10: Community Monitoring

1. Distinguish strengths and weaknesses of univariate and multivariate monitoring approaches

2. Identify three alternatives to multivariate monitoring

3. Describe resources for implementing multivariate monitoring

What is a Community?

The naturally occurring assemblage of populations living in the same general place and time. Community may refer to all species in the assemblage or a subset, such as the plant community (*e.g.*, spruce-fir forest) or the neotropical bird community. – Noss *et al.* 1997

What is a Community?

The ensemble of species in some area whose limits are determined by the practical extent of energy flow. The key to determining community limits is to identify boundaries, manifest as interspecific interactions broadly defined, by documenting where the population dynamics of a species in an ensemble (including indirect and cascading effects) are unaffected by each other.... Such a definition may include a large number of species, so much so that critics might plead unwieldy complexity. However, *nature proceeds without regard to human logistical and analytical sophistication.* – Drake 1990

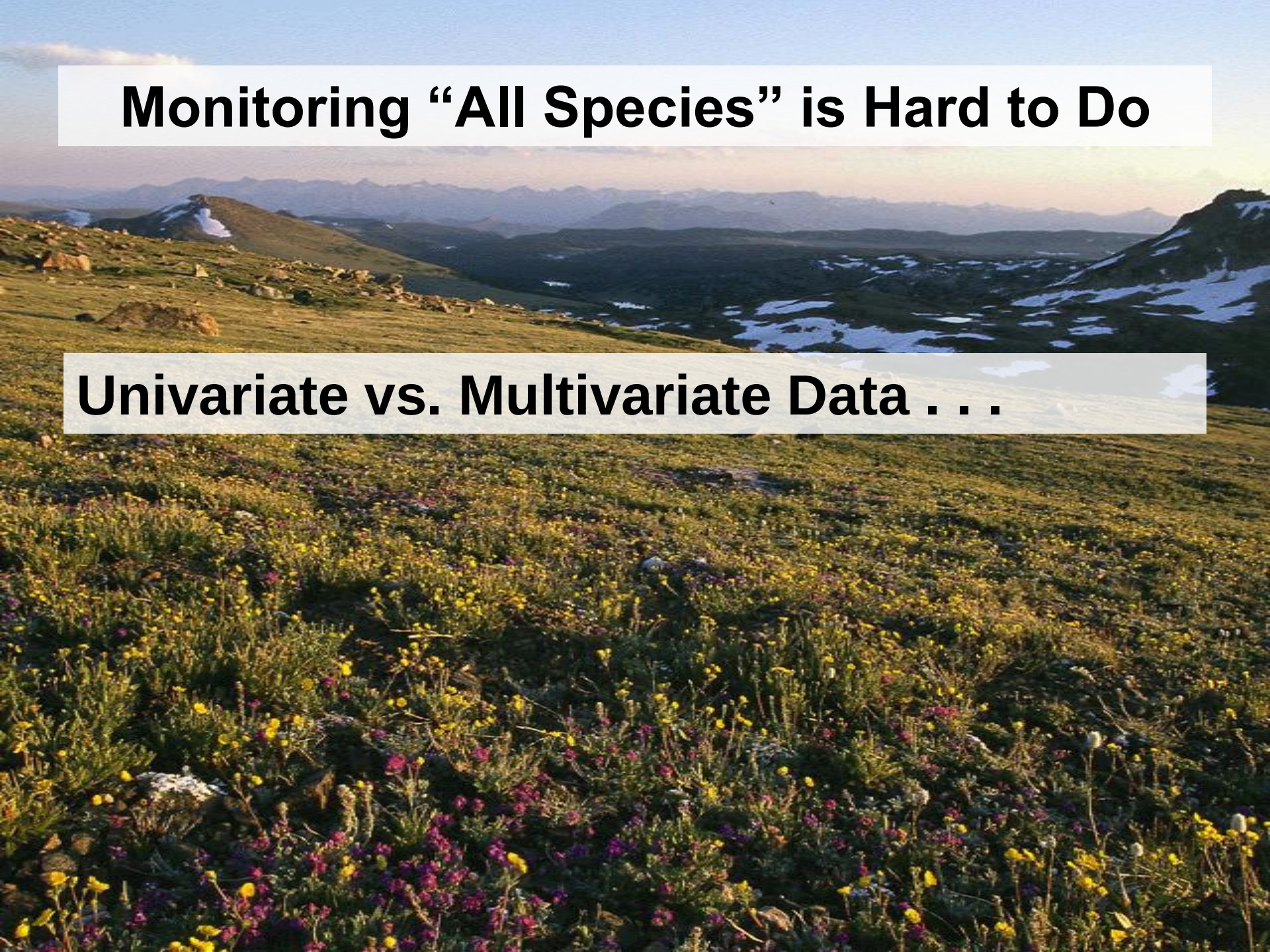
Managing Communities (examples)

restore the native plant communities typically found in an undisturbed riparian corridor

with prescribed burning, maintain a natural tallgrass prairie plant assemblage

Monitoring Communities is *Generally* Hard to Do

- Identifying boundaries can be difficult
- Community classifications are heavily scale-dependent
- Community classification schemes are often based on subjective thresholds
- Developing a ecological model for an entire community is difficult-to-impossible



Monitoring “All Species” is Hard to Do

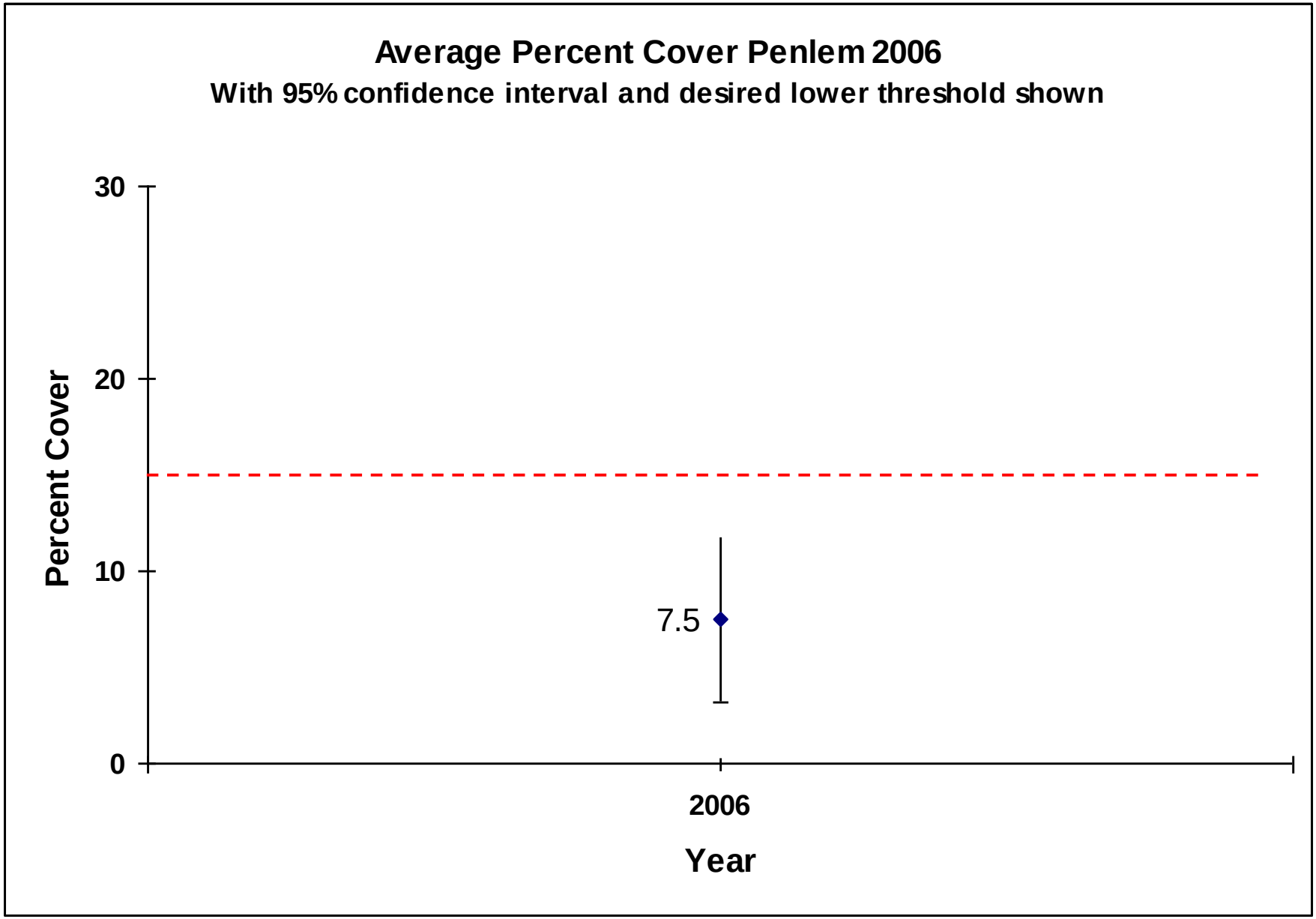
Univariate vs. Multivariate Data . . .

Univariate Dataset

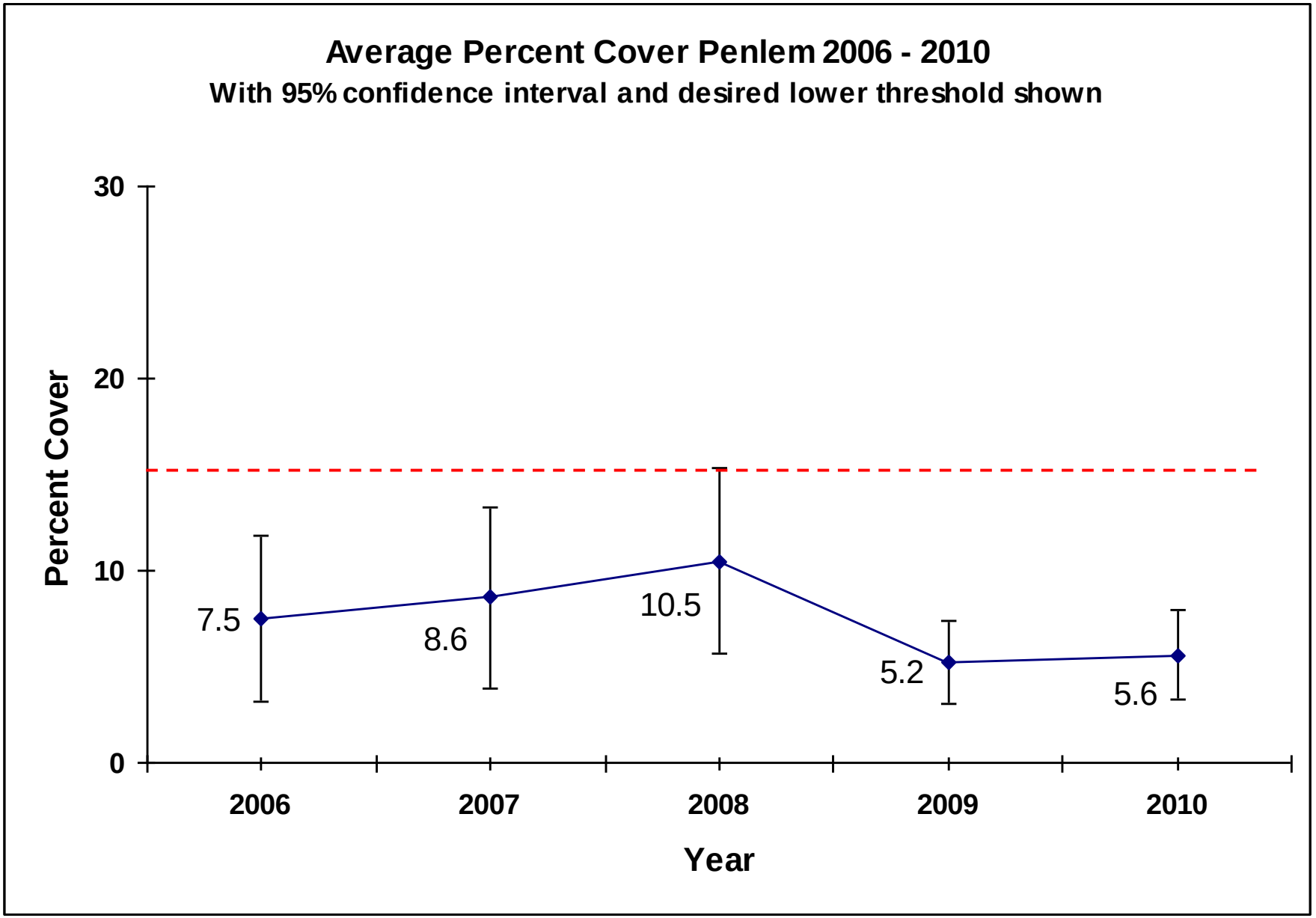
2006 Data

Quadrat	1	2	3	4	5	6	7	8	9	10
Penlem Cover	**0.5**	**10**	**3**	**15**	**5**	**20**	**15**	**0.5**	**3**	**3**

Univariate Dataset



Univariate Dataset

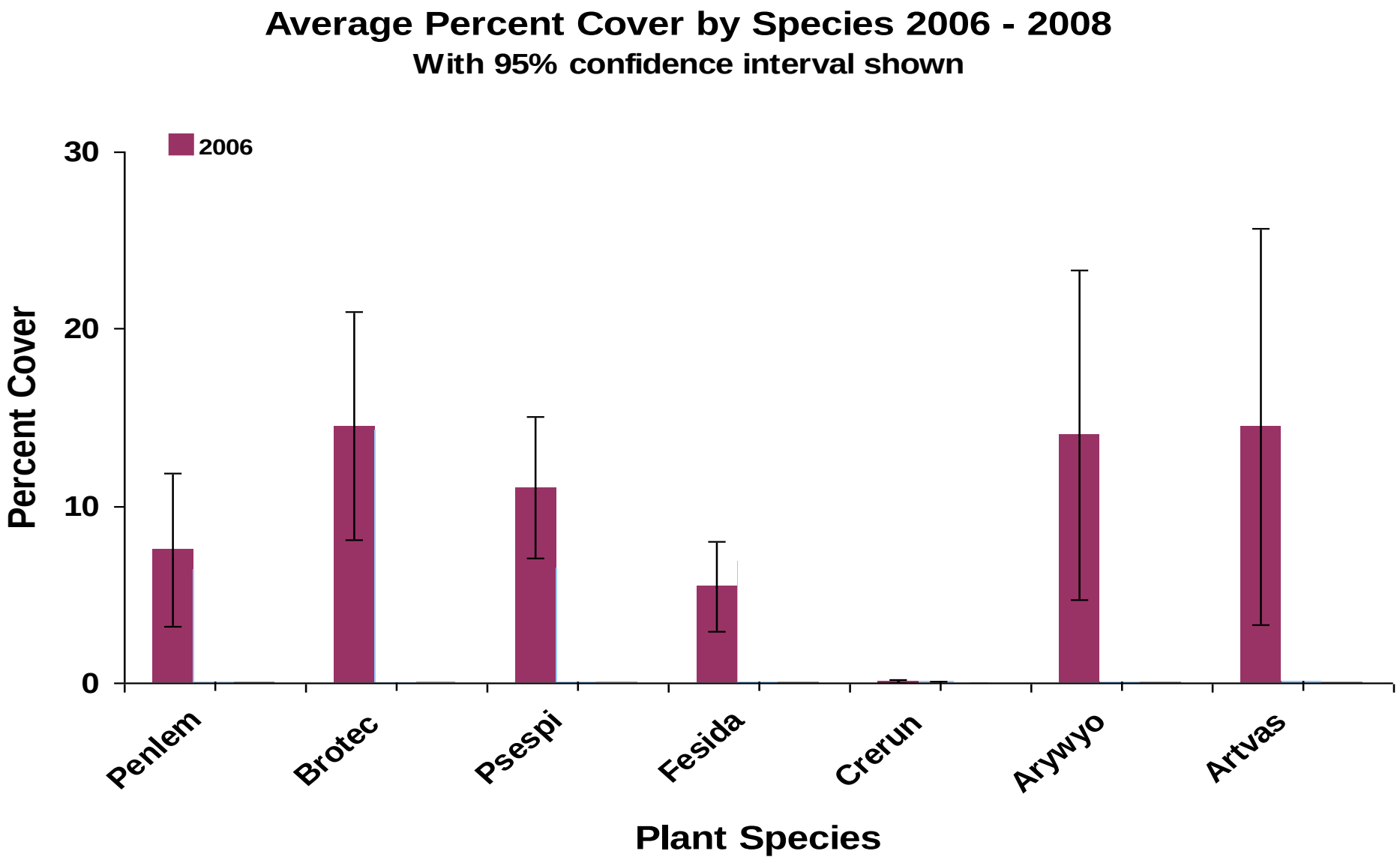


Multivariate Dataset

2006 Data

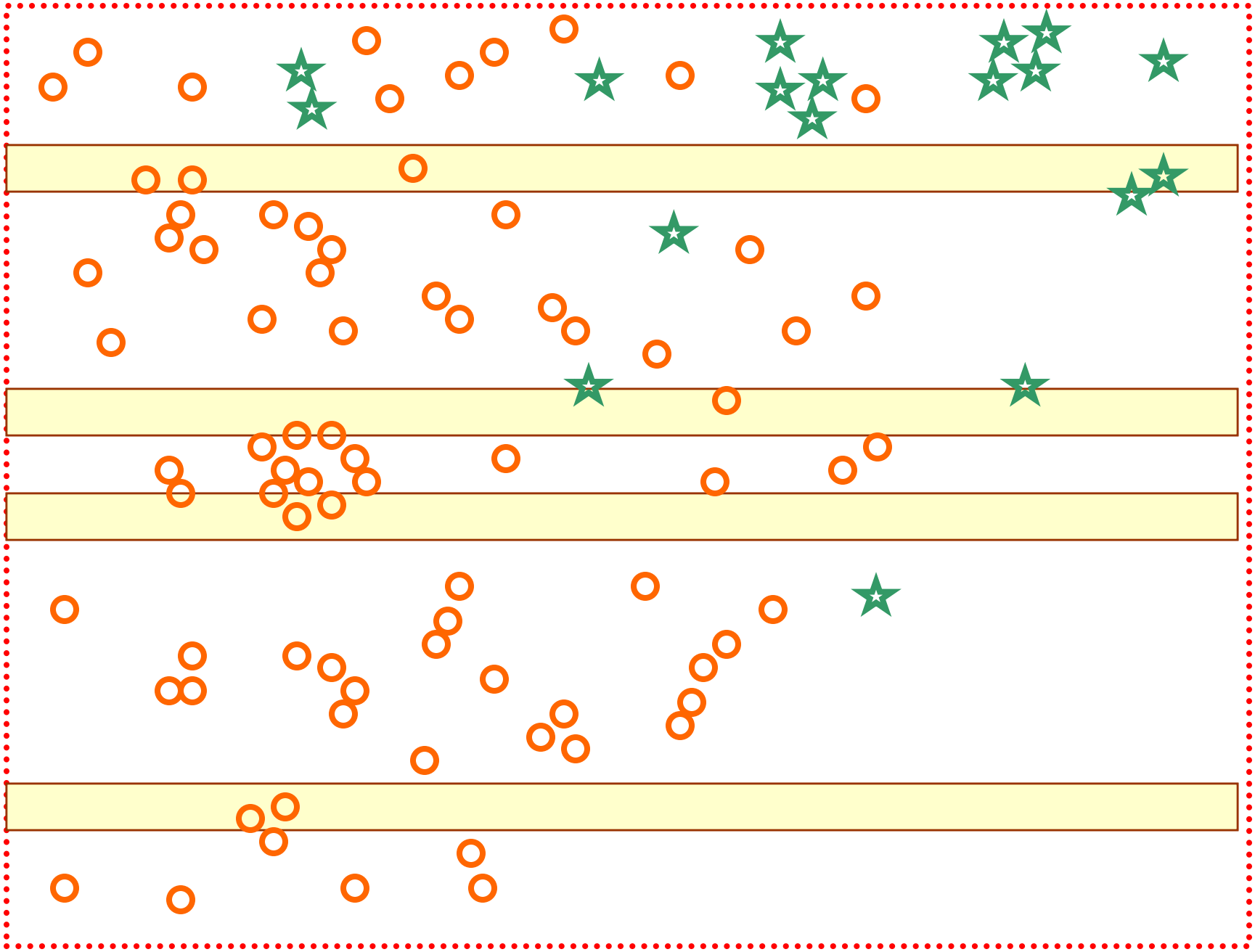
Quadrat	1	2	3	4	5	6	7	8	9	10
Penlem Cover	**0.5**	**10**	**3**	**15**	**5**	**20**	**15**	**0.5**	**3**	**3**

Multivariate Dataset



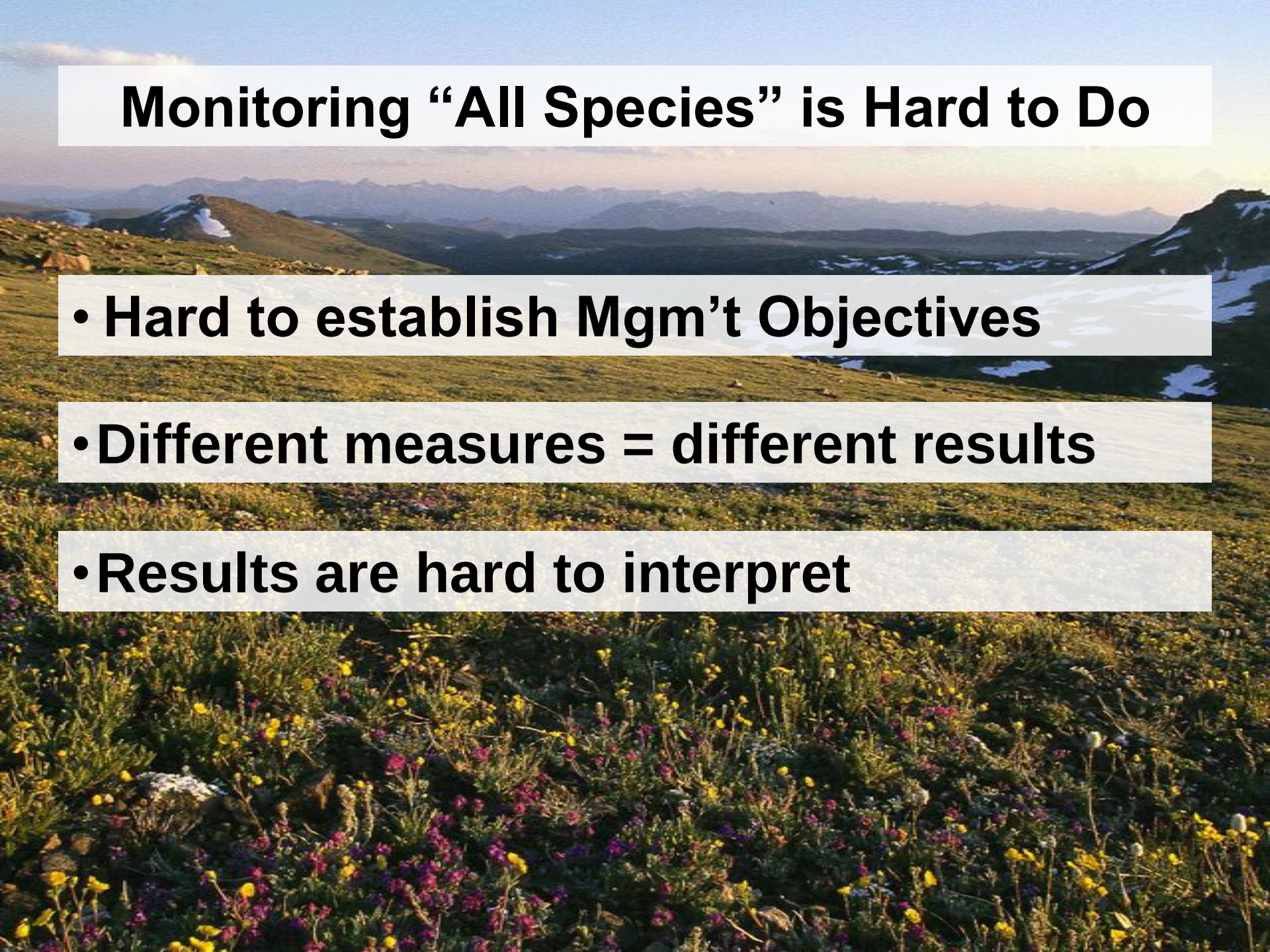
Monitoring “All Species” is Hard to Do

- A design can’t be optimal for all species



Monitoring “All Species” is Hard to Do

- A design can’t be optimal for all species
- Observer bias is very high
- Data collection & analysis are expensive
- Some species are very difficult to detect



Monitoring “All Species” is Hard to Do

- Hard to establish Mgm’t Objectives
- Different measures = different results
- Results are hard to interpret

Three Surrogates for True Multivariate Monitoring

1. Univariate

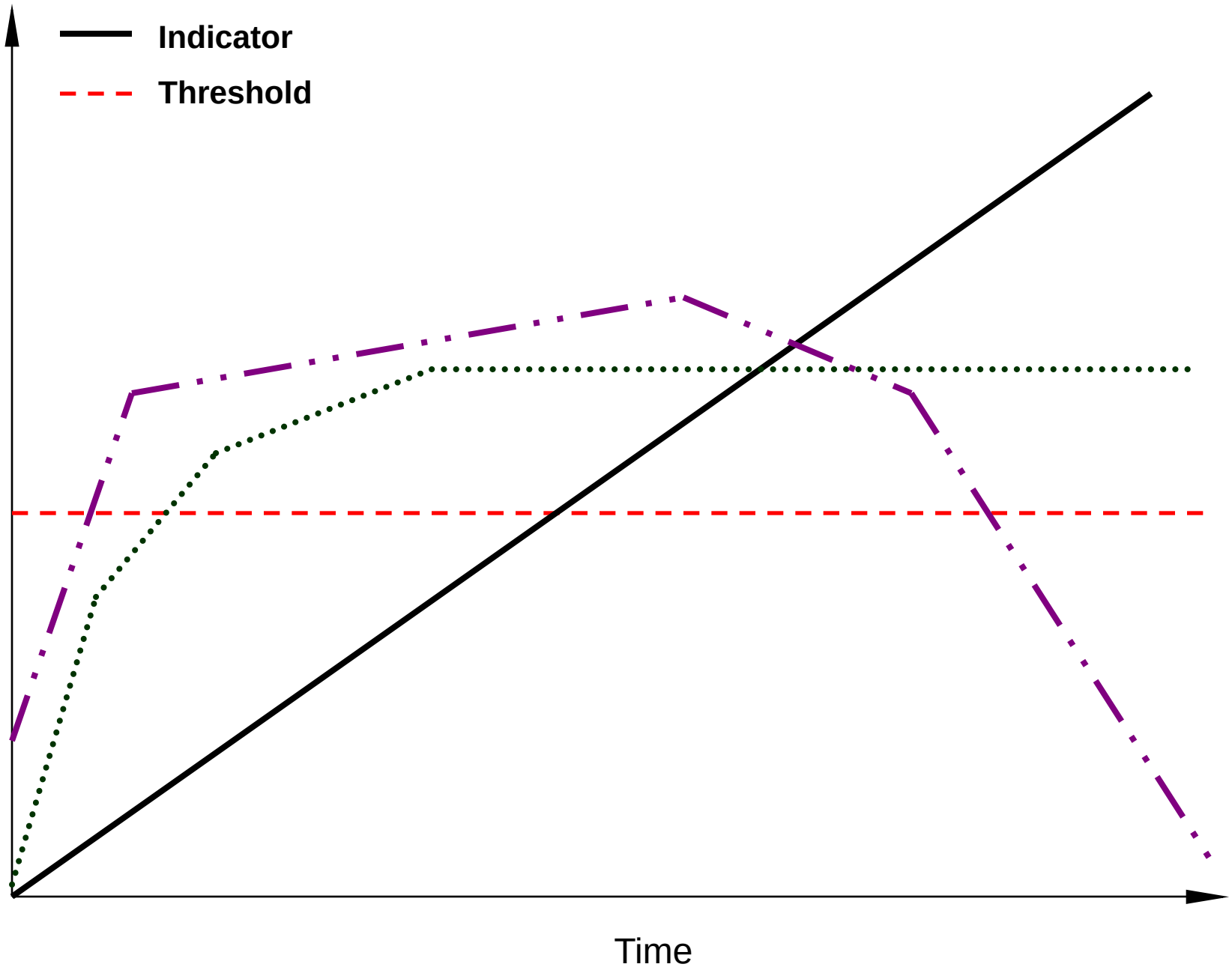
2. Qualitative Monitoring

3. Indices

Three Surrogates for True Multivariate Monitoring

1. Univariate

Proxies & Indicators


Indicator
Threshold
Time

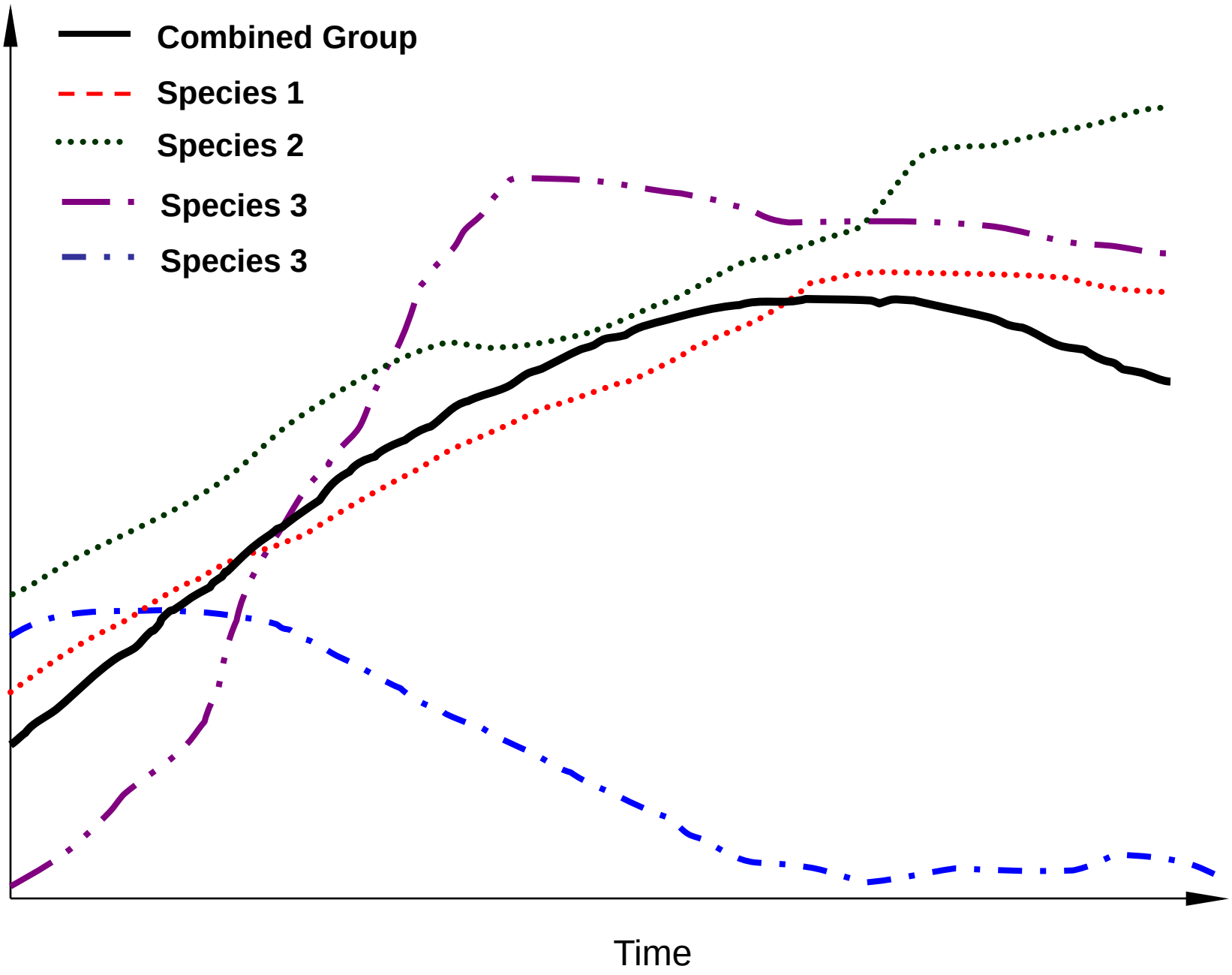
Three Surrogates for True Multivariate Monitoring

1. Univariate

A. Proxies & Indicators

B. Structural Characteristics

C. Guilds & Functional Groups


Combined Group
Species 1
Species 2
Species 3
Species 3
Time

A Good Univariate Metric . . .

- Is Sensitive to management action
- Corresponds to management goals
- Has Large response to management
- Is Cheap and easy
- Resists observer-bias errors

Three Surrogates for True Multivariate Monitoring

2. Qualitative

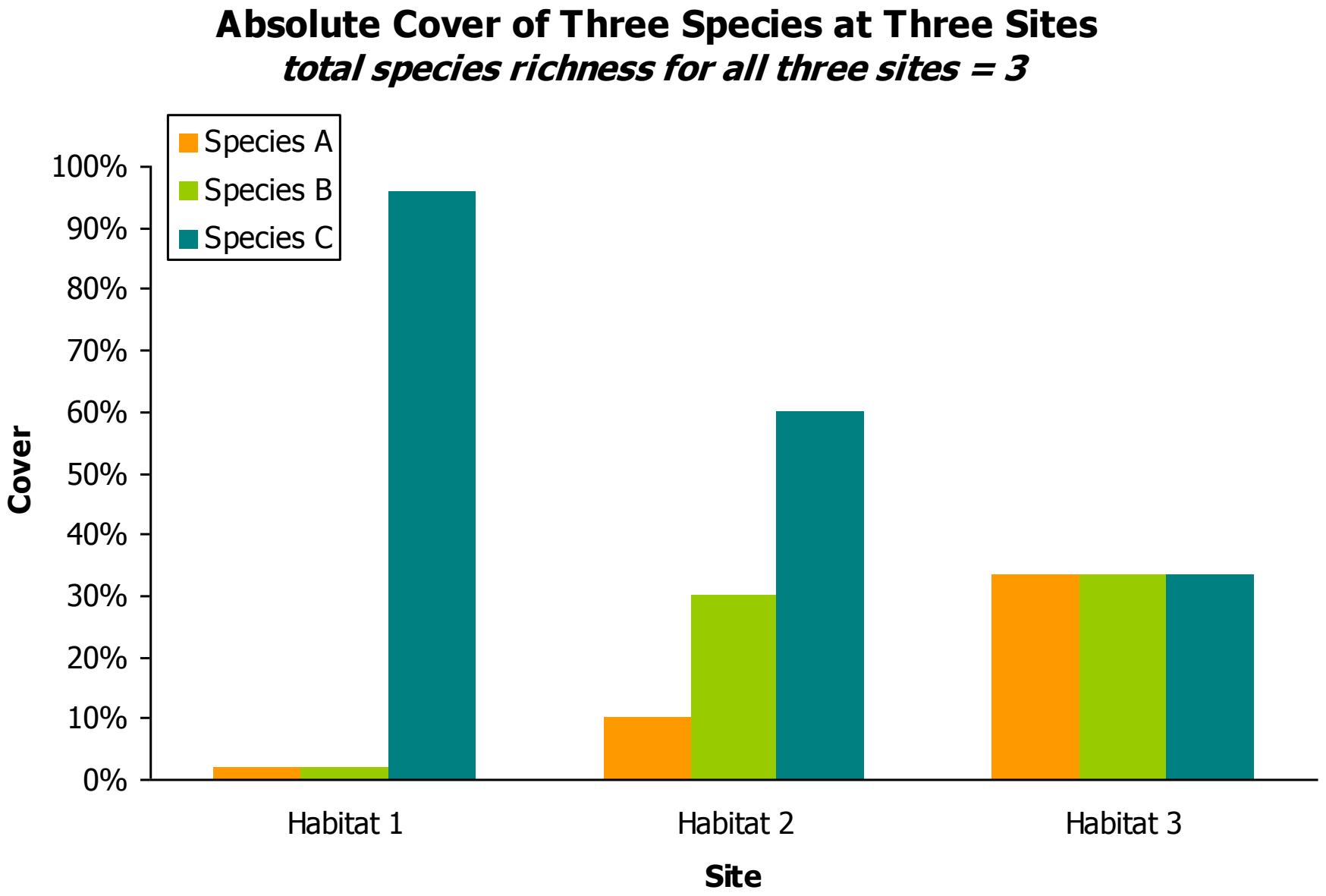
- A. Site Condition Assessment
- B. Boundary Mapping
- C. Photomonitoring
- D. Aerial Photography
- E. Species Checklists

Three Surrogates for True Multivariate Monitoring

3. Indices

A. Diversity Indices

Richness vs. Evenness



Three Surrogates for True Multivariate Monitoring

3. Indices

A. Diversity Indices

B. Special Interest Indices

Native Species Index

NSI = number of native species/
total species count

Wetland Indicator Classification

OBL	Obligate	>99%
FACW	Facultative-Wet	75%
FAC	Facultative	50%
FACU	Facultative-Upland	25%
UPL	Upland	0

+ after the code indicates more wet tolerant
- after the code indicates less wet tolerant

Three Surrogates for True Multivariate Monitoring

3. Indices

A. Diversity Indices

B. Special Interest Indices

C. “Biotic Integrity” Indices

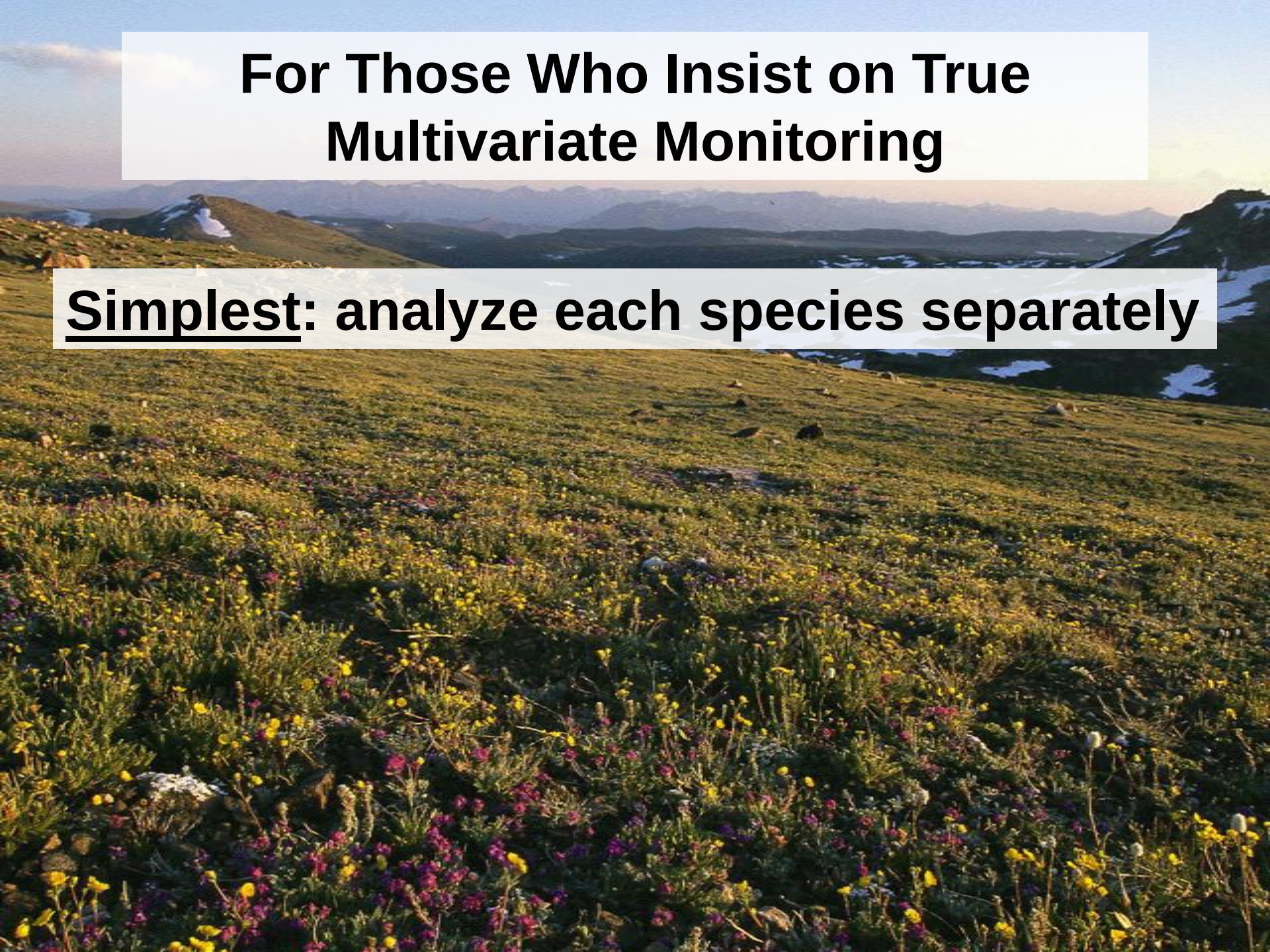
Floristic Quality Assessment Index

Each species assigned a "Coefficient of Conservation"

Entire site receives an assessment of floristic quality based on the following formula:

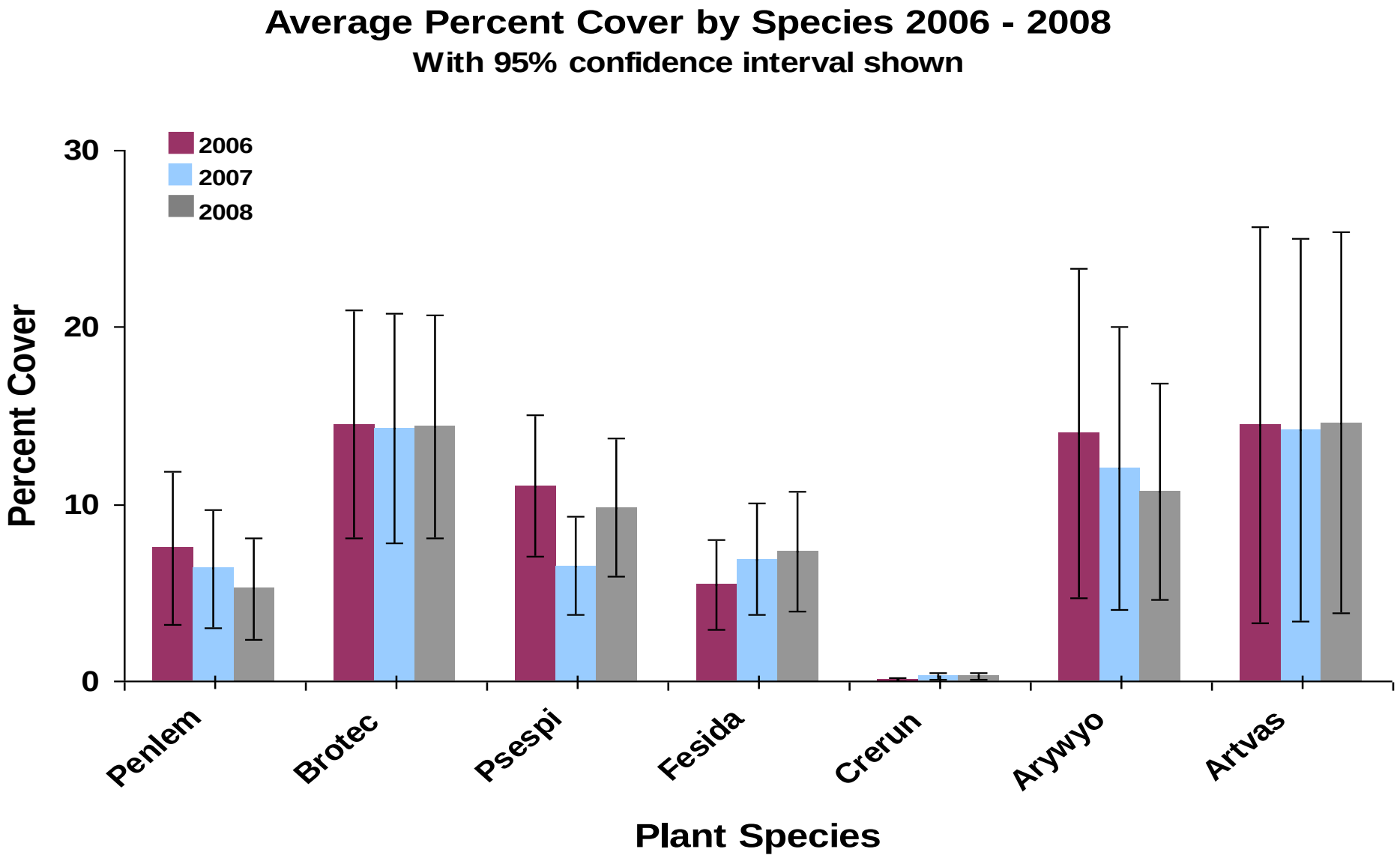
$$FQAI = \frac{\sum CC}{\sqrt{N}}$$

For Those Who Insist on True Multivariate Monitoring



Simplest: analyze each species separately

Multivariate Dataset



For Those Who Insist on True Multivariate Monitoring

Simplest: analyze each species separately

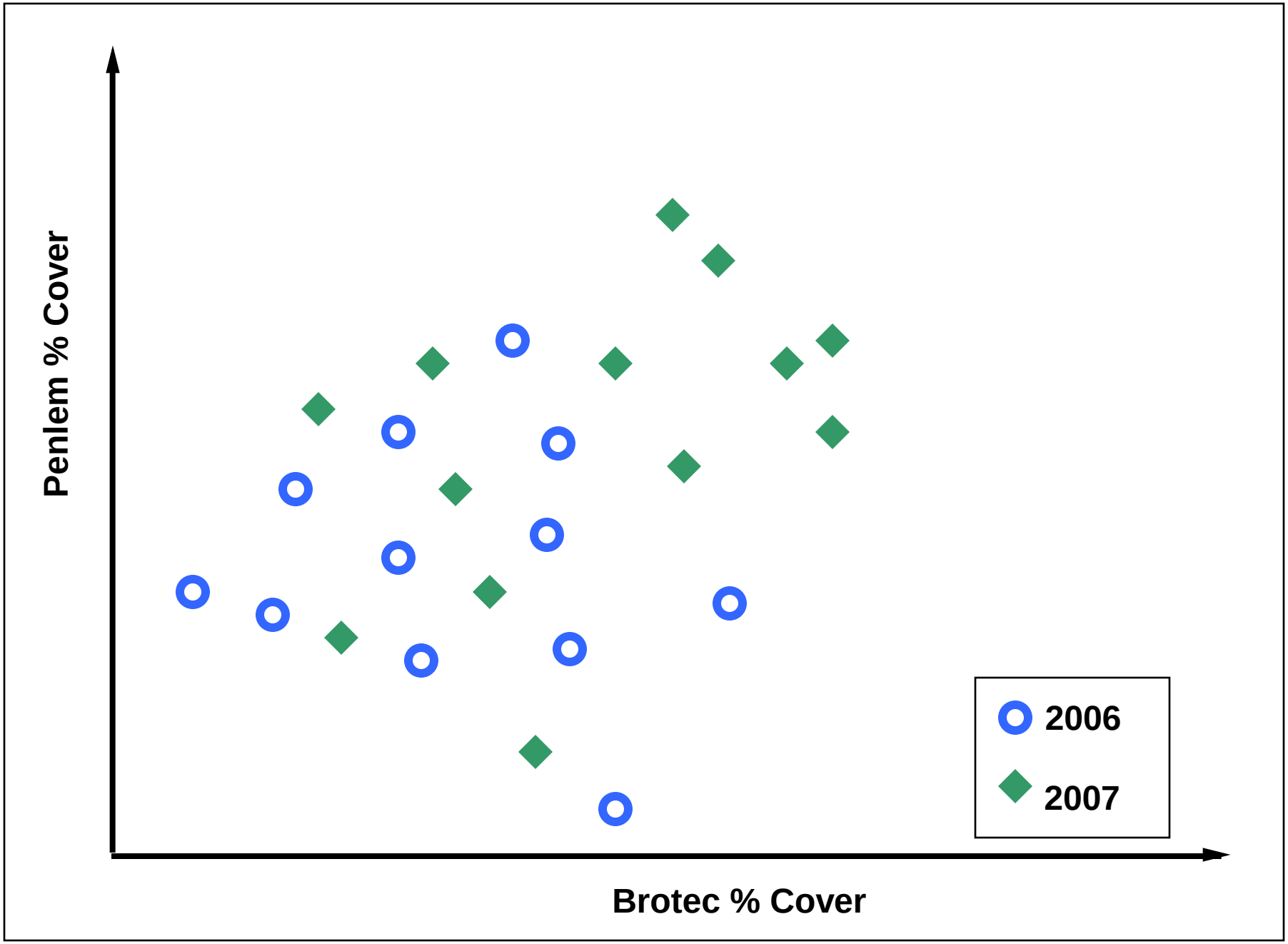
Also simple: one metric for all species

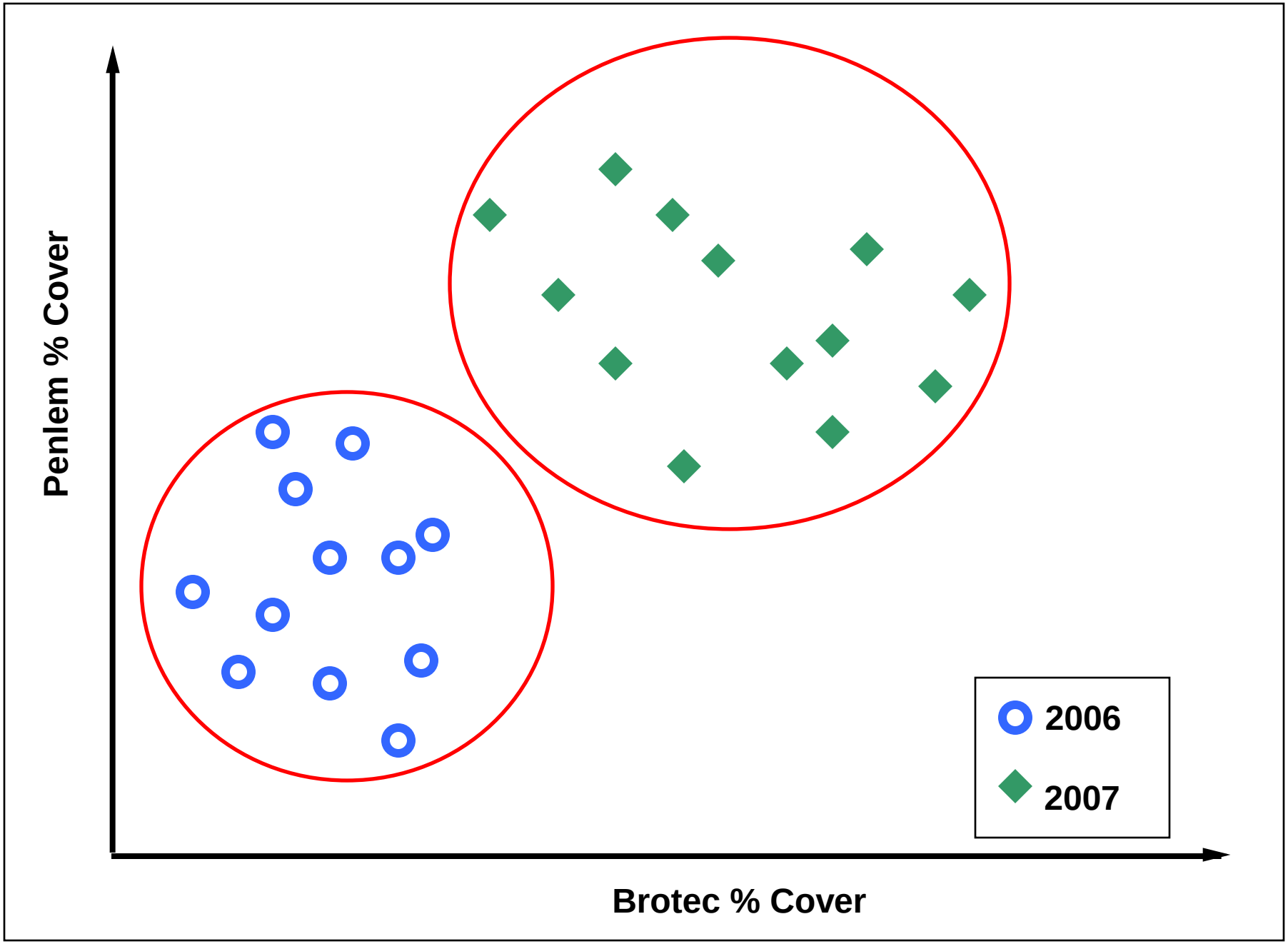
MUCH less simple: try to understand the relationship between all species and habitat characteristics measured

Multivariate Dataset

2006 - 2008 Data

	2006	2007	2008
Penlem Cover	7.5	6.4	5.2
Brotec Cover	14.5	14.3	14.4
Psespi Cover	11.1	6.5	9.8
Fesida Cover	5.5	6.9	7.3
Crerun Cover	0.1	0.3	.3
Arywyo Cover	14.0	12.0	10.7
Artvas Cover	14.5	14.2	14.6
Shade	0	0	2
Soil Moisture	0	0	2


Penlem % Cover
Brotec % Cover
2006
2007


Penlem % Cover
Brotec % Cover
2006
2007

Cautions for those who insist on true multivariate monitoring

Different ordination methods yield different results

Defining a “significant” threshold difficult

Sampling design: you’re on your own

Interpretation difficult

10: Community Monitoring

1. Distinguish strengths and weaknesses of univariate and multivariate monitoring approaches

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