

Cattle Grazing Impacts on
California Coastal Prairie
and
Associated Wildflowers
Over a Broad Geographic Range

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California Coastal Prairie



Rare and Endangered Coastal Prairie Annual Forb Species

<i>Blennosperma nanum</i> var. <i>robustum</i>	Point Reyes Blennosperma
<i>Campanula californica</i>	Swamp harebell
<i>Chorizanthe cuspidata</i> var. <i>cuspidata</i>	San Francisco Bay spineflower
<i>Chorizanthe cuspidata</i> var. <i>villosa</i>	San Francisco spineflower
<i>Chorizanthe howellii</i>	Mendocino spineflower
<i>Chorizanthe robusta</i> <i>hartwegii</i>	Howell's spineflower
<i>Chorizanthe valida</i>	Sonoma spineflower
<i>Eriogonum luteolum</i> var. <i>caninum</i>	Tiburon buckwheat
<i>Hemizonia congesta</i> ssp. <i>tracyi</i>	Tracy's tarplant
<i>Hemizonia parryi</i> ssp. <i>congdonii</i>	Congdon's tarplant
<i>Holocarpha macradenia</i>	Santa Cruz tarplant
<i>Limnanthes douglasii</i> ssp. <i>sulphurea</i>	Point Reyes meadowfoam
<i>Limnanthes vinculans</i>	Sebastopol meadowfoam
<i>Linanthus acicularis</i>	bristly linanthus
<i>Linanthus grandiflorus</i>	large-flower linanthus
<i>Micropus amphibolus</i>	Mt. Diablo cottonweed
<i>Plagiobothrys chorisianus</i>	artist's popcornflower
<i>Plagiobothrys diffusus</i>	San Francisco popcornflower
<i>Polygonum hickmanii</i>	Scotts Valley Polygonum
<i>Stebbinsoseris decipiens</i>	Santa Cruz Microseris
<i>Trifolium amoenum</i>	showy Indian clover
<i>Trifolium grayii</i>	Gray's clover
<i>Trifolium buckwestiorum</i>	Santa Cruz clover
<i>Trifolium polyodon</i>	Pacific Grove clover
<i>Triphysaria floribunda</i>	San Francisco owl's-clover

Past Research



All litter removed



Moderate litter



Heavy litter

From Heady, 1956

Hypothesis:

Cattle grazing increases the diversity and abundance of native annual forbs, because of

- decreased vegetation height
- decreased litter depth
- increased bare soil

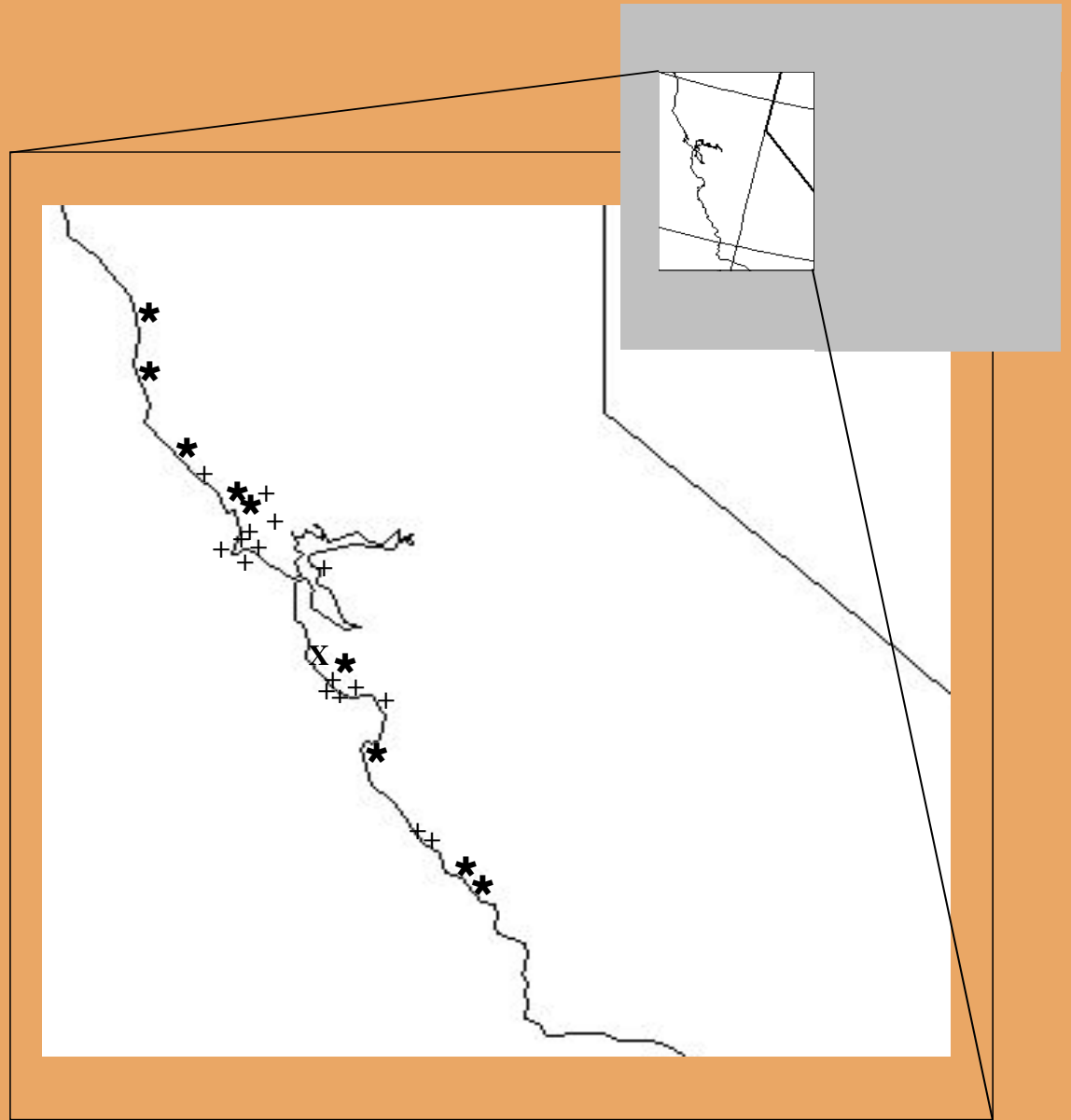
Site Selection Criteria

- Paired plots, in proximity, with similar
 - Slopes
 - Soils
 - Aspect
- Grazed – by cattle, only
- Ungrazed – for at least 5 years
- Access

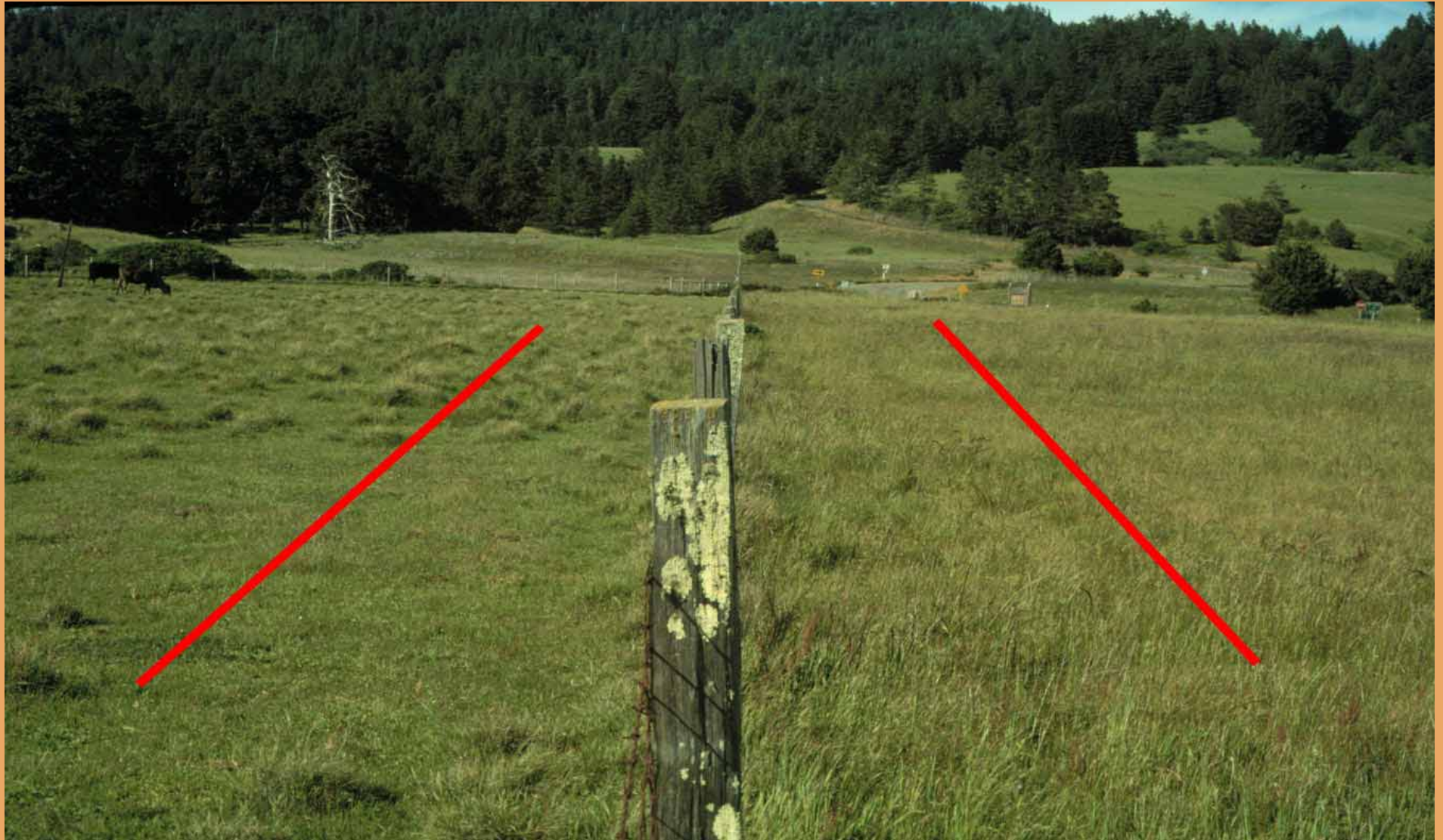
Survey Sites

LEGEND

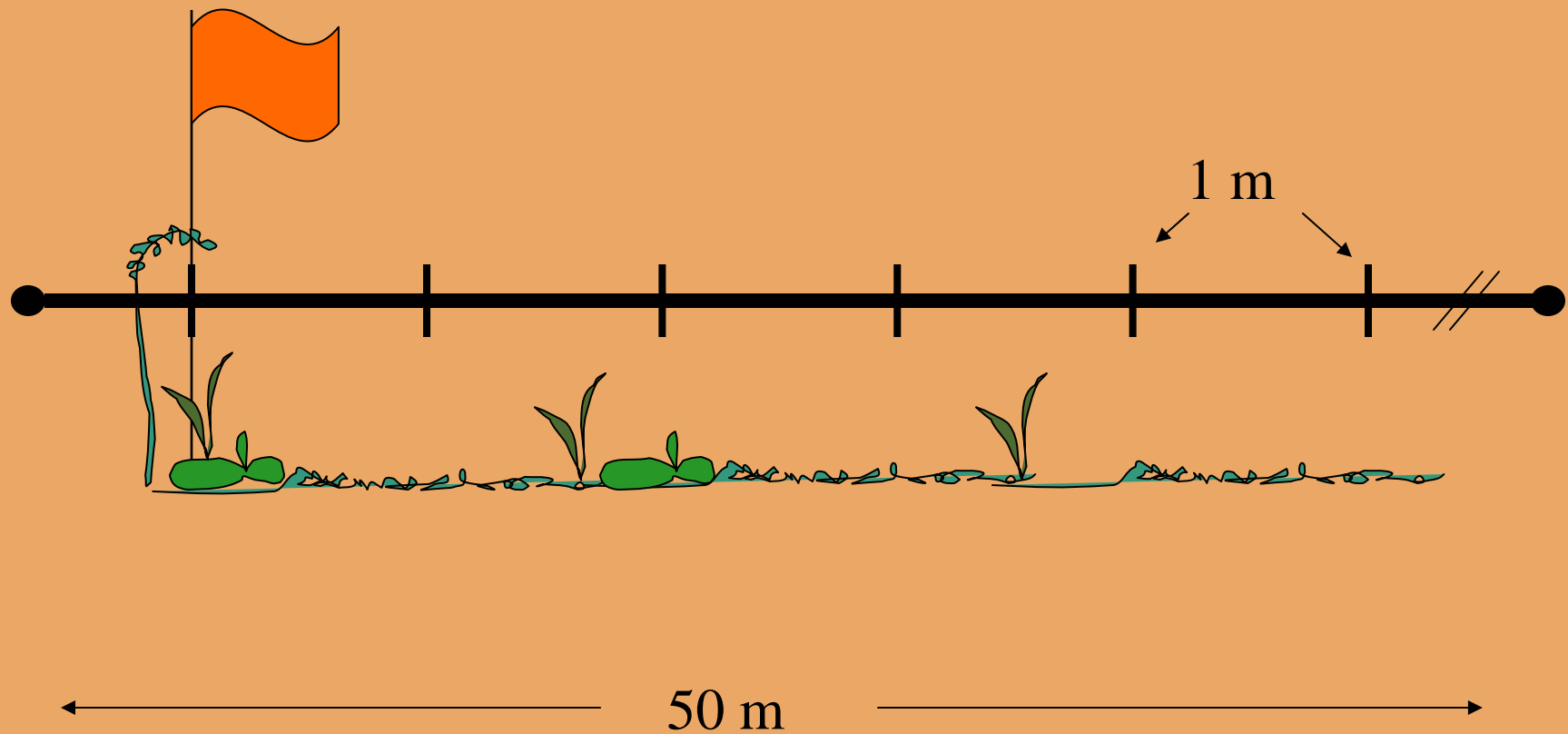
- X** 2000
- *** 2001
- +** Both years



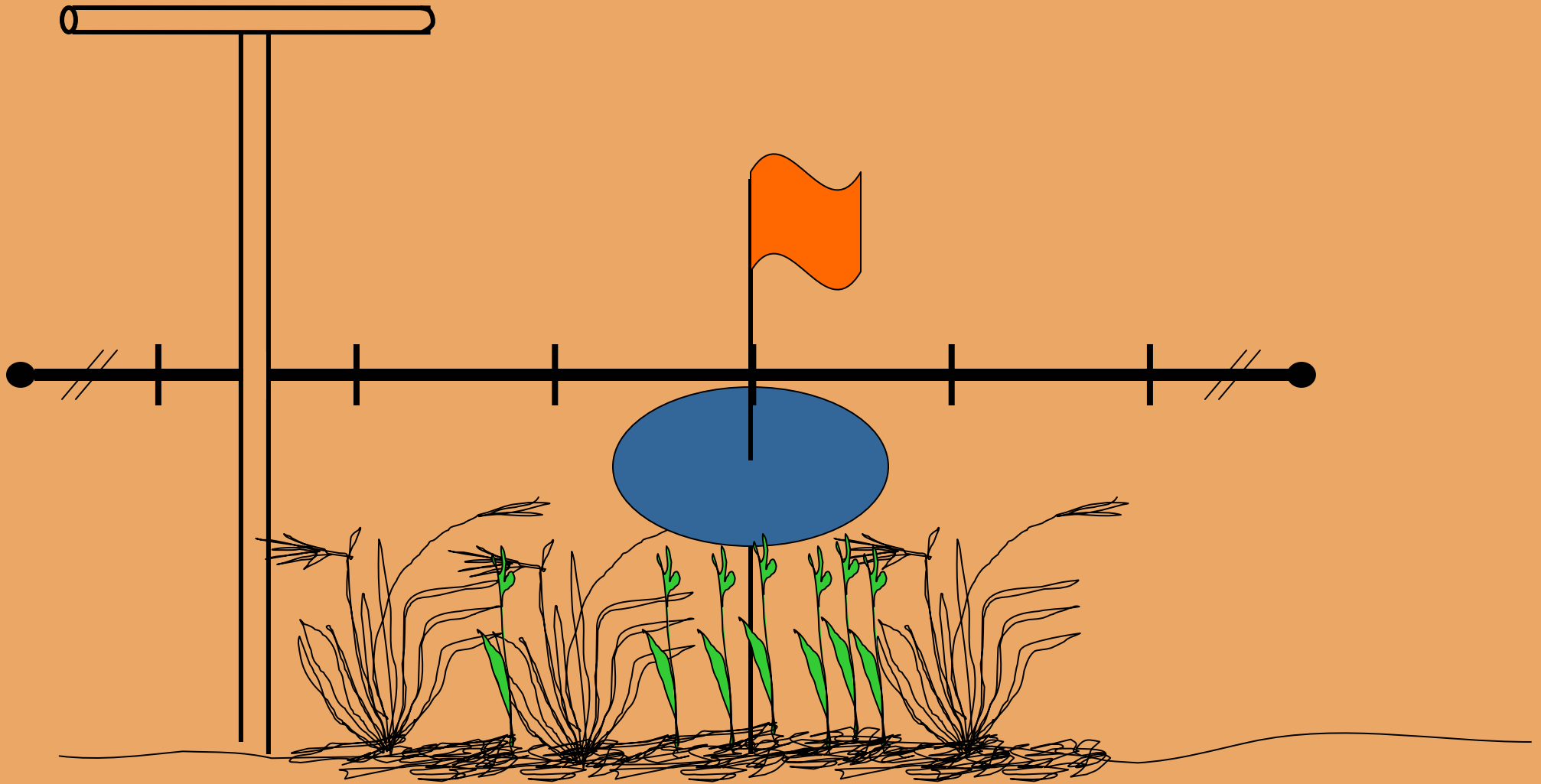
Transect Placement



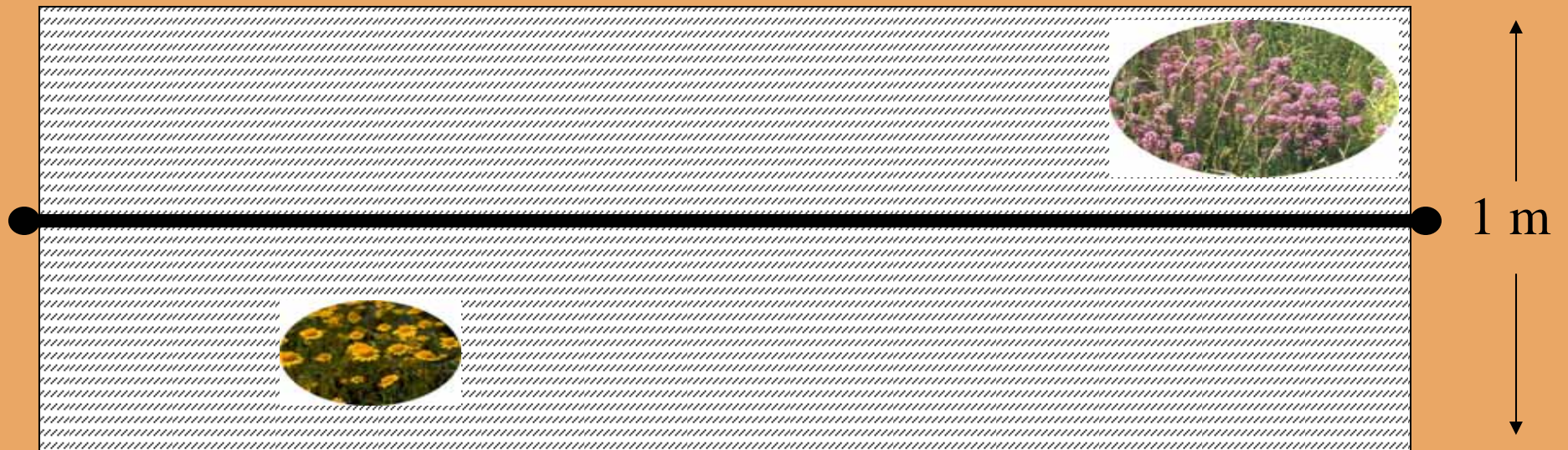
Line Transect Data



Vegetation Height, Litter Depth, and Soil Samples



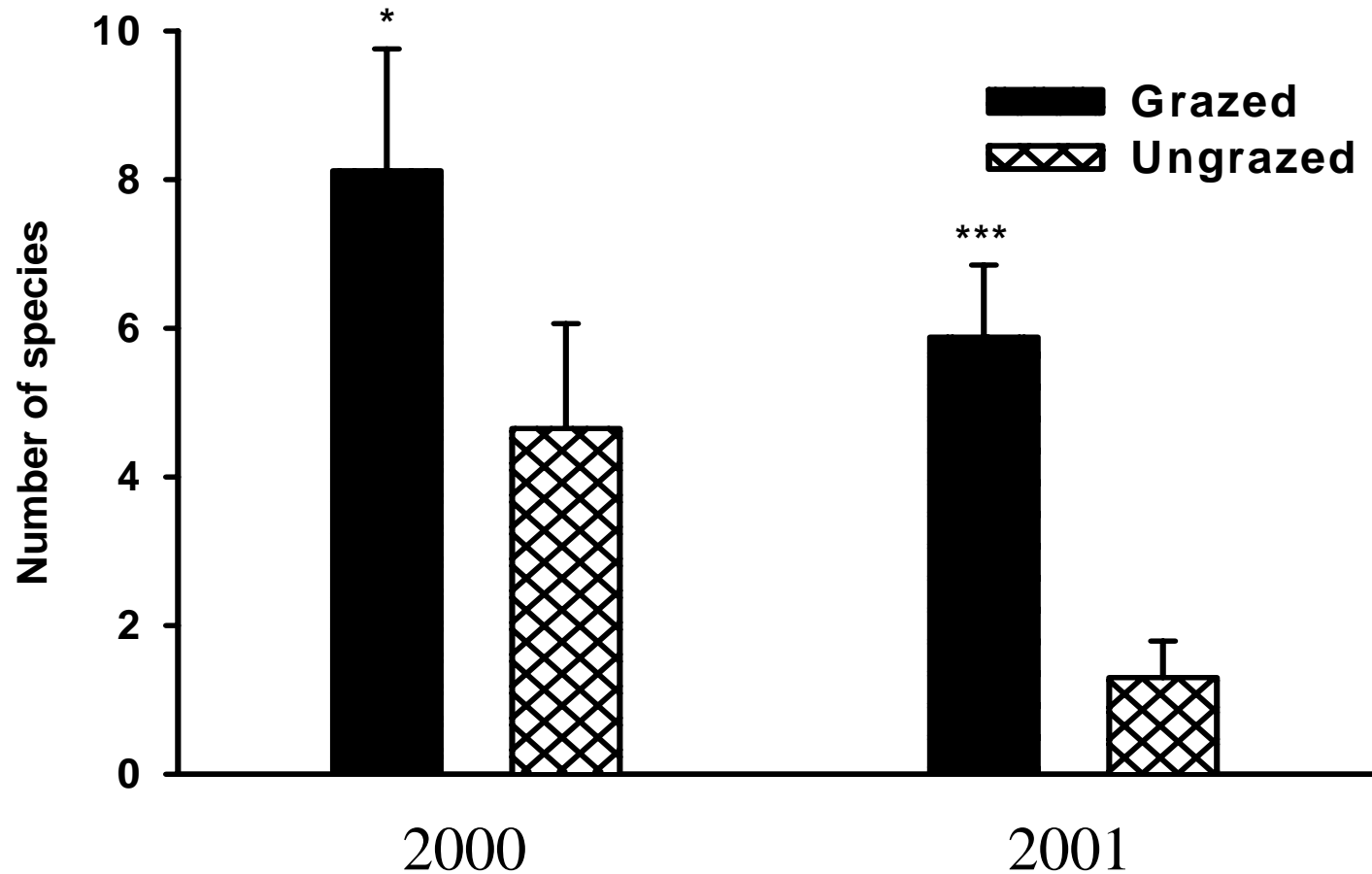
Belt Transect Data



Results

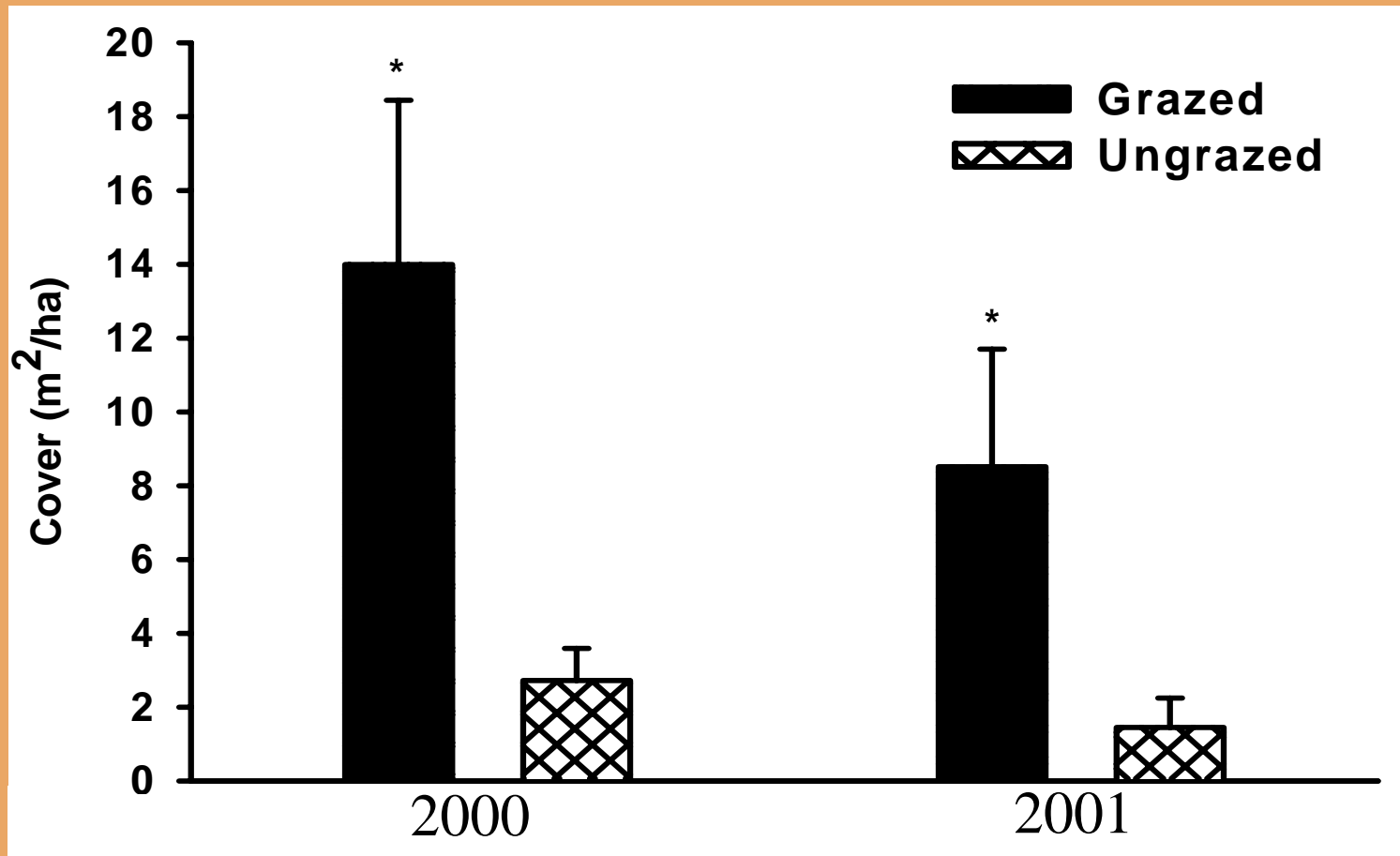
- Focal species- annual forbs
- Community composition
- Explanatory variables

Annual Forb Species Richness



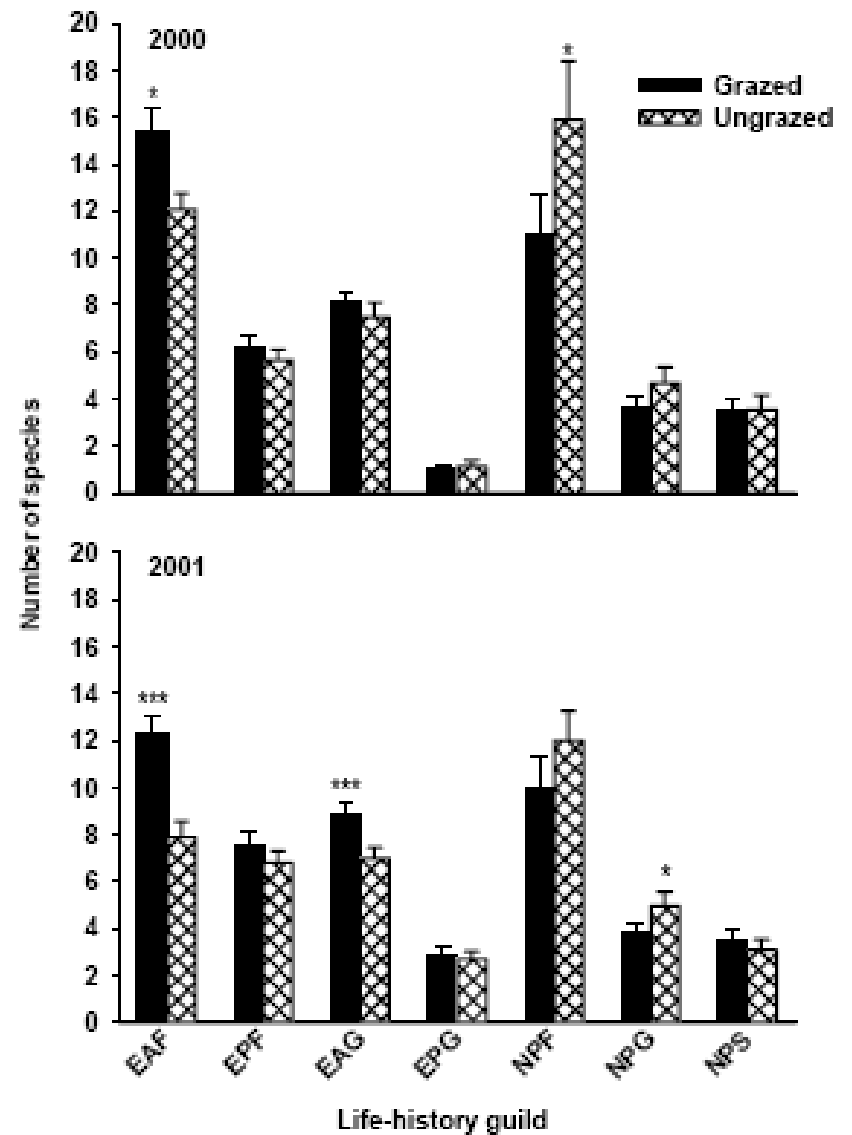
* = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$

Annual Forb Cover



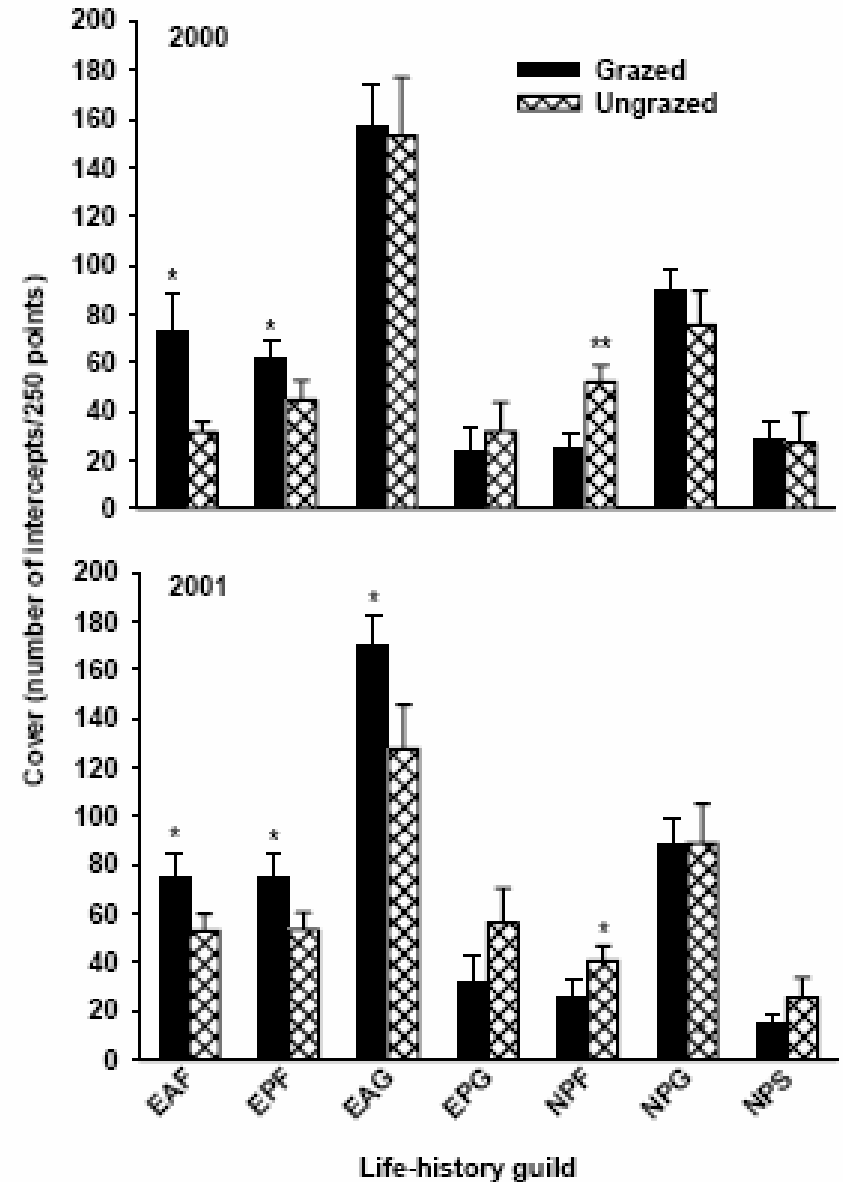
Species Richness of Guilds

- Exotic Annual Grass trends higher in grazed sites
- Exotic Annual Forb richness higher in grazed sites
- Native Perennial Grass & Native Perennial Forb richness trends higher in ungrazed sites



Guild Abundance

- Exotic Annual Grasses trend higher in grazed
- Exotic forbs higher in grazed sites
- Native Perennial Forbs higher in ungrazed sites

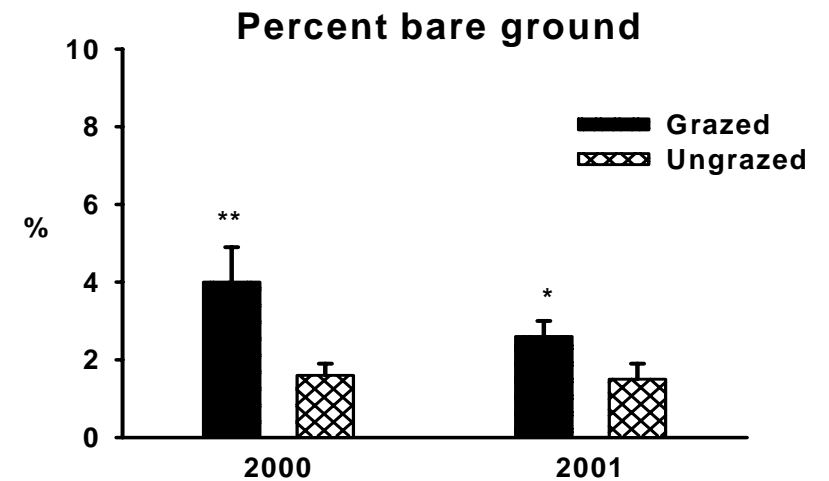
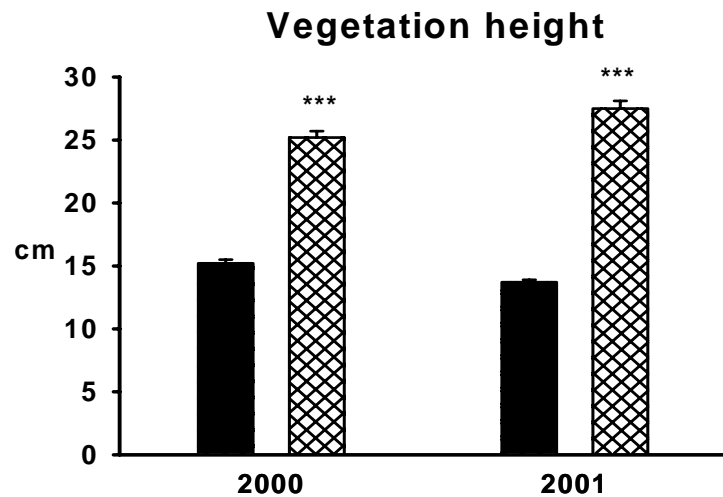
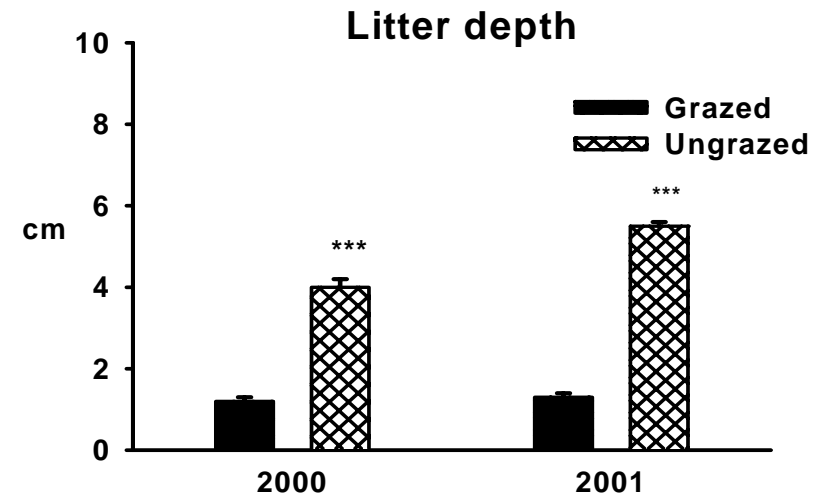


Soil Characteristics

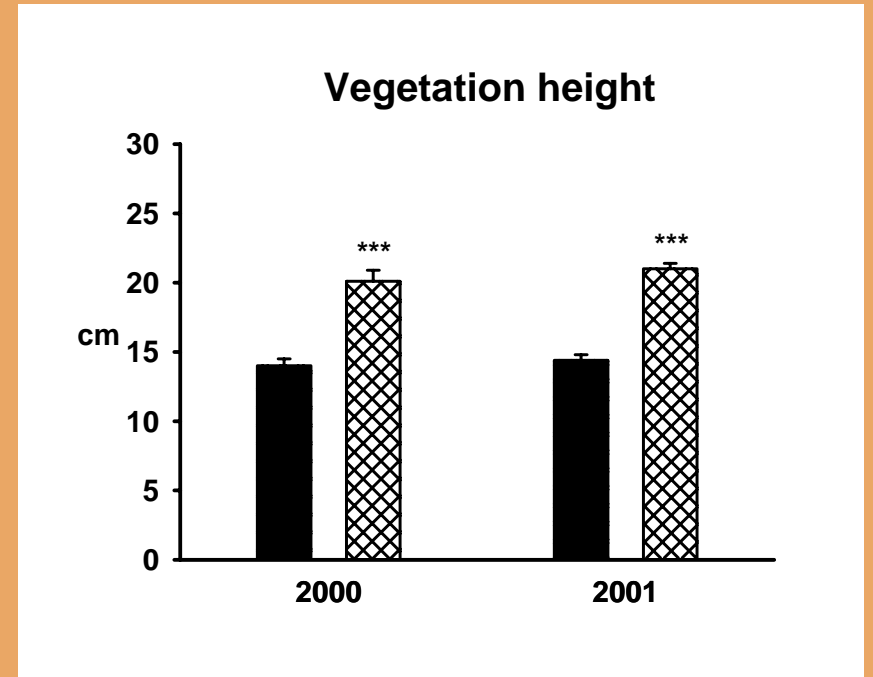
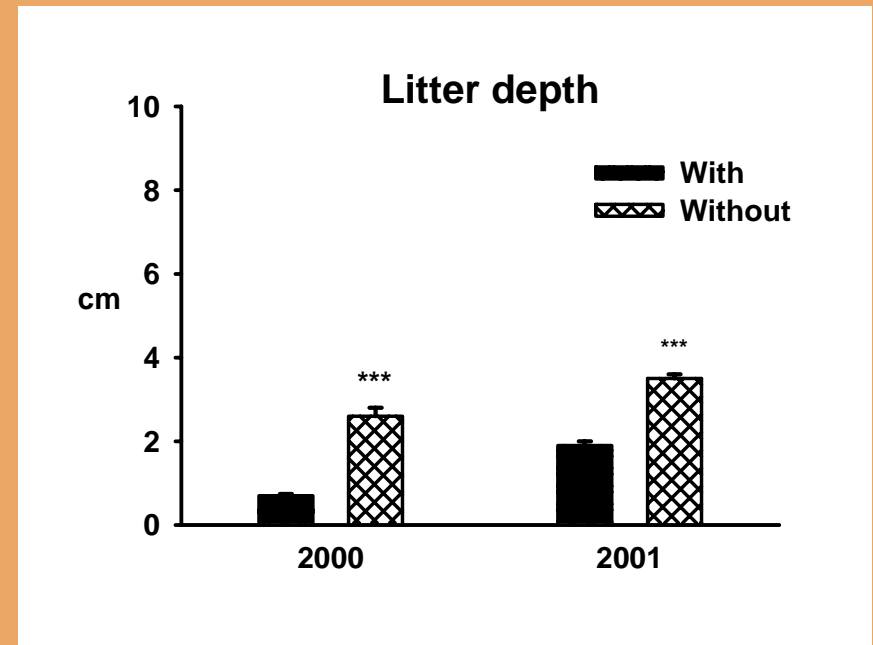
- pH
- Organic matter
- Nitrogen (TKN)
- CEC
- Phosphorus
- Potassium
- Calcium
- Magnesium

Grazed = Ungrazed

Litter, Canopy, and Bare Ground along Line Transects



Litter and Canopy with and without Annual Forbs



Regression Analysis

Dependent variable	Year	Independent variables ^a	R ²	p
Annual cover	2000	vegetation height, organic matter	0.26	0.0086
	2001	vegetation height, organic matter	0.38	<0.0001
Annual richness	2000	vegetation height	0.16	0.0172
	2001	Ca, litter depth	0.43	<0.0001

Conclusions

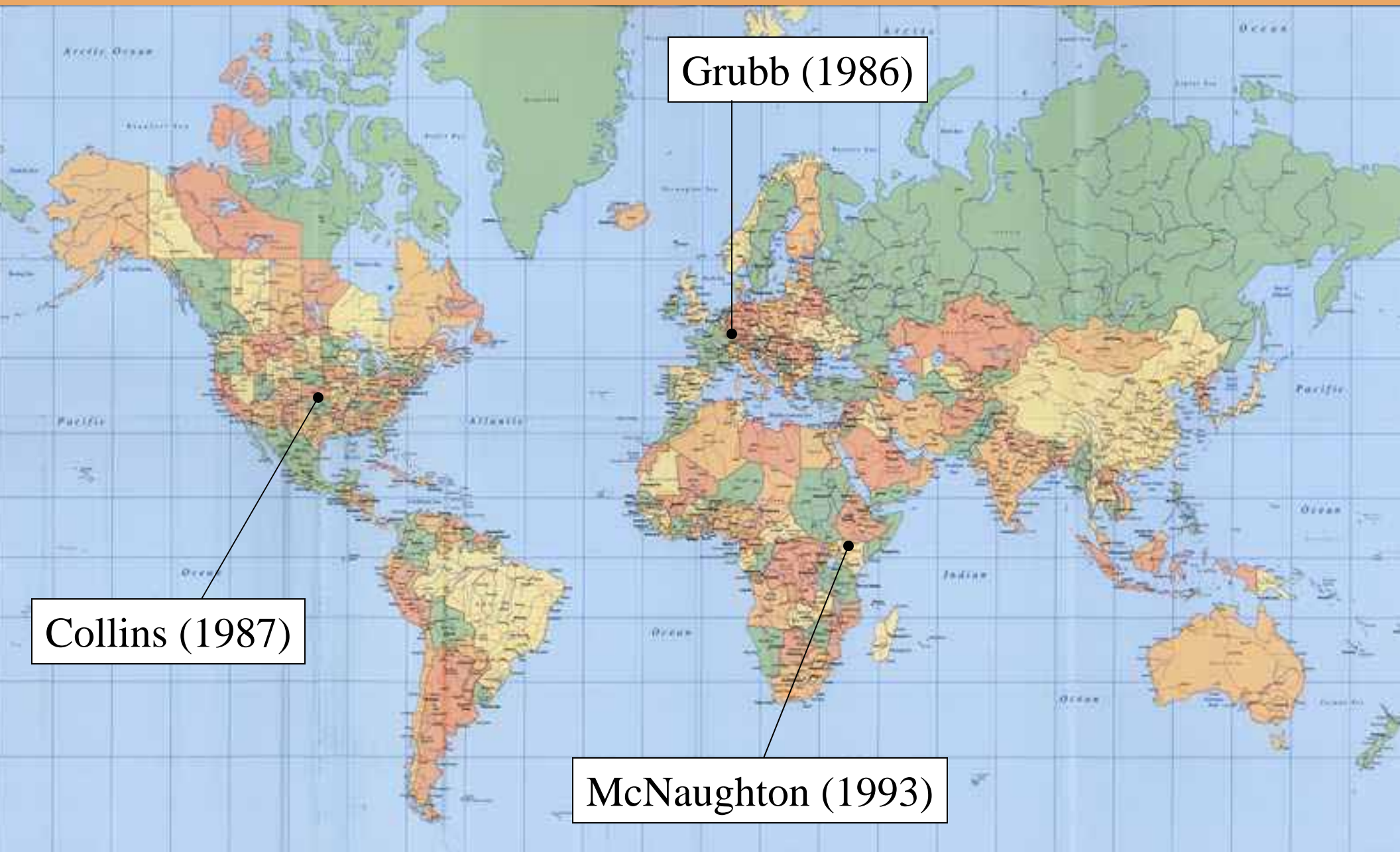
- Grazing increases native annual forb diversity and abundance in California coastal prairie
- This may be due to decreased vegetation height and litter depth

Conclusions, continued

- Grasses show mixed responses to grazing
- Exotic forb abundance increases with grazing
- Native perennial forb abundance decreases with grazing

Land management recommendations

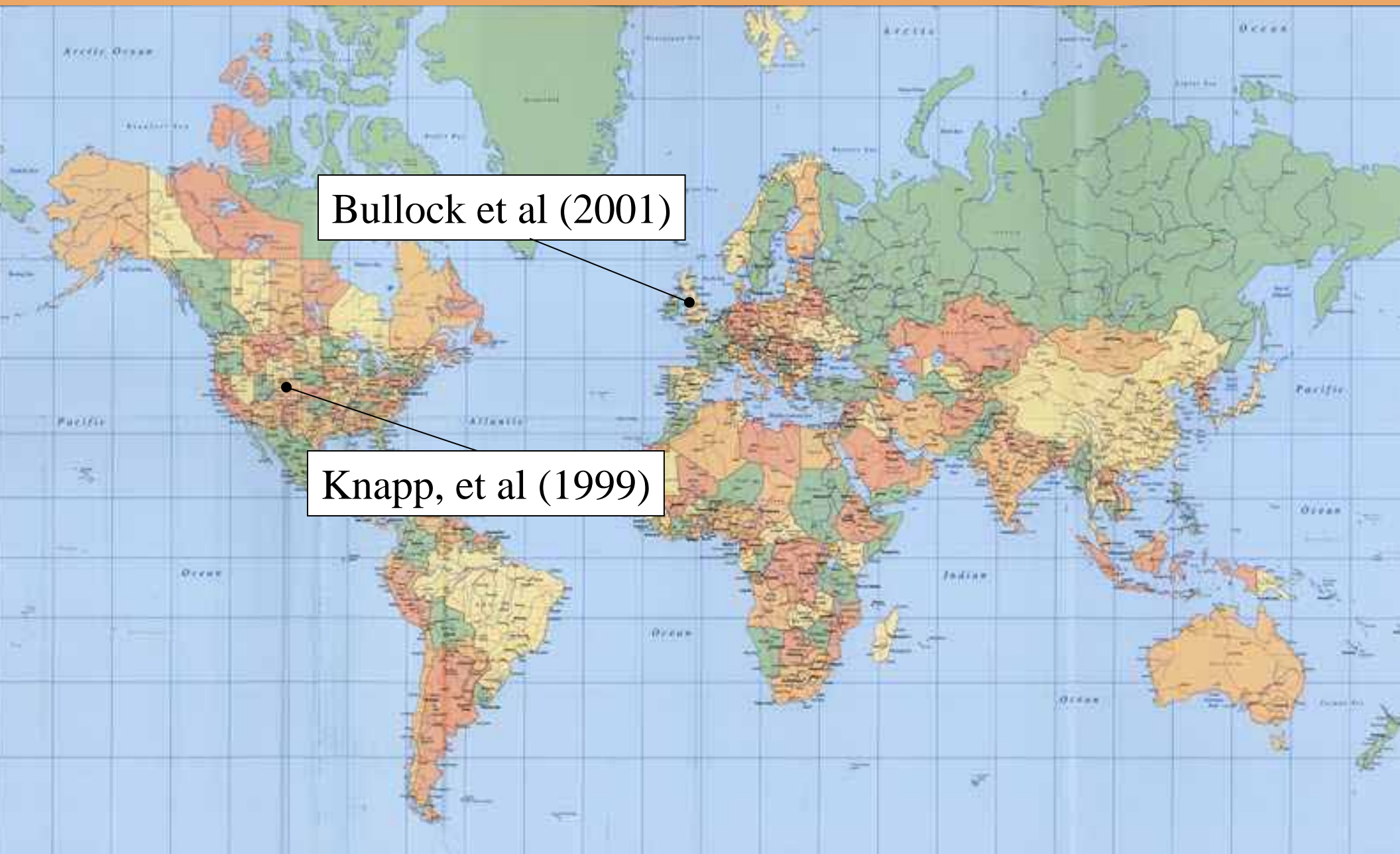
- Grazing should be considered as a management tool in mesic grasslands
- Vary disturbance regimes across the landscape



Grubb (1986)

Collins (1987)

McNaughton (1993)



Bullock et al (2001)

Knapp, et al (1999)



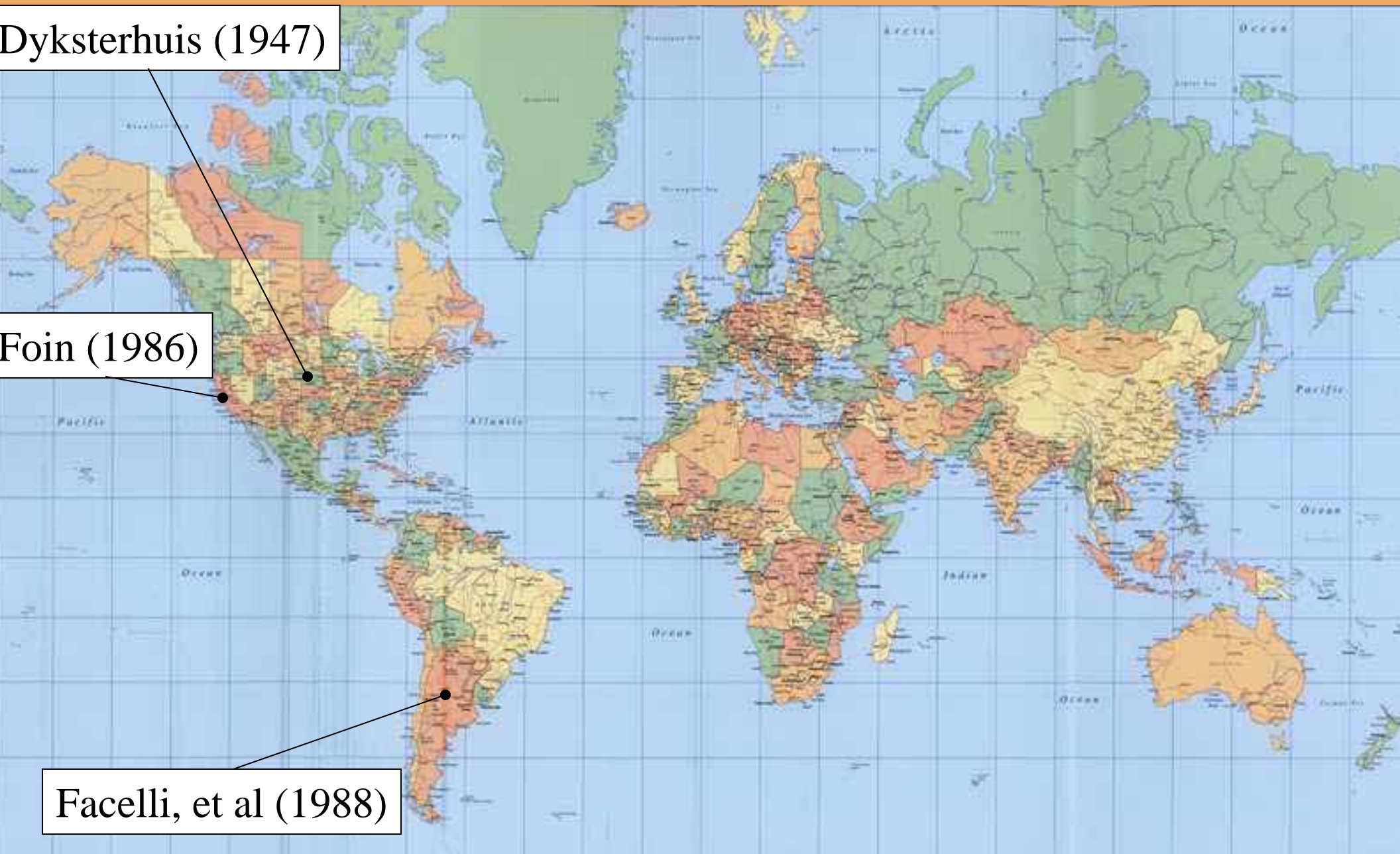
Talbot (1939)

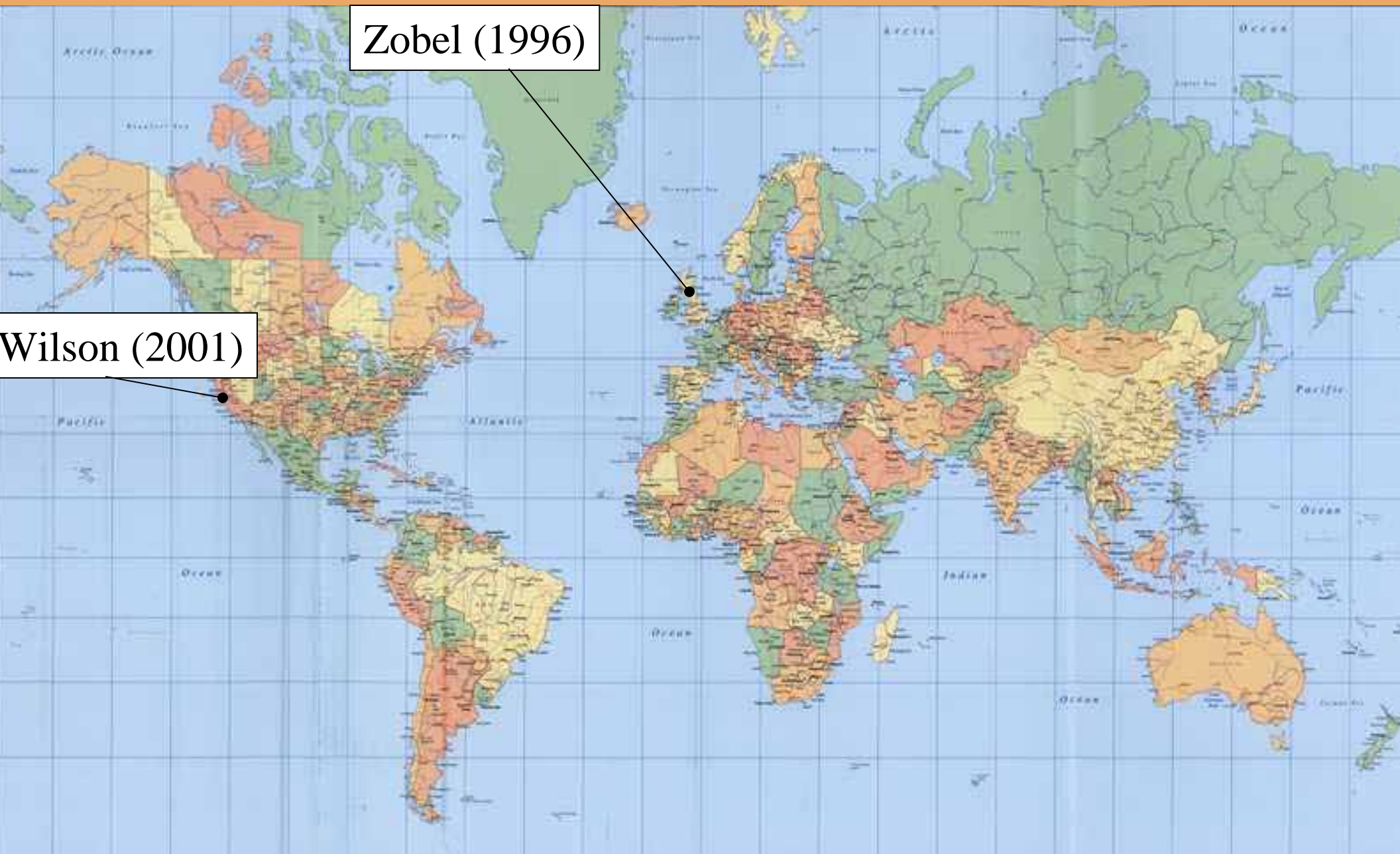
Fensham, et al (1999)

Dyksterhuis (1947)

Foin (1986)

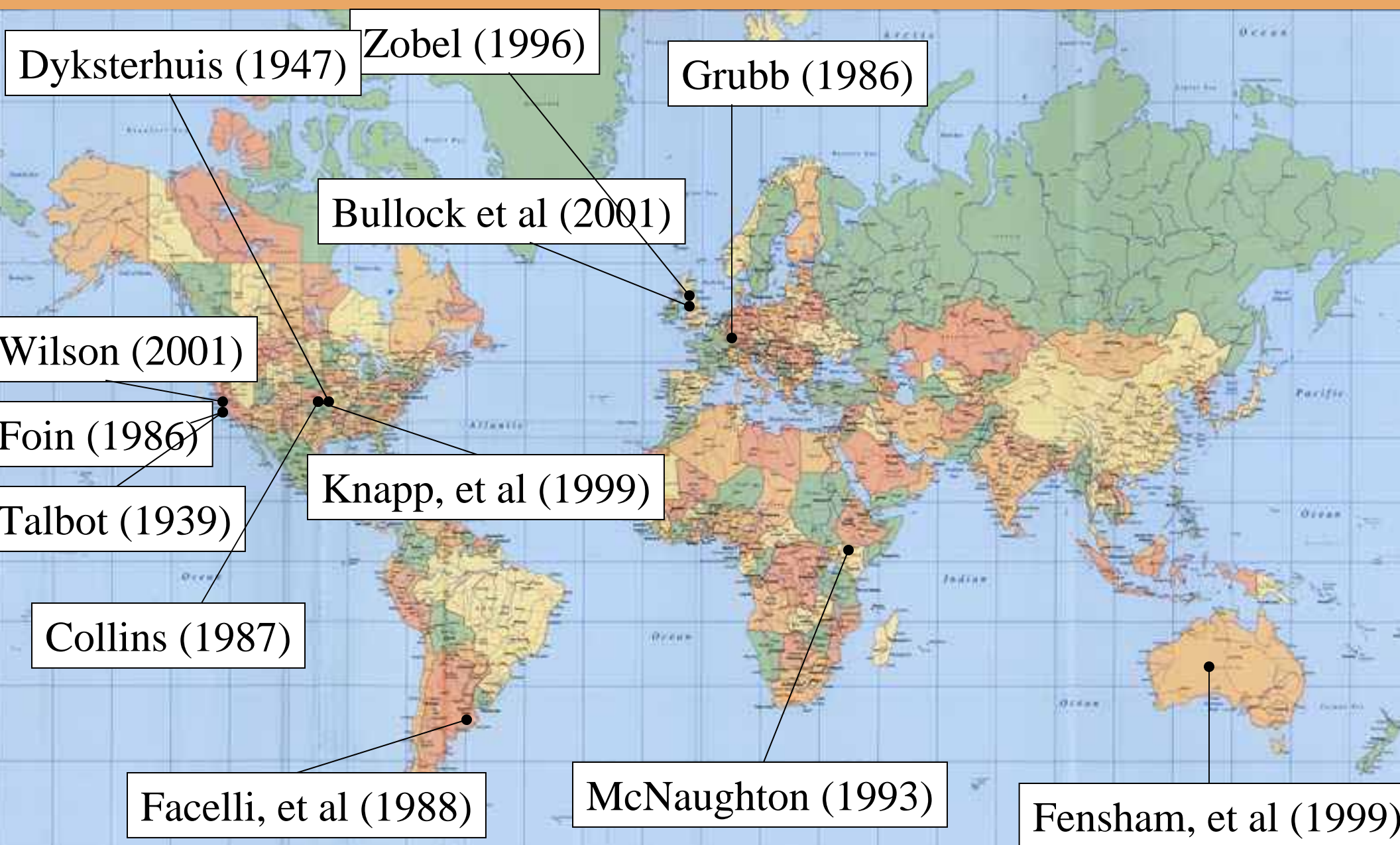
Facelli, et al (1988)





Zobel (1996)

Wilson (2001)



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