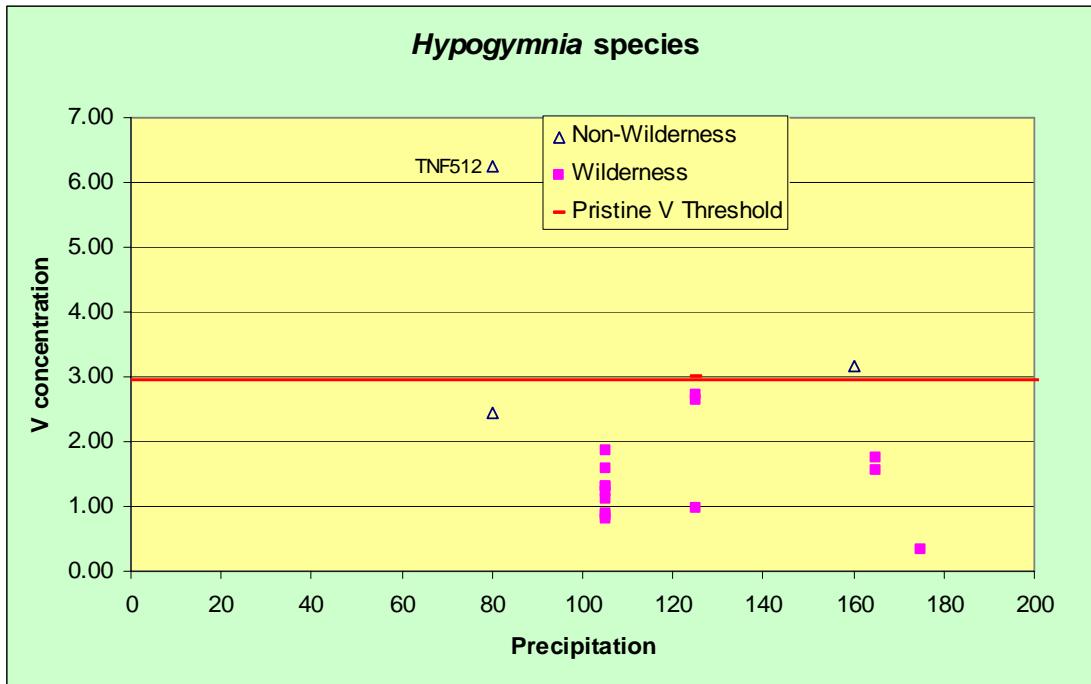


Figure XXX-13. Wilderness and Non-Wilderness plot means of V ppm
in *Hypogymnia species* vs. plot Precipitation.

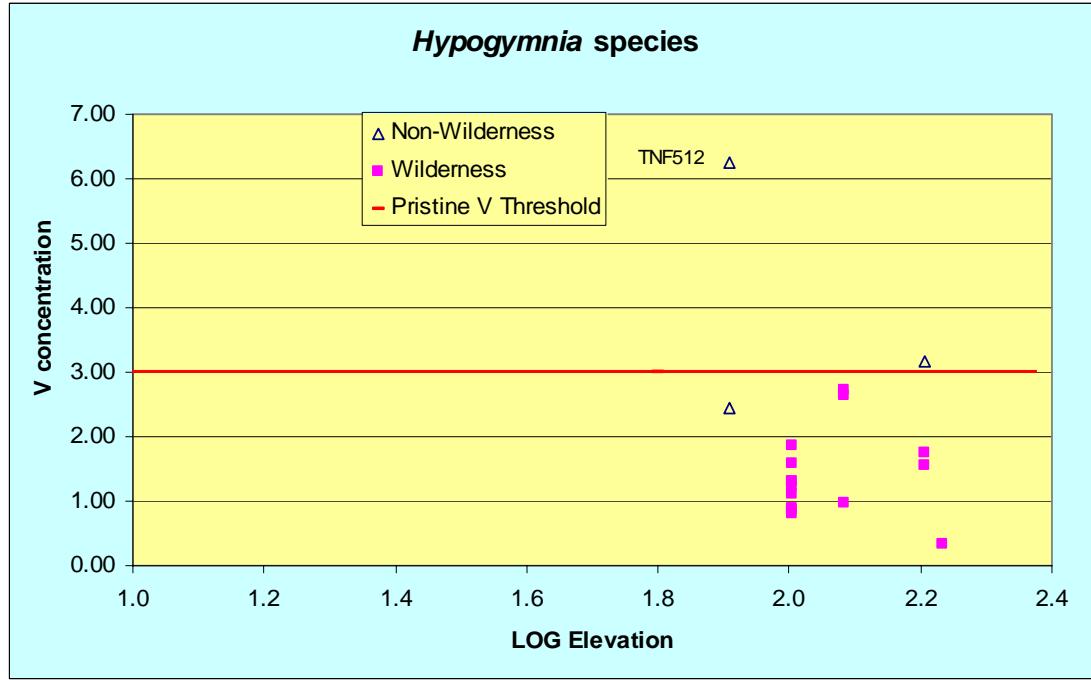


Figure XXX-14. Wilderness and Non-Wilderness plot means of V ppm
in *Hypogymnia species* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

V ppm

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Lobaria oregana

Table XXX-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the V ppm content of *Lobaria oregana* per year.

V ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	1.11	0.3151	0.3360	1.8779
2005	Non-Wilderness	2.34	NA	NA	NA
2005	Wilderness	0.51	0.1711	-0.0302	1.0587

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

V ppm

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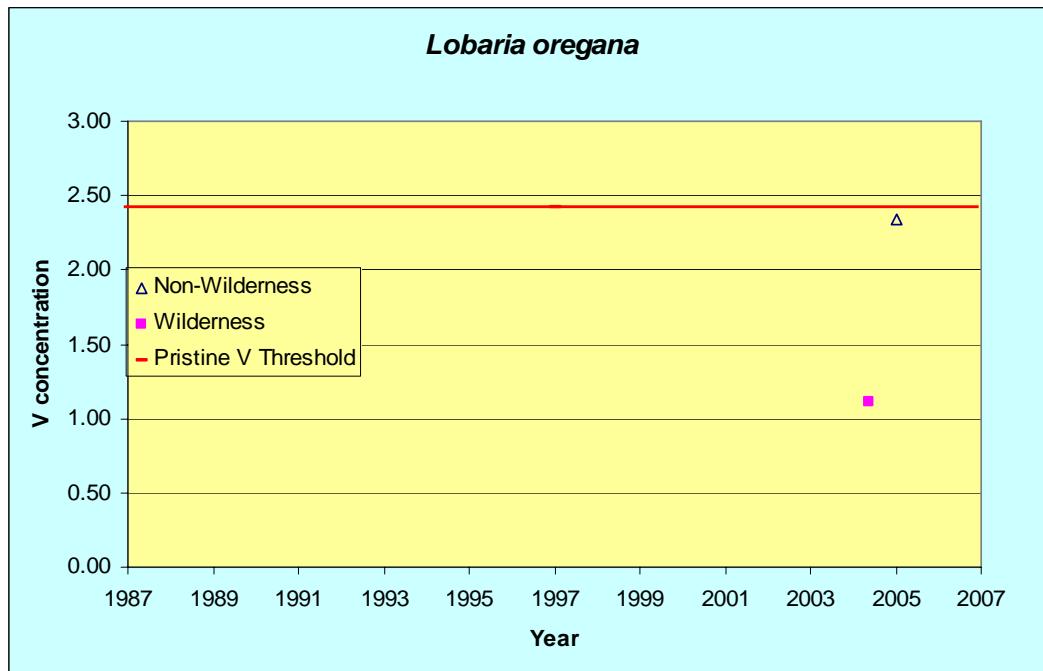


Figure XXX-15. Wilderness and Non-Wilderness yearly means of V ppm in *Lobaria oregana* per year.

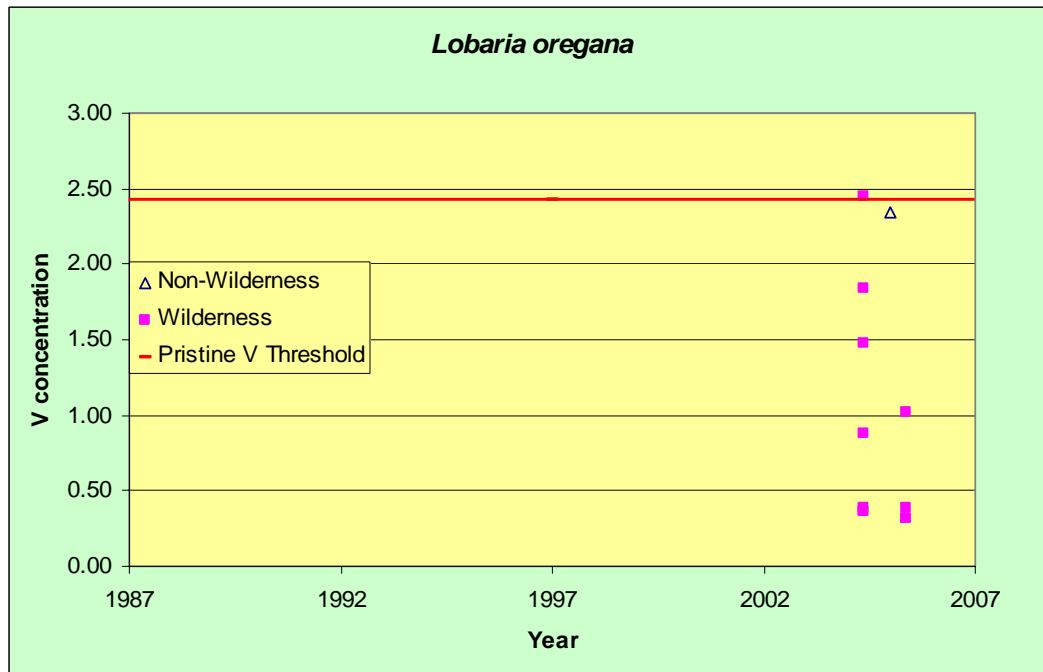


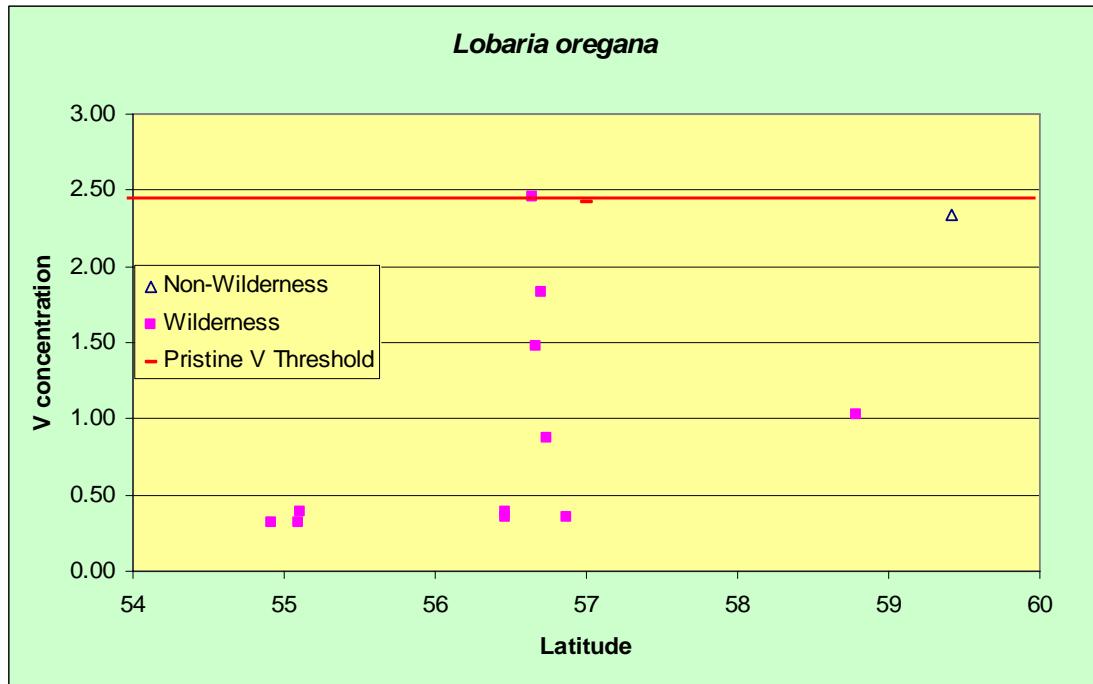
Figure XXX-16. Wilderness and Non-Wilderness plot means of V ppm in *Lobaria oregana* per year.

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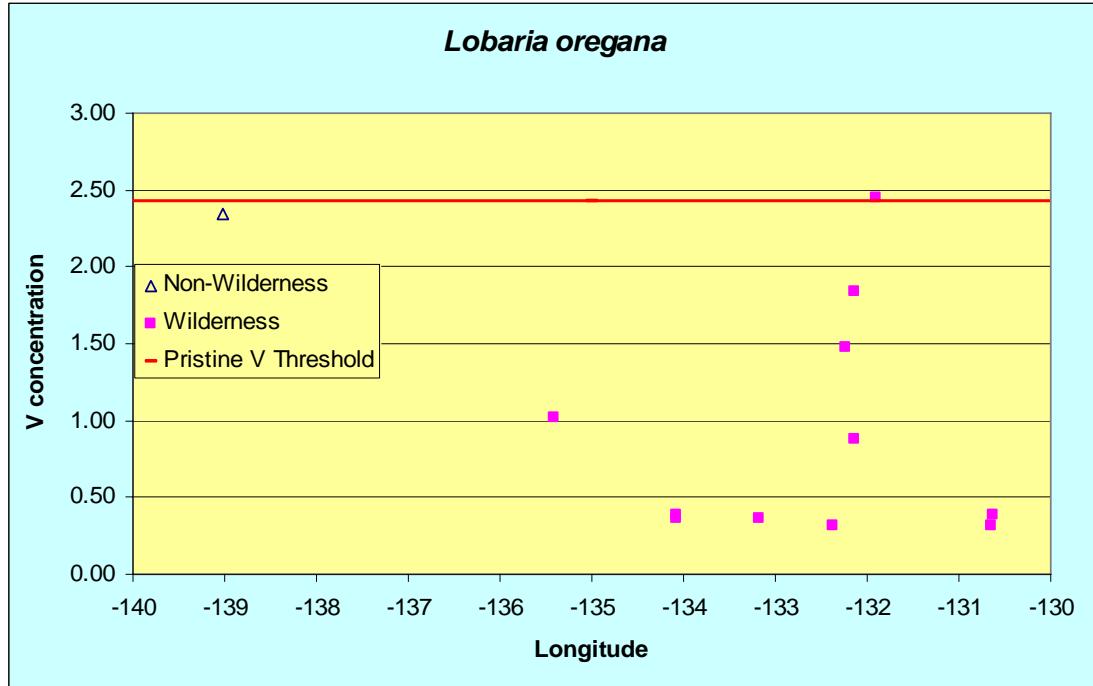
ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

V ppm

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**Figure XXX-17. Wilderness and Non-Wilderness plot means of V ppm
in *Lobaria oregana* vs. plot Latitude.**



**Figure XXX-18. Wilderness and Non-Wilderness plot means of V ppm
in *Lobaria oregana* vs. plot Longitude.**

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

V ppm

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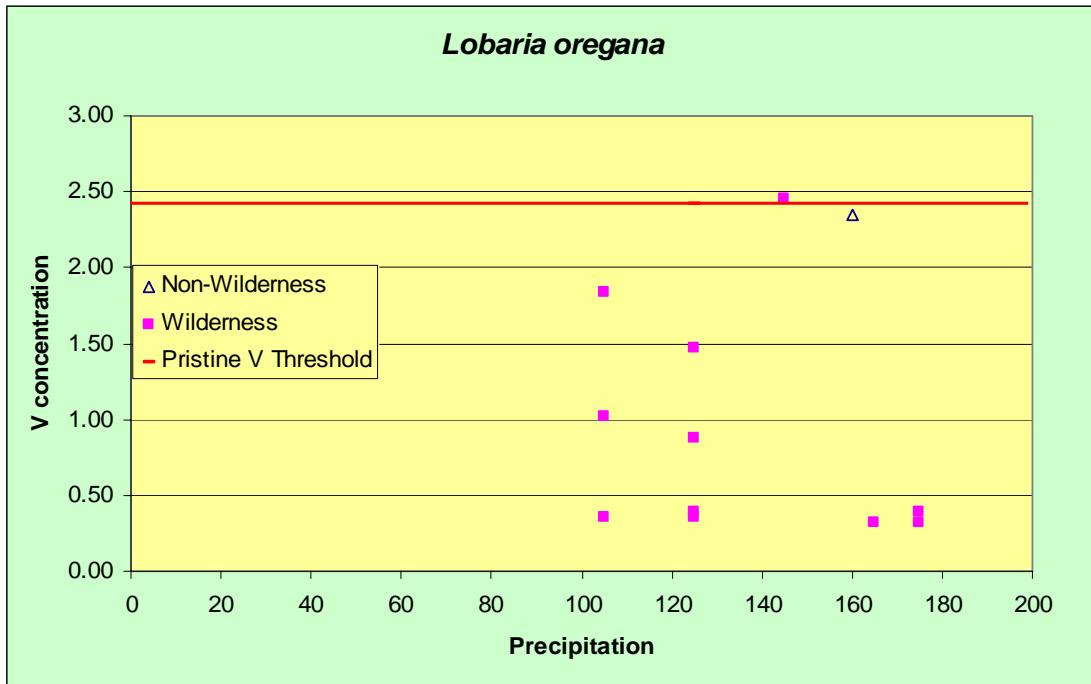


Figure XXX-19. Wilderness and Non-Wilderness plot means of V ppm
in *Lobaria oregana* vs. plot Precipitation.

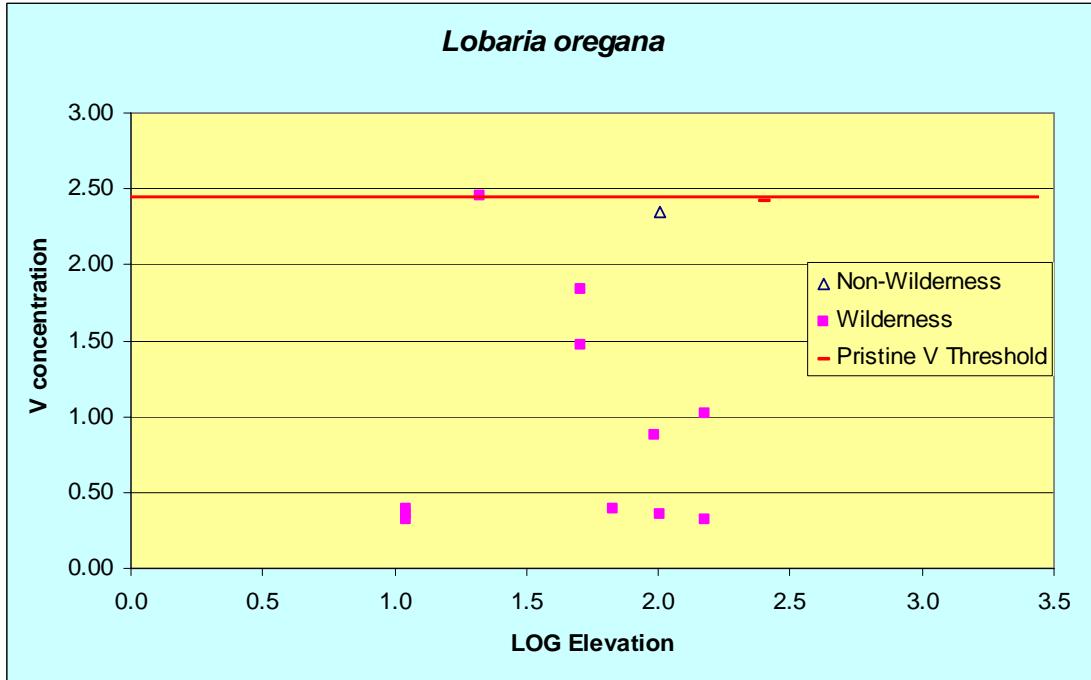


Figure XXX-20. Wilderness and Non-Wilderness plot means of V ppm
in *Lobaria oregana* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

V ppm

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Platismatia glauca

Table XXX-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the V ppm content of *Platismatia glauca* per year.

V ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2004	Wilderness	1.41	0.2856	0.7614	2.0535
2005	Non-Wilderness	3.55	0.4823	2.4584	4.6403
2005	Wilderness	1.45	0.3682	0.5794	2.3206

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

V ppm

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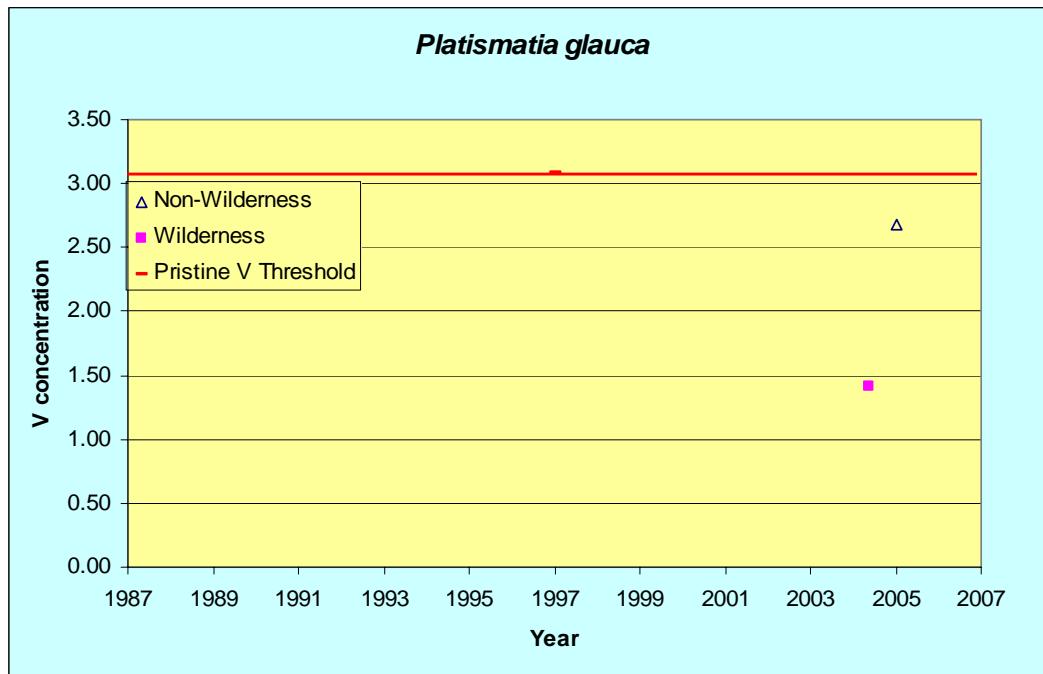


Figure XXX-21. Wilderness and Non-Wilderness yearly means of V ppm in *Platismatia glauca* per year.

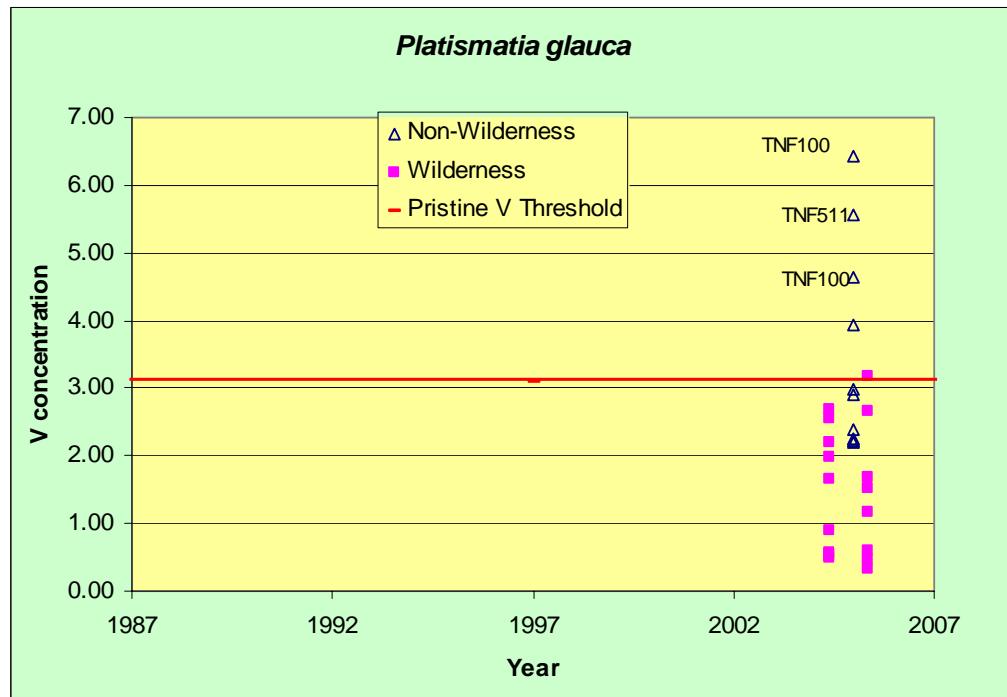


Figure XXX-22. Wilderness and Non-Wilderness plot means of V ppm in *Platismatia glauca* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

V ppm

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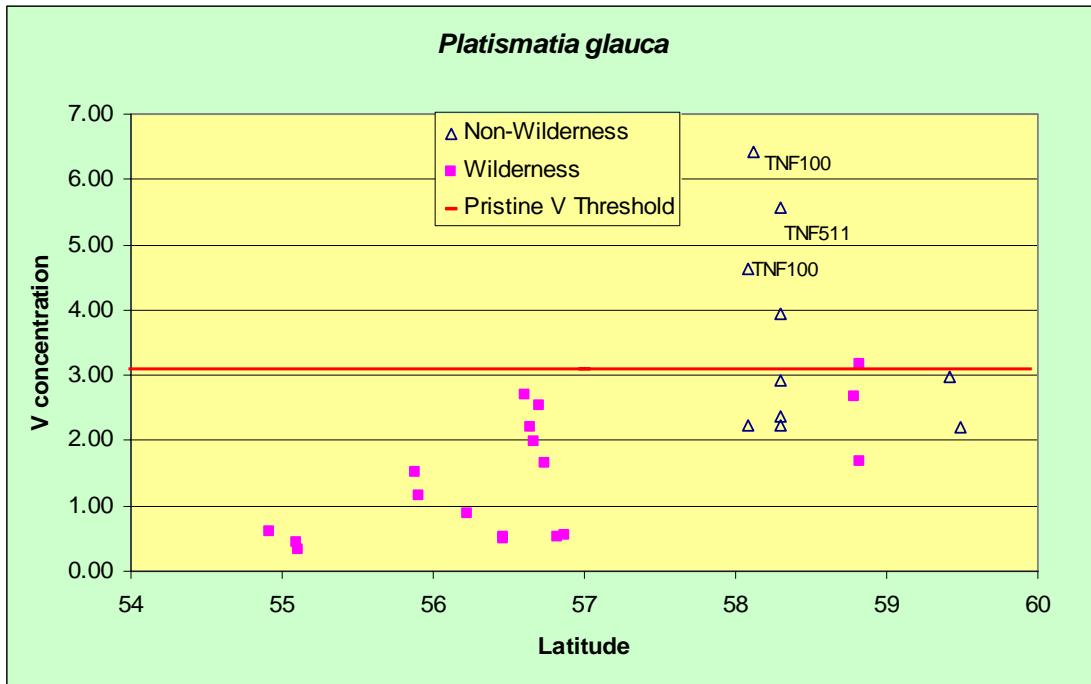


Figure XXX-23. Wilderness and Non-Wilderness plot means of V ppm
in *Platismatia glauca* vs. plot Latitude.

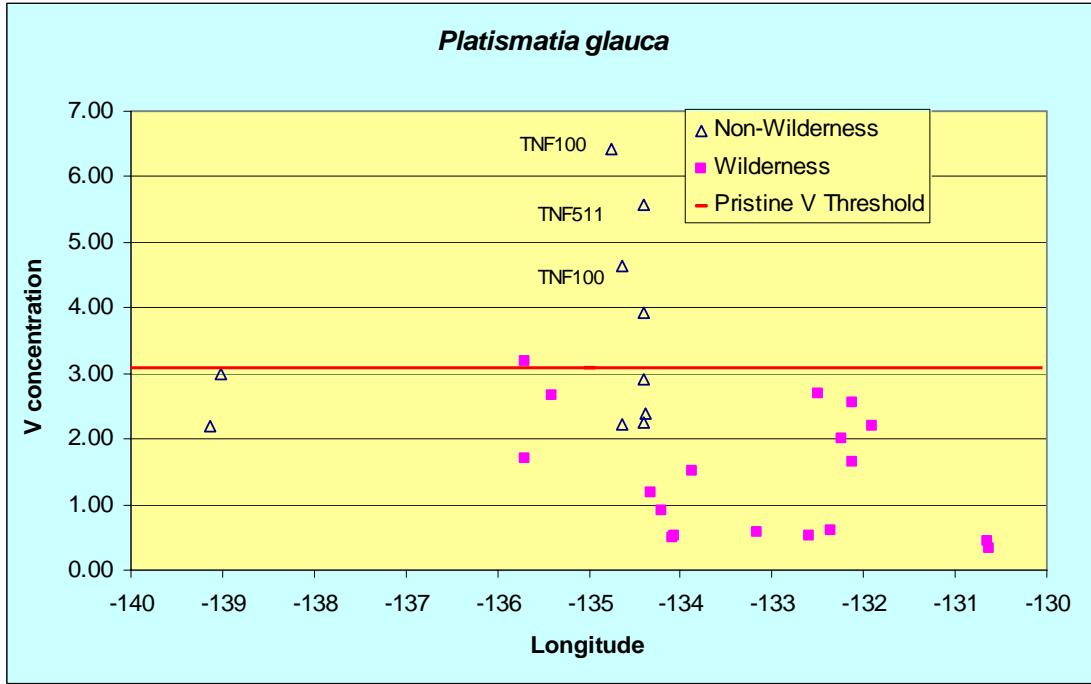


Figure XXX-24. Wilderness and Non-Wilderness plot means of V ppm
in *Platismatia glauca* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

V ppm

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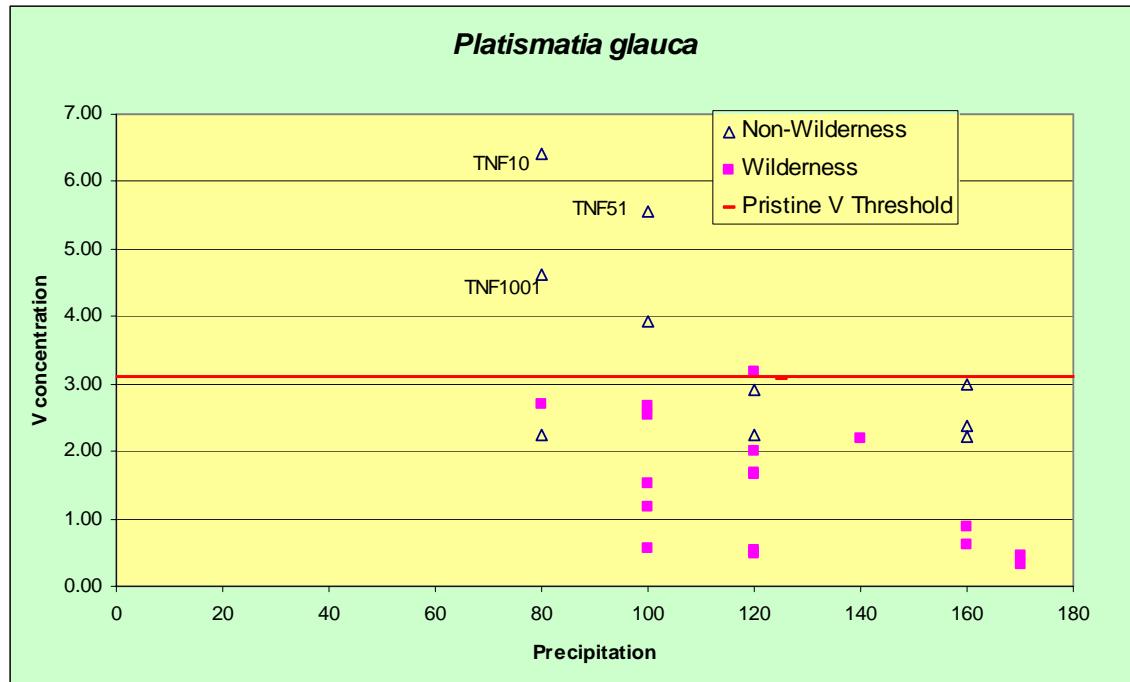


Figure XXX-25. Wilderness and Non-Wilderness plot means of V ppm
in *Platismatia glauca* vs. plot Precipitation.

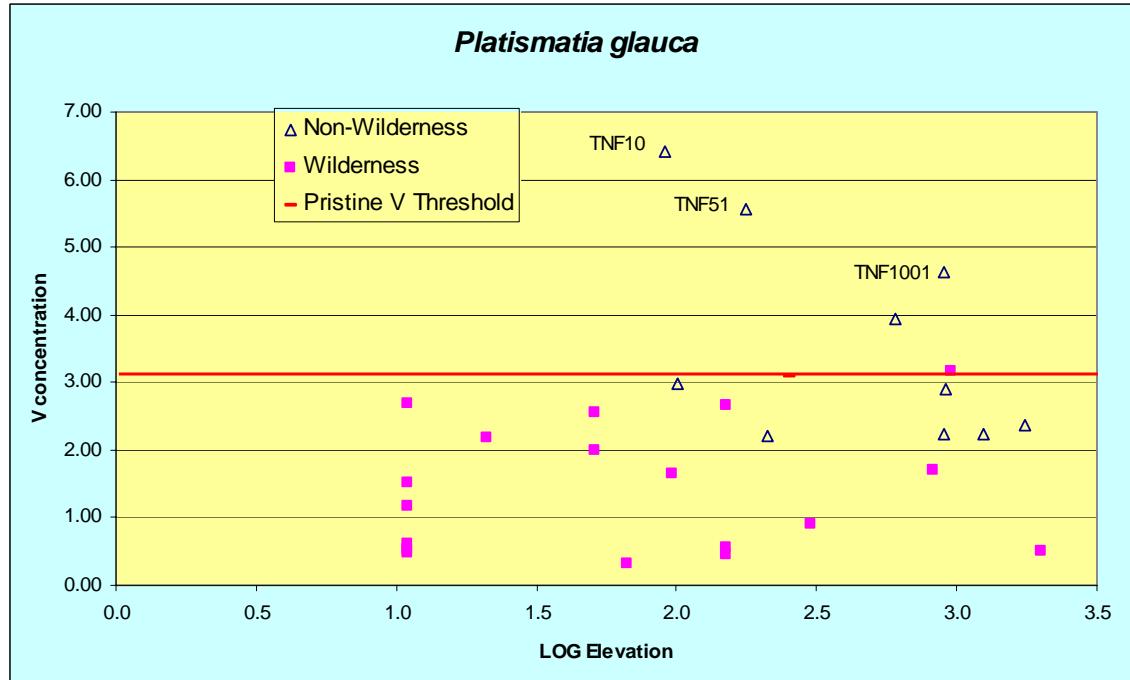


Figure XXX-26. Wilderness and Non-Wilderness plot means of V ppm
in *Platismatia glauca* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Zn ppm

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XXXI. SUMMARY OF Zn PPM DATA ANALYSIS

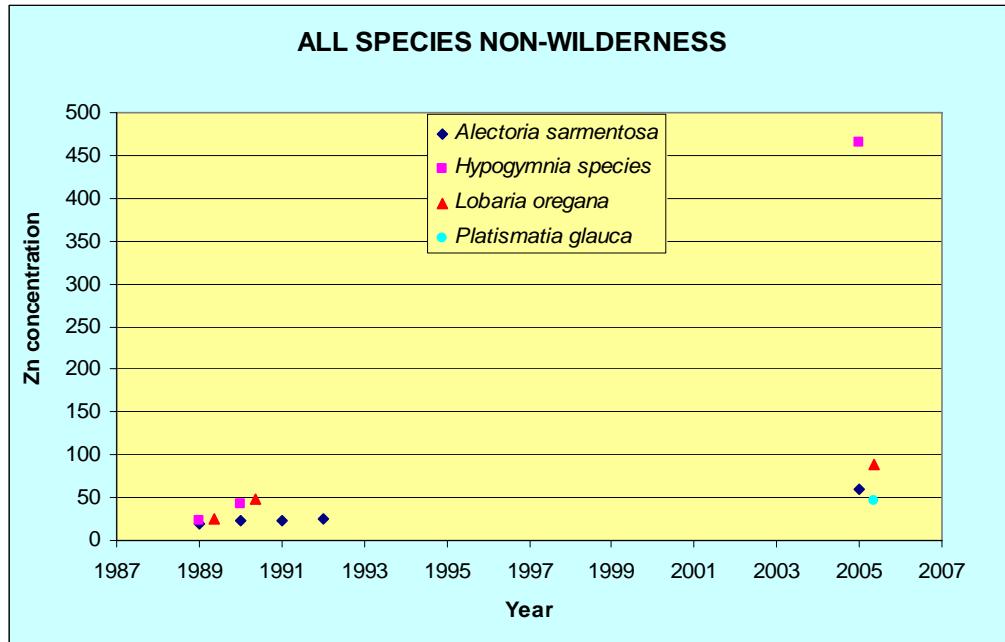


Figure XXXI-27. Wilderness plot means of Zn ppm
in All Species per year.

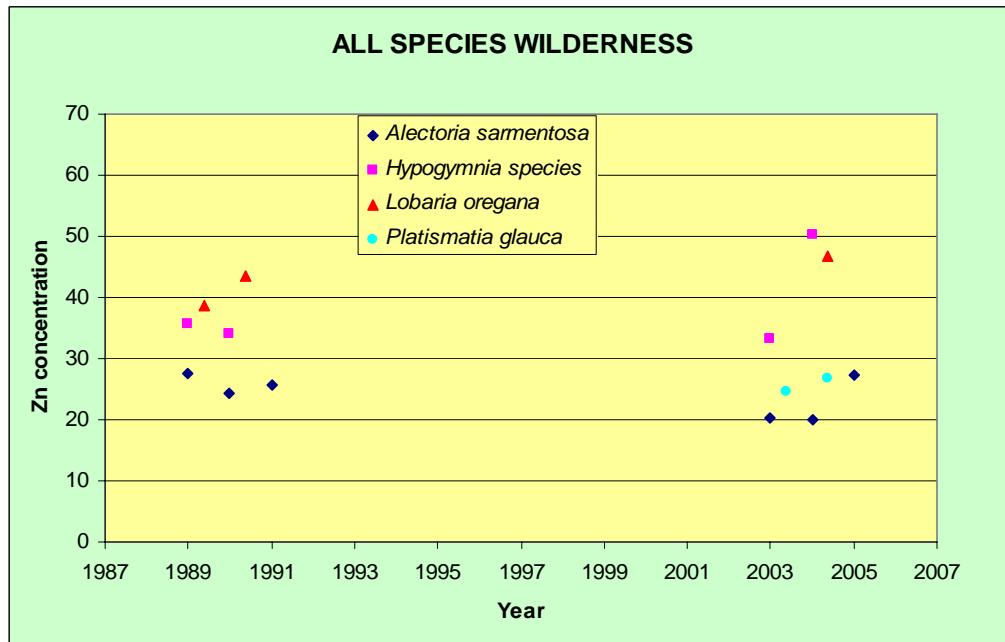


Figure XXXI-28. Non-Wilderness plot means of Zn ppm
in All Species per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Zn ppm

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Alectoria sarmentosa

Summary Statistics:

Table XXXI-2. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Zn ppm content of *Alectoria sarmentosa* per year.

Zn ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	19.23	1.4279	15.2625	23.1915
1989	Wilderness	27.70	2.1087	22.2788	33.1200
1990	Non-Wilderness	22.61	1.7568	19.0031	26.2253
1990	Wilderness	24.43	2.4163	18.5126	30.3374
1991	Non-Wilderness	22.3505	0.7525	20.7696	23.9314
1991	Wilderness	25.74	2.1710	19.7112	31.7663
1992	Non-Wilderness	26.01	2.7419	19.5289	32.4961
2003	Wilderness	20.21	7.9278	80.5194	120.9439
2004	Wilderness	20.04	1.1782	17.6020	22.4764
2005	Non-Wilderness	60.43	10.7321	32.8410	88.0166
2005	Wilderness	27.16	1.9577	22.7344	31.5919

Summary of Statistical Tests:

$$t = -0.048, \text{ df} = 8, \text{ p-value} = 0.9629$$

There is no evidence of a difference in Zn ppm content in *Alectoria sarmentosa* from pre-2000 and post 2000 samples (p-value = 0.9629).

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Zn ppm

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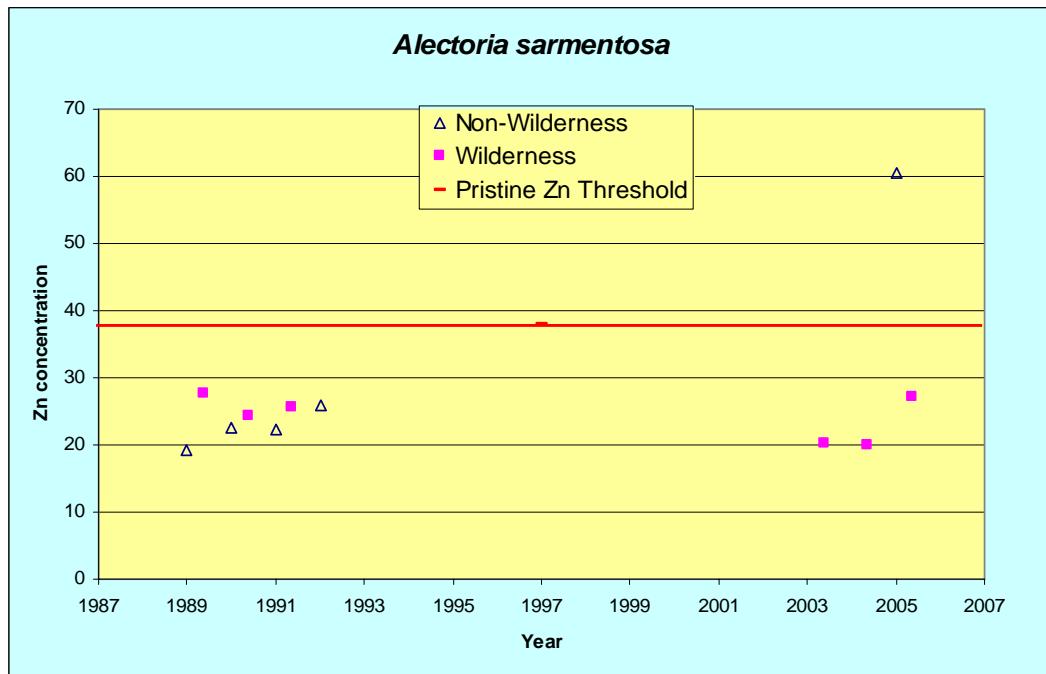


Figure XXXI-3. Wilderness and Non-Wilderness yearly means of Zn ppm in *Alectoria sarmentosa* per year.

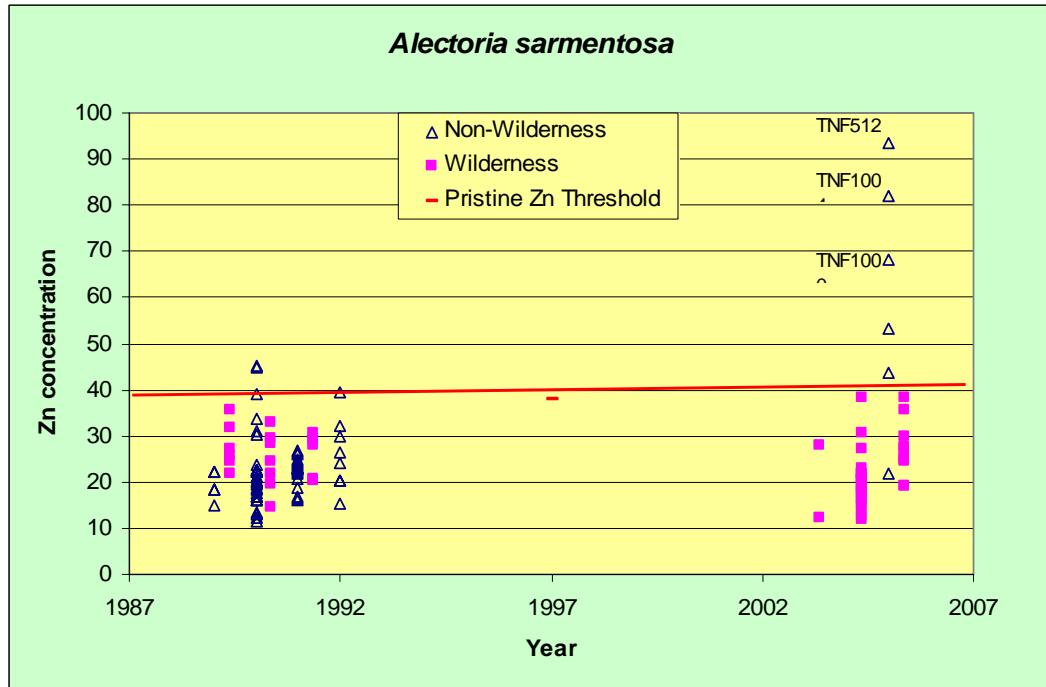


Figure XXXI-4. Wilderness and Non-Wilderness plot means of Zn ppm in *Alectoria sarmentosa* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Zn ppm

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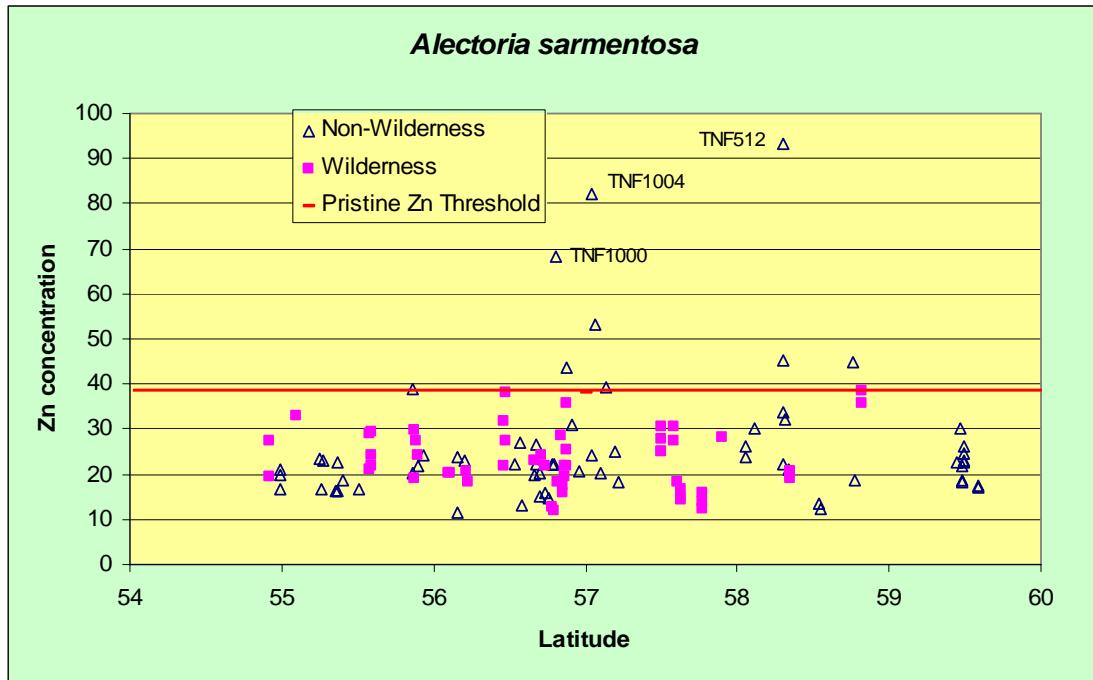


Figure XXXI-5. Wilderness and Non-Wilderness plot means of Zn ppm in *Alectoria sarmentosa* vs. plot Latitude.

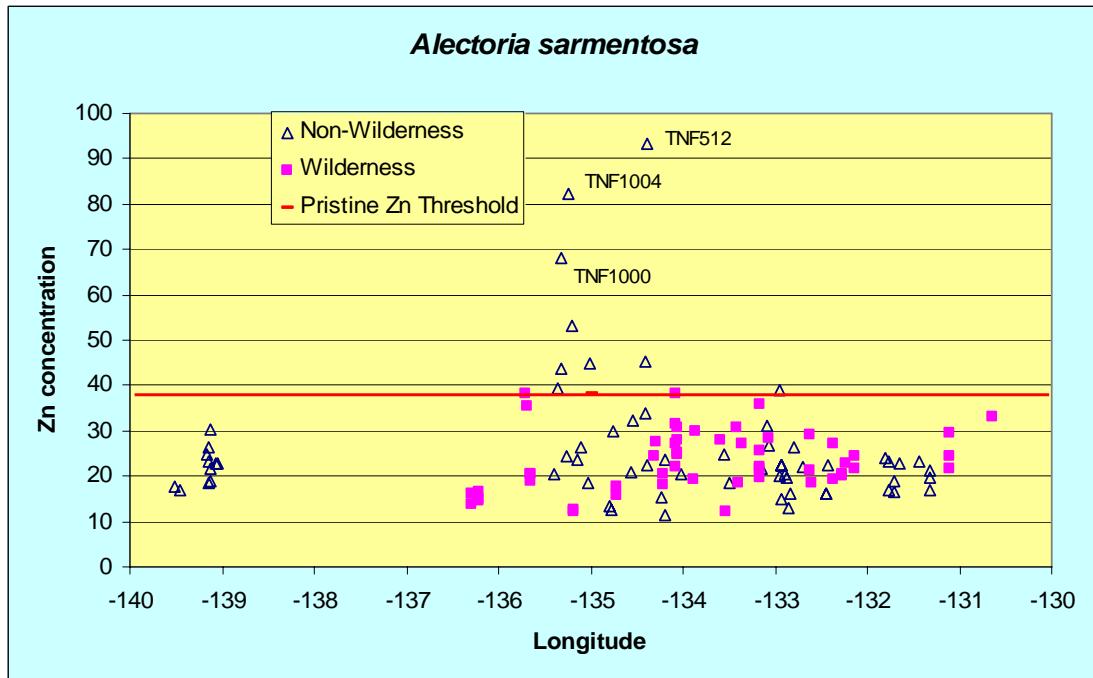


Figure XXXI-6. Wilderness and Non-Wilderness plot means of Zn ppm in *Alectoria sarmentosa* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Zn ppm

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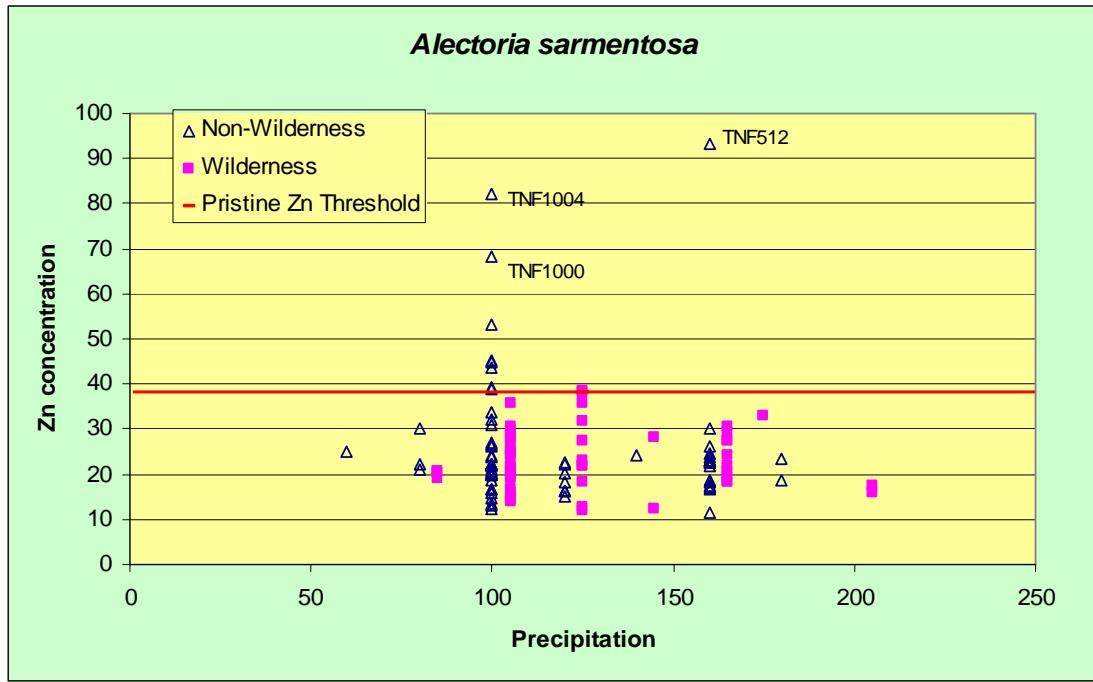


Figure XXXI-7. Wilderness and Non-Wilderness plot means of Zn ppm in *Alectoria sarmentosa* vs. plot Precipitation.

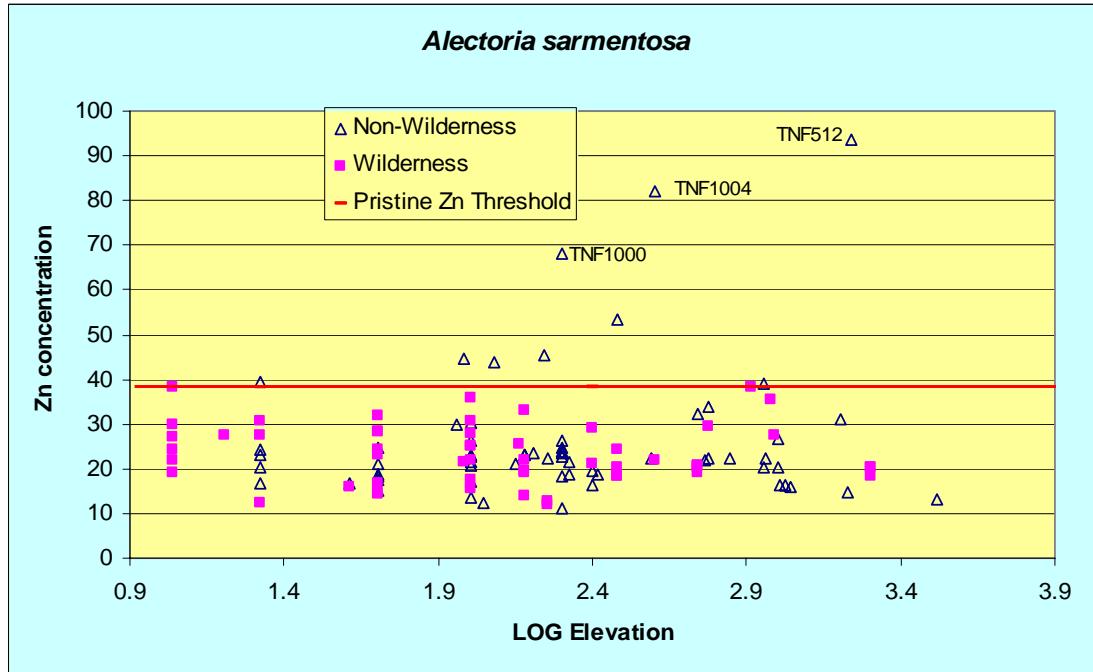


Figure XXXI-8. Wilderness and Non-Wilderness plot means of Zn ppm in *Alectoria sarmentosa* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Zn ppm

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Hypogymnia species

In this series, all of the *Hypogymnia* species were included as a group.

Table XXXI-3. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Zn ppm content of *Hypogymnia species* per year.

Zn ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	24.05	2.2500	4.5390	52.6390
1989	Wilderness	35.66	4.5948	22.8977	48.4123
1990	Non-Wilderness	43.21	4.2690	34.2443	52.1820
1990	Wilderness	33.94	2.8097	27.0677	40.8180
2003	Wilderness	33.15	NA	NA	NA
2004	Wilderness	50.18	5.1319	36.9903	63.3743
2005	Non-Wilderness	465.56	227.7318	514.2949	1445.4066
2005	Wilderness	58.42	4.7799	47.3967	69.4416

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Zn ppm

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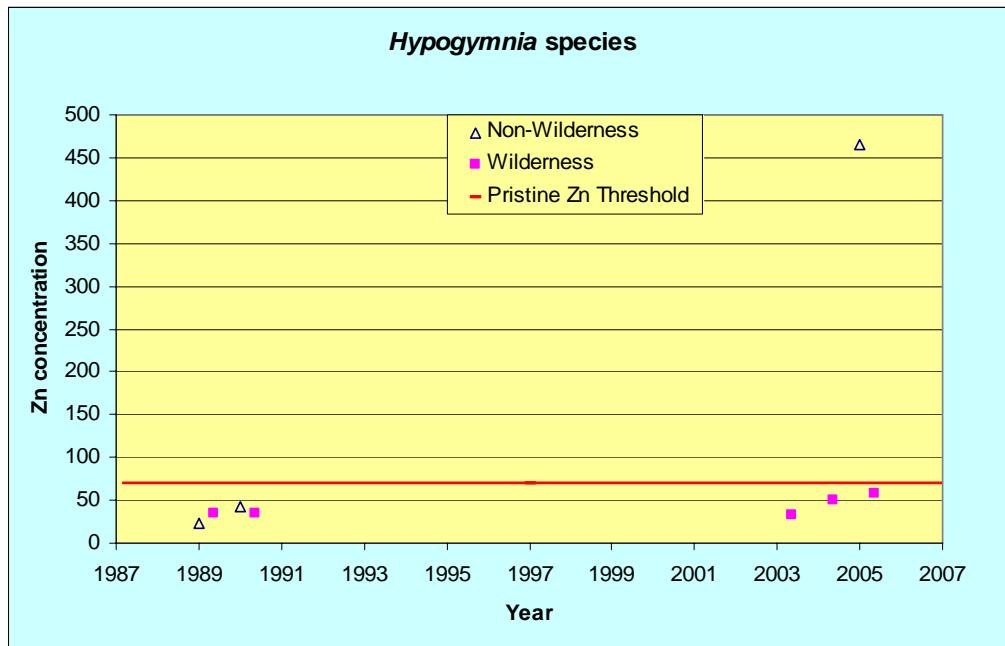


Figure XXXI-9. Wilderness and Non-Wilderness yearly means of Zn ppm in *Hypogymnia species* per year.

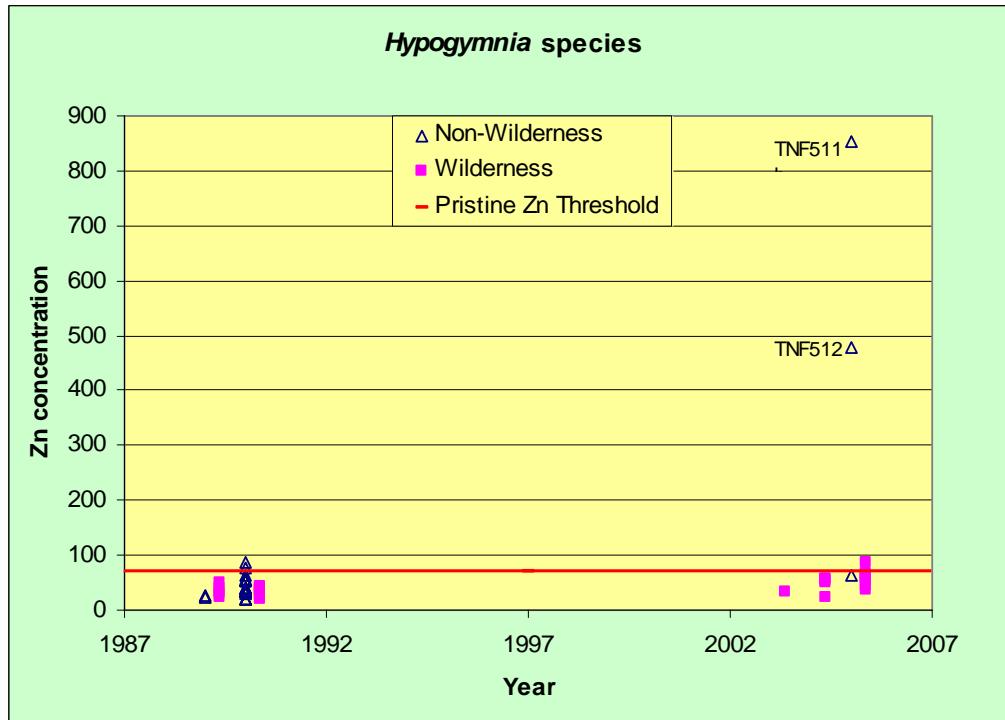


Figure XXXI-10. Wilderness and Non-Wilderness plot means of Zn ppm in *Hypogymnia species* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Zn ppm

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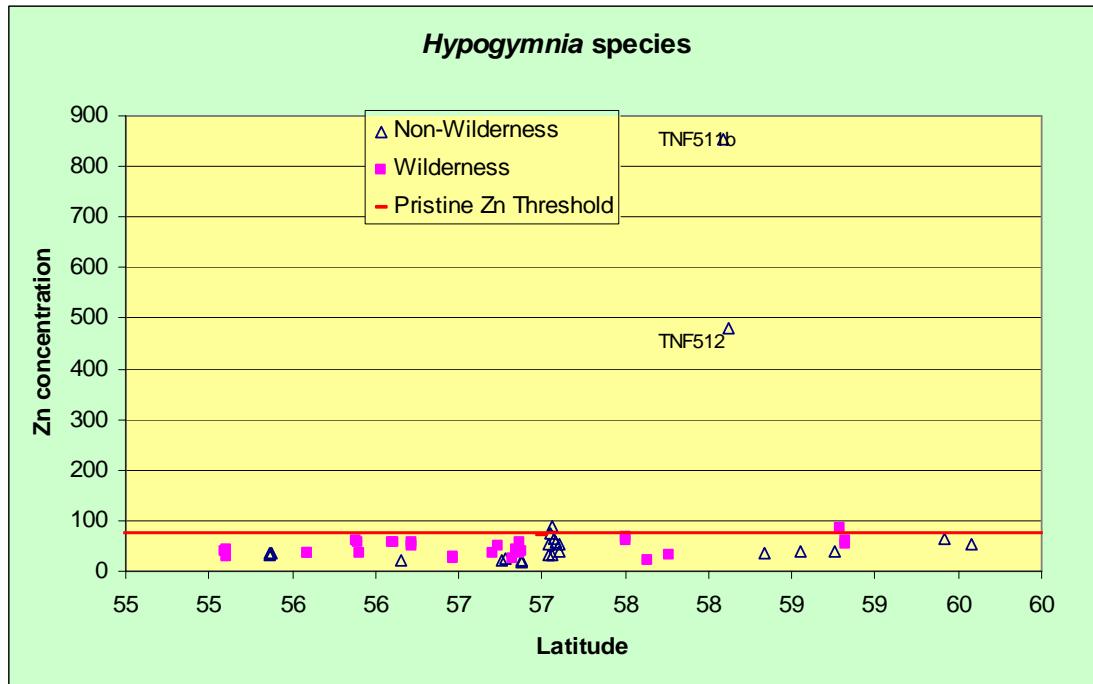


Figure XXXI-11. Wilderness and Non-Wilderness plot means of Zn ppm in *Hypogymnia* species vs. plot Latitude.

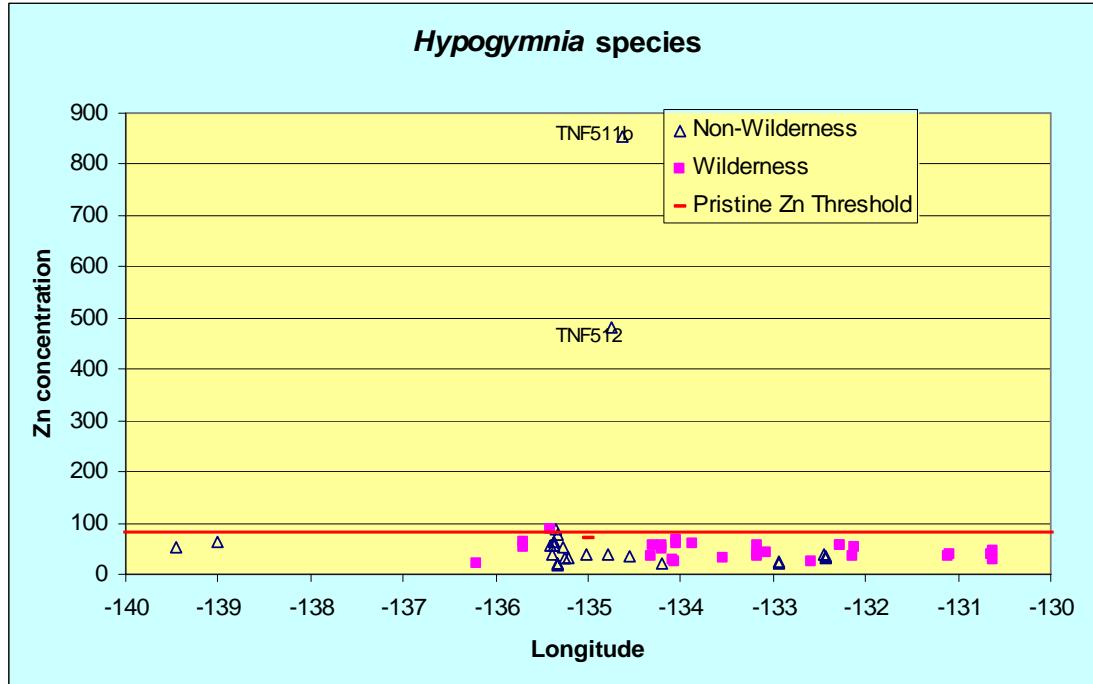


Figure XXXI-12. Wilderness and Non-Wilderness plot means of Zn ppm in *Hypogymnia* species vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Zn ppm

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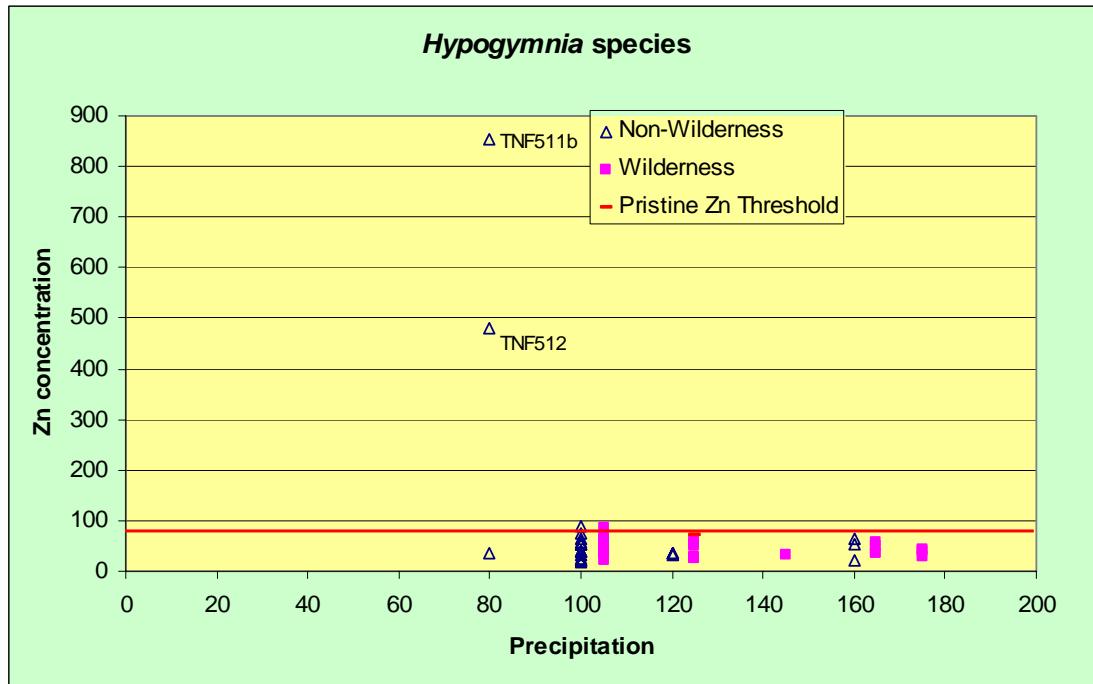


Figure XXXI-13. Wilderness and Non-Wilderness plot means of Zn ppm in *Hypogymnia* species vs. plot Precipitation.

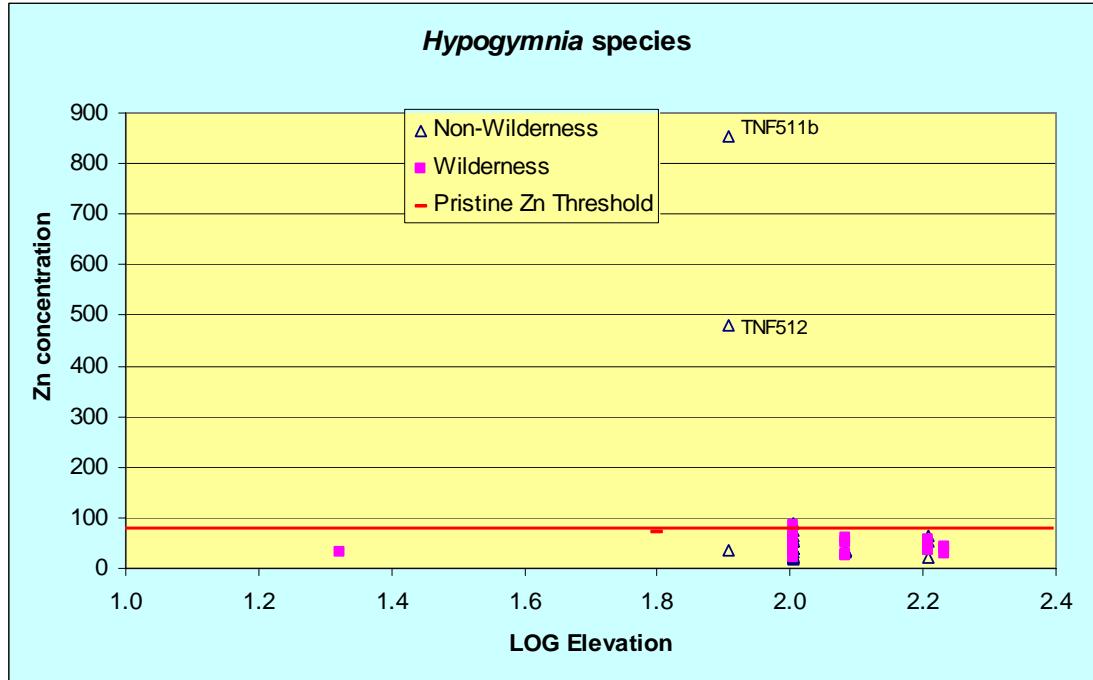


Figure XXXI-14. Wilderness and Non-Wilderness plot means of Zn ppm in *Hypogymnia* species vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Zn ppm

██

Lobaria oregana

Table XXXI-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Zn ppm content of *Lobaria oregana* per year.

Zn ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
1989	Non-Wilderness	24.95	6.2151	5.1709	44.7291
1989	Wilderness	38.52	5.9265	22.0631	54.9723
1990	Non-Wilderness	48.98	5.5963	36.7844	61.1708
1990	Wilderness	43.61	2.7187	36.6252	50.6026
2004	Wilderness	46.80	6.0877	31.9051	61.6971
2005	Non-Wilderness	88.41	NA	NA	NA
2005	Wilderness	46.39	12.1530	7.7157	85.0684

Summary of Statistical Tests:

$$t = -0.7491, \text{ df} = 4, \text{ p-value} = 0.4955$$

There is no evidence of a difference in Zn ppm content in *Lobaria oregana* from pre-2000 and post 2000 samples (p-value = 0.4955).

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Zn ppm

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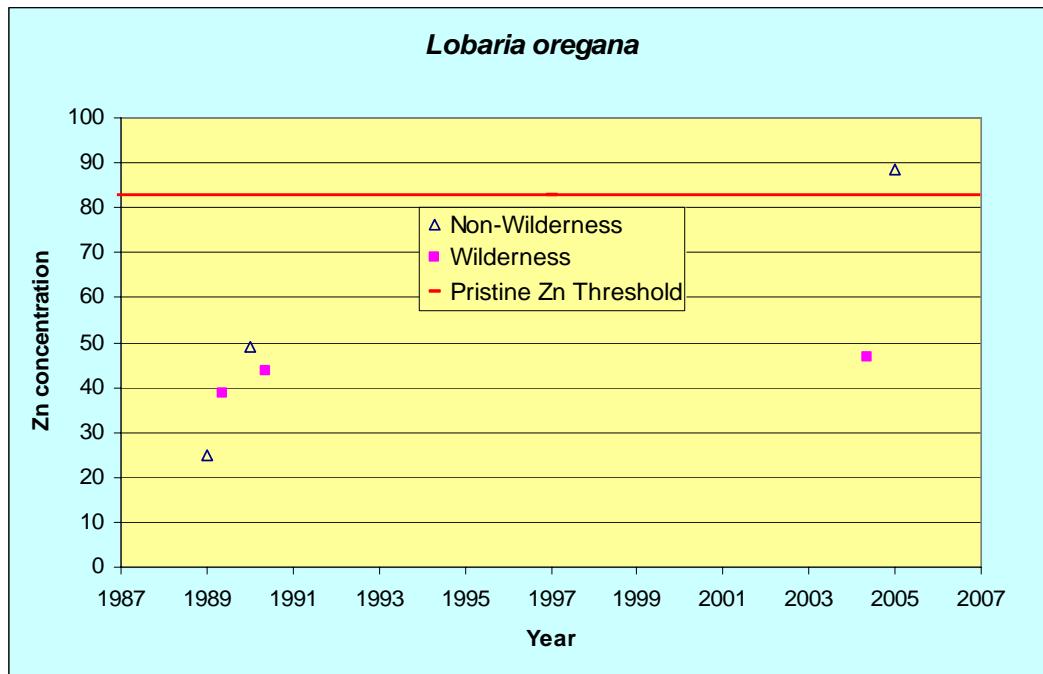


Figure XXXI-15. Wilderness and Non-Wilderness yearly means of Zn ppm in *Lobaria oregana* per year.

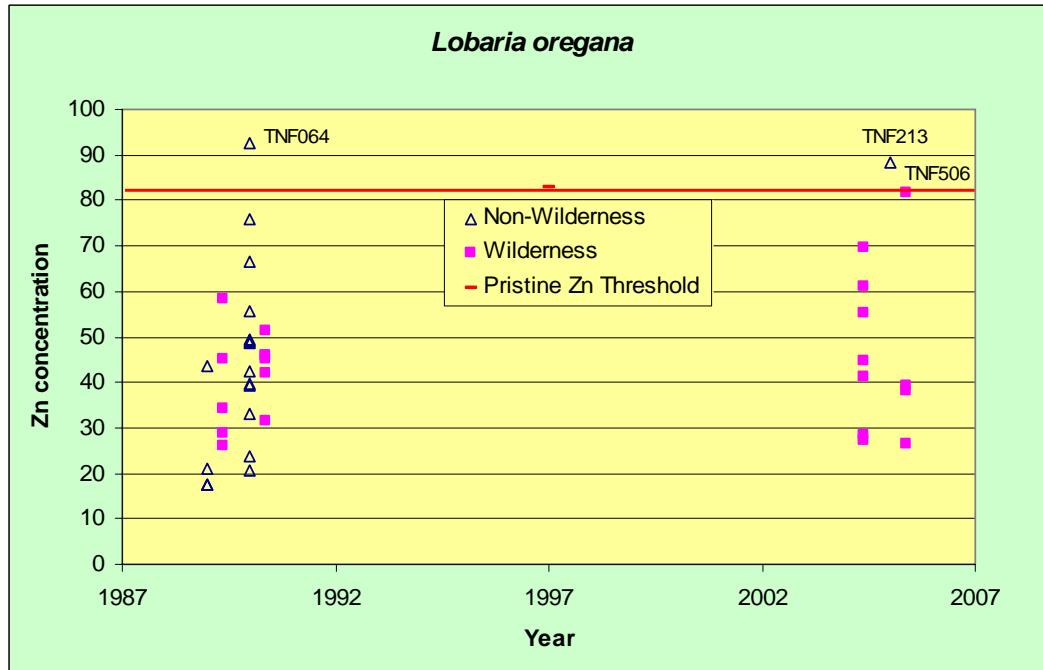


Figure XXXI-16. Wilderness and Non-Wilderness plot means of Zn ppm in *Lobaria oregana* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Zn ppm

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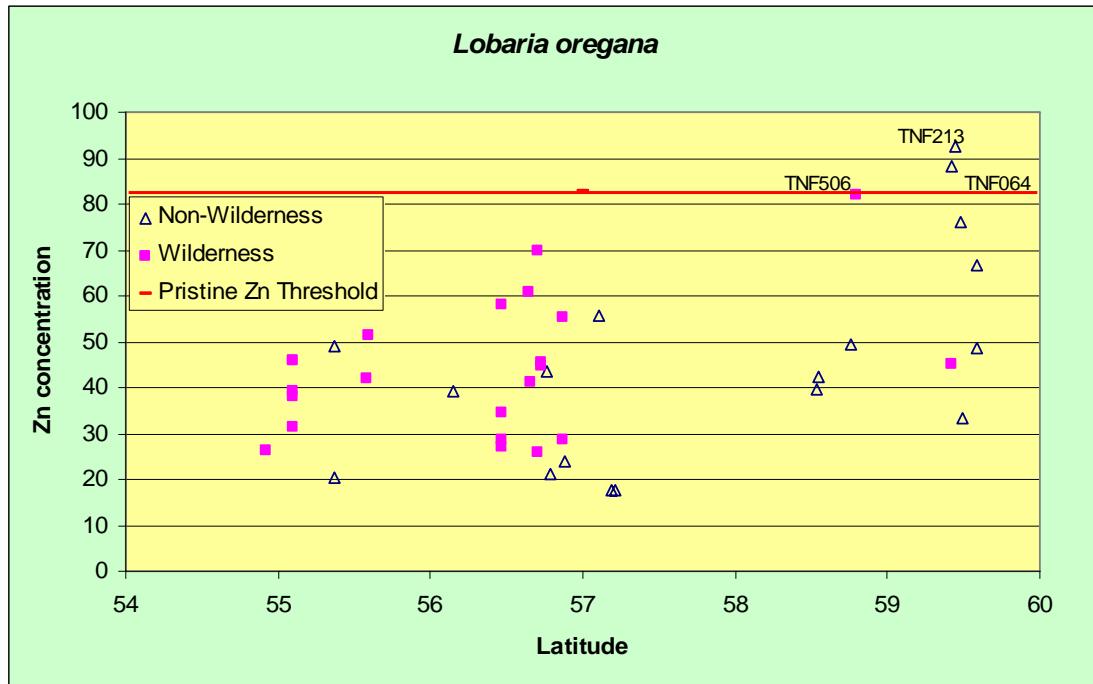


Figure XXXI-17. Wilderness and Non-Wilderness plot means of Zn ppm in *Lobaria oregana* vs. plot Latitude.

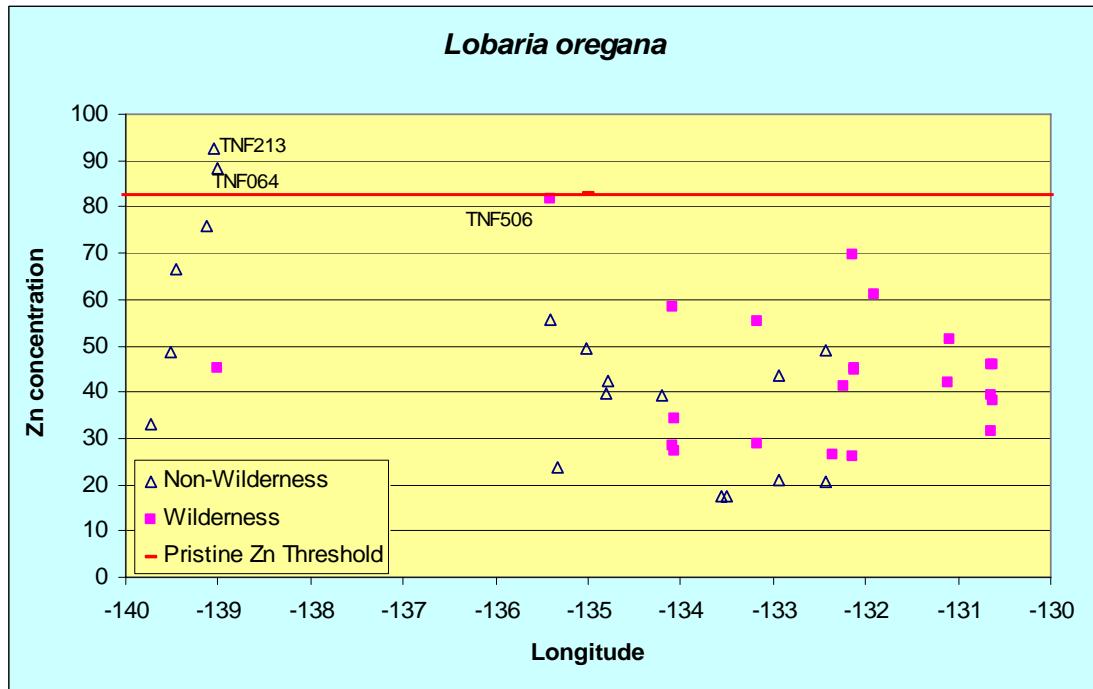


Figure XXXI-18. Wilderness and Non-Wilderness plot means of Zn ppm in *Lobaria oregana* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Zn ppm

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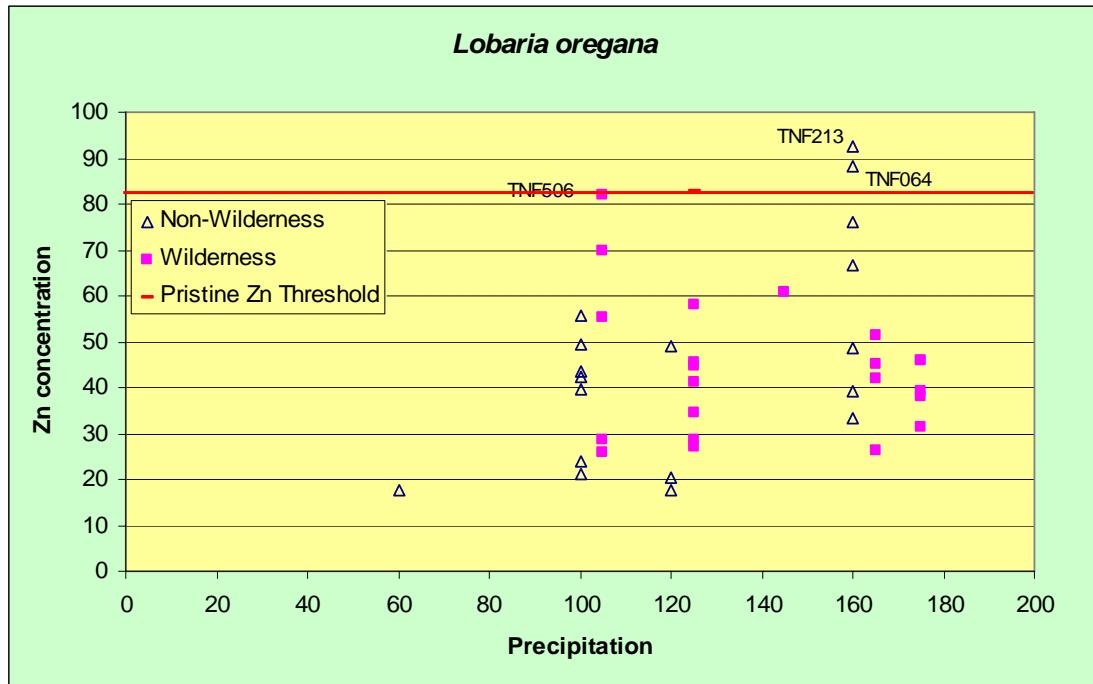


Figure XXXI-19. Wilderness and Non-Wilderness plot means of Zn ppm in *Lobaria oregana* vs. plot Precipitation.

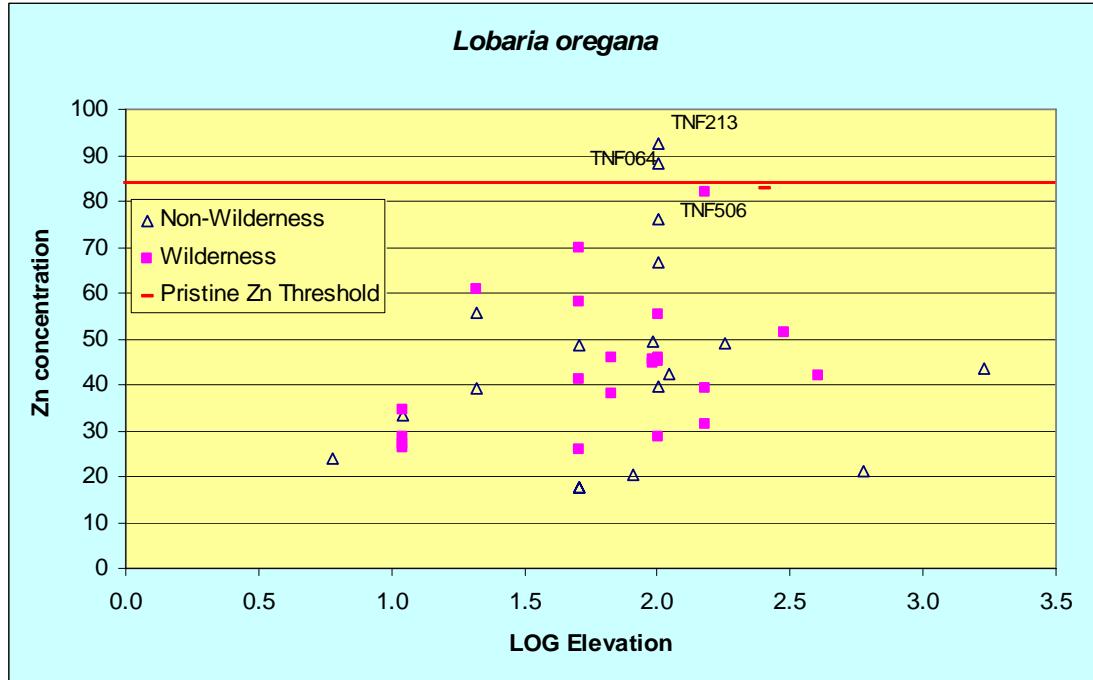


Figure XXXI-20. Wilderness and Non-Wilderness plot means of Zn ppm in *Lobaria oregana* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Zn ppm

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Platismatia glauca

Table XXXI-4. Wilderness and Non-Wilderness Means, Standard Errors, and 95% Confidence Intervals for the Zn ppm content of *Platismatia glauca* per year.

Zn ppm				95% CI	
Year	Plot Type	Mean	Std. Error	Lower	Upper
2003	Wilderness	24.65	NA	NA	NA
2004	Wilderness	26.81	2.2295	21.7695	31.8566
2005	Non-Wilderness	317.57	164.4844	54.5146	689.6646
2005	Wilderness	33.70	5.2992	21.1646	46.2260

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Zn ppm

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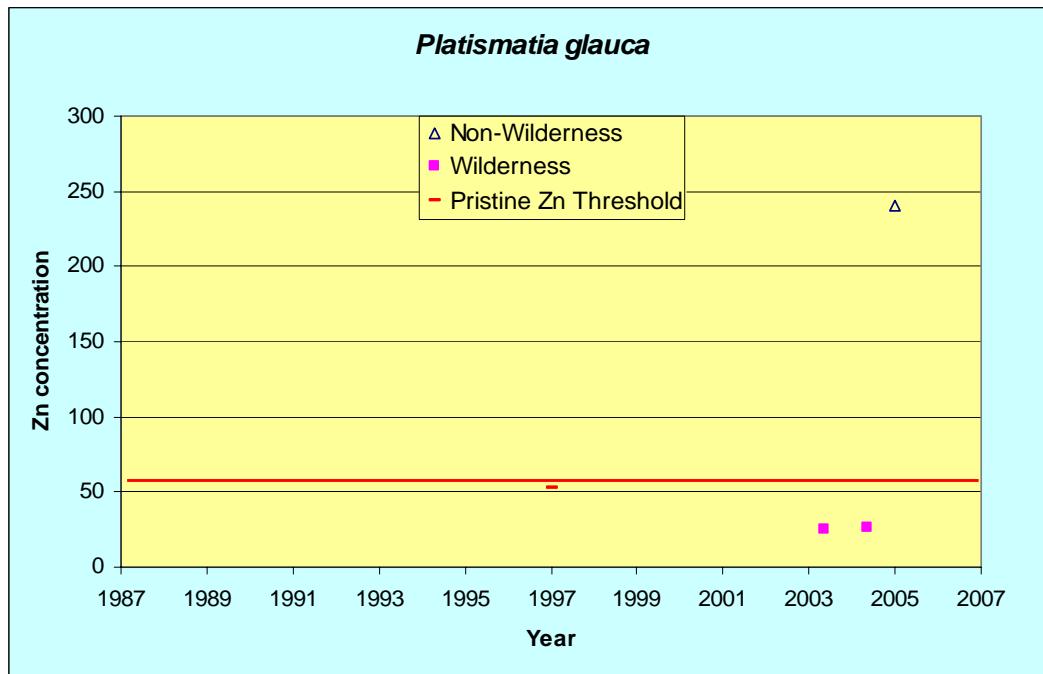


Figure XXXI-21. Wilderness and Non-Wilderness yearly means of Zn ppm in *Platismatia glauca* per year.

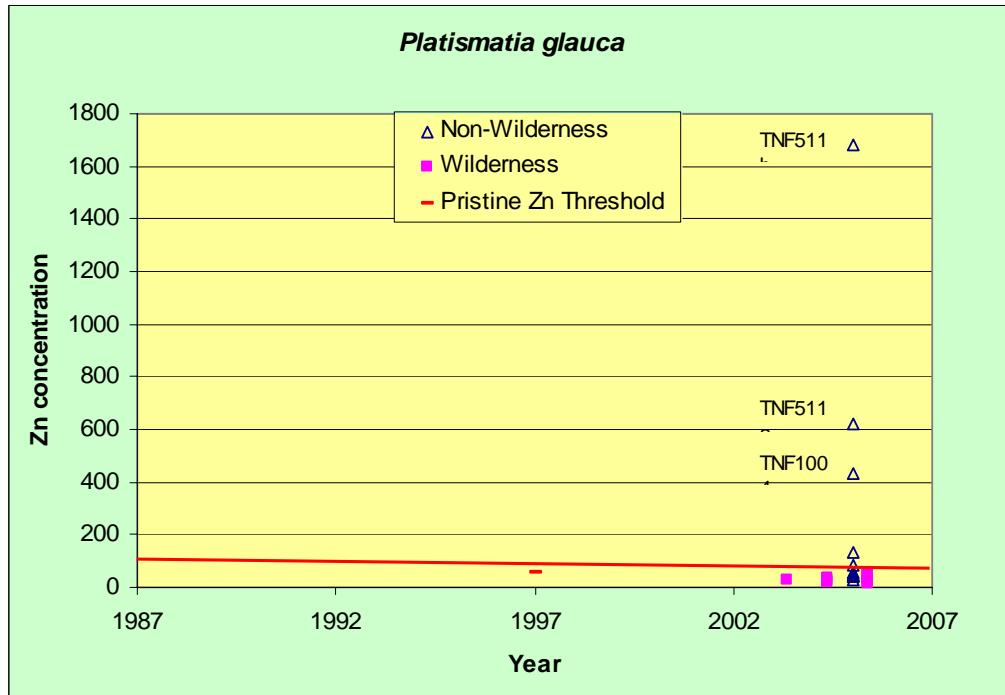


Figure XXXI-22. Wilderness and Non-Wilderness plot means of Zn ppm in *Platismatia glauca* per year.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Zn ppm

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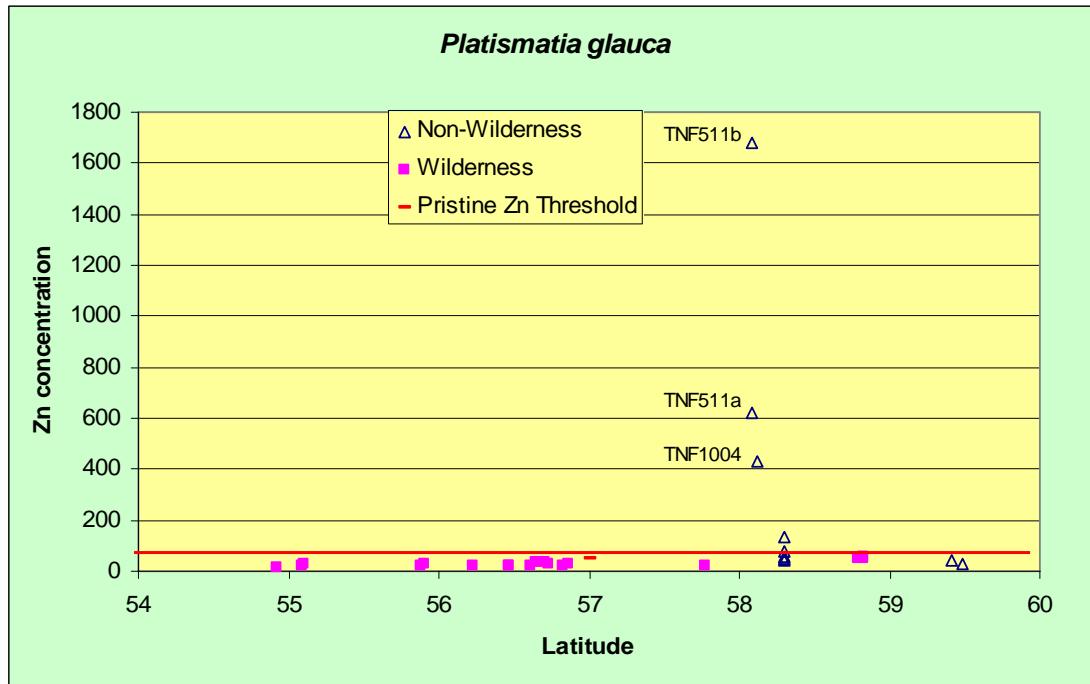


Figure XXXI-23. Wilderness and Non-Wilderness plot means of Zn ppm in *Platismatia glauca* vs. plot Latitude.

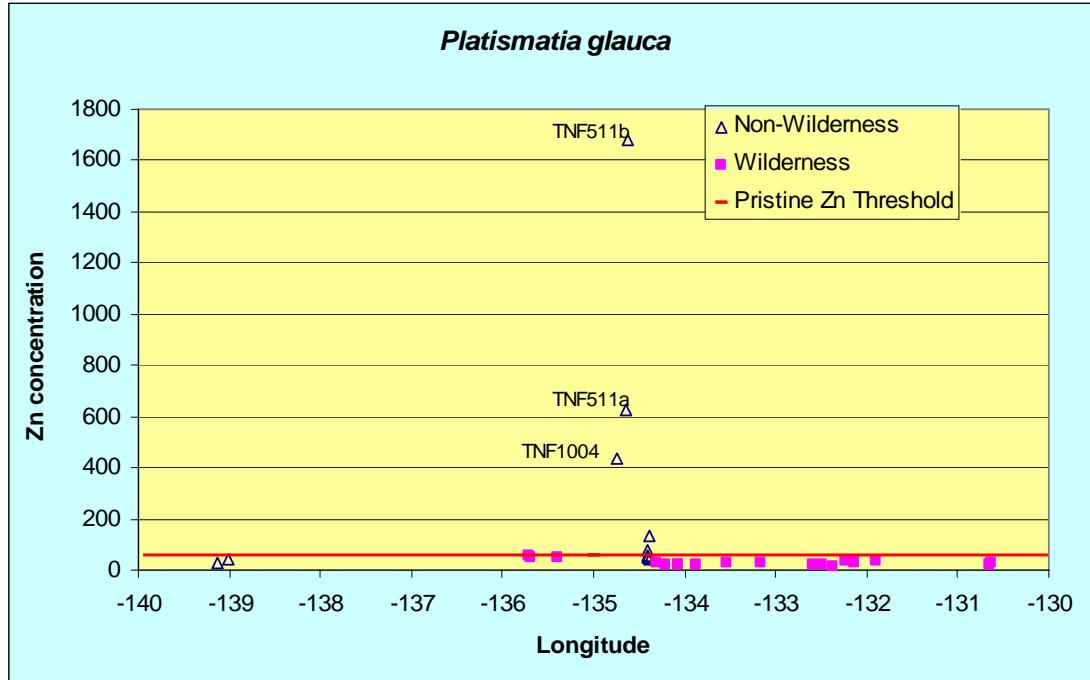


Figure XXXI-24. Wilderness and Non-Wilderness plot means of Zn ppm in *Platismatia glauca* vs. plot Longitude.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Zn ppm

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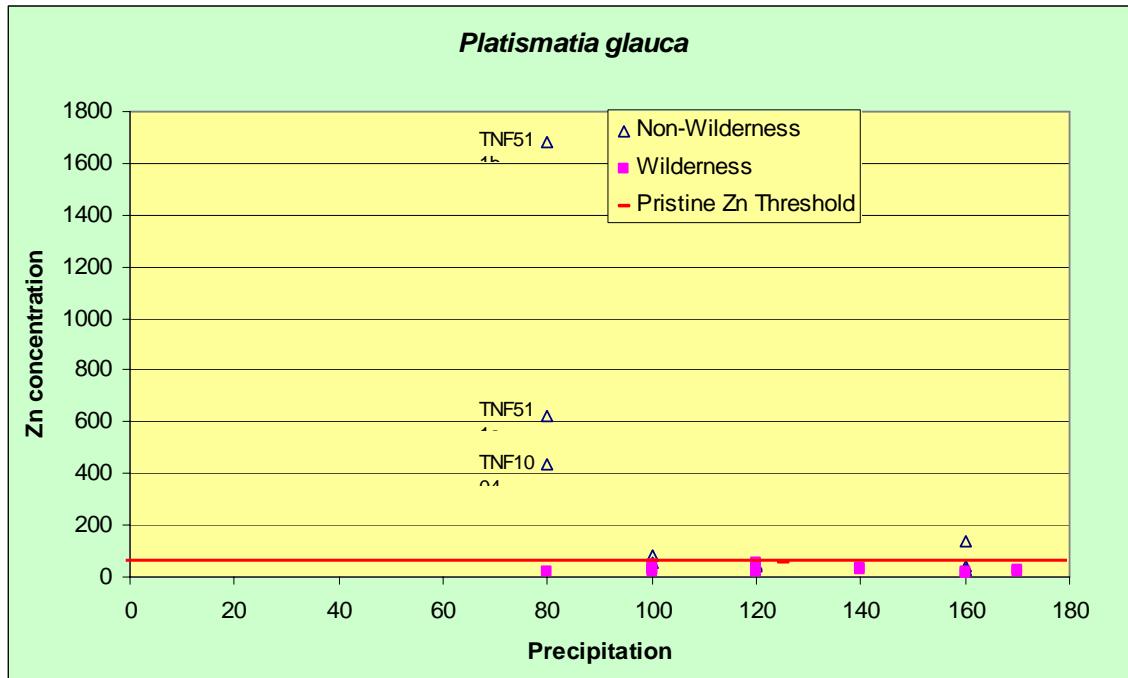


Figure XXXI-25. Wilderness and Non-Wilderness plot means of Zn ppm in *Platismatia glauca* vs. plot Precipitation.

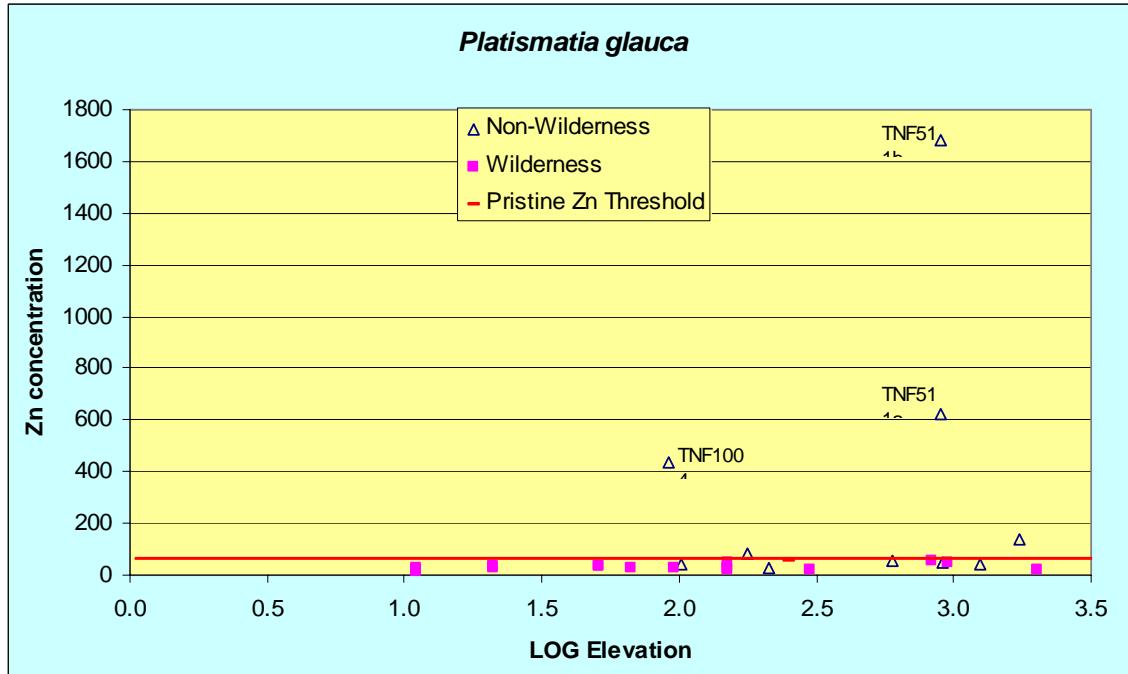


Figure XXXI-26. Wilderness and Non-Wilderness plot means of Zn ppm in *Platismatia glauca* vs. plot Log-Elevation.

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Thresholds

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XXXII. THRESHOLDS

Species	S	N	Al	B	Ba	Be
Alesar	0.06	0.56	56.78	9.33	15.84	0.04
Hypog	0.09	0.88	1126.44	9.47	76.62	0.04
Lobore	0.13	NA	580.03	4.06	16.46	0.04
Plagla	0.08	0.80	1063.57	6.05	53.80	0.04

Species	Ca	Cd	Co	Cr	Cu	Fe
Alesar	9689.25	0.40	0.78	0.73	1.86	55.64
Hypog	24671.17	0.61	1.25	2.38	31.31	1990.78
Lobore	1158.10	0.55	0.83	1.51	10.18	1010.97
Plagla	4104.48	0.32	1.14	3.29	7.55	1773.56

Species	K	Li	Mg	Mn	Mo	Na
Alesar	2413.25	0.40	740.83	188.24	0.54	893.16
Hypog	3284.34	0.71	2127.70	860.85	0.54	929.13
Lobore	8001.57	0.59	735.79	168.00	0.54	394.30
Plagla	2523.88	0.60	1717.08	483.70	0.54	693.21

Species	Ni	P	Pb	Rb	Si	Sr
Alesar	0.96	913.75	5.00	53.00	134.75	33.56
Hypog	4.26	1597.23	10.13	53.00	563.82	61.26
Lobore	1.65	2532.49	3.52	53.00	681.18	6.30
Plagla	2.65	1115.00	3.52	53.00	635.83	28.91

Species	Ti	V	Zn
Alesar	4.93	0.37	38.06
Hypog	62.42	2.99	70.20
Lobore	45.30	2.42	82.93
Plagla	76.86	3.08	52.85

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ANALYSIS OF ICP LICHEN BIO-MONITORING DATA

Literature Cited

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XXXIII. LITERATURE CITED

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