Monitoring strategies and what they mean for invasive plants

Steve Sutherland RMRS/USFS
Matt Brooks WERC/USGS

Why monitor?

- Detect new invasions after fire
- Determine postfire changes in established nonnative species
- Determine effect of fire suppression on nonnative species
- Determine effect of restoration on native and nonnative species
- Determine effectiveness of prescribed fire for control of nonnative species

Well-designed Monitoring

- Measures essential variables
- Accurate, quick and easy
- Well documented
- Easily repeated

Agency protocols:
to facilitate and standardize

- Measuring and Monitoring Plant Populations. (1998) BLM
- Sampling vegetation attributes (1999) BLM
- Fuel and fire effects monitoring guide (1999) USFWS
- Fire monitoring handbook (2003) NPS
- Monitoring manual for grassland, shrubland, and savanna ecosystems (2005) ARS
- FireMon: fire effects monitoring and inventory protocol (2006) USFS
- Land condition trend analysis (1999) Range and training land assessment (2006) US Army

Common elements of monitoring programs

- Identify objectives
- Select appropriate monitoring techniques
- Select appropriate statistical analyses
- Modify management and monitoring as additional data and understanding become available

after Wirth and Pyke, in press

Identify objectives

- Management or research objectives
- Monitoring objectives

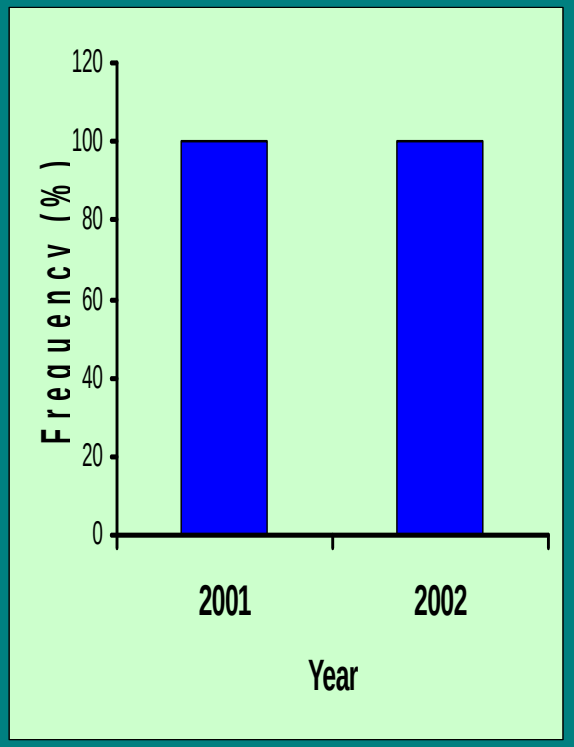
Select appropriate monitoring technique

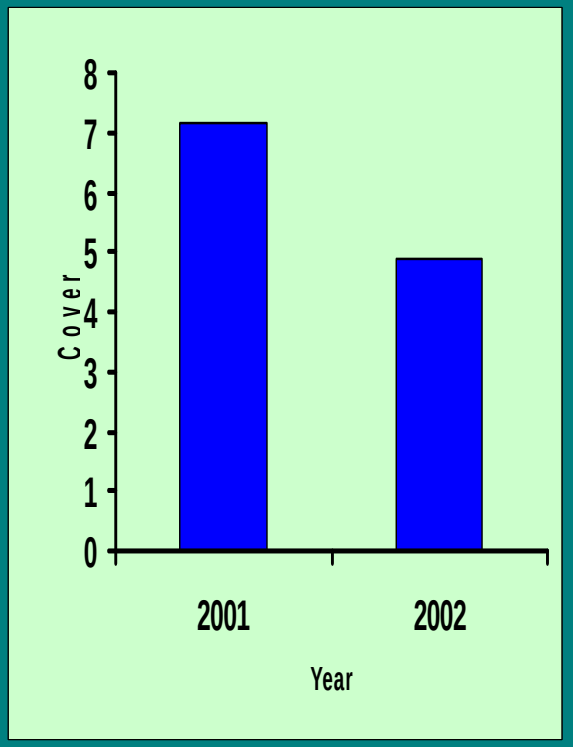
- Random sampling
- Stratification
- Sample adequacy
- Pseudoreplication
- Field techniques
- Sample length
- Controls

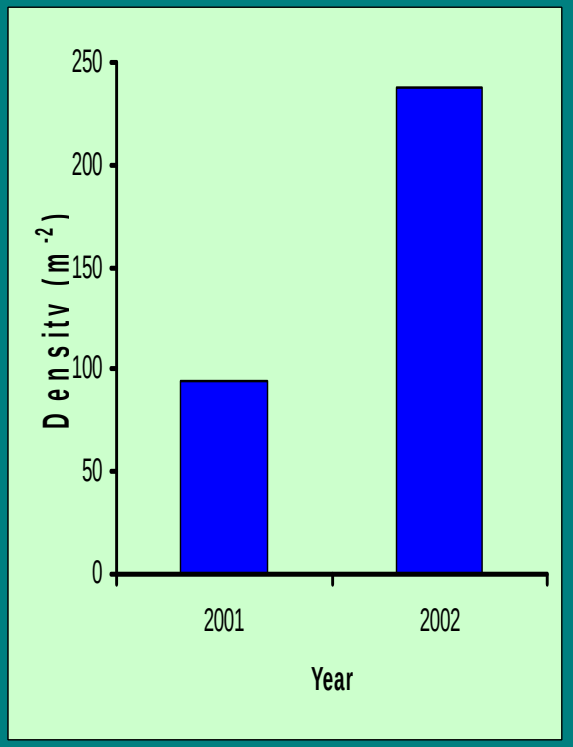
Field techniques

- Frequency
- Cover (ocular, line, point, plotless)
- Density
- Gap
- Biomass

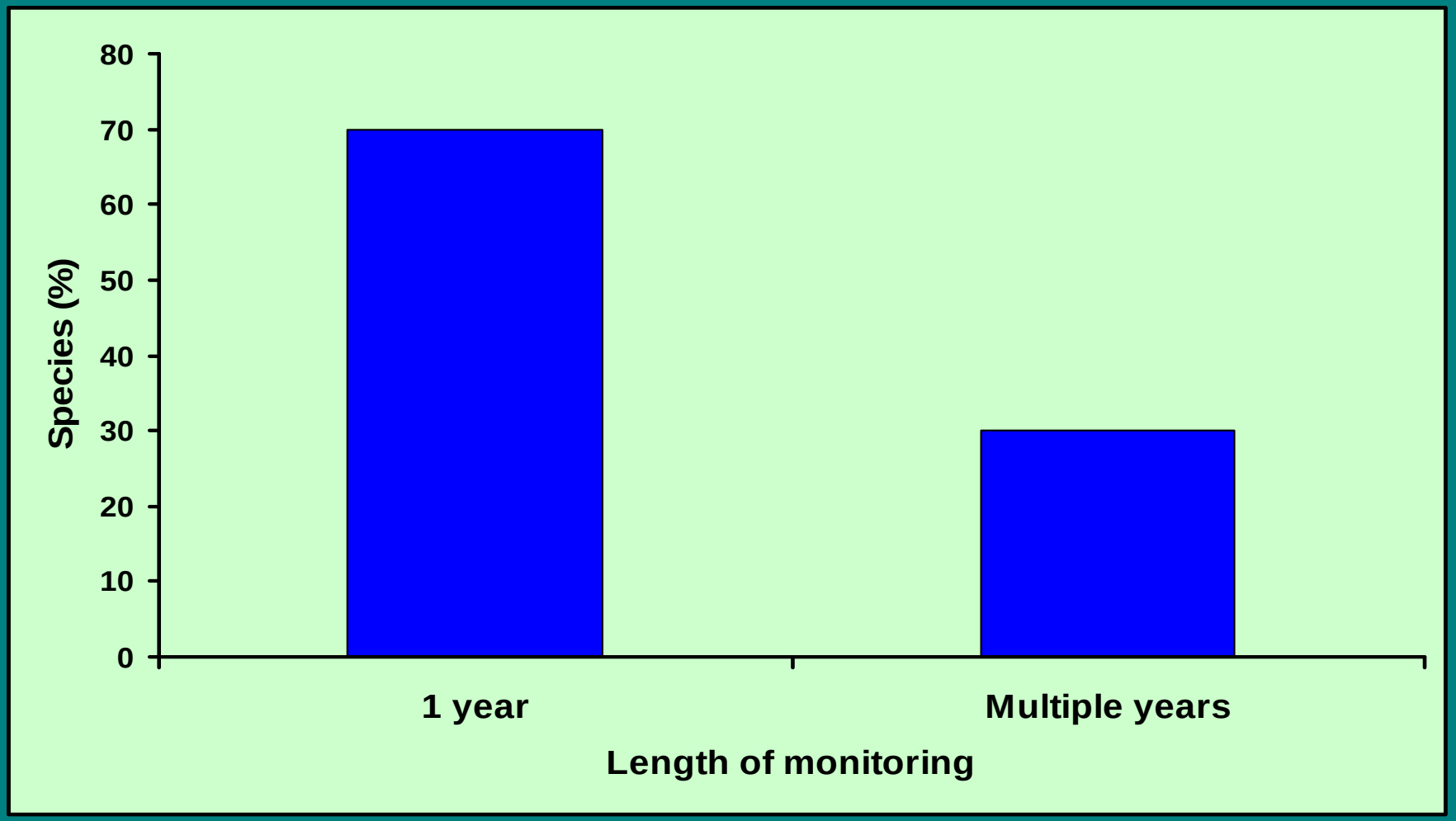
Do all methods give the same result? knapweed abundance





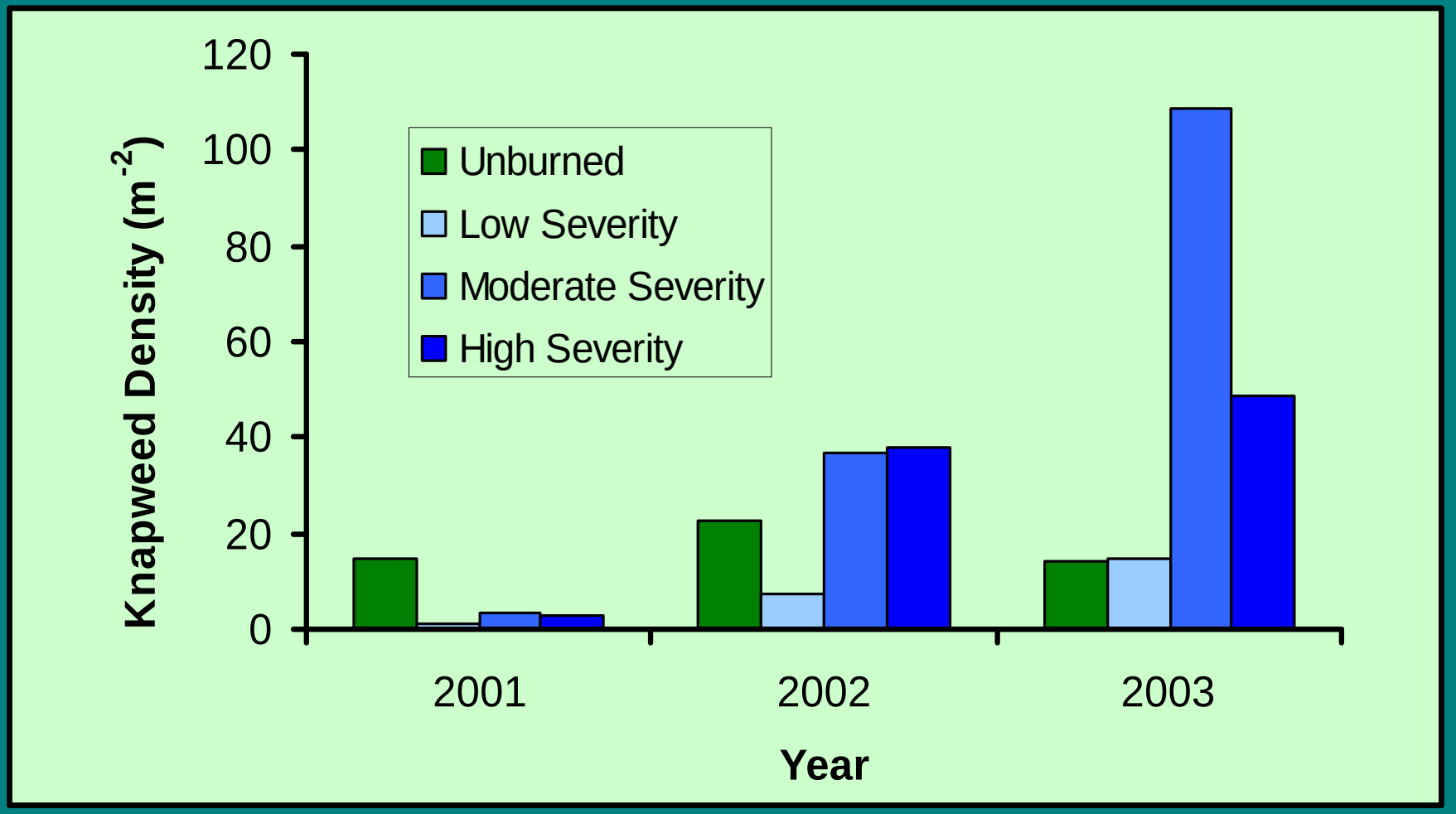


How long do you monitor? Multiple years



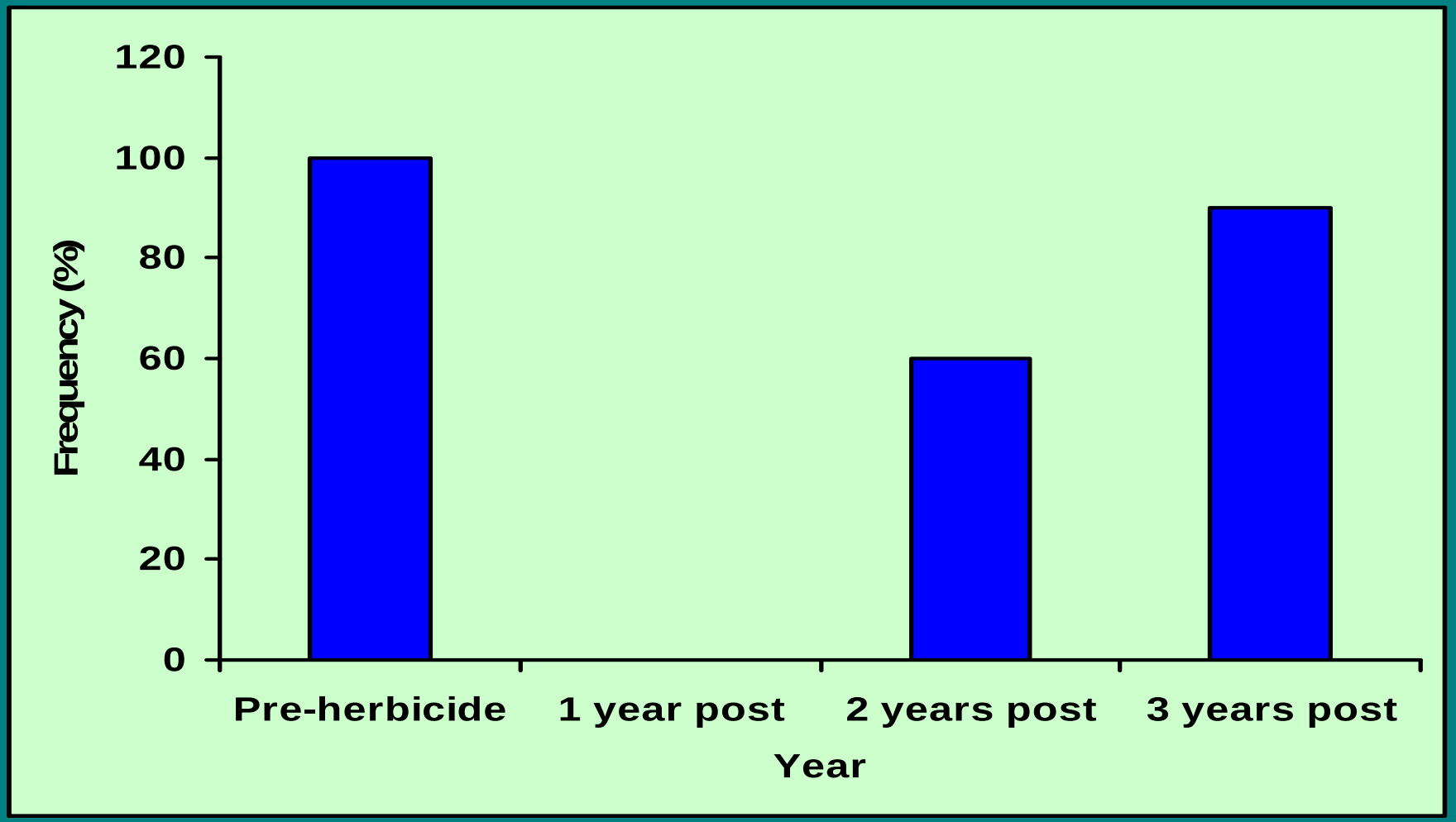
How long do you monitor?

postfire knapweed abundance



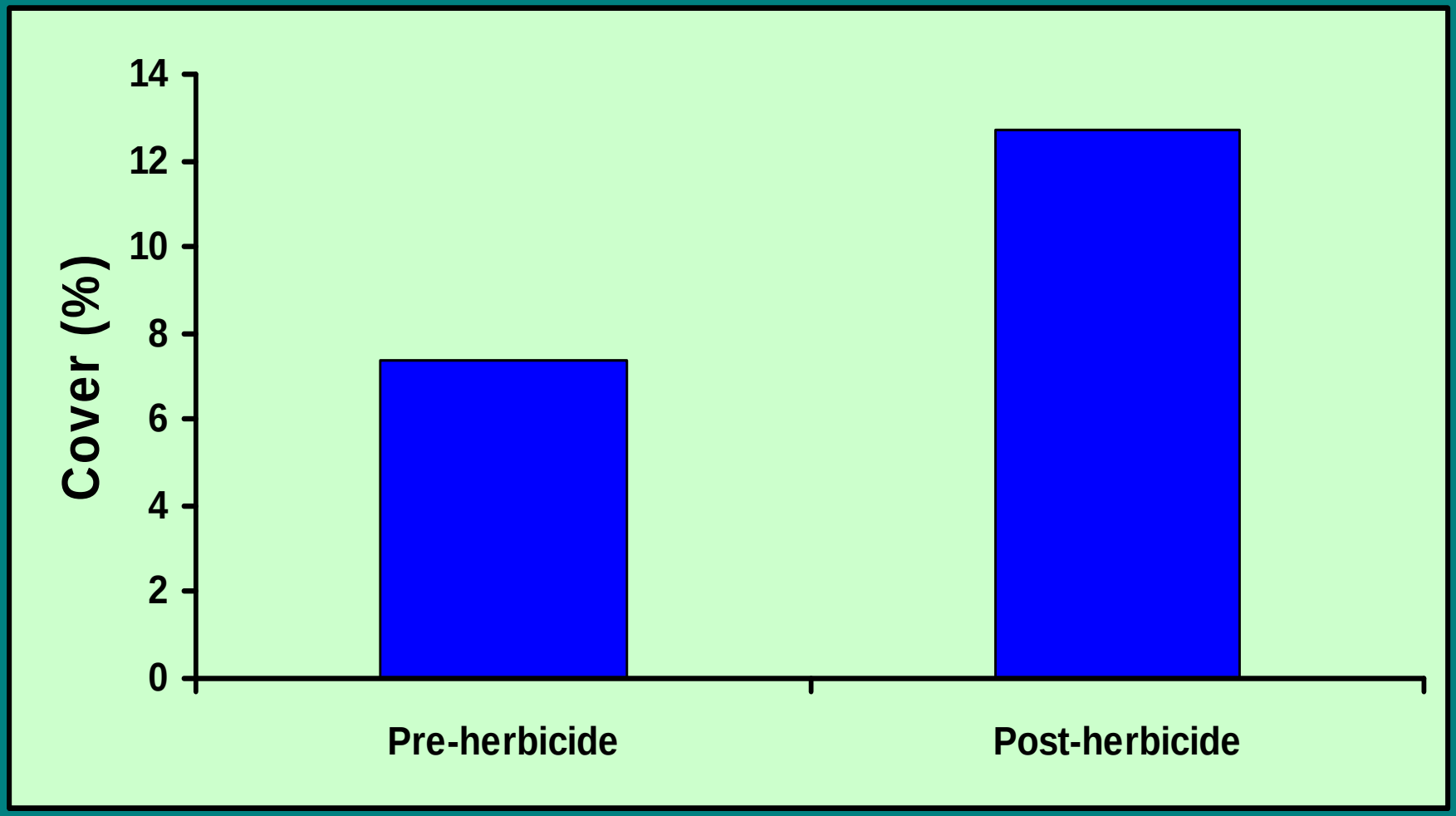
How long do you monitor?

Herbicide impact on knapweed



Why use controls?

Tordon efficacy on spurge



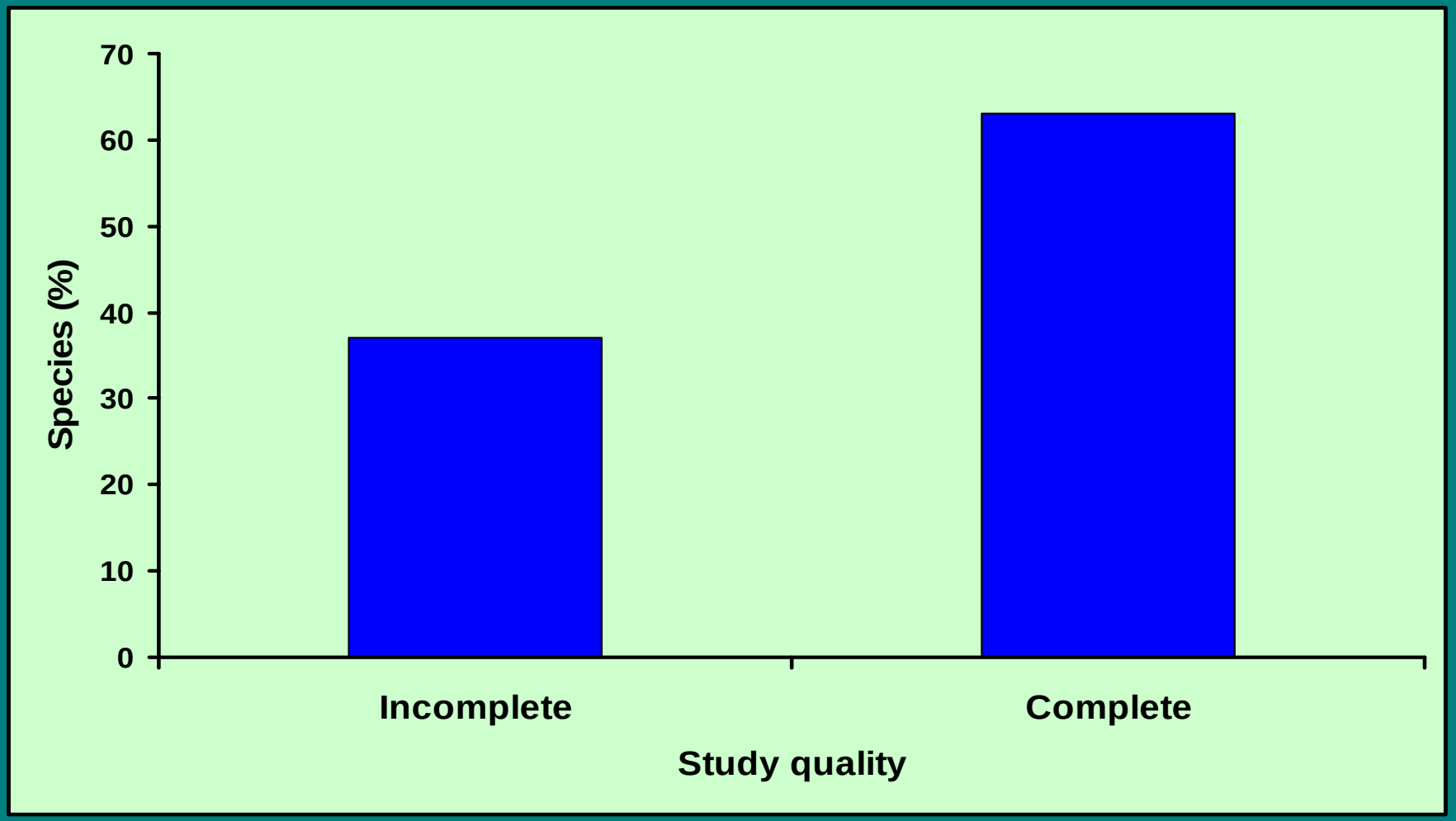
Select appropriate statistical analyses

- Statistical assumptions (normal distribution, equal variance)
- Parametric vs. non-parametric statistics

Modify management and monitoring as additional data and understanding become available

- Analyze results frequently,
- Compare with management and monitoring objectives,
- Modify monitoring plan,
- Modify management (adaptive management).

Complete studies



Fire monitoring

Above ground

- Temperature sensors
- Flame length
- Consumption and scorch
- Light levels

Below ground

- Temperature sensors
- Litter and duff consumption
- Surface fire severity

Canopy burn severity

Surface burn severity

Common Failures of Monitoring

Technical Problems

- Poor design
- Observer error too high
- Data lost
  - Poor storage or documentation
  - Cannot decipher
- Lack analytical skills
- Natural fluctuations > project impacts

Institutional Problems

- Lack of support
  - Personnel, budget, priorities, politics
- Resources limit completion
  - Data collected, but not analyzed
- Data are questioned & never used
- Results-to-mgmt adaptation not applied

after Elzinga et al, 1998, Beyers and Pyke

Resources for Monitoring Design

- Elzinga C, Salzar D, Willoughby J (1998) Measuring and Monitoring Plant Populations. BLM/RS/ST-98/005+1730, Denver CO.
- Sampling vegetation attributes (1999) http://www.blm.gov/nstc/library/pdf/samplveg.pdf
- Fuel and fire effects monitoring guide (1999) http://www.fws.gov/fire/downloads/monitor.pdf
- Elzinga C, Salzar D, Willoughby J, Gibbs J (2001) Monitoring plant & animal populations. Blackwell Sci. http://www.esf.edu/efb/gibbs/monitor/popmonroot.html
- Fire monitoring handbook (2003) http://www.nps.gov/fire/fmh/FEMHandbook.pdf
- FireMon: fire effects monitoring and inventory protocol (2006) http://fire.org/firemon/lc.htm
- Range and training land assesment (2006) http://www.cemml.colostate.edu/files/Final%20Draft%20RTLA%20TRM%20April%202006.pdf


R1/R4 Adaptive Management
and Monitoring Program
Joint Fire Sciences Program