Synthesis of responses to Lehmann lovegrass invasion at Walnut Gulch Experimental Watershed

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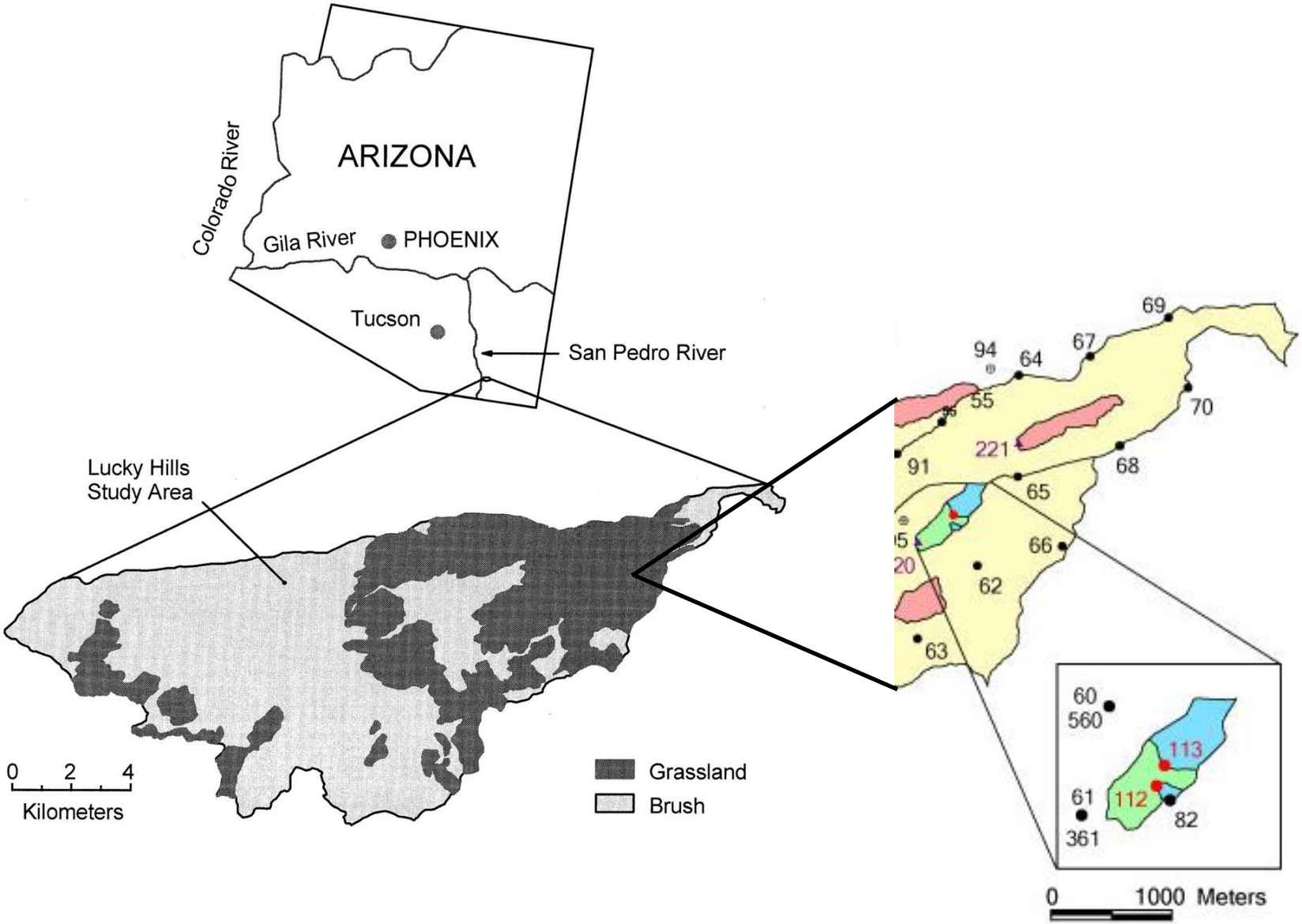
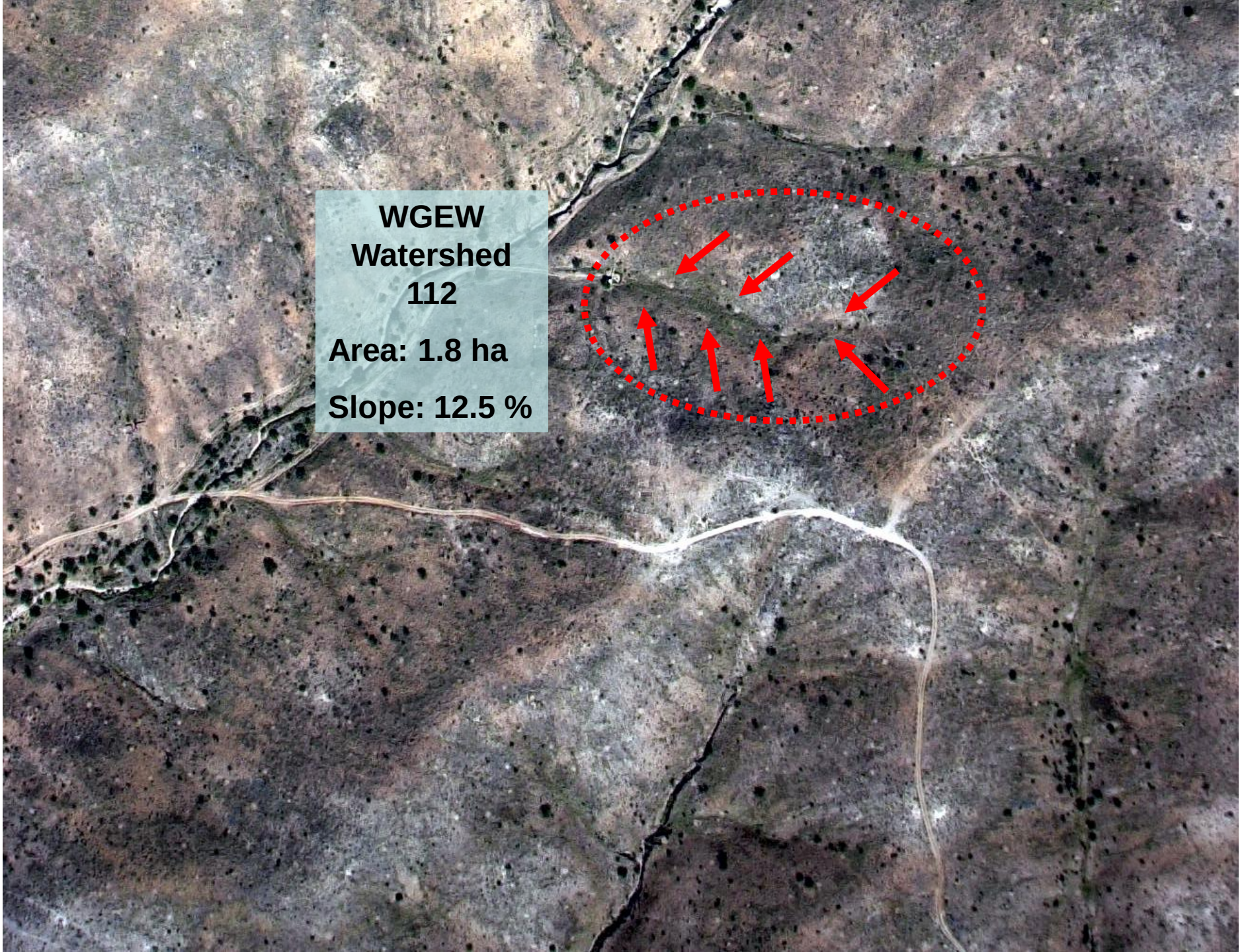
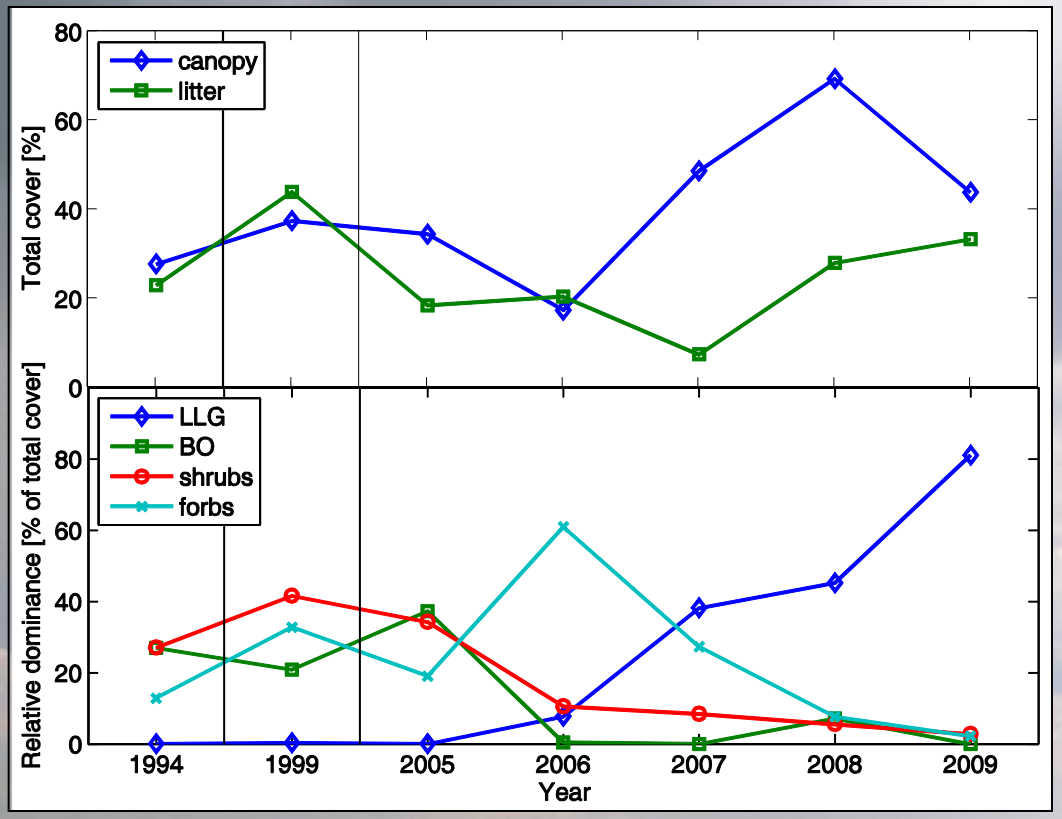
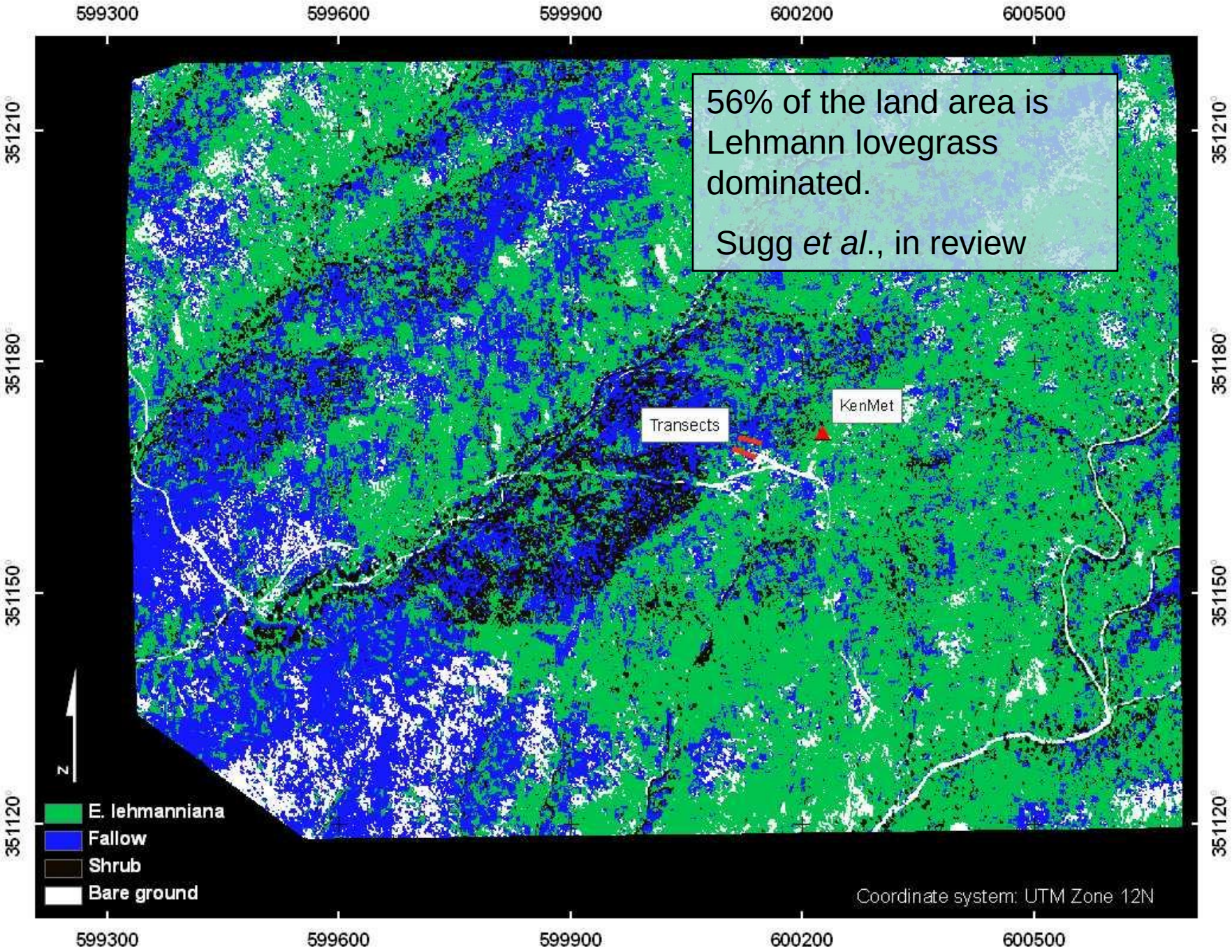
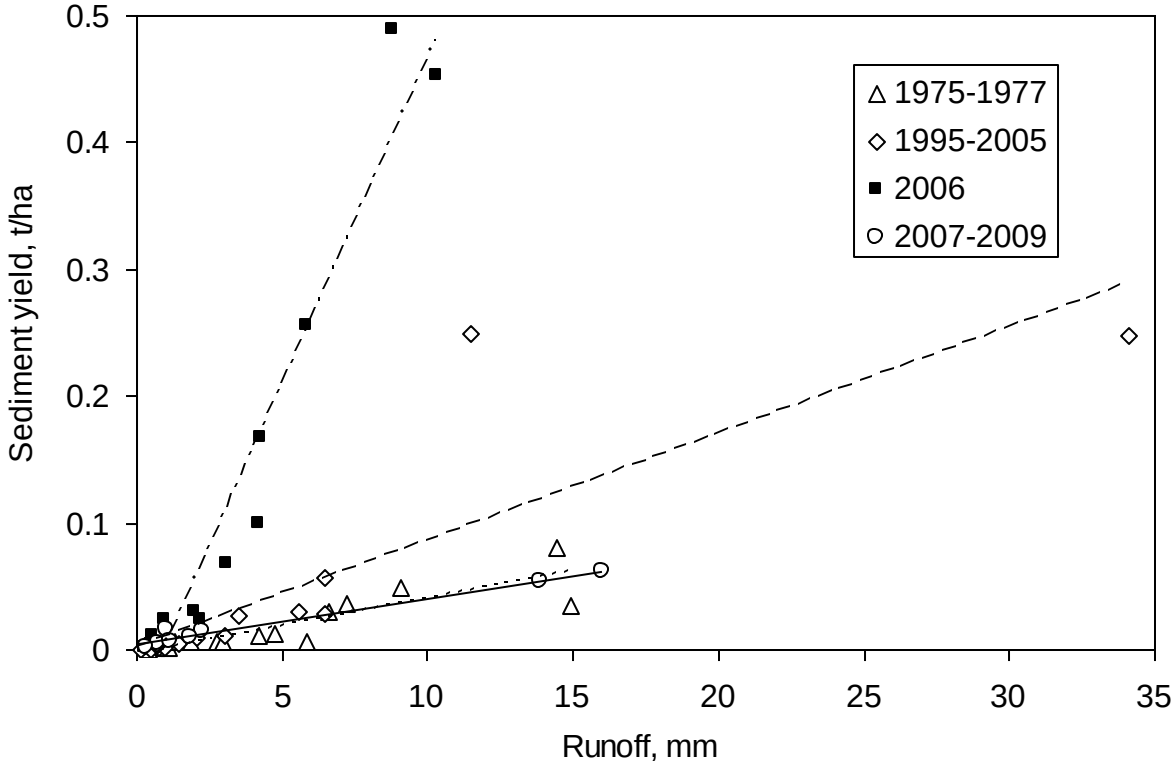

ARIZONA
Colorado River
Gila River
PHOENIX
Tucson
San Pedro River
Lucky Hills
Study Area
0 2 4
Kilometers
Grassland
Brush
69
94
64
67
55
70
221
91
68
65
66
62
63
60
560
113
112
61
361
82
0 1000 Meters


WGEW
Watershed
112
Area: 1.8 ha
Slope: 12.5 %

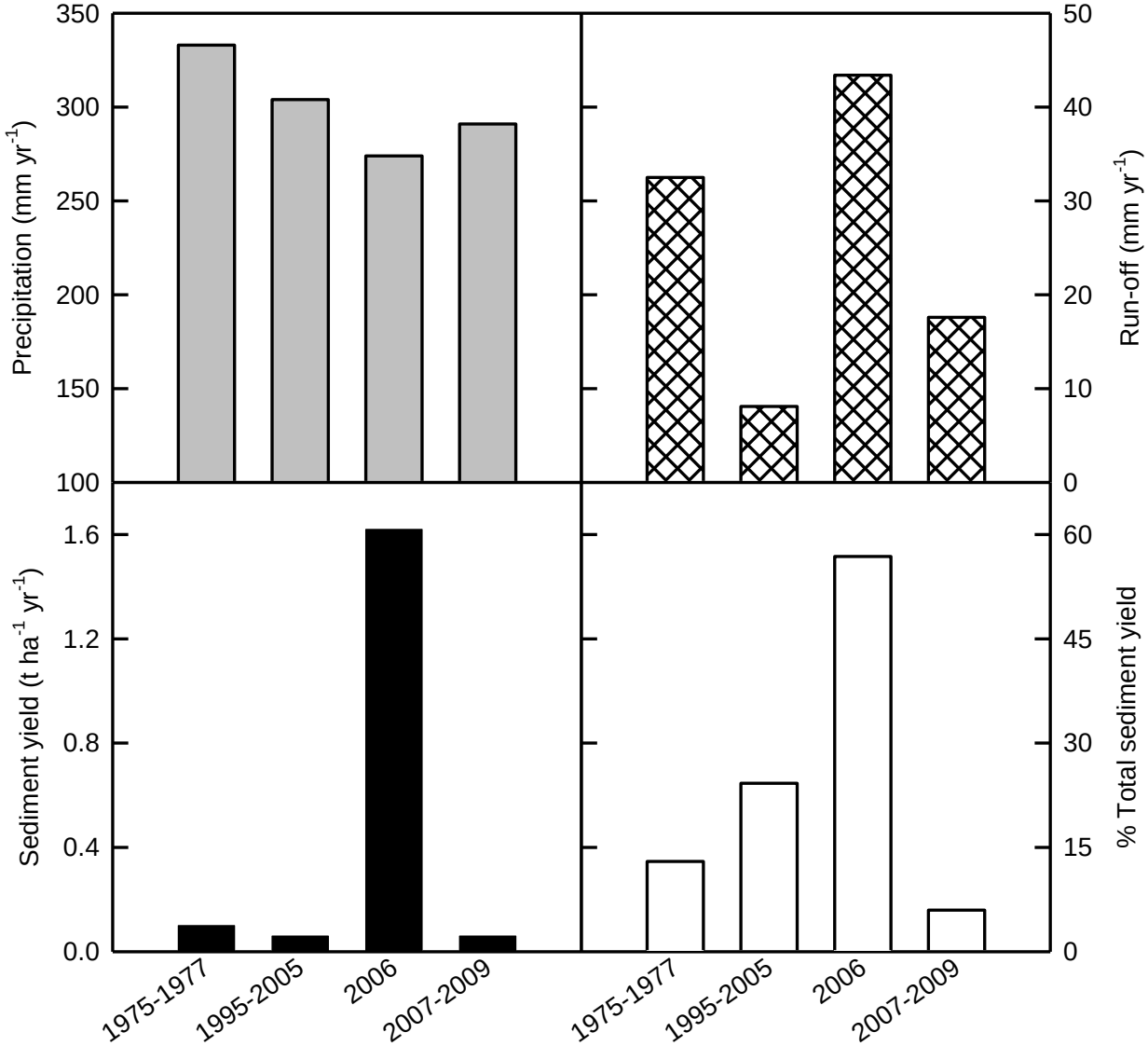

canopy
litter
Total cover [%]
80
60
40
20
0
LLG
BO
shrubs
forbs
Relative dominance [% of total cover]
80
60
40
20
0
1994
1999
2005
2006
2007
2008
2009
Year


599300
599600
599900
600200
600500
351210
351180
351150
351120
56% of the land area is Lehmann lovegrass dominated.
Sugg *et al*., in review
Transects
KenMet
N
E. lehmanniana
Fallow
Shrub
Bare ground
Coordinate system: UTM Zone 12N

1) Watershed response

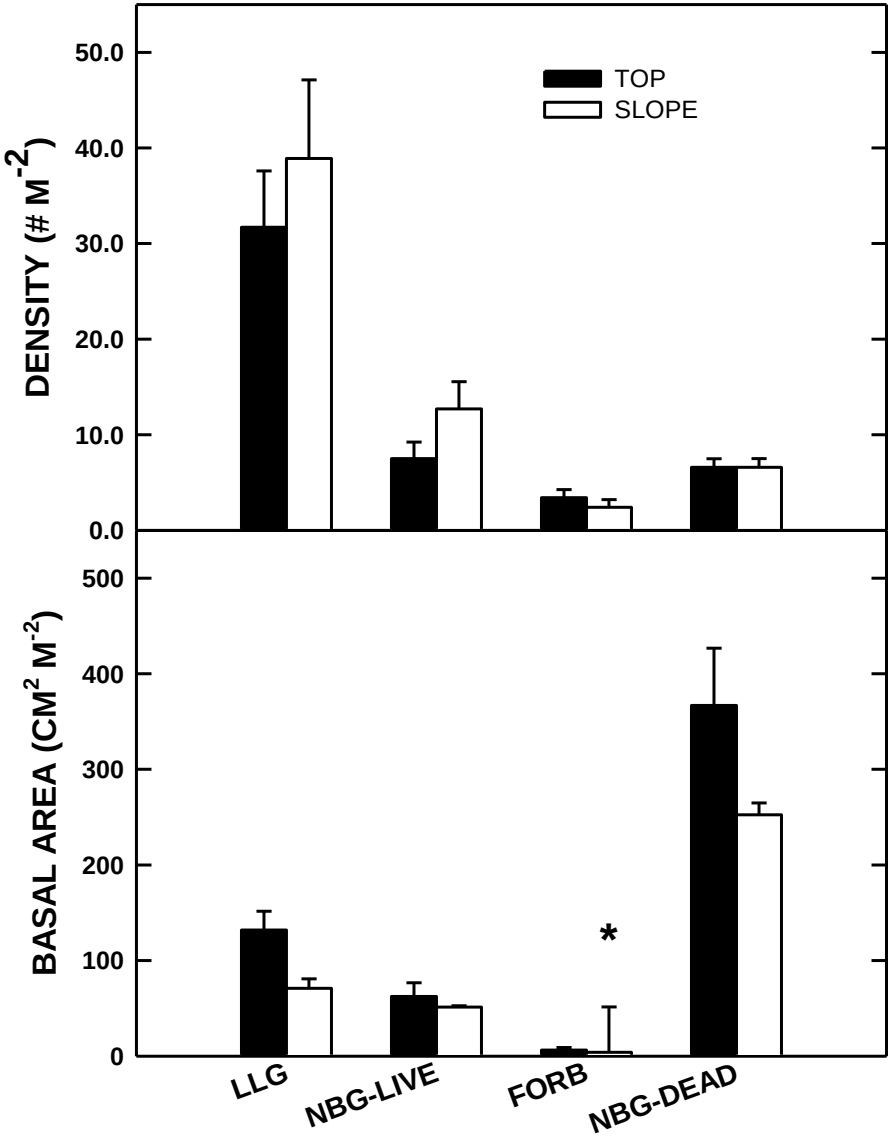


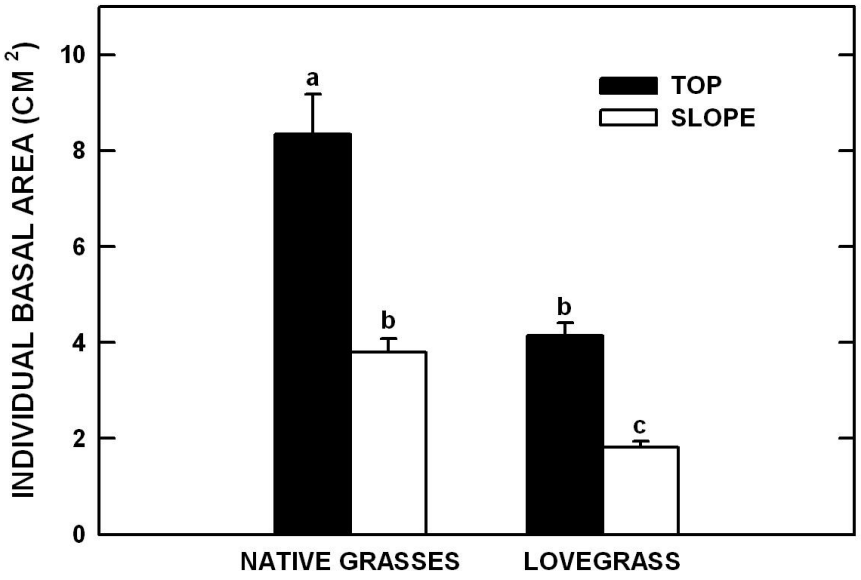
Polyakov *et al*., 2010

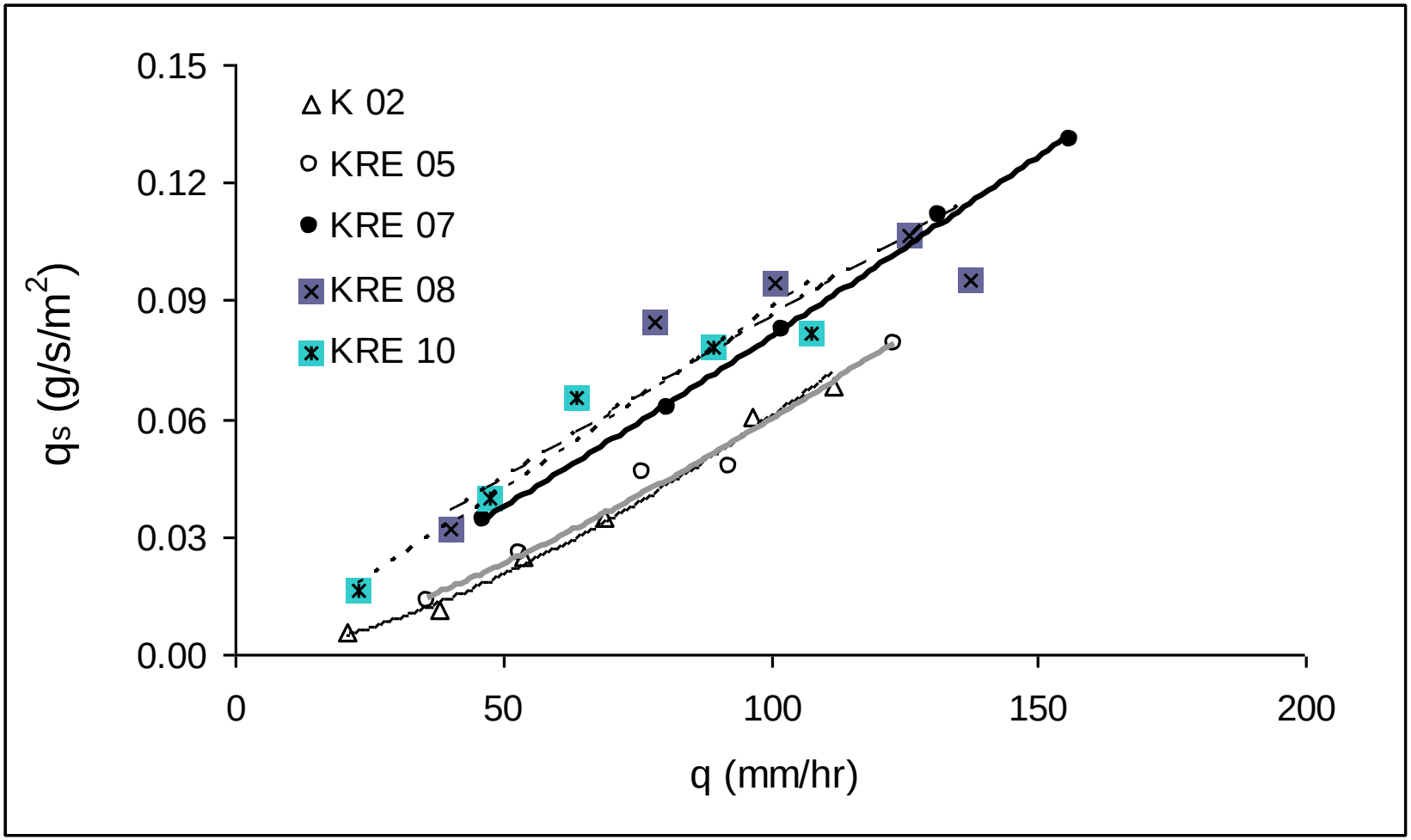


Polyakov *et al*., 2010

2) Hill-slope response

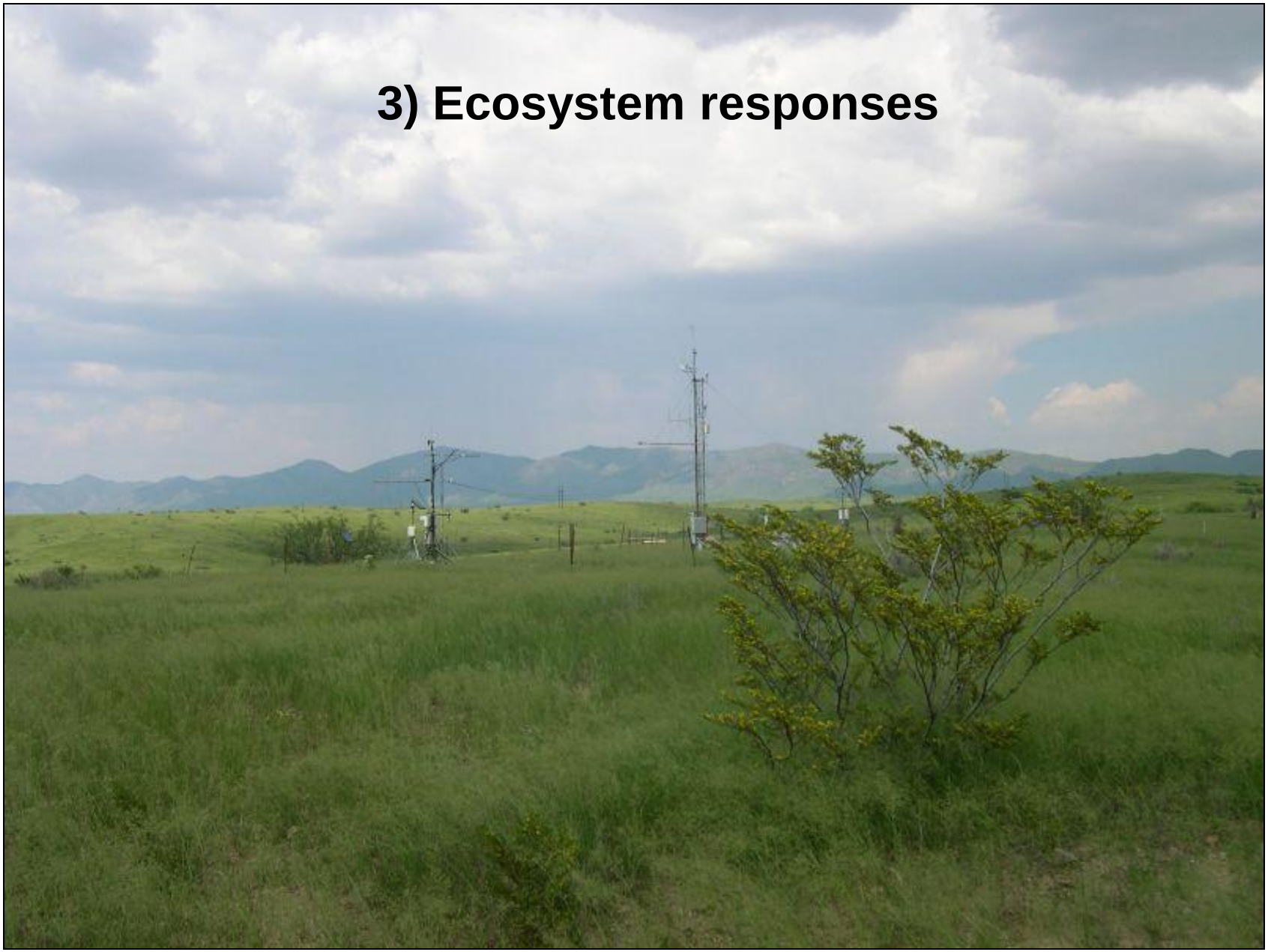

DENSITY (# M-2)
50.0
40.0
30.0
20.0
10.0
0.0
TOP
SLOPE
BASAL AREA (CM2 M-2)
500
400
300
200
100
0
*
LLG
NBG-LIVE
FORB
NBG-DEAD

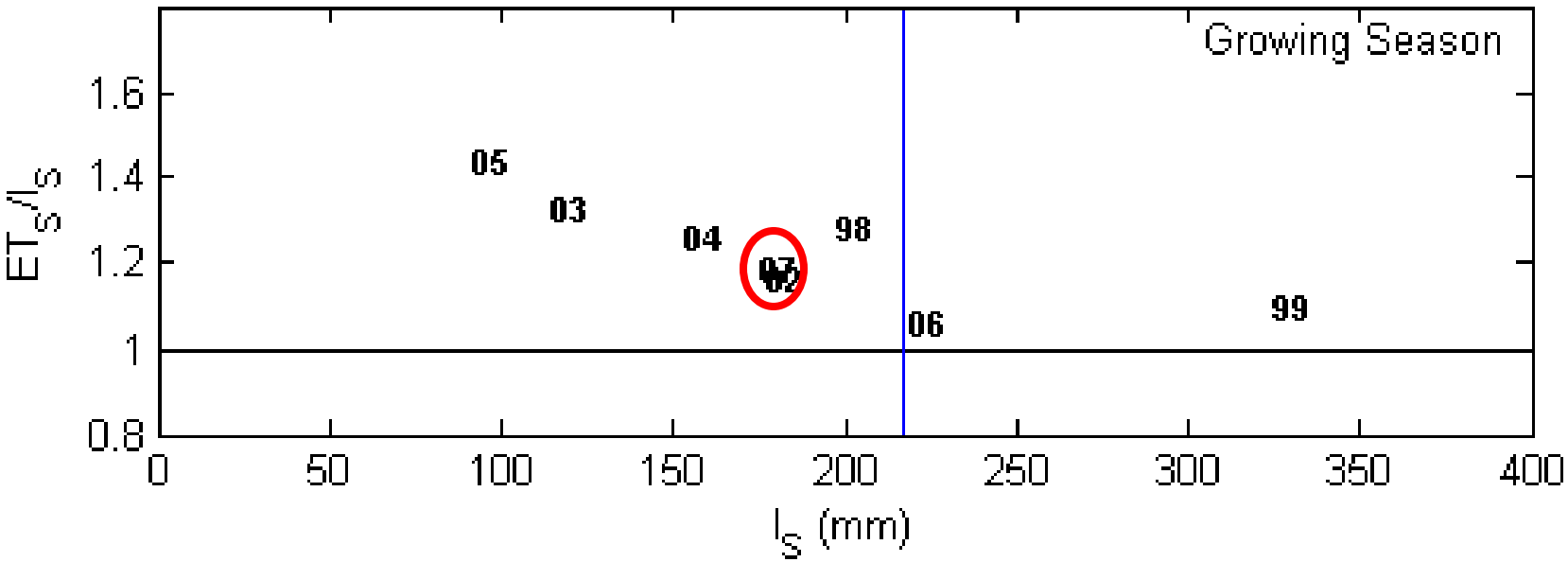

INDIVIDUAL BASAL AREA (CM 2)
10
8
6
4
2
0
a
b
b
c
TOP
SLOPE
NATIVE GRASSES
LOVEGRASS



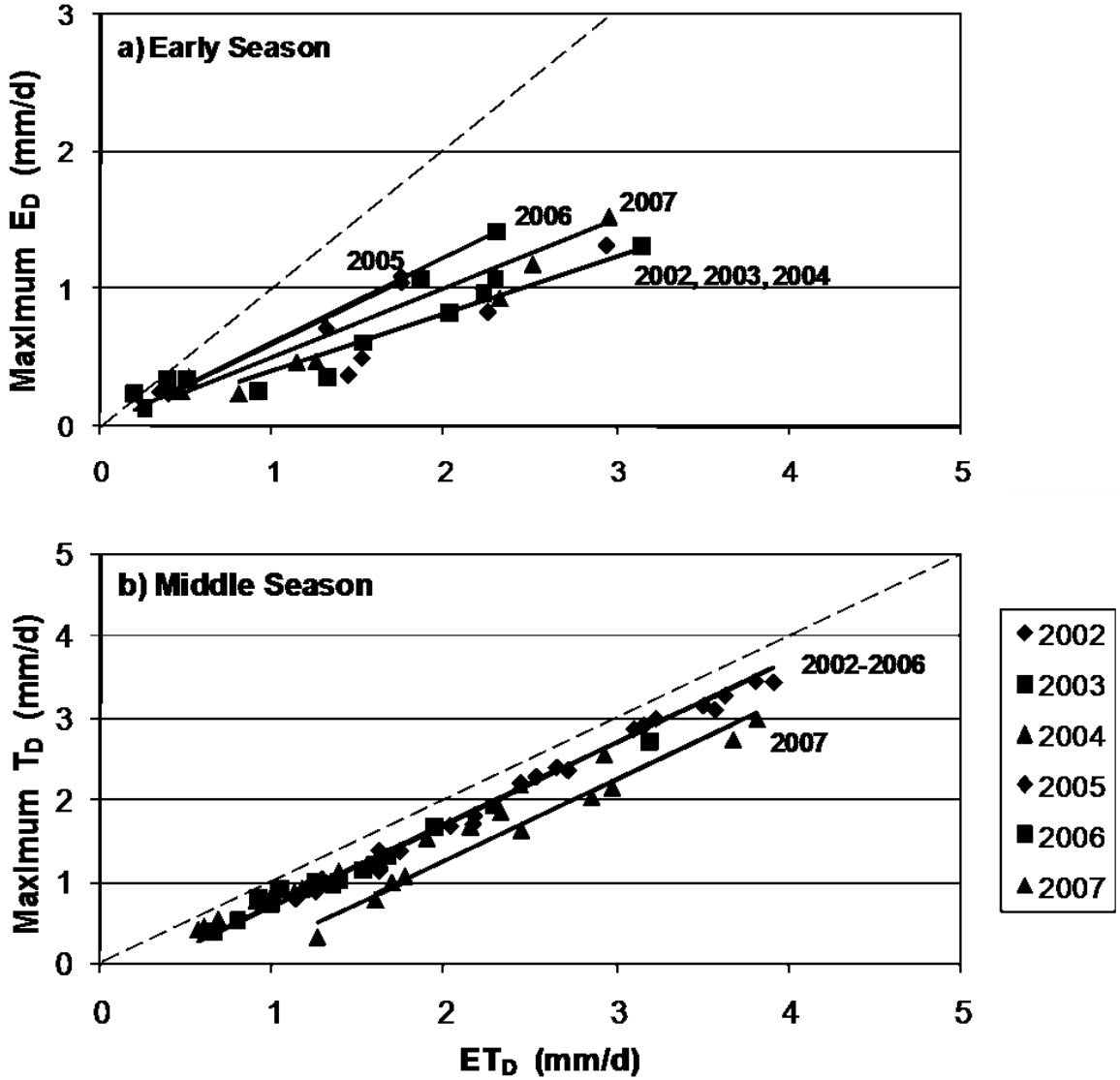
Polyakov *et al*., 2010

3) Ecosystem responses

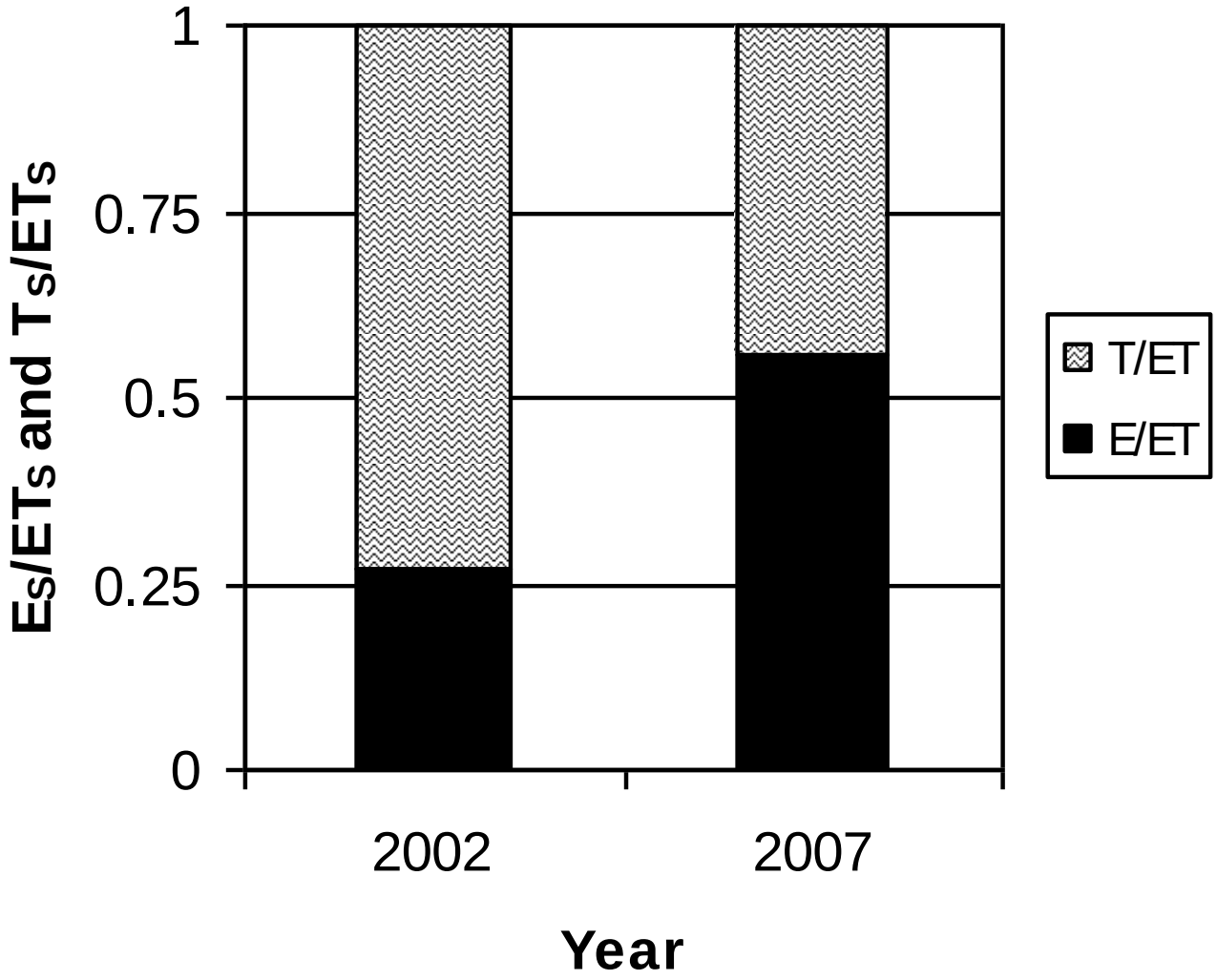




Moran *et al*., 2009

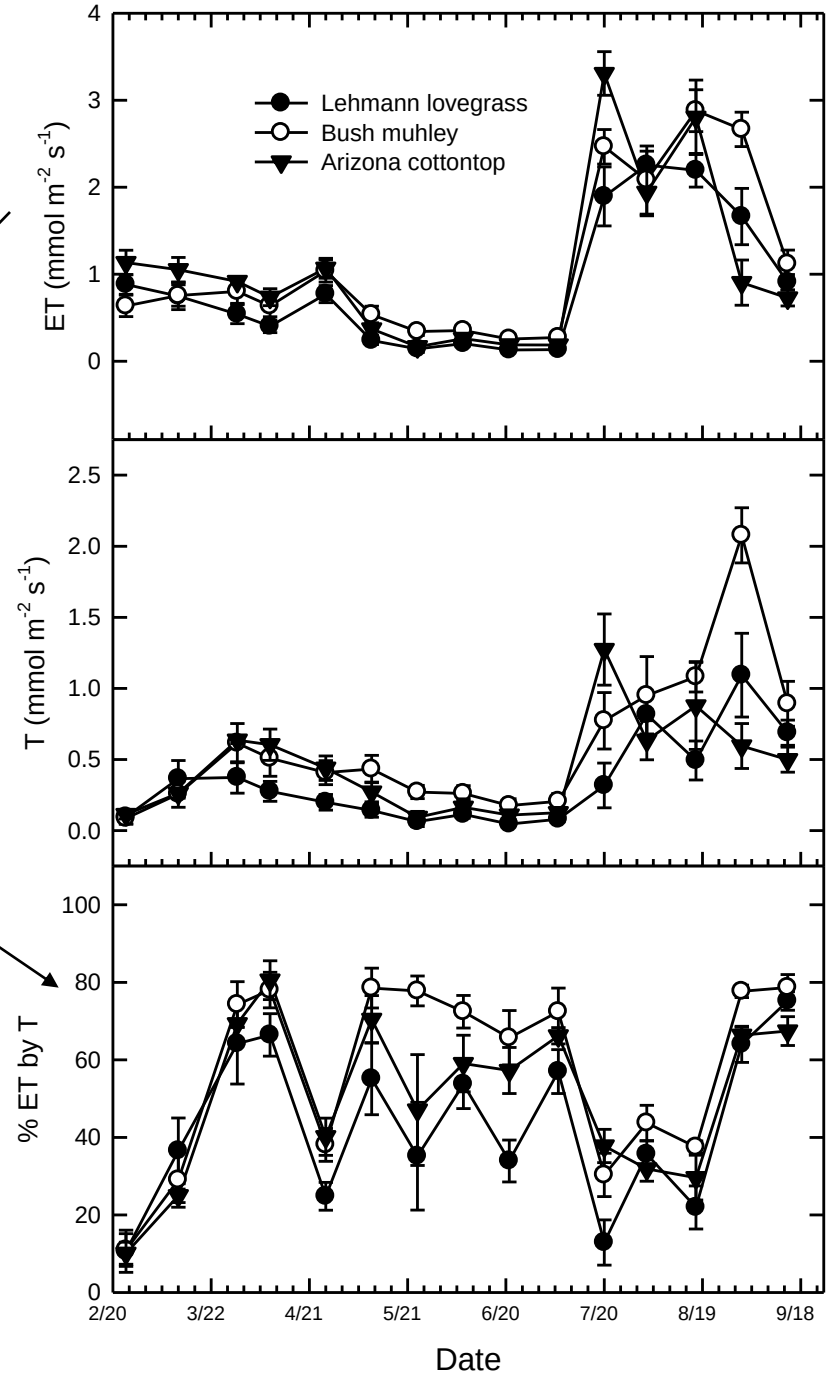


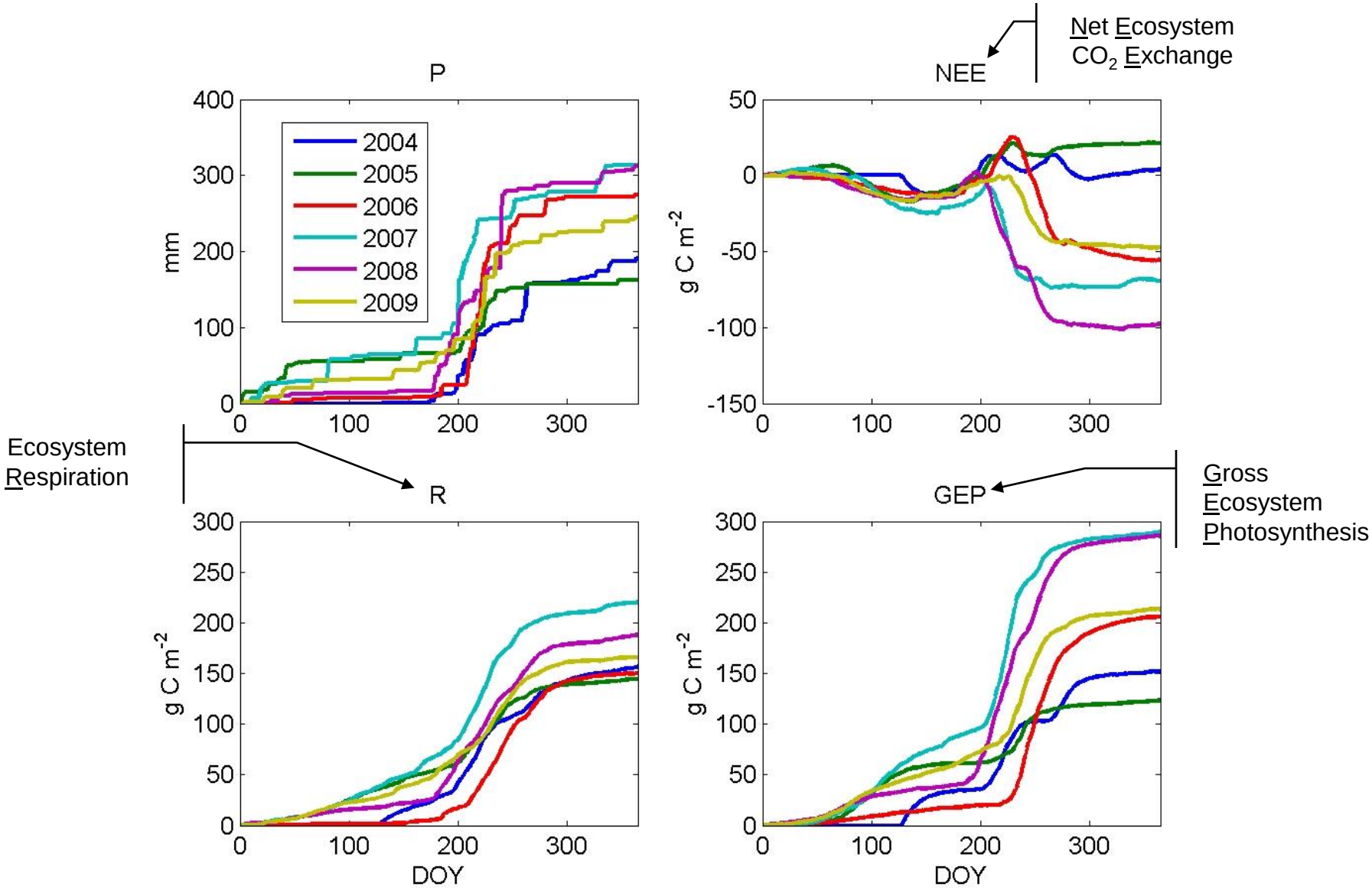
Moran *et al*., 2009



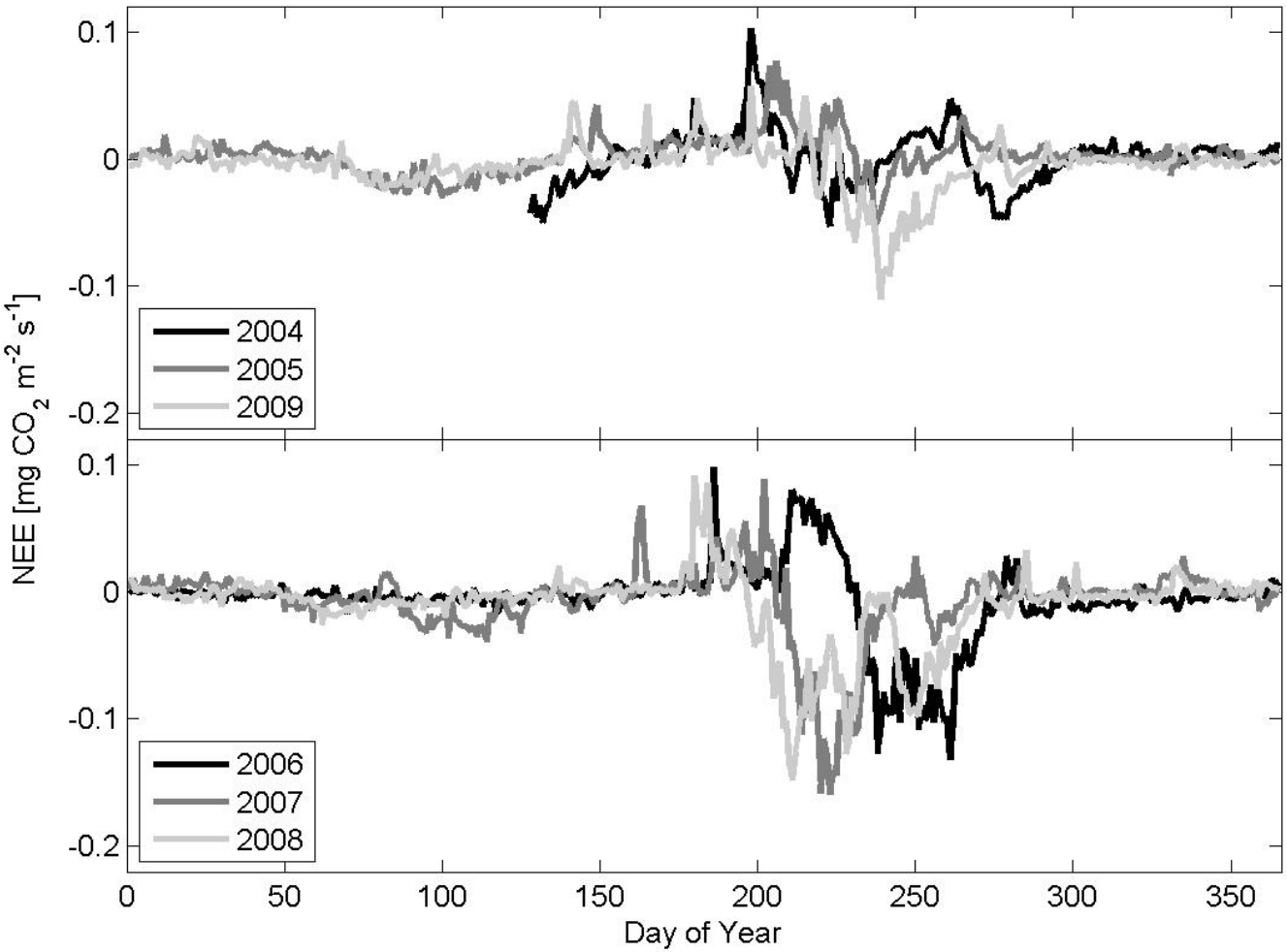
Moran *et al*., 2009

A little independent verification from SRER …

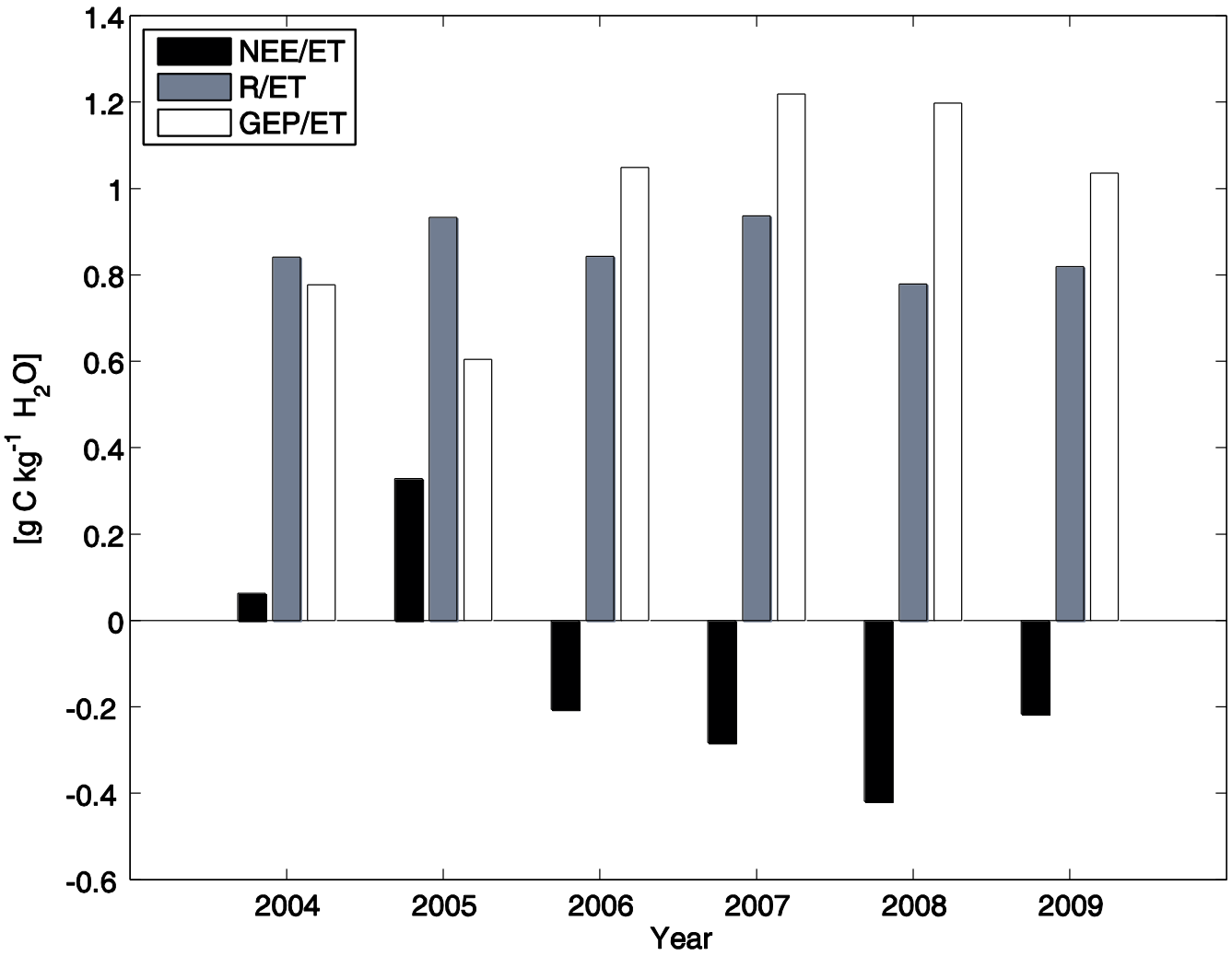




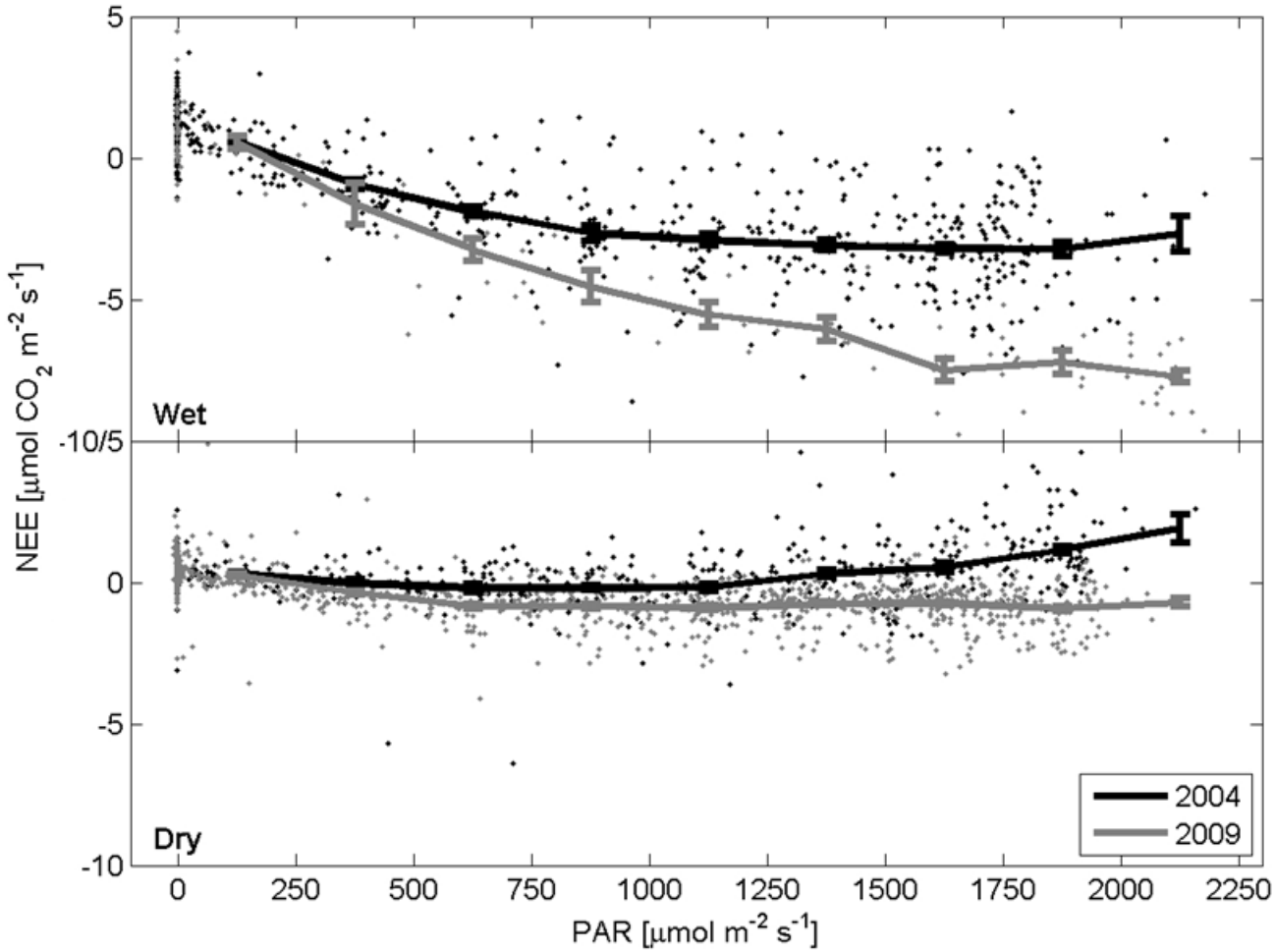
Scott *et al*., 2010



Scott *et al*., 2010



Scott *et al*., 2010



Scott *et al*., 2010

1) **Watershed:**
   - Runoff modestly affected
   - Sediment yield rapidly re-established

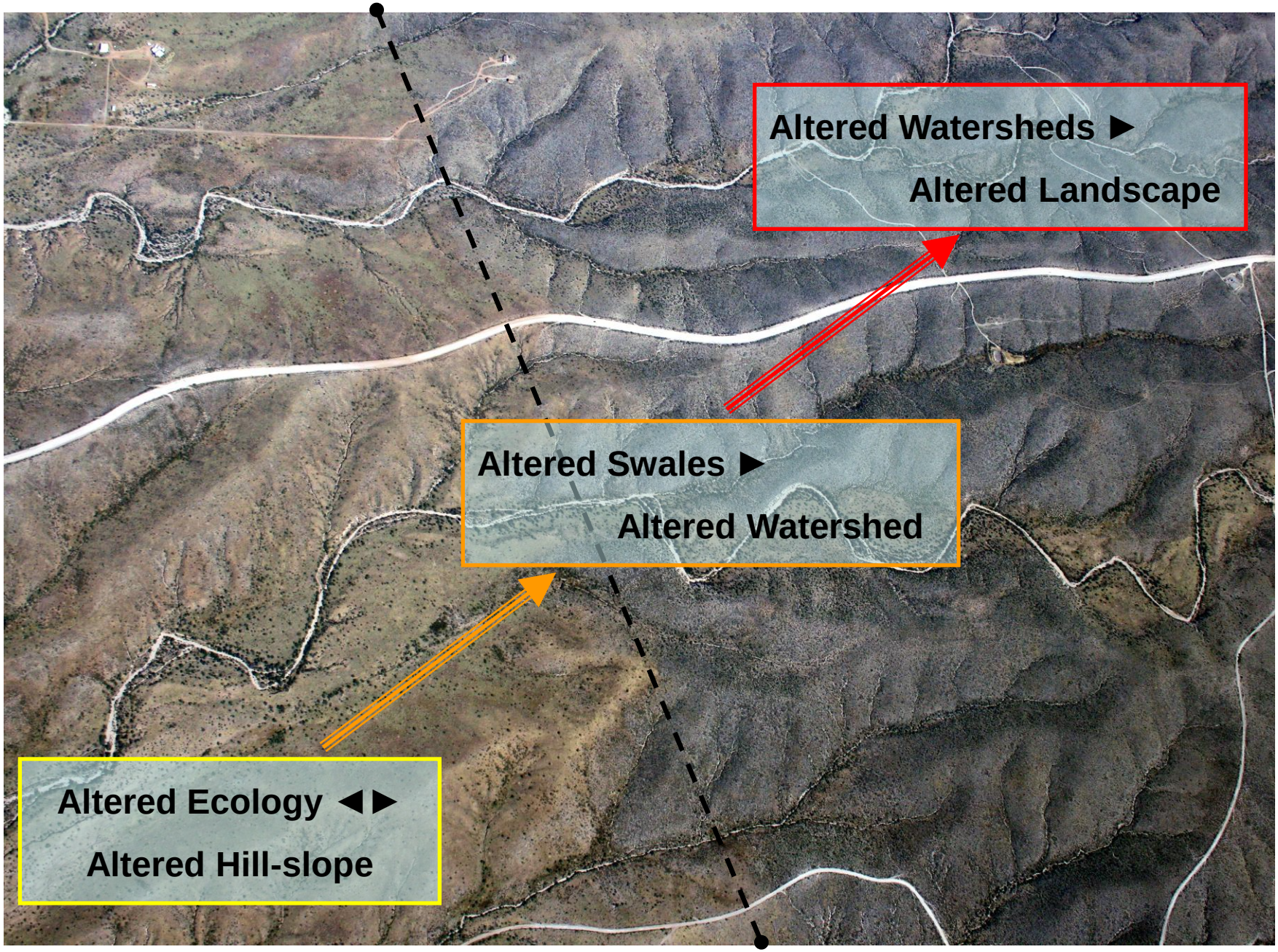
   = ***Little changed?***

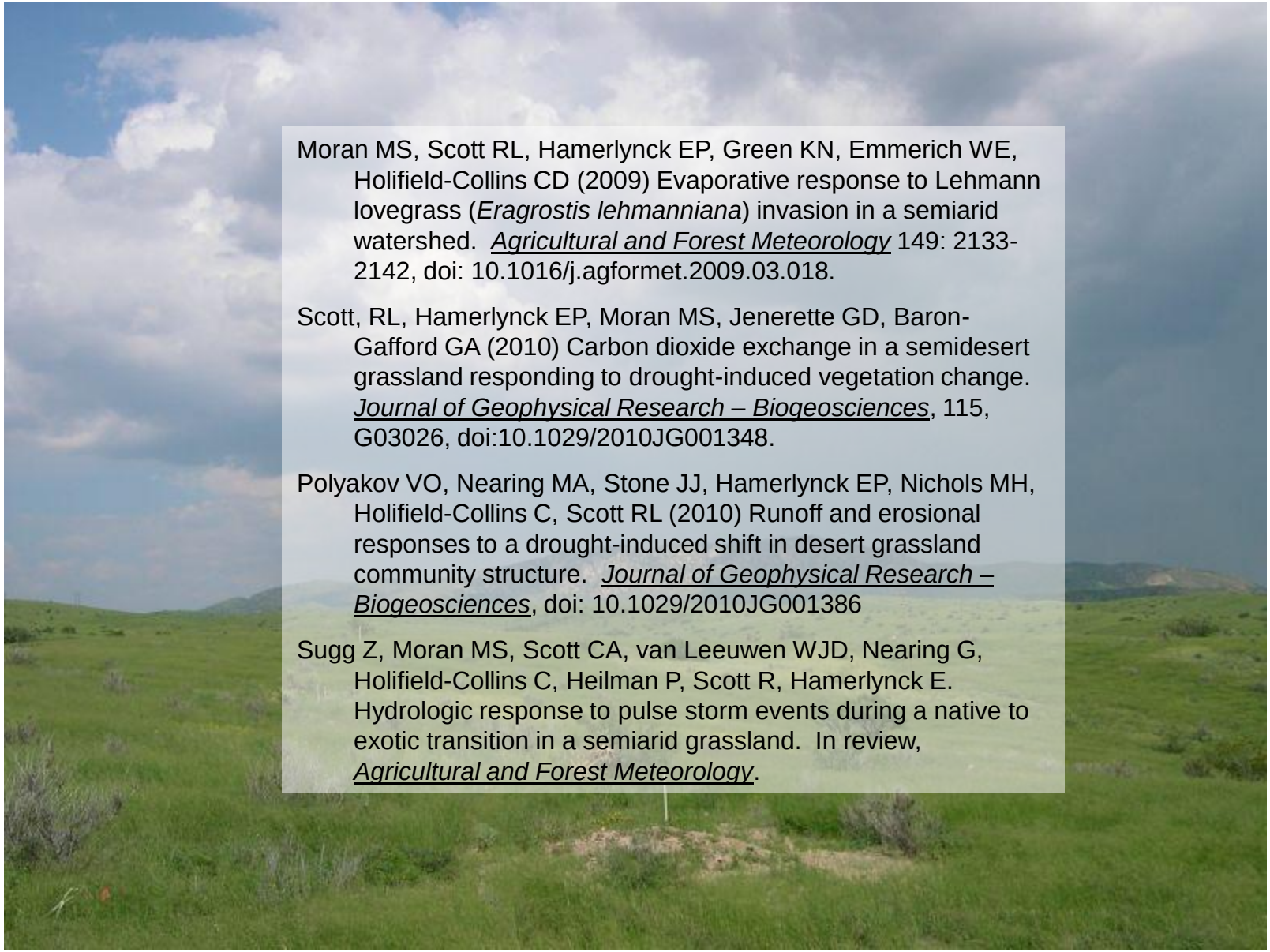
2) **Hillslope:**
   - Increased sediment discharge

   = ***Loading up the swale***

3) **Ecosystem:**
   - Same total ET, but shift towards E and less biotic control
   - Higher WUE, but more variable NEE

   = ***Greater soil moisture and productivity variation***


Altered Watersheds ►
Altered Landscape
Altered Swales ►
Altered Watershed
Altered Ecology ◄►
Altered Hill-slope



Moran MS, Scott RL, Hamerlynck EP, Green KN, Emmerich WE, Holifield-Collins CD (2009) Evaporative response to Lehmann lovegrass (*Eragrostis lehmanniana*) invasion in a semiarid watershed. *Agricultural and Forest Meteorology* 149: 2133-2142, doi: 10.1016/j.agformet.2009.03.018.

Scott, RL, Hamerlynck EP, Moran MS, Jenerette GD, Baron-Gafford GA (2010) Carbon dioxide exchange in a semidesert grassland responding to drought-induced vegetation change. *Journal of Geophysical Research – Biogeosciences*, 115, G03026, doi:10.1029/2010JG001348.

Polyakov VO, Nearing MA, Stone JJ, Hamerlynck EP, Nichols MH, Holifield-Collins C, Scott RL (2010) Runoff and erosional responses to a drought-induced shift in desert grassland community structure. *Journal of Geophysical Research – Biogeosciences*, doi: 10.1029/2010JG001386

Sugg Z, Moran MS, Scott CA, van Leeuwen WJD, Nearing G, Holifield-Collins C, Heilman P, Scott R, Hamerlynck E. Hydrologic response to pulse storm events during a native to exotic transition in a semiarid grassland. In review, *Agricultural and Forest Meteorology*.