



Coeur d'Alene, Idaho
31 March – 4 April, 2003

Oregon's Experience with Multimetric and Multivariate Approaches

Presented by
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Index Tools and Uses?

- Oregon has been using both multi-metric and multivariate analysis tools since mid 1990's
- Two primary uses of indexes
 - Evaluate biological condition and set criteria for impairment.
 - Characterize biological assemblages and identify environmental factors affecting them.

Evaluating Indexes?

Sensitivity: How well do they distinguish changes from expected conditions?

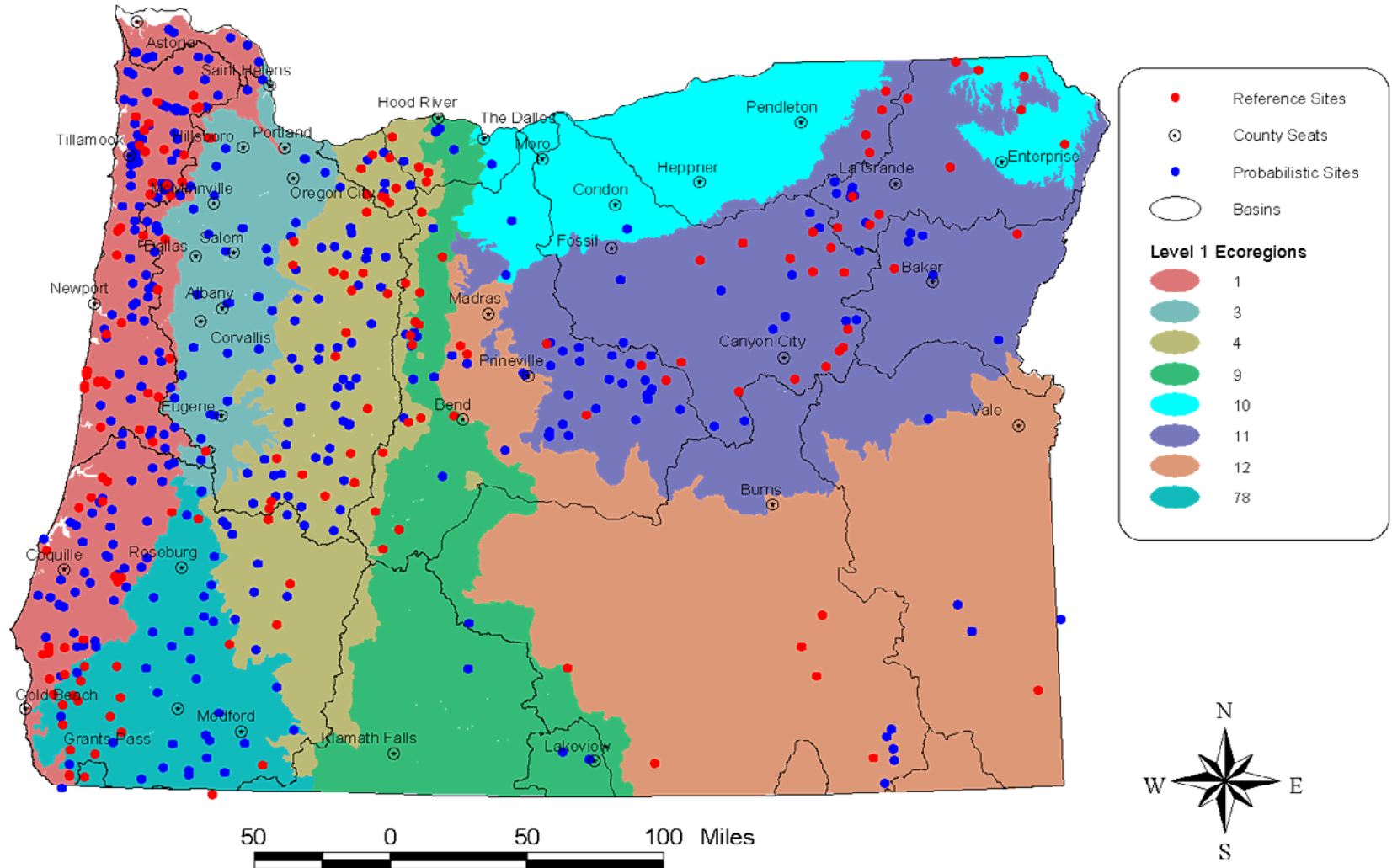
Precision: How much within site variability is there for index scores?

Stressor ID: Can the index help determine environmental stressors?

Reference site requirements: What kind of reference site network is necessary to develop the index?

Oregon's Monitoring Sites

Oregon DEQ Biomonitoring Sites



Example Project Sites

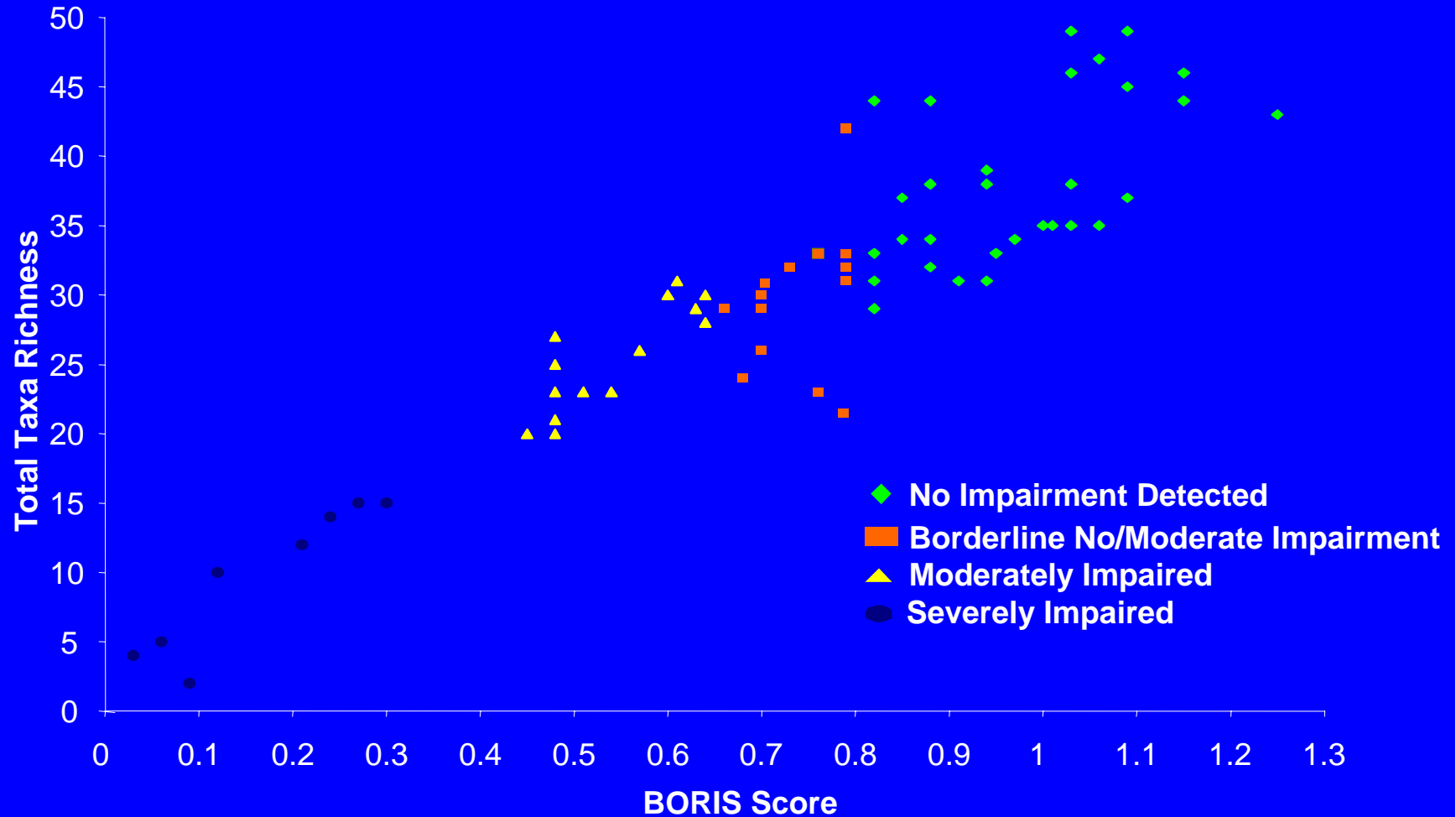
Grande Ronde Study



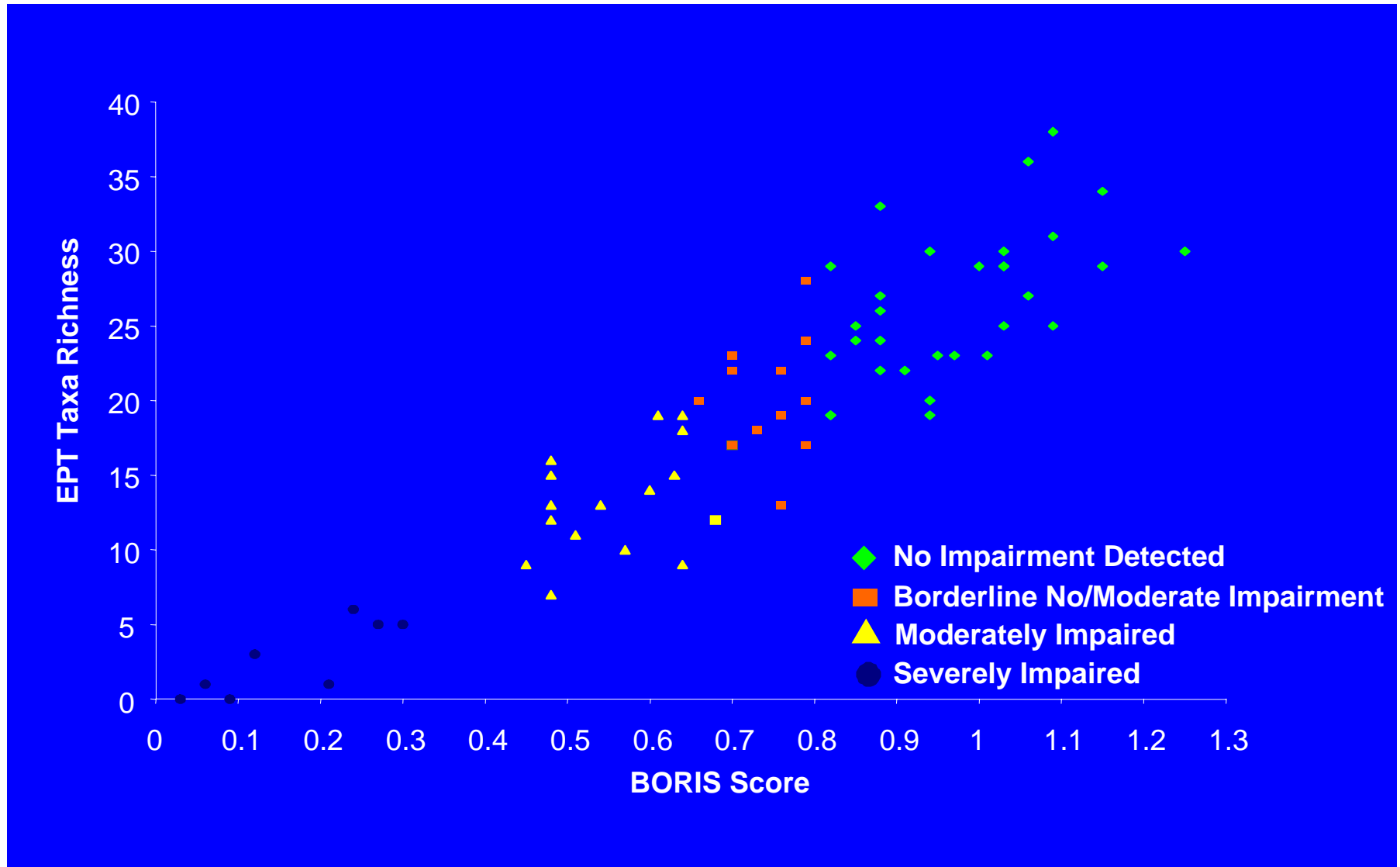
Factors Influencing Choice of Indexes in Oregon

- Range of disturbance between reference and impacted sites often small, especially in forested regions of the state.
- Small range of disturbance requires more intensive field and lab protocols and sensitive biological index.
 - 8 square feet composite sample from multiple riffles
 - 500 minimum count subsamples
 - Identification level - Genus/species for most families.
 - Multi-metric and multivariate models evaluated.
 - BORIS Multivariate Model – “**B**enthic evaluation of **O**Regon **r**iver**S**”

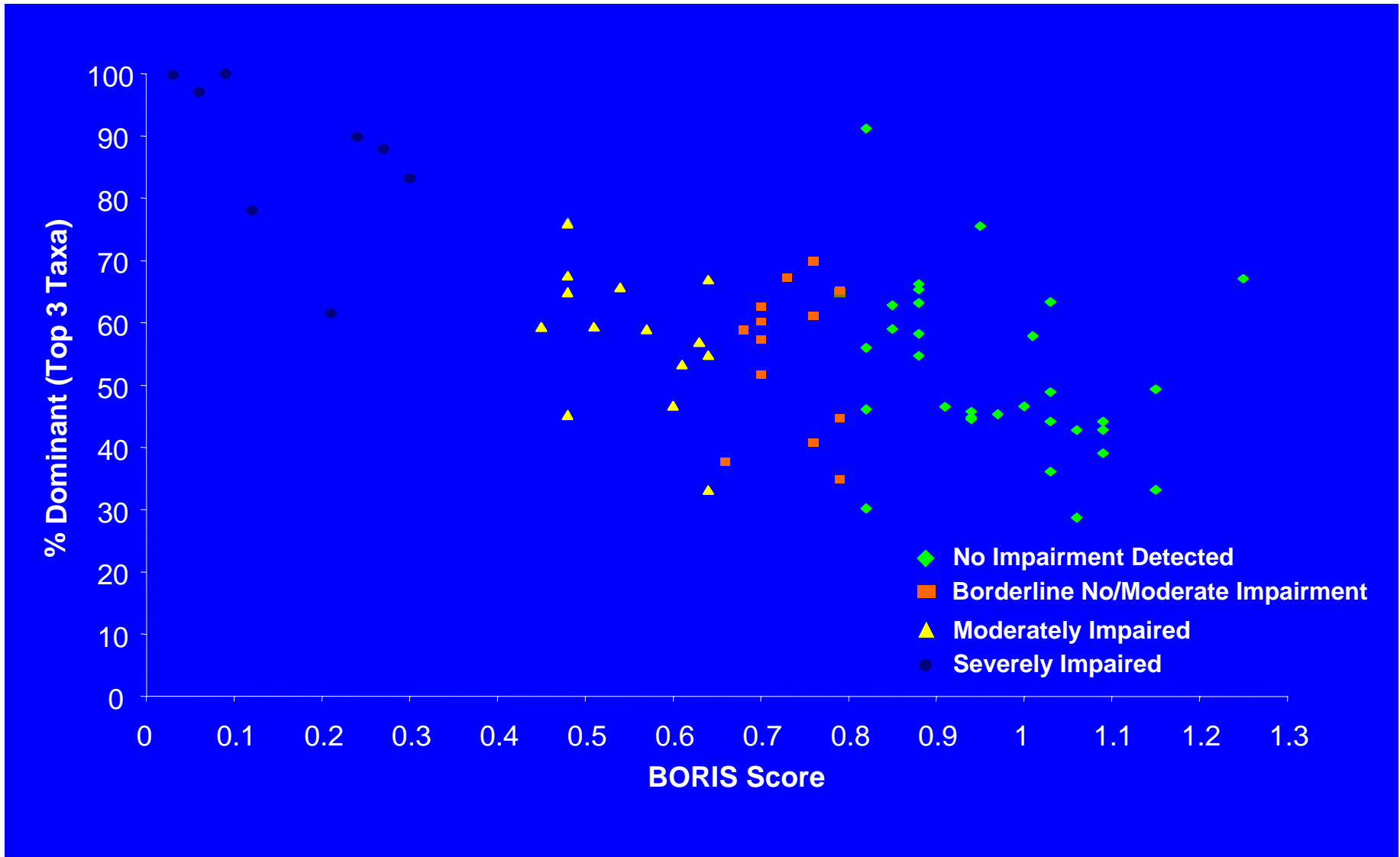
Metric & Multivariate Results



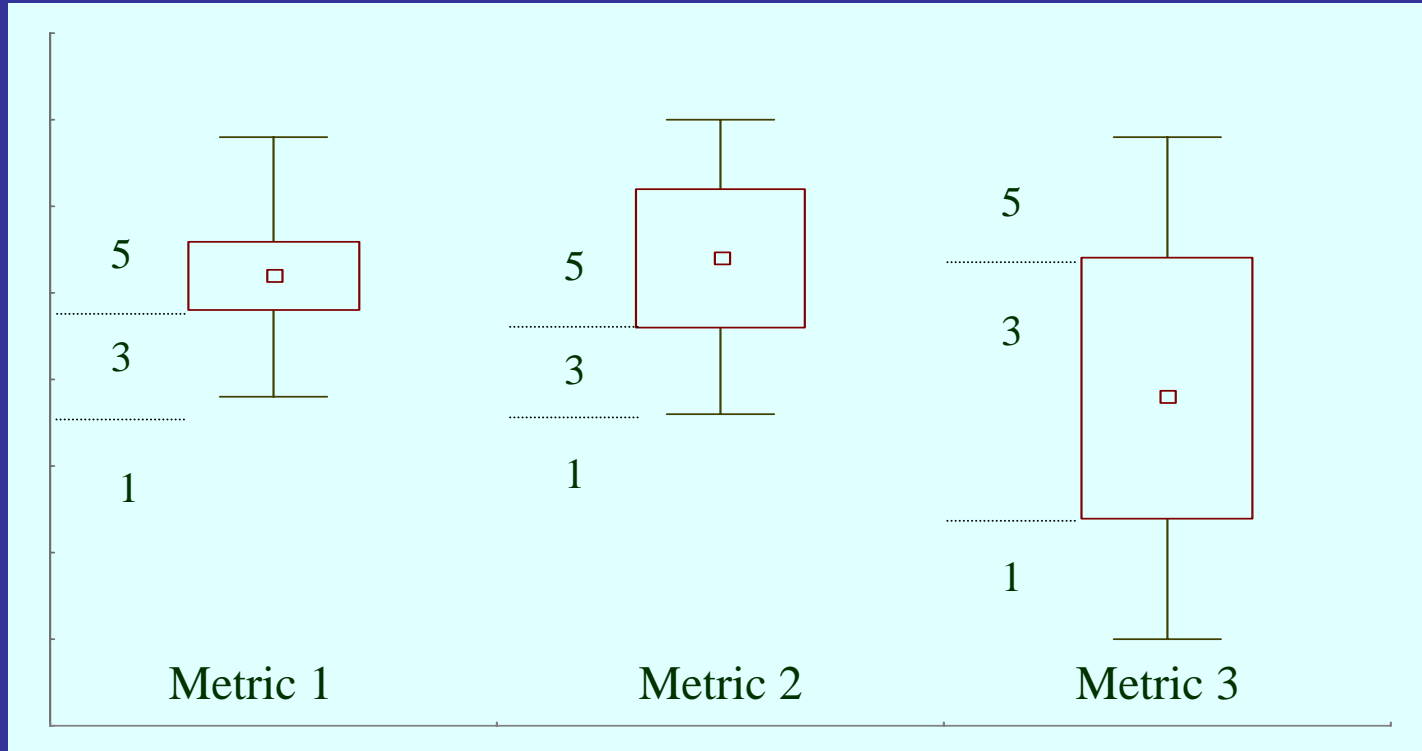
Metric & Multivariate Results



Metric & Multivariate Results



Multi-metrics



Metric 1 = 25th & 10th percentile of reference condition

Metric 2 = X1 & X2 Std. Dev. from reference mean

Metric 3 = 20th & 70th percentile of population range

Multi-metric Scoring Criteria

April

	TotTaxa	EphTaxa	PleTaxa	TriTaxa	SenTaxa	SedInt	%Dom	%Tol	%SedTol	HBI
5pts	>29	>7	>6	>4	>4	>1	<60	<11	<10	<3.2
3pts	24-29	6-7	5-6	3-4	3-4	1	60-71	11-16	10-15	3.2-3.5
1pt	<24	<6	<5	<3	<3	0	>71	>16	>15	>3.5

July

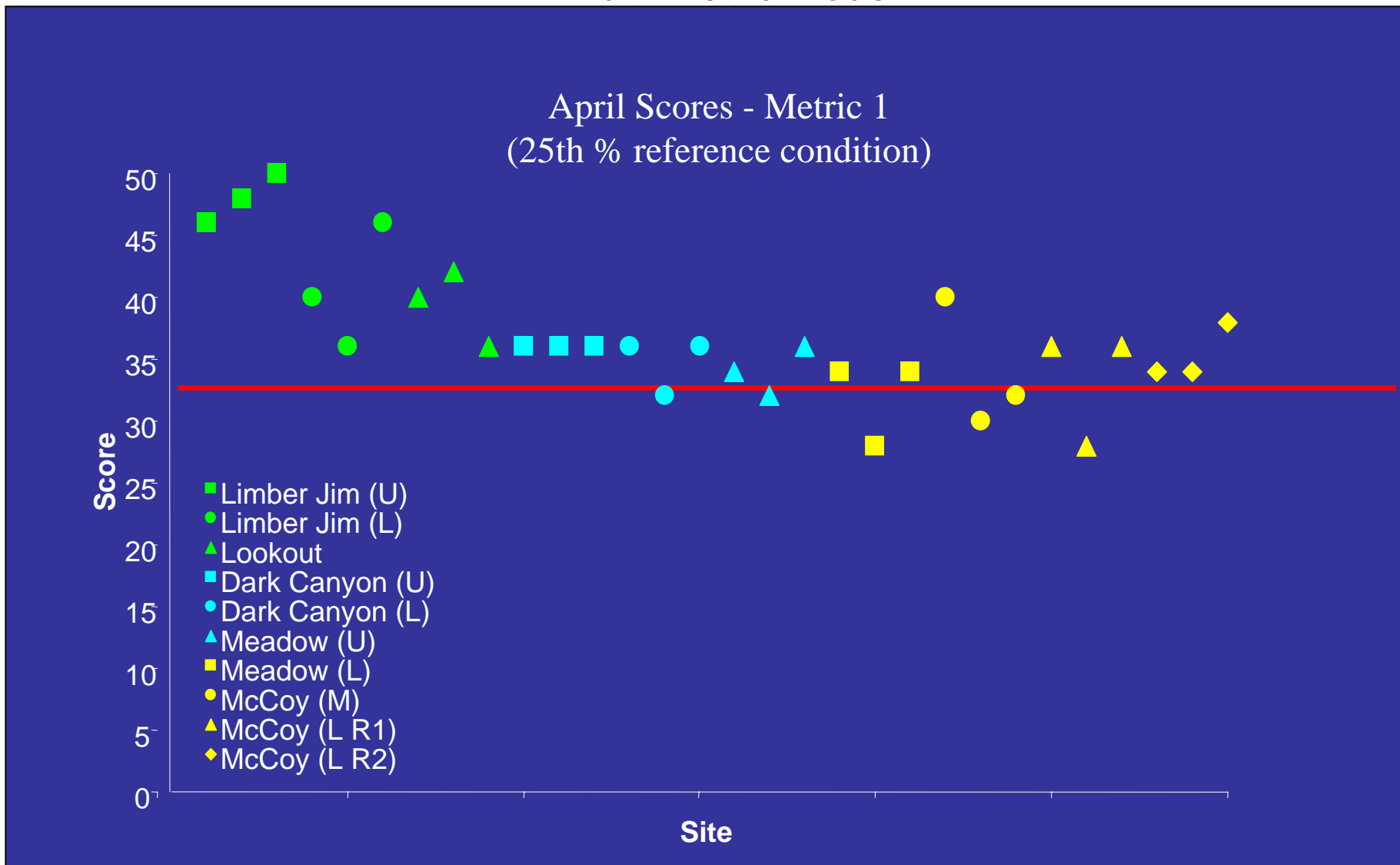
	TotTaxa	EphTaxa	PleTaxa	TriTaxa	SenTaxa	SedInt	%Dom	%Tol	%SedTol	HBI
5pts	>31	>7	>6	>3	>4	>1	<38	<24	<10	<3.9
3pts	24-31	6-7	5-6	1-2	3-4	1	39-42	24-36	10-15	3.9-4.3
1pt	<24	<6	<5	<3	<3	0	>42	>36	>15	>4.3

September

	TotTaxa	EphTaxa	PleTaxa	TriTaxa	SenTaxa	SedInt	%Dom	%Tol	%SedTol	HBI
5pts	>37	>7	>7	>5	>5	>1	<53	<11	<7	<4.0
3pts	33-37	6-7	6-7	4-5	2-5	1	53-62	11-16	7-10	4.0-4.6
1pt	<33	<6	<6	<4	<2	0	>62	>16	>10	>4.6

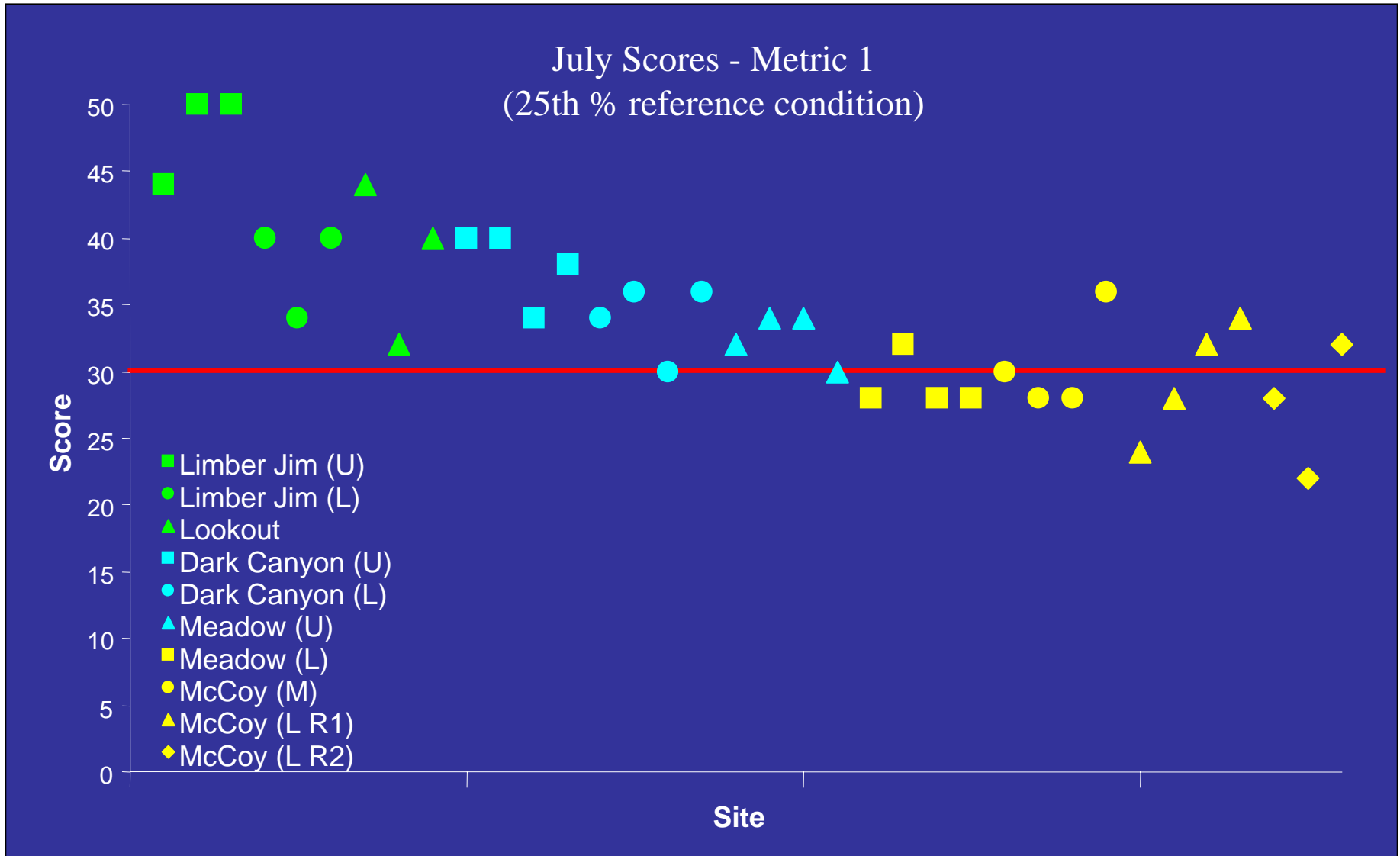
Sensitivity?

Multi-metric Model



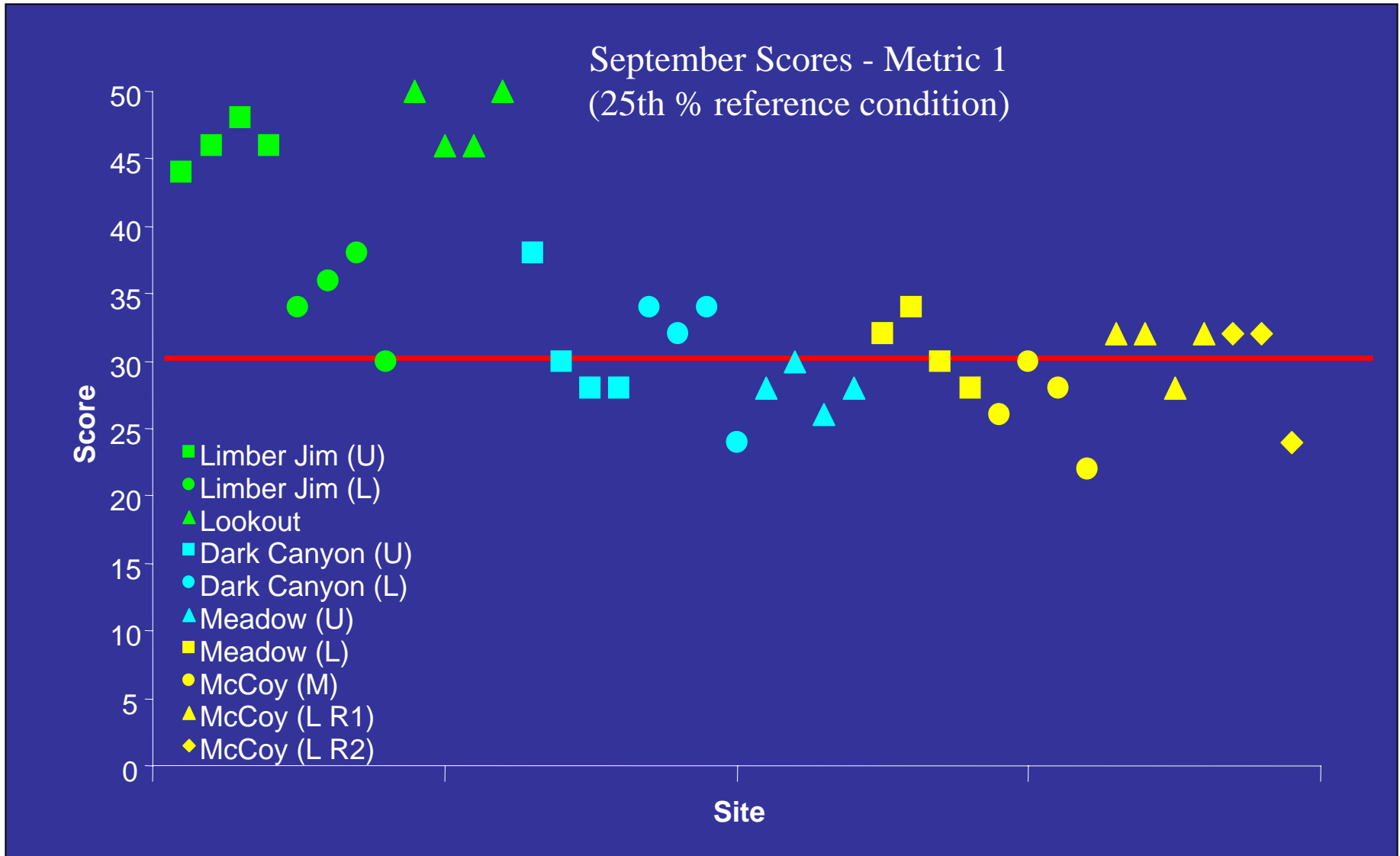
Sensitivity?

Multi-metric Model



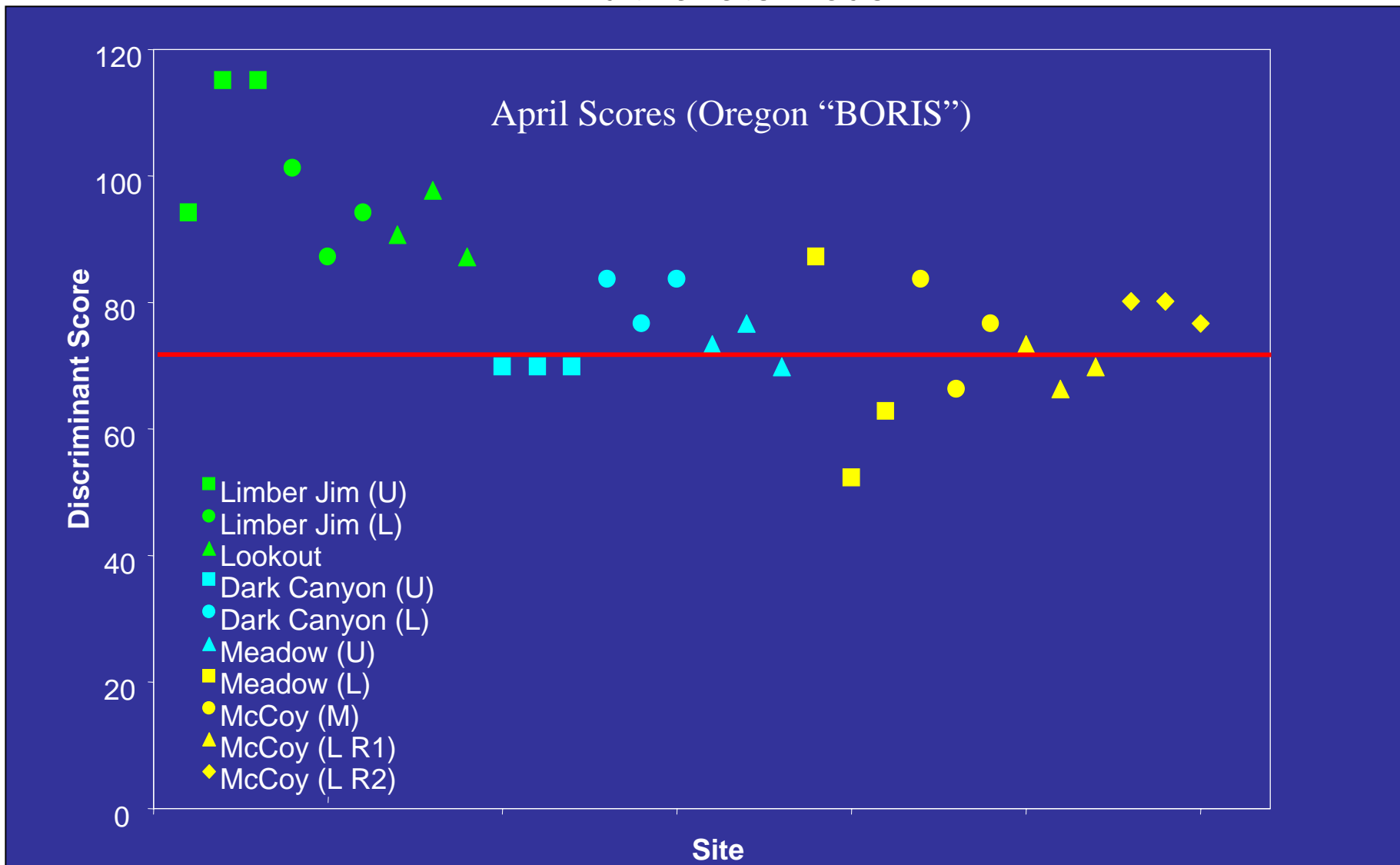
Sensitivity?

Multi-metric Model



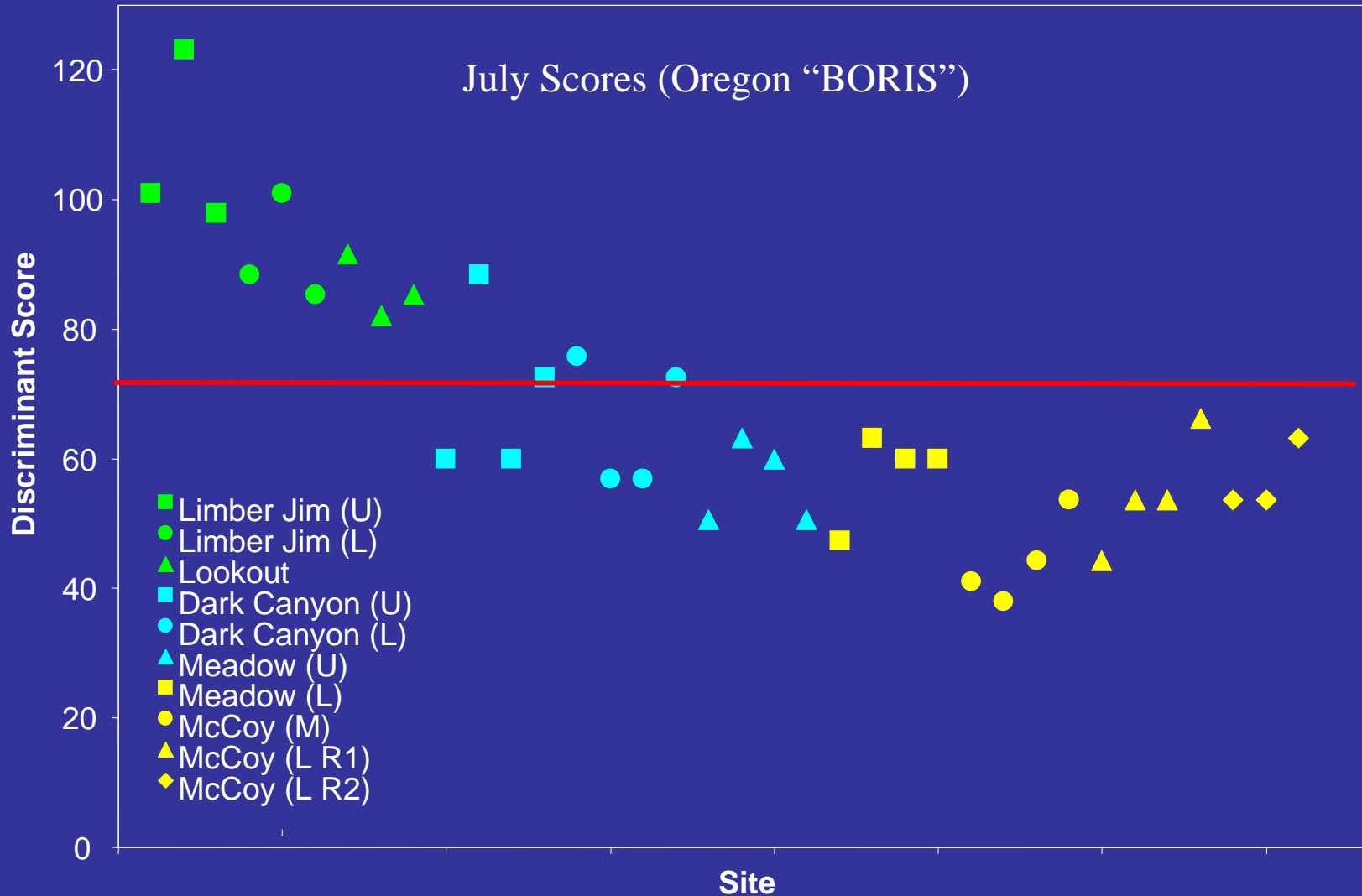
Sensitivity?

Multivariate Model



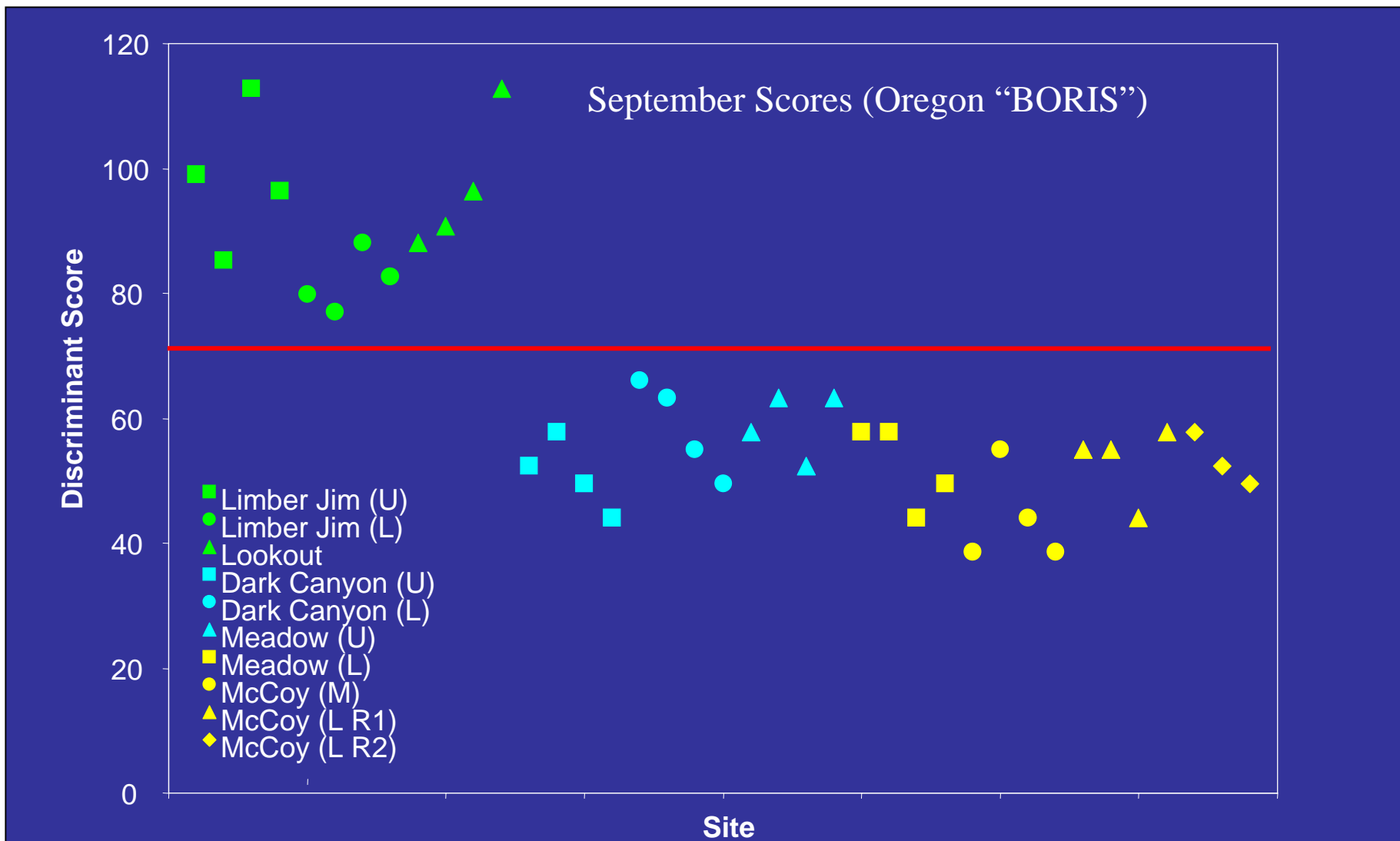
Sensitivity?

Multivariate Model



Sensitivity?

Multivariate Model



Precision

Replicate Site Data Comparison

***15 same day duplicate samples compared**

	Range between Duplicate Samples	Mean Difference Between Duplicates
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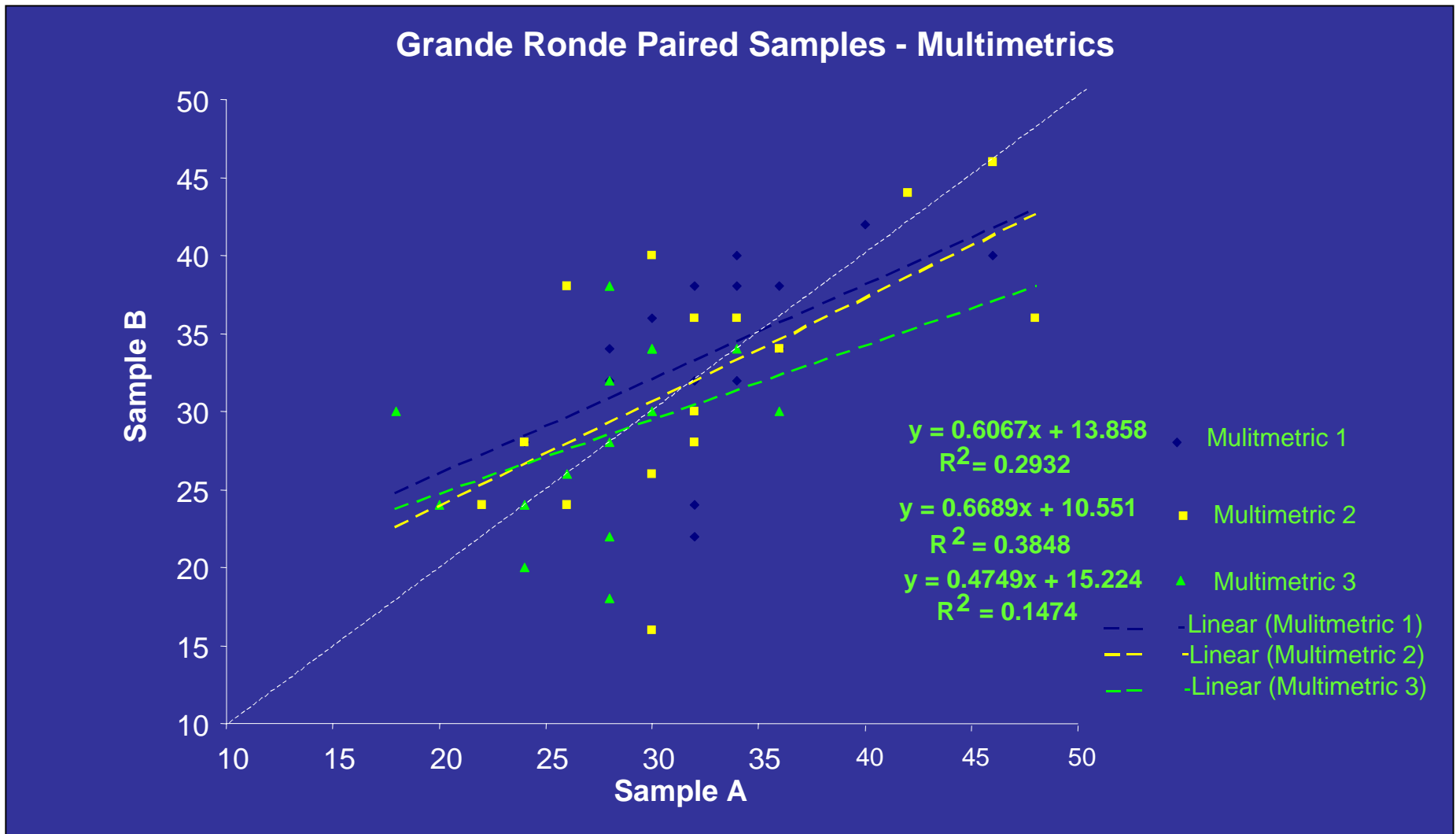
Metrics:

25 th Percentile	0-25	11.3
1 Std. Dev.	0-35	12.7
20 th & 70 Percentile	0-30	12
BORIS Model	0-14	6.3

* Data standardized to a 100 point scale

Precision

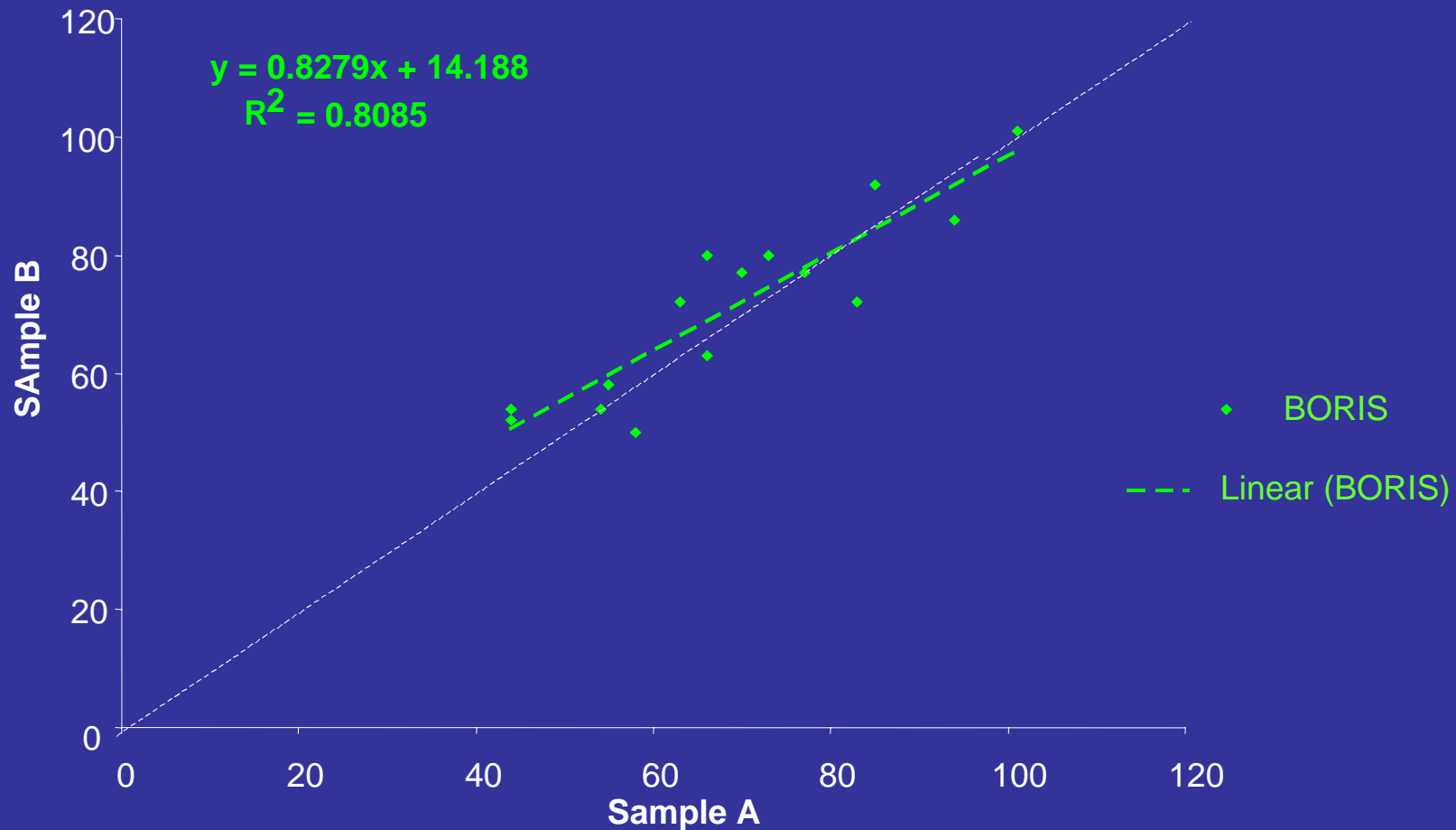
Replicate Site Data



Precision

Replicate Site Data

Grande Ronde Paired Samples - BORIS

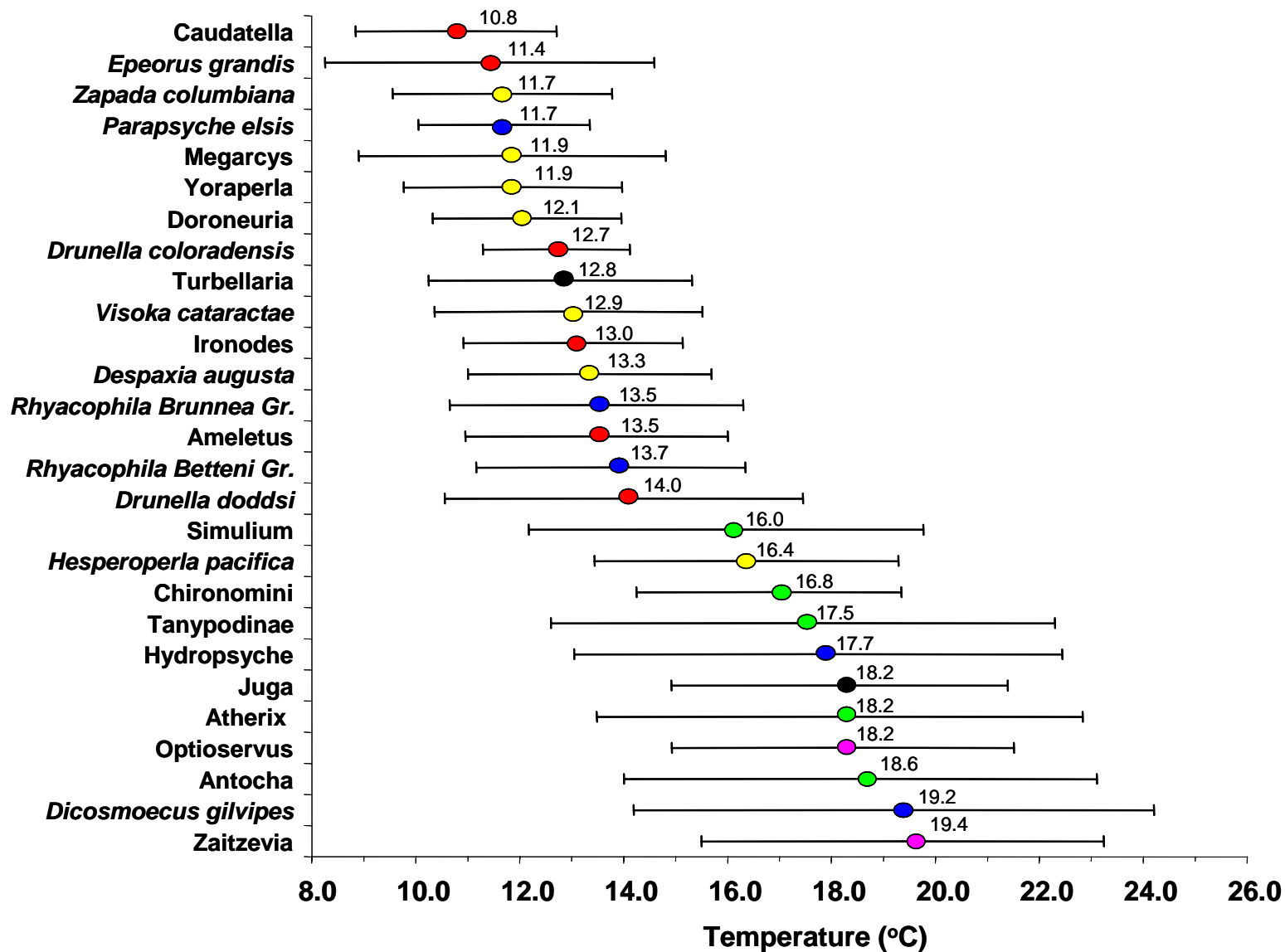


Characterizing Possible Stressors

Multivariate Analysis: List of missing and replacement taxa can be used to characterize some stressor variables.

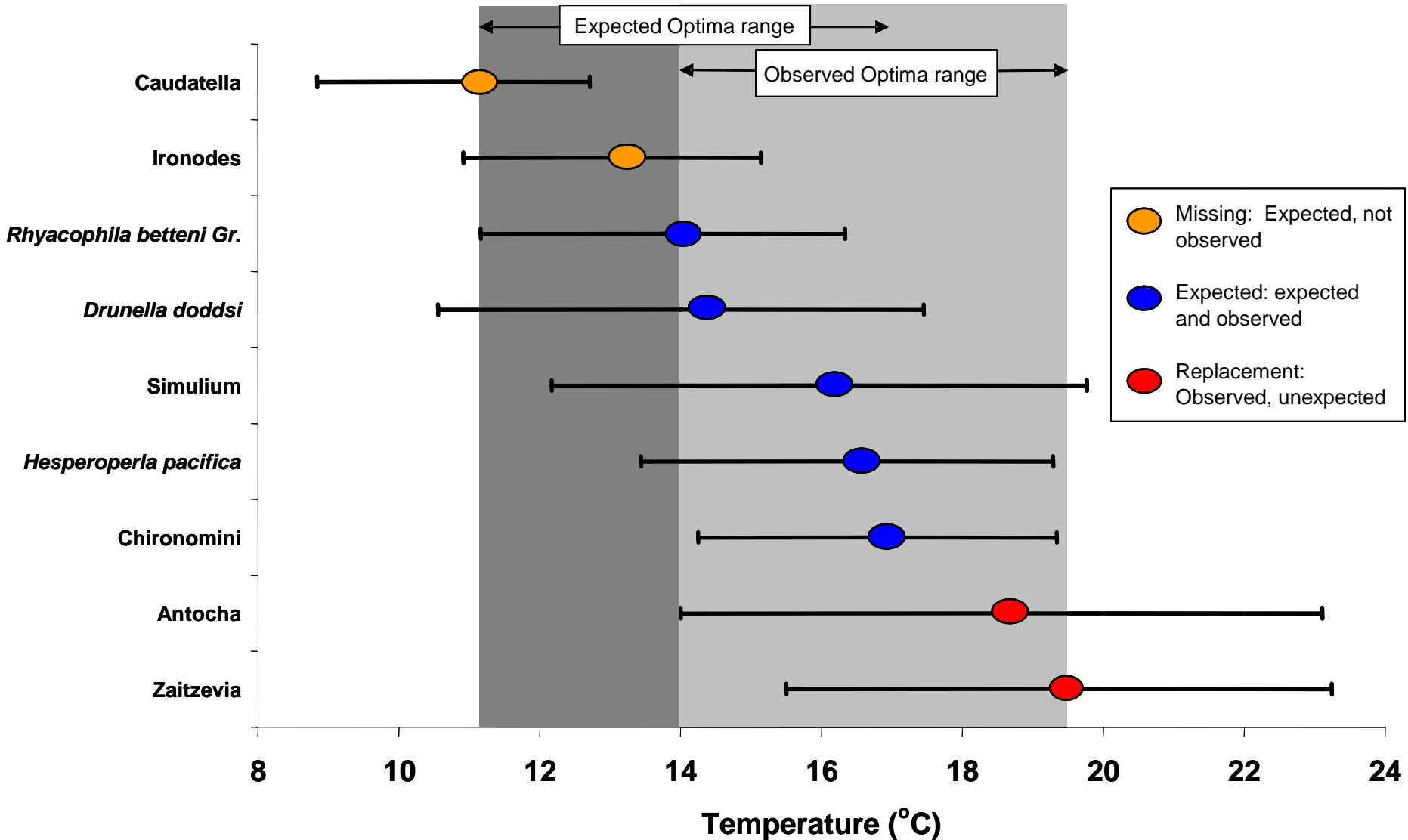
Multi-metric Analysis: Individual metrics provide useful information about different environmental stresses.

Stressor Indicators



Stressor Indicators

(Hypothetical Example)



Evaluating Indexes?

Sensitivity: In Oregon multivariate models have shown a slightly higher level of sensitivity to detect changes from reference condition than multi-metric indexes.

Precision: Oregon replicate site data have shown less variability for multivariate models than multi-metric models.

Stressor ID: Both models used in combination probably provide best assessment of environmental stressors.

Reference site requirements: Both methods require reference site information, but multivariate models probably require more intensive reference site sampling than multi-metric indexes.