
Bryophytes at Springs in the American Southwest
John Spence
National Park Service

Haploid Dominant

Diploid Dominant

zygote

green algae

bryophytes

ferns

gymnosperms

angiosperms

DECREASING SIZE OF GAMETOPHYTE

What is a Bryophyte?

- Gametophyte the dominant generation
- Lacks a lignified vascular system for distributing water and nutrients
  - No roots
  - Water and nutrient transfer by osmosis or capillary action
  - Small size, thin leaves
  - Many very dessication tolerant

Bryophyte Diversity

- **Hornworts ~300 species**
- **Liverworts ~8,000 species**
- **Mosses ~12,000 species**

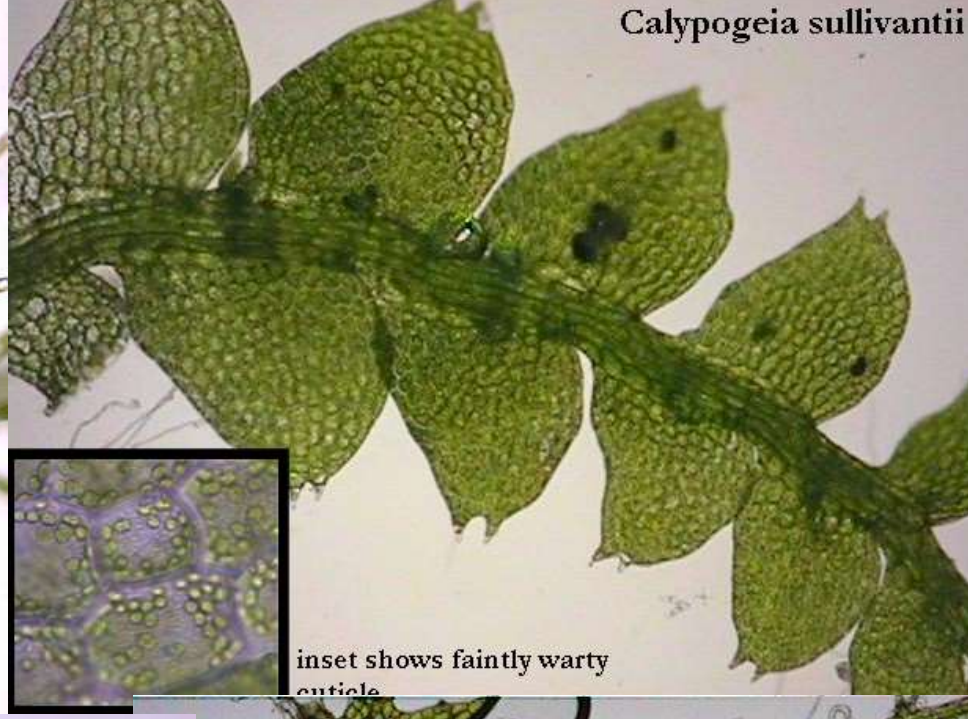
Bryophyte species tend to be geographically widespread due to small easily dispersed spores

Bryophytes are strongly tied to microclimates reflecting specific moisture, humidity, substrate and chemical characteristics

Bryophyte Growth Forms

- Hornworts
- Liverworts
  - Thallose
    - Simple
    - Complex
  - Leafy
- Mosses
  - Acrocarps
  - Pleurocarps

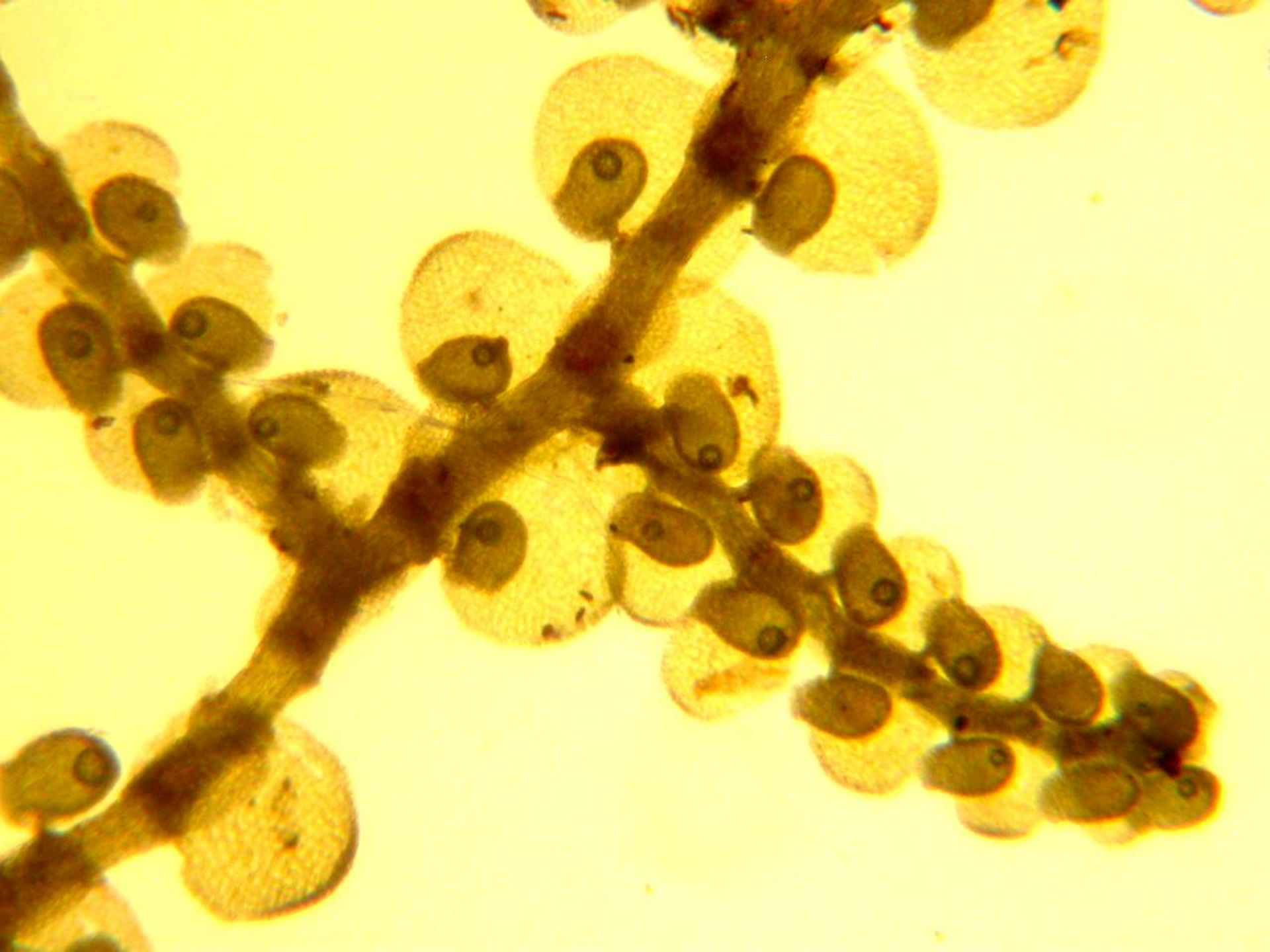
Blepharostoma trichophyllum



Calypogeia sullivantii

inset shows faintly warty cuticle

Gymnocolea inflata



Data Sources – very limited

Most don't mention springs

- Unpublished reports
- Gray literature
- Theses
- Published checklists
- Collections
  - Spence
  - Stevens
  - Rink
  - Ardith Johnson (MNA-Grand Canyon)
  - Sonoran Desert Network I&M Program

~500 species reported from region

GEOGRAPHIC DISTRIBUTIONS

- **Boreal-Temperate:** mostly northern hemisphere, scattered in tropical mountains and Antarctic regions
- **Widespread:** most continents, ecological generalists
- **Southern Temperate:** predominantly subtropical-Madrean and arid regions

WETLAND STATUS

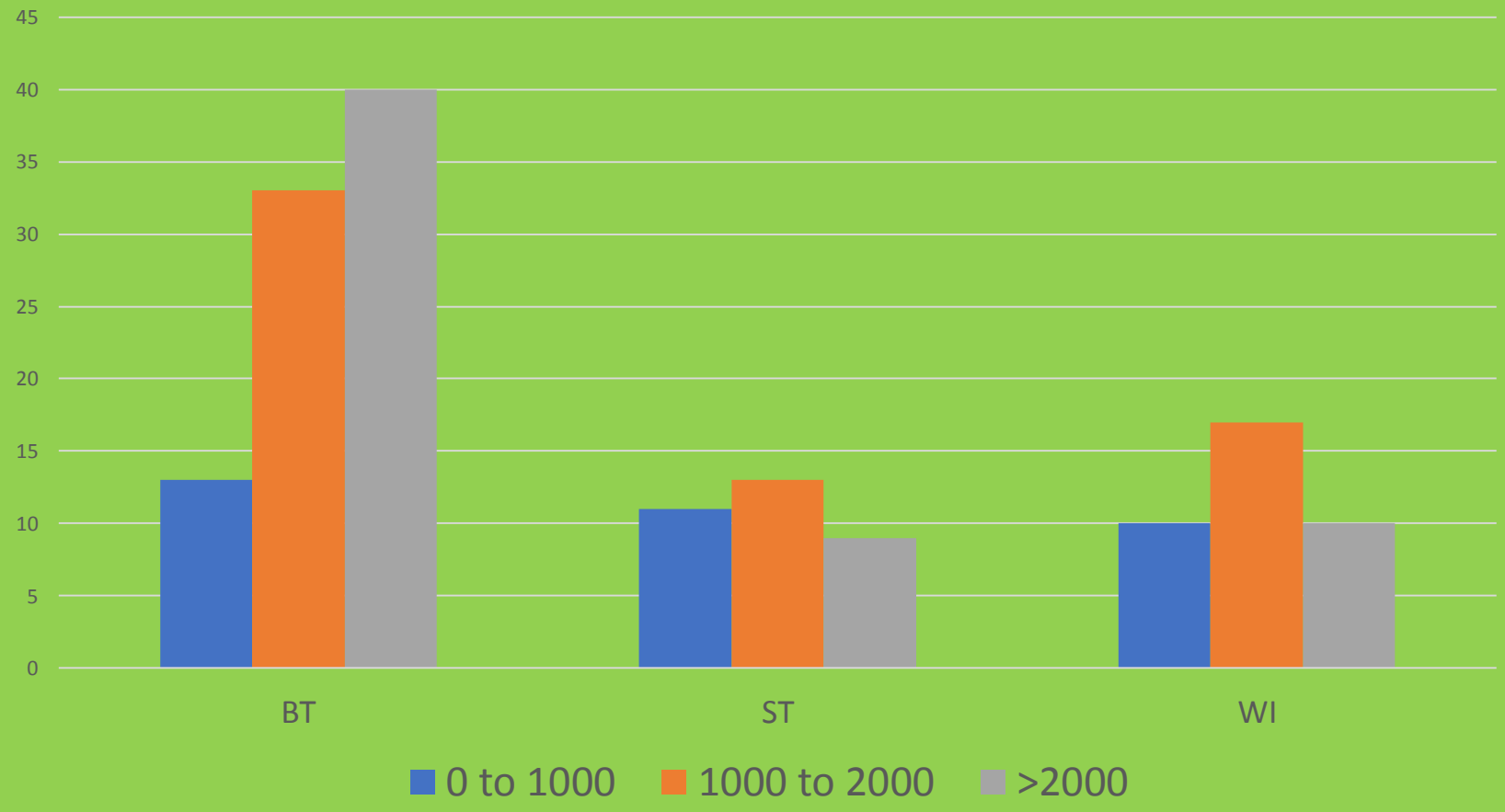
- **Obligate species:** require water throughout the growing season; limited desiccation tolerance

- **Facultative species:** can withstand desiccation, varying from a few weeks to months, but still requiring water for portions of the growing season

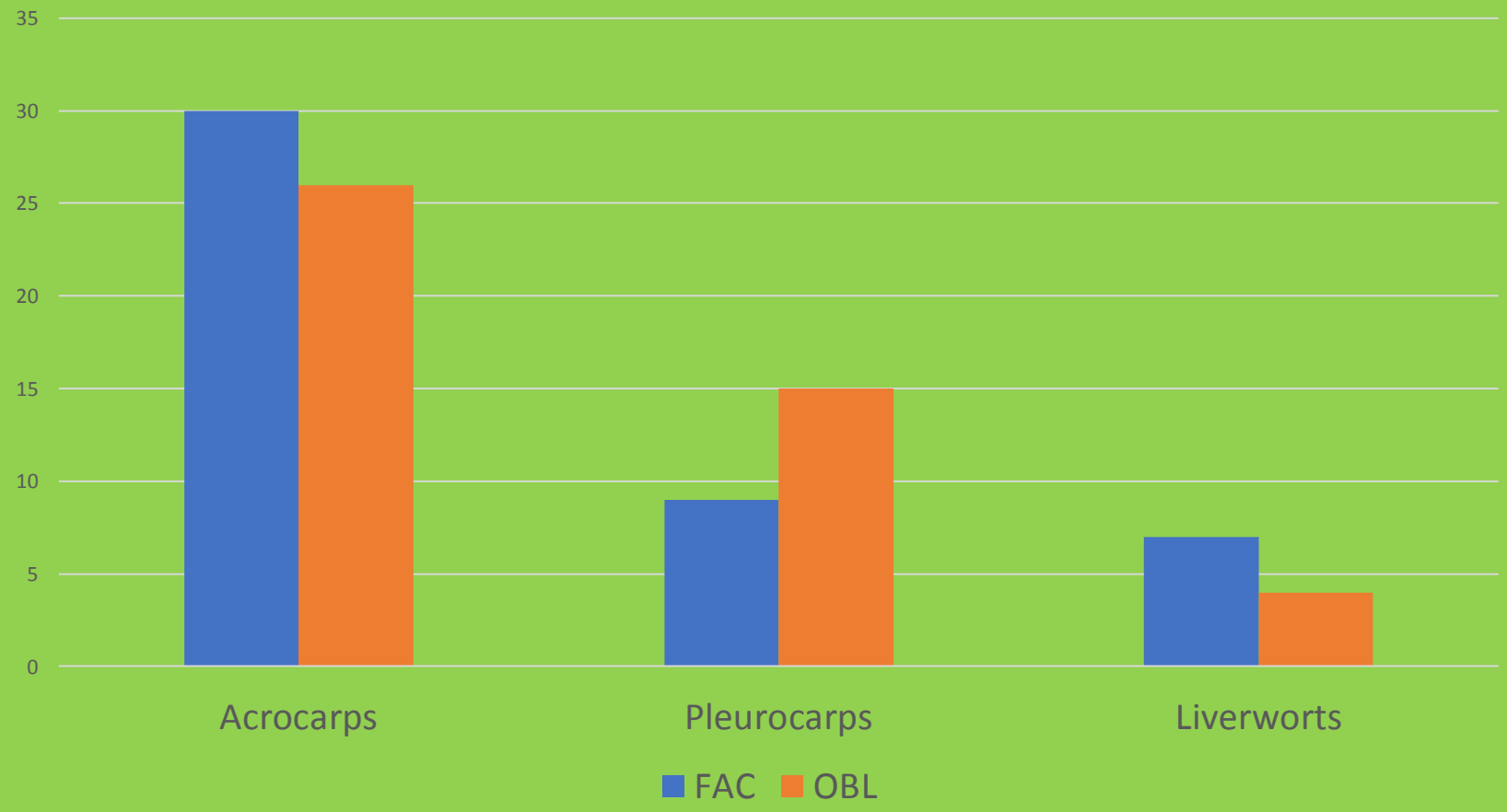
Diversity, Life Forms and Geographic Distributions

	Acrocarpous Mosses	Pleurocarpous Mosses	Leafy Liverworts	Thallose Liverworts	
Boreal Temperate	32	19	3	1	55
Southern Temperate	15	2	0	3	20
Widespread	9	3	0	4	16
	56	24	3	8	91

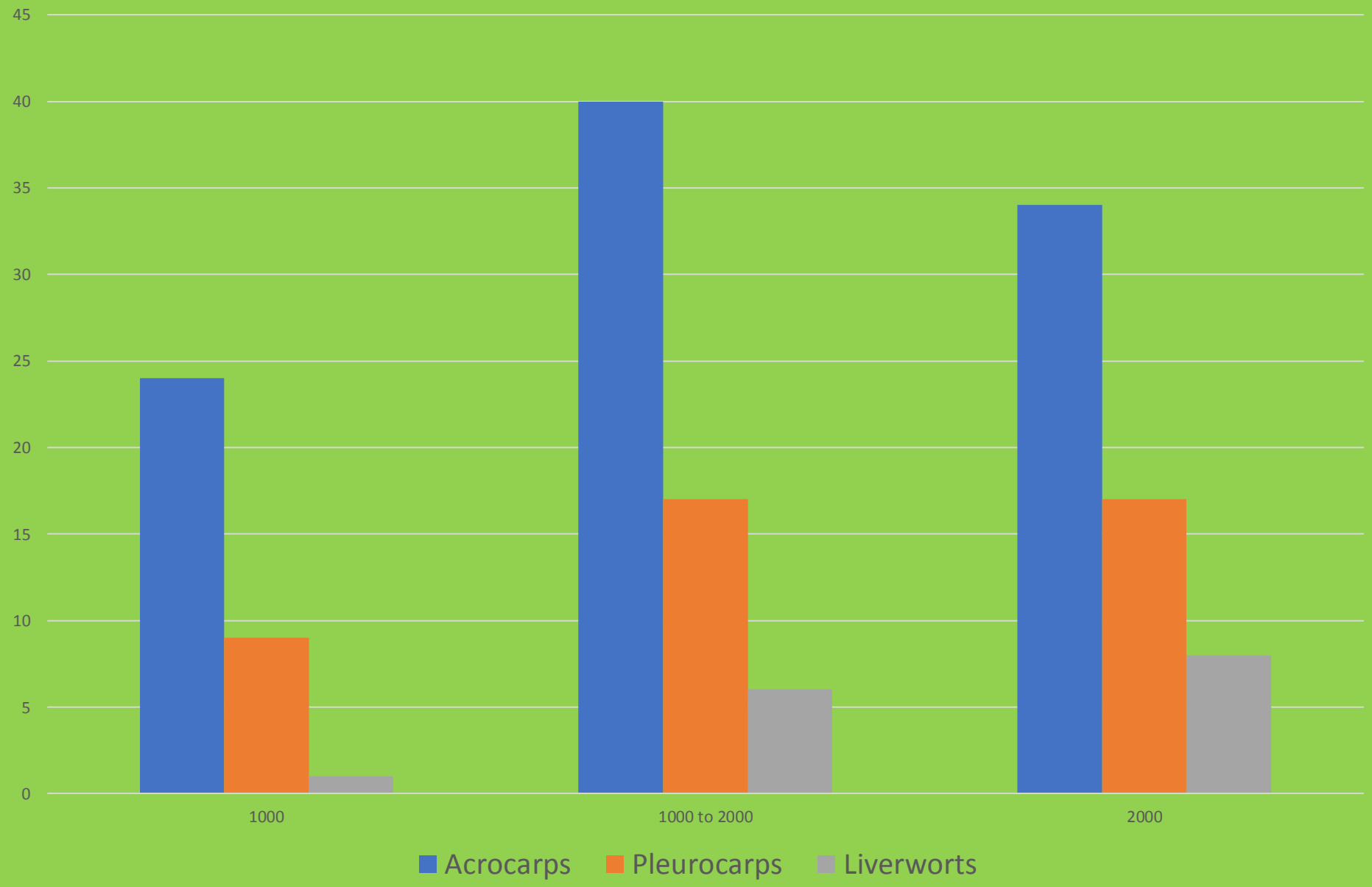
Geographic Distributions across Elevations

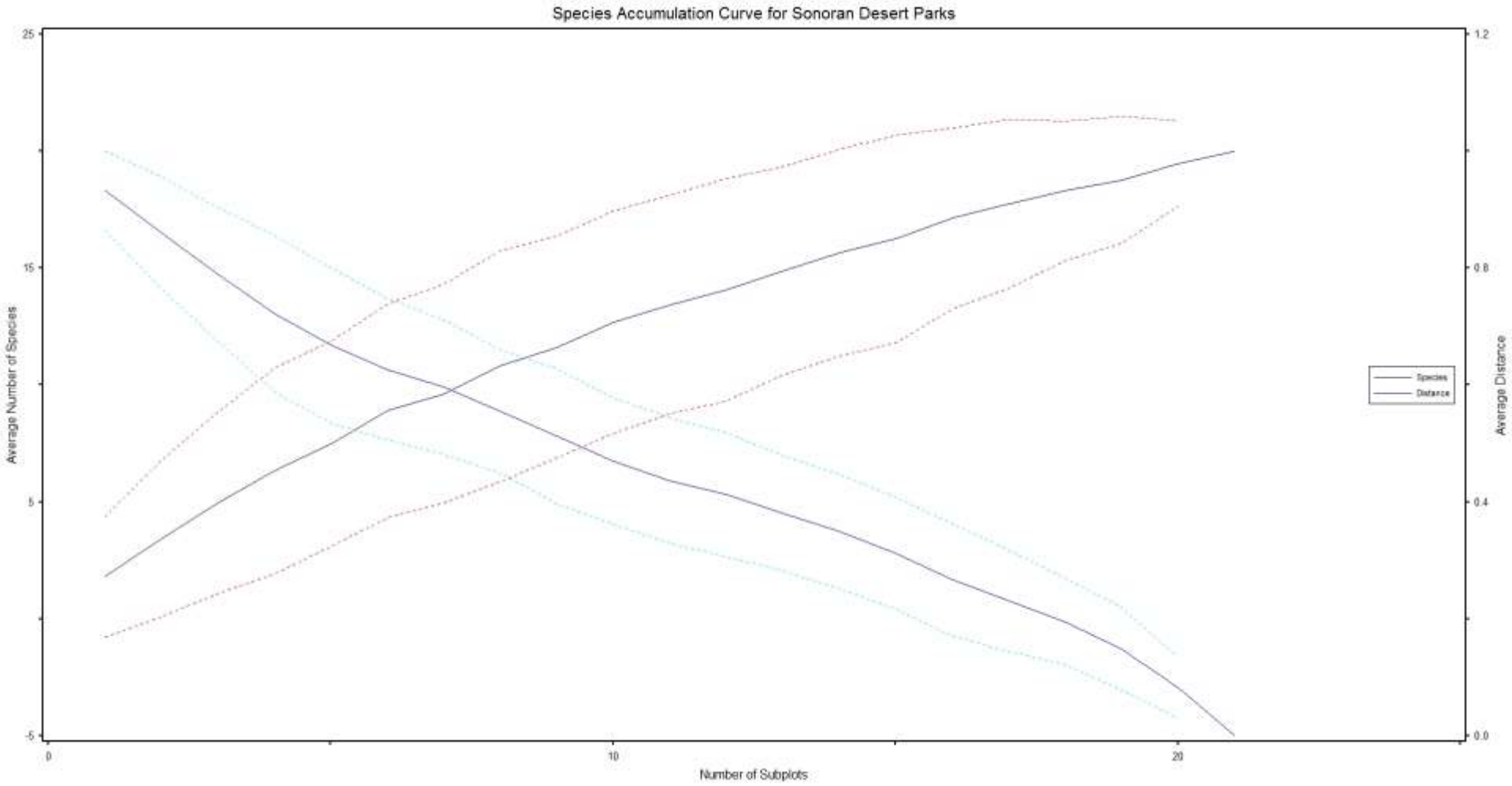


Life Forms and Wetland Status



Elevational Distributions





Species Accumulation Curve *(21 springs, 20 species)*

Jackknife1=31.4

Jackknife2=39.7

Other Results

- 29 species found at a single spring (32%)
- 50% obligate wetland species
- 3 undescribed species; all Southern Temperate-Madrean
- Widespread species are water chemistry generalists
- Southern temperate species mostly found in basic water springs


Conclusions

- **Estimated 140-180 species in Southwestern springs**
- **Many regionally rare species**
- **Very sensitive to alterations in microclimate such as shade, moisture, humidity**
- **Highly vulnerable to regional extirpation resulting from spring losses**
- **A few species dominate and are widespread**
- **Much more survey work and collecting is needed!**

ACKNOWLEDGEMENTS

- Larry Stevens and Jeri Ledbetter
- John Brinda, Theresa Clark
- Andy Hubbard, Evan Gwilliam, Sonoran Desert Network Inventory and Monitoring Program, NPS
- Many past researchers and collectors