

# Diverse uses of herbarium data: opportunities and challenges

M.W. Denslow

National Ecological Observatory Network (NEON)

# Herbarium Specimens

- Kinds of data
  - Plant taxa
  - Spatial
  - Temporal

No. ....

DESERT BOTANICAL GARDEN  
Phoenix, Arizona

Ref. .... Family. **AMARYLLIDACEAE** .....

Vol. & Page ..... Collection Date. **18 May 1975** .....

Botanical Name **Agave murpheyi F. Gibson** .....

Variety .....

Locality .....

Cover Type .....

Slope ..... Soil Type .....

Abundance ..... Altitude .....

Other Data **Clone of ca. 200 plants, 6 with emergent inflorescence**

Collector's Name **R.G. Engard et al.** No. **479**

Checked by .....



No. ....

DESERT BOTANICAL GARDEN  
Phoenix, Arizona

Ref. .... Family. **AMARYLLIDACEAE** .....

Vol. & Page ..... Collection Date. **18 May 1975** .....

Botanical Name **Agave murpheyi F. Gibson** .....

Variety .....

Locality .....

Cover Type .....

Slope ..... Soil Type .....

Abundance ..... Altitude .....

Other Data **Clone of ca. 200 plants, 6 with emergent inflorescence**

Collector's Name **R.G. Engard et al.** No. **479**

Checked by .....

Photo ASU herbarium

# Scope of Review

- Not dealing with activities traditionally associated with herbaria
  - Systematics
  - Monography
  - Floristics
- Underutilized?



# Advantages of Herbarium Data

- Suited for large and small scale analyses
- Spatial, temporal information
- Important links with other organisms
- Current environmental issues
  - Energy
  - Land use
  - Species conservation





# Literature Search

1. Invasions
2. Species conservation
3. Diversity patterns
4. Phenology
5. Species ranges
6. Other
  - Knowledge gaps, sequencing

Bibliography available by request





Contents lists available at SciVerse ScienceDirect

# Perspectives in Plant Ecology, Evolution and Systematics

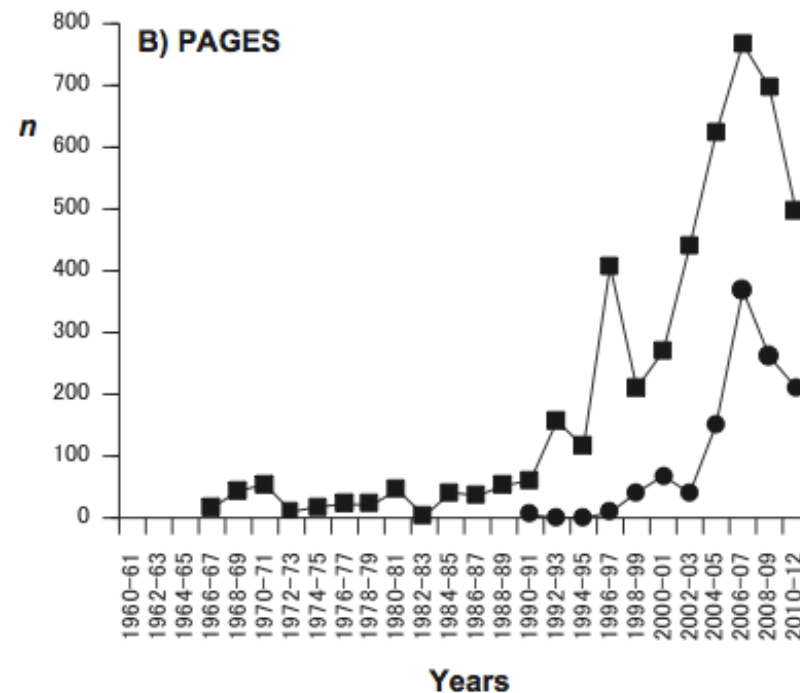
journal homepage: [www.elsevier.com/locate/ppees](http://www.elsevier.com/locate/ppees)



Review

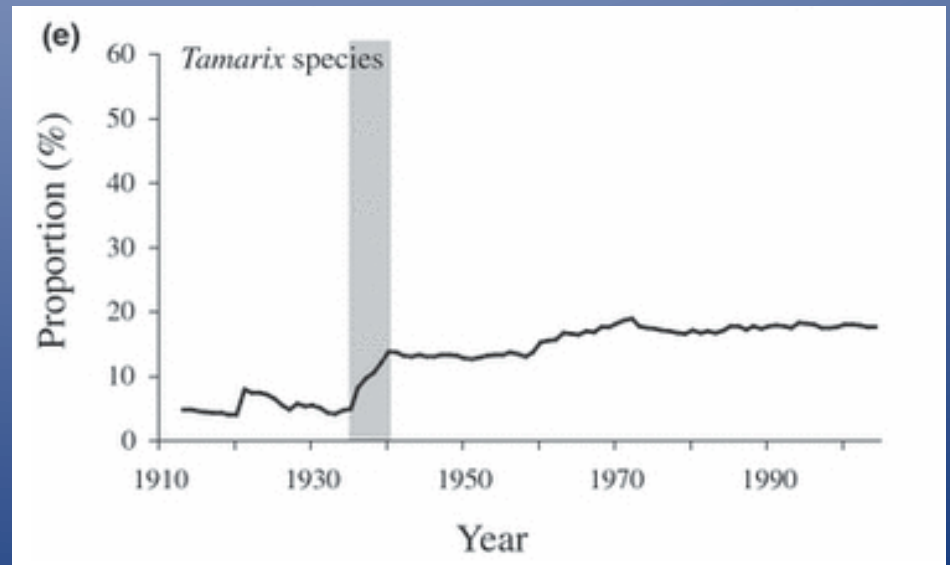
## Biological collections in an ever changing world: Herbaria as tools for biogeographical and environmental studies

Claude Lavoie\*



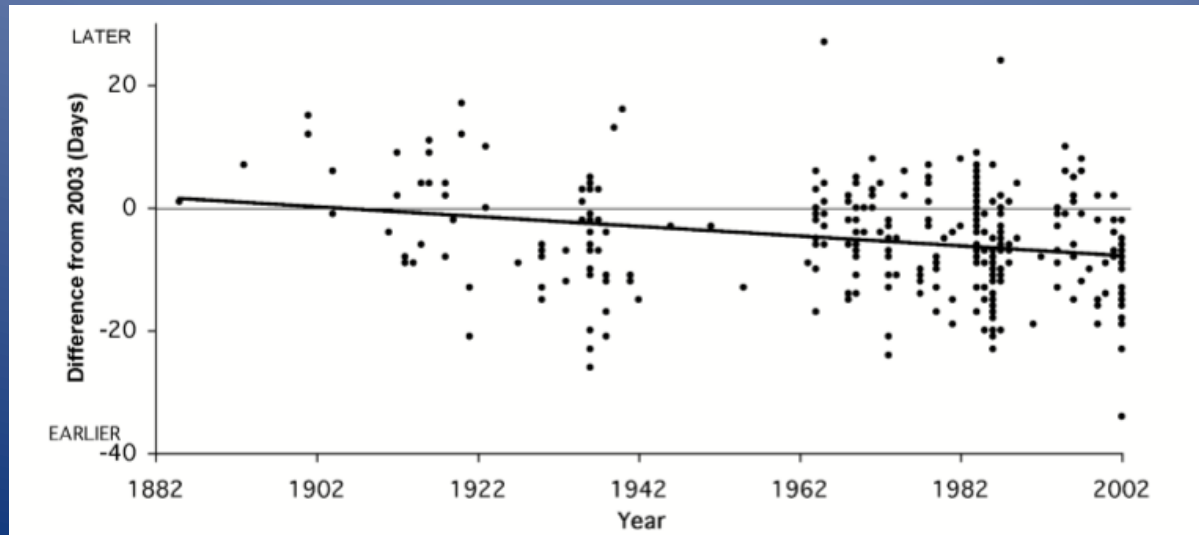
# Critical Issues

- Invasions
  - Spatial and temporal data
    - Range expansion
    - Temporal trends
  - Sequence data
    - Cryptic invasions



# Critical Issues

- Phenology
  - Flowering date
    - Phenological Shift
      - Species survival
      - Disruption of species interactions

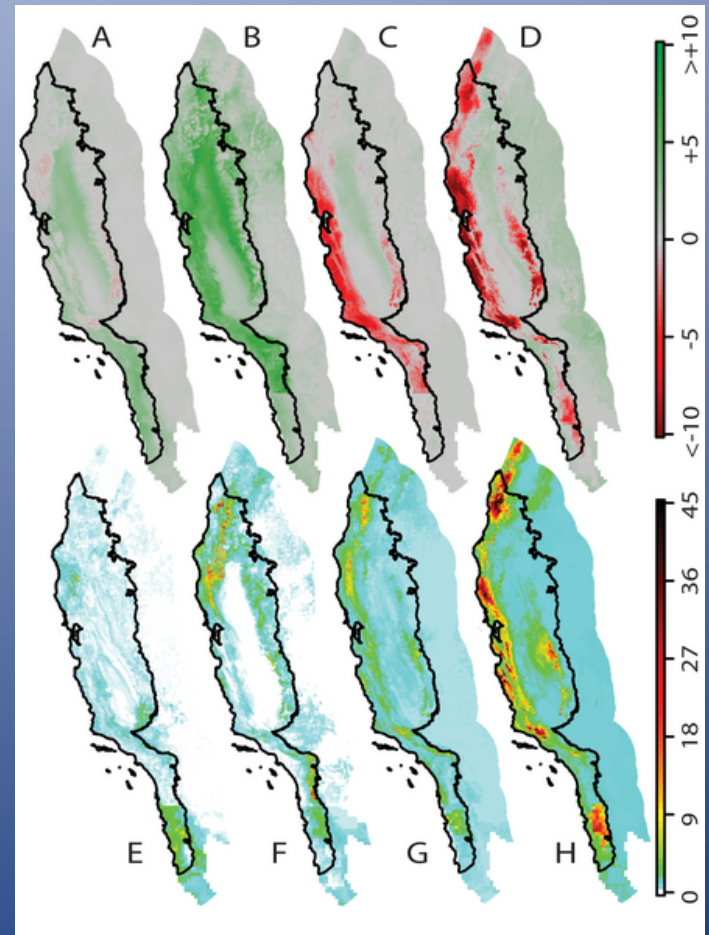


Primack et al.  
2004



# Critical Issues

- Niche Models
  - Georeferenced specimens and climate data
    - Species ranges
      - Range shifts under global change
      - Range size reduction for endemics



# Critical Issues

- Species Ranges
  - Food plants
    - *Ipomoea batatas* (L.) Lam.
  - Archeological evidence, specimens, molecular analysis
  - Roullier et al. 2013



# Critical Issues

- Media coverage
  - ‘State’ s flora at risk from climate change, study says’  
Los Angeles Times
  - ‘Grim look at state's plant life’  
San Francisco Chronicle
  - ‘Thoreau Is Rediscovered as a Climatologist’  
New York Times

# Data Limitations

- Biases and limitations
  - Unequal sampling in space and time
  - Location information
  - Disproportionate taxa sampling
    - Steege et. Al 2011
  - Botanist effect
  - Taxon absences



# Data Limitations

- Methods to overcome
  - ‘proportion curve’ (Delisle et al. 2003)
    - Crawford & Hoagland 2009
  - Pyšek’s ‘invasion curve’
  - Distinguish sampling effects from lag-times
    - Aikio et al. 2010
  - POC plots
    - Phillips & Elith 2010

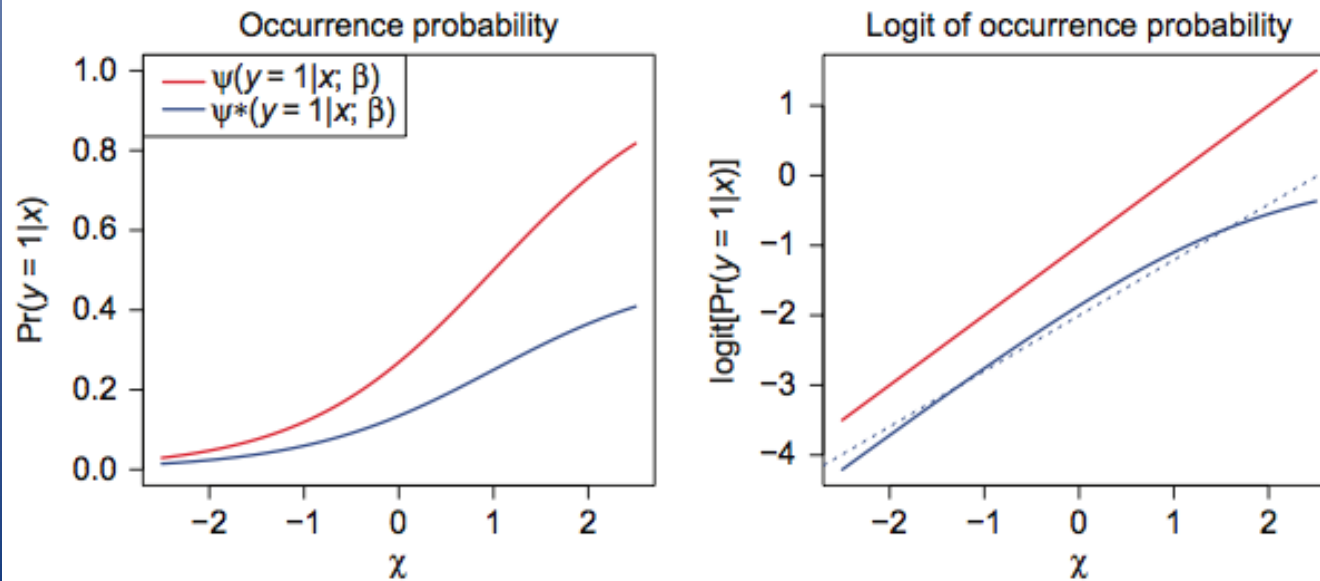


# Data Limitations

## Inference from presence-only data; the ongoing controversy

Trevor Hastie and Will Fithian

*T. Hastie (hastie@stanford.edu) and W. Fithian, Statistics Dept, Stanford Univ., CA 94305, USA.*



# Considerations

- Importance of data consolidation
- Increase mobilization
  - More digitization = more use
    - Lavoie 2013
- Outreach?
  - Increase awareness of this critical resource
    - Mergen et al. 2010
- Decrease in plant collecting / education

- Thank you!
- [mdenslow@neoninc.org](mailto:mdenslow@neoninc.org)
- @mwdenslow