Desert Tortoise Monitoring

UNR/USGS

UNR/USGS

Collaborators

- Steve Corn – USGS
- Jill Heaton – UNR
- Rich Inman – USGS
- Ron Marlow –UNR
- Phil Medica-USGS
- Ken Nussear – USGS
- Dick Tracy – UNR

UNR/USGS

Project Elements

- Training
- Preliminary Data QA/QC
- Analysis
- Threats
- Behavior – G_0

UNR/USGS

Goals

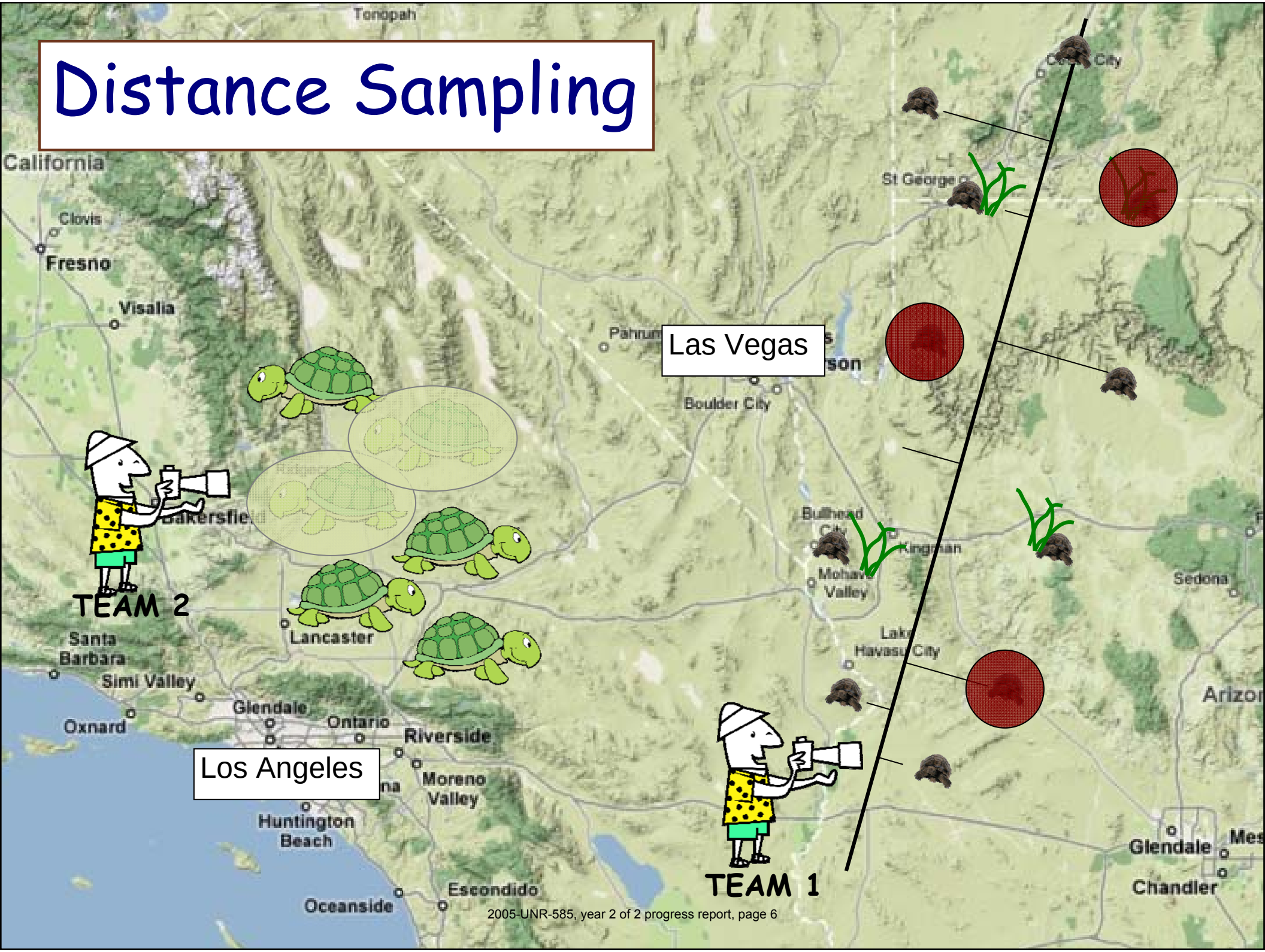
- Increase accuracy
- Increase precision
- Improve efficacy
- Improve cost effectiveness

Predicting spring activity in desert tortoises

Richard D. Inman[1]
Kenneth E. Nussear[1]
C. Richard Tracy[2]

USGS, BRD-WERC Henderson, NV[1]
UNR, Dept. of Biology, Reno, NV[2]

Distance Sampling



Distance Sampling

$CV(n)$ Overdispersed?

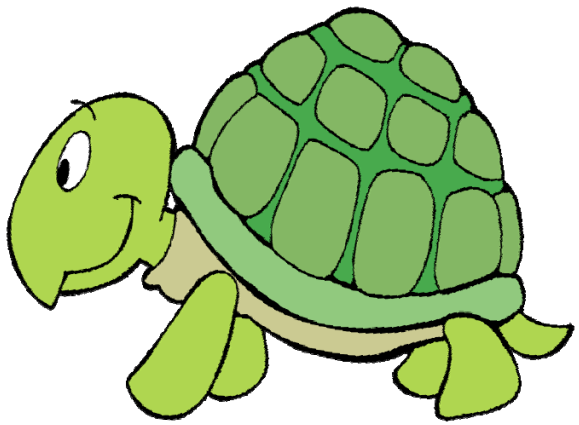
+

$CV(D) = CV(P_a)$ Observer skill, vegetation, habitat, etc.

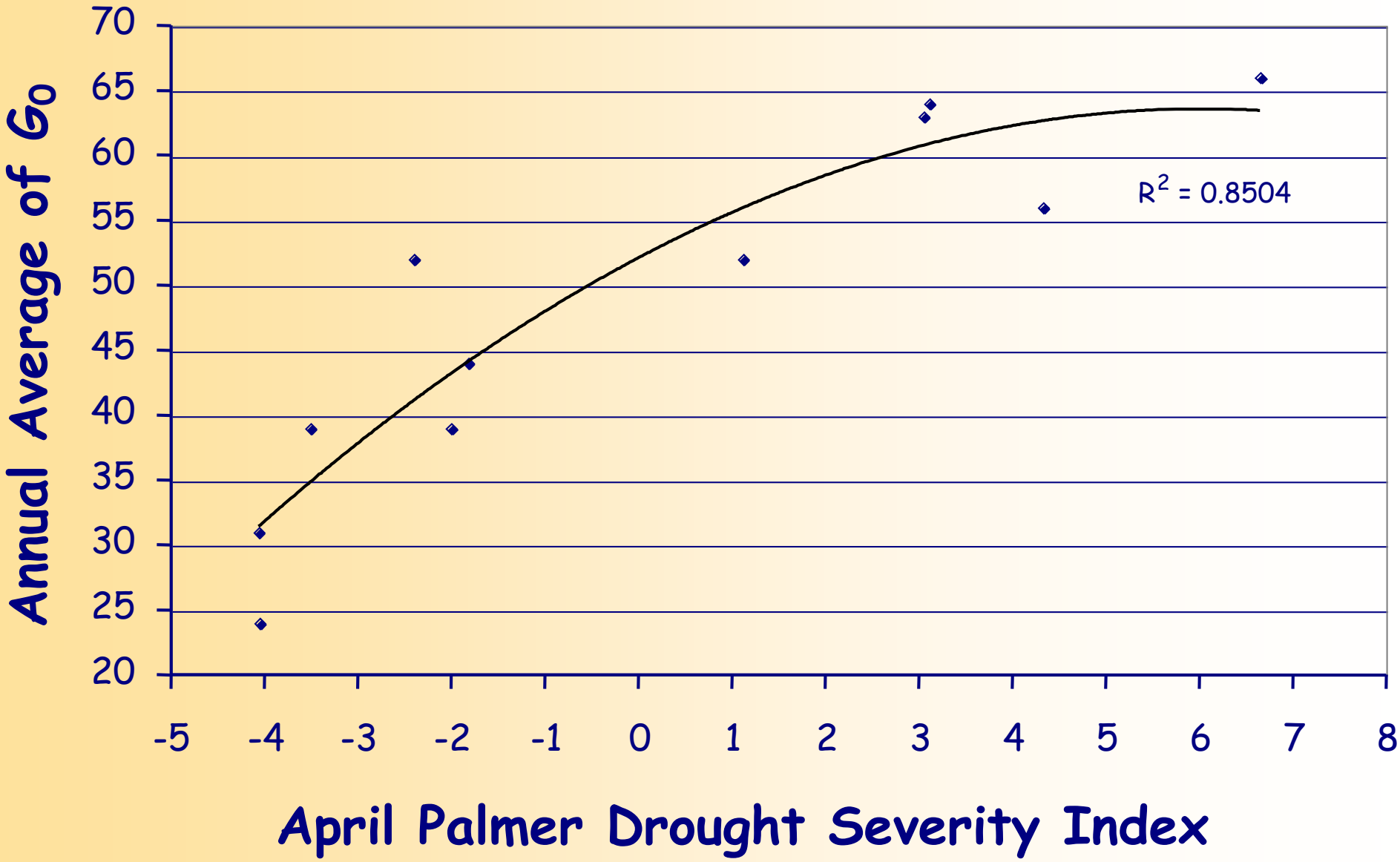
+

$CV(g_o)$ Behavior

Inactive vs Active

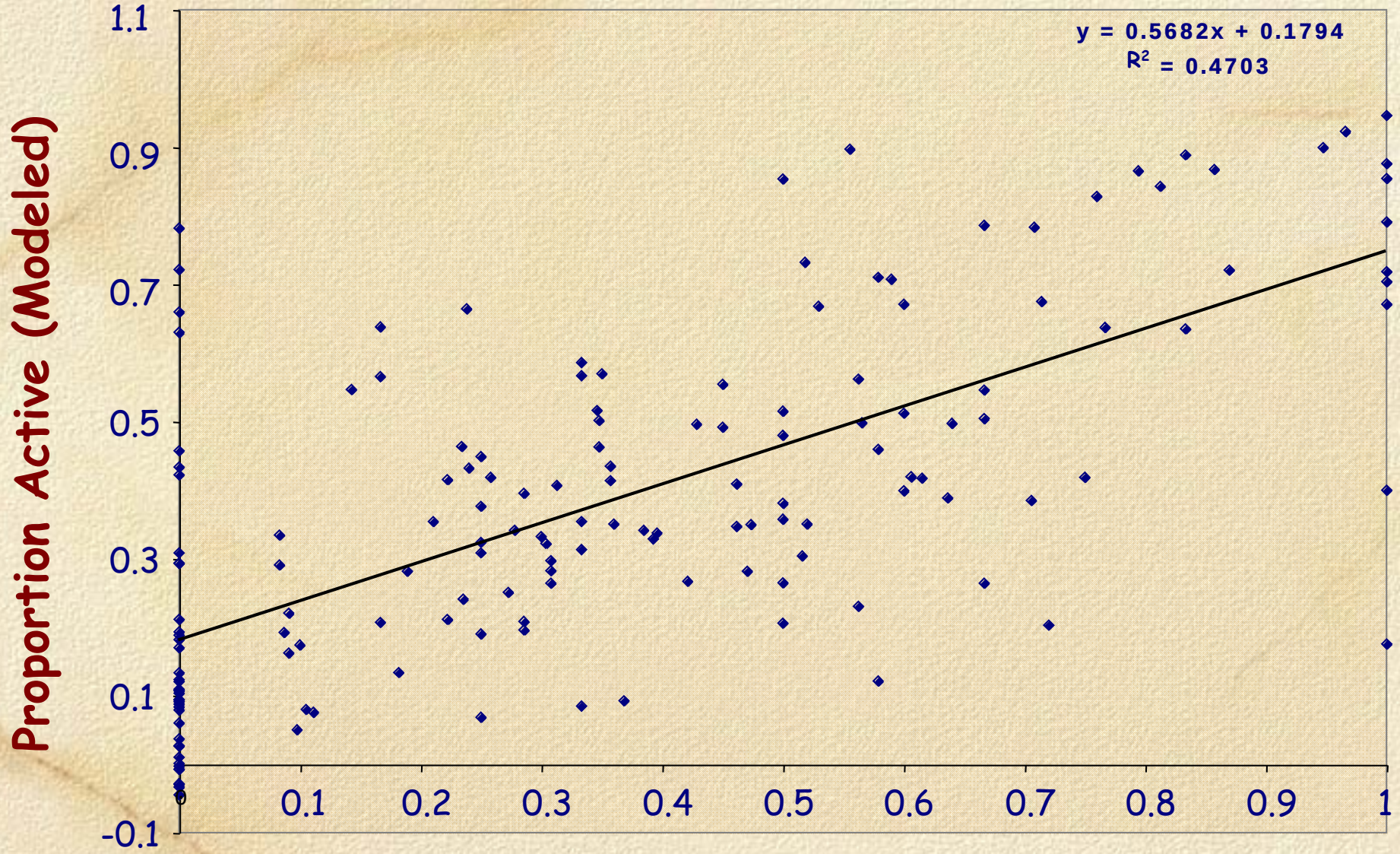


G_0 and April Drought Index



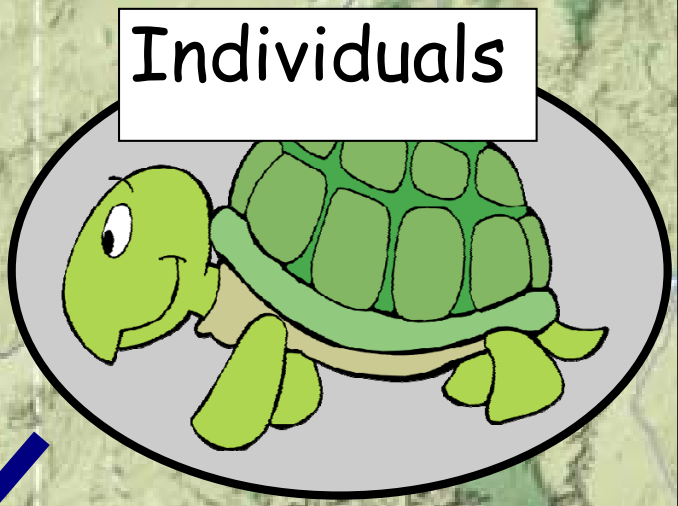
Data from Corn unpublished data

Model Performance



CV = 44%

Study Sites



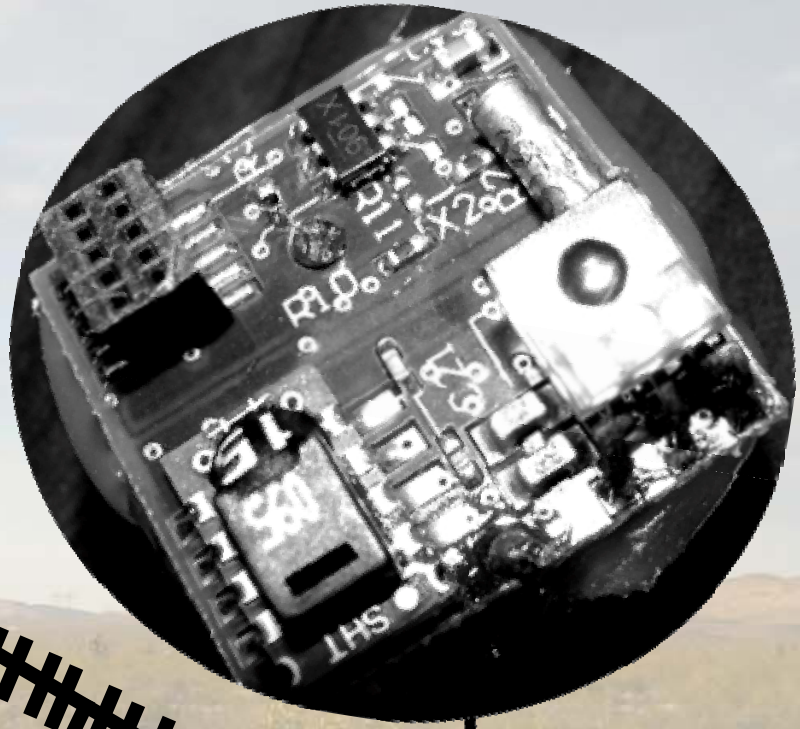
Las Vegas

Los Angeles

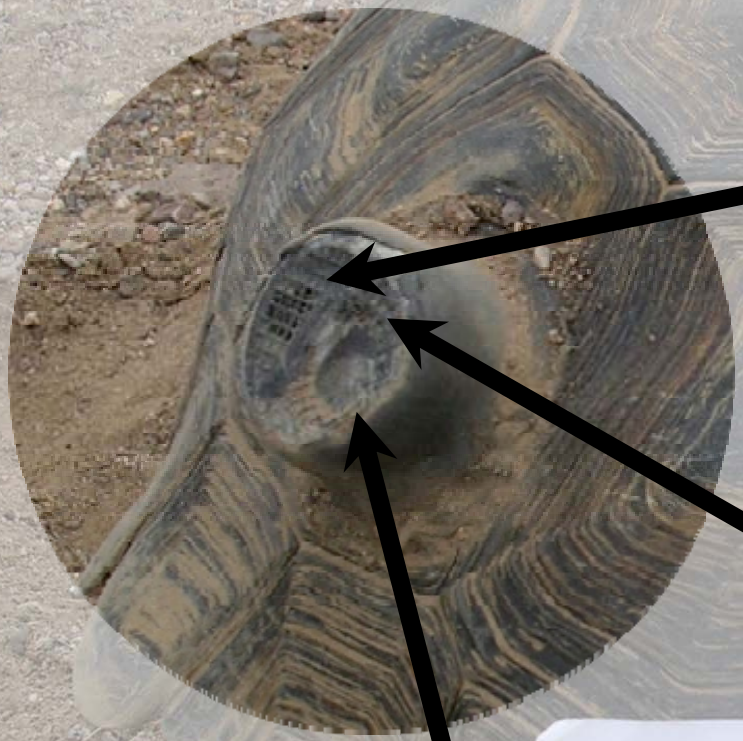
Tonopah
California
Clovis
Fresno
Visalia
Pahrump
Las Vegas
Henderson
Boulder City
Ridgecrest
Bakersfield
Bullhead City
Kingman
Mohave Valley
Sedona
Lancaster
Santa Barbara
Simi Valley
Oxnard
Riverside
Los Angeles
Corona
Moreno Valley
Huntington Beach
Lake Havasu City
Arizona
Glendale
Mesa
Chandler
Oceanside
Escondido

Google Maps

Estimating Behavior



Microloggers

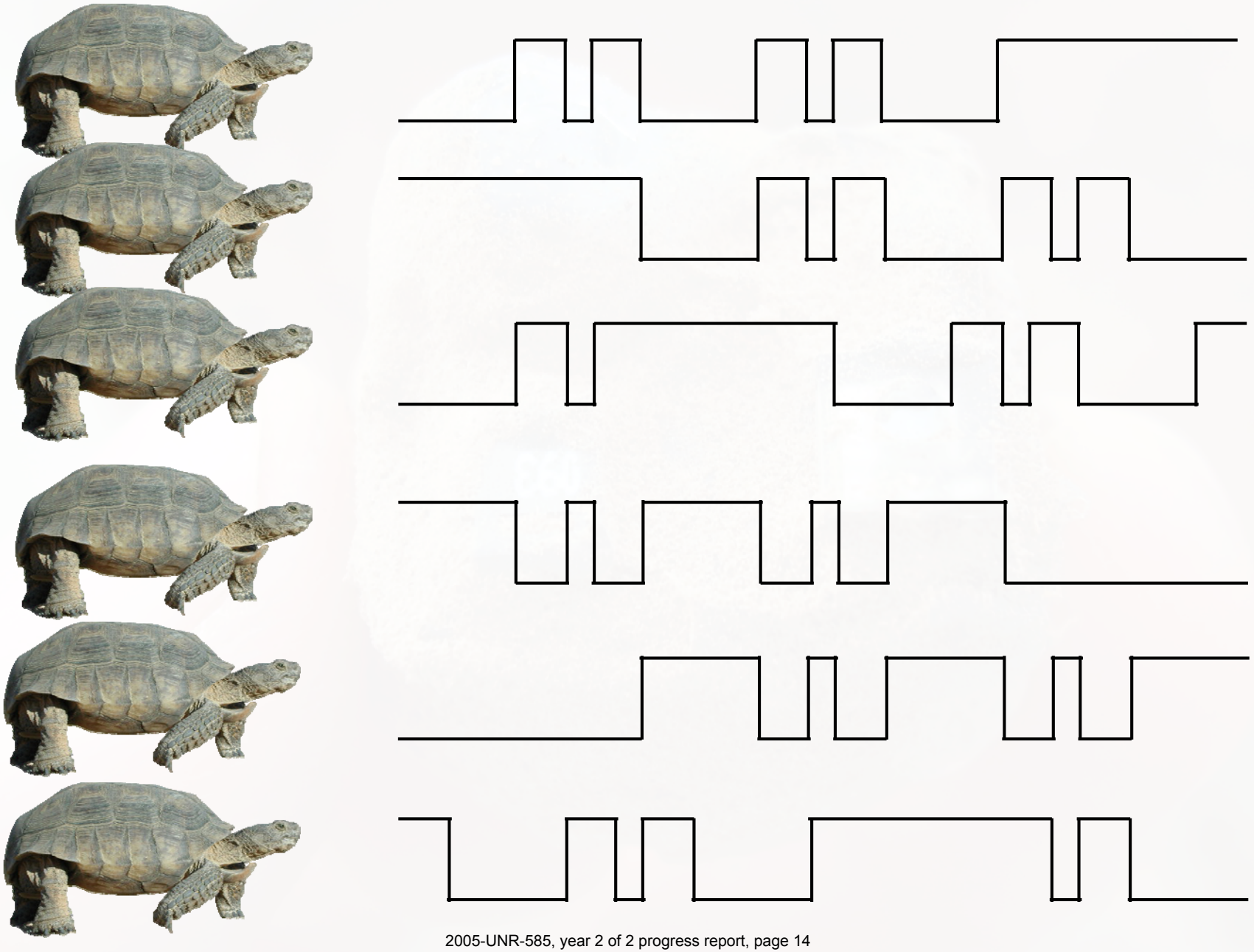


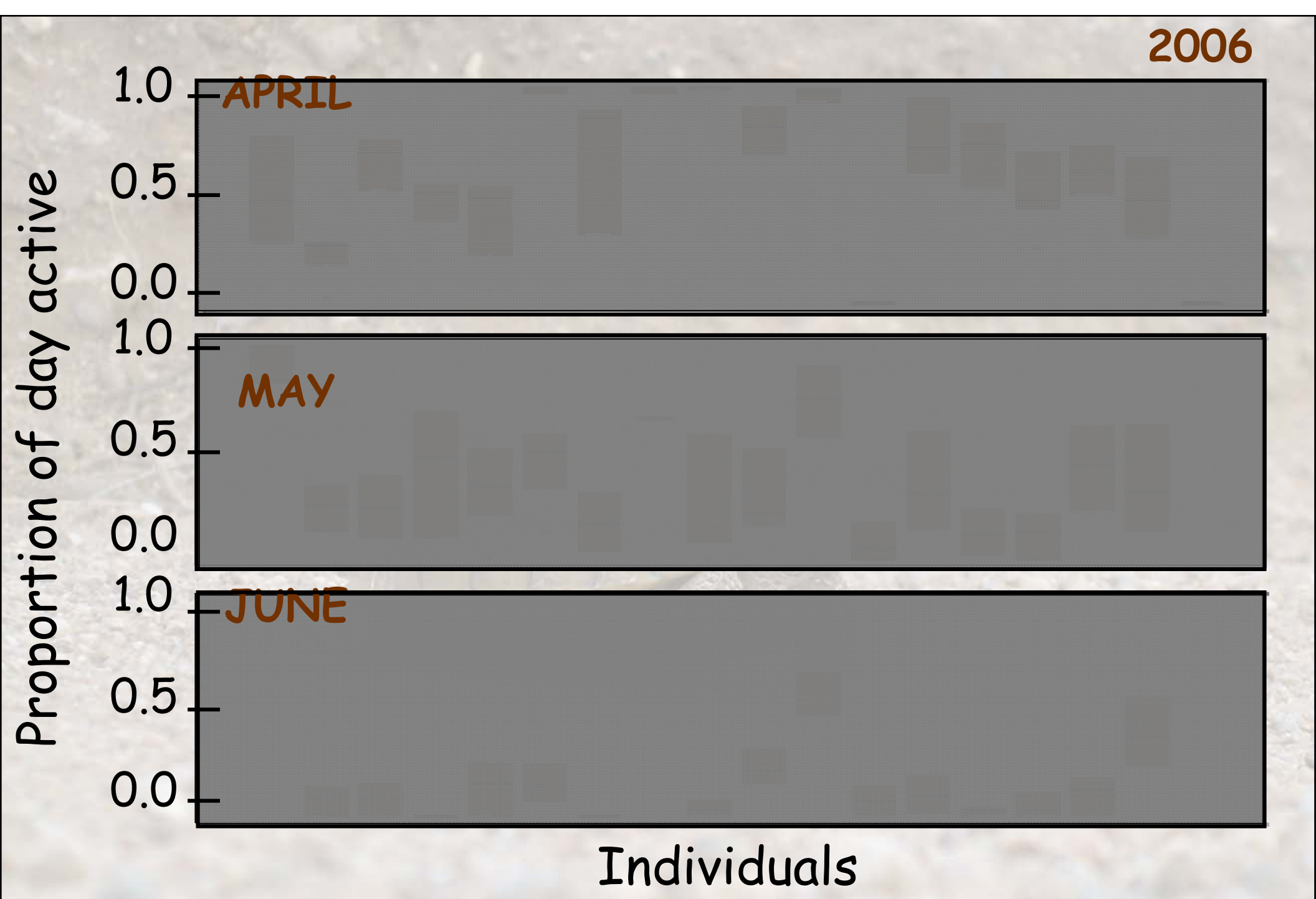
Temperature

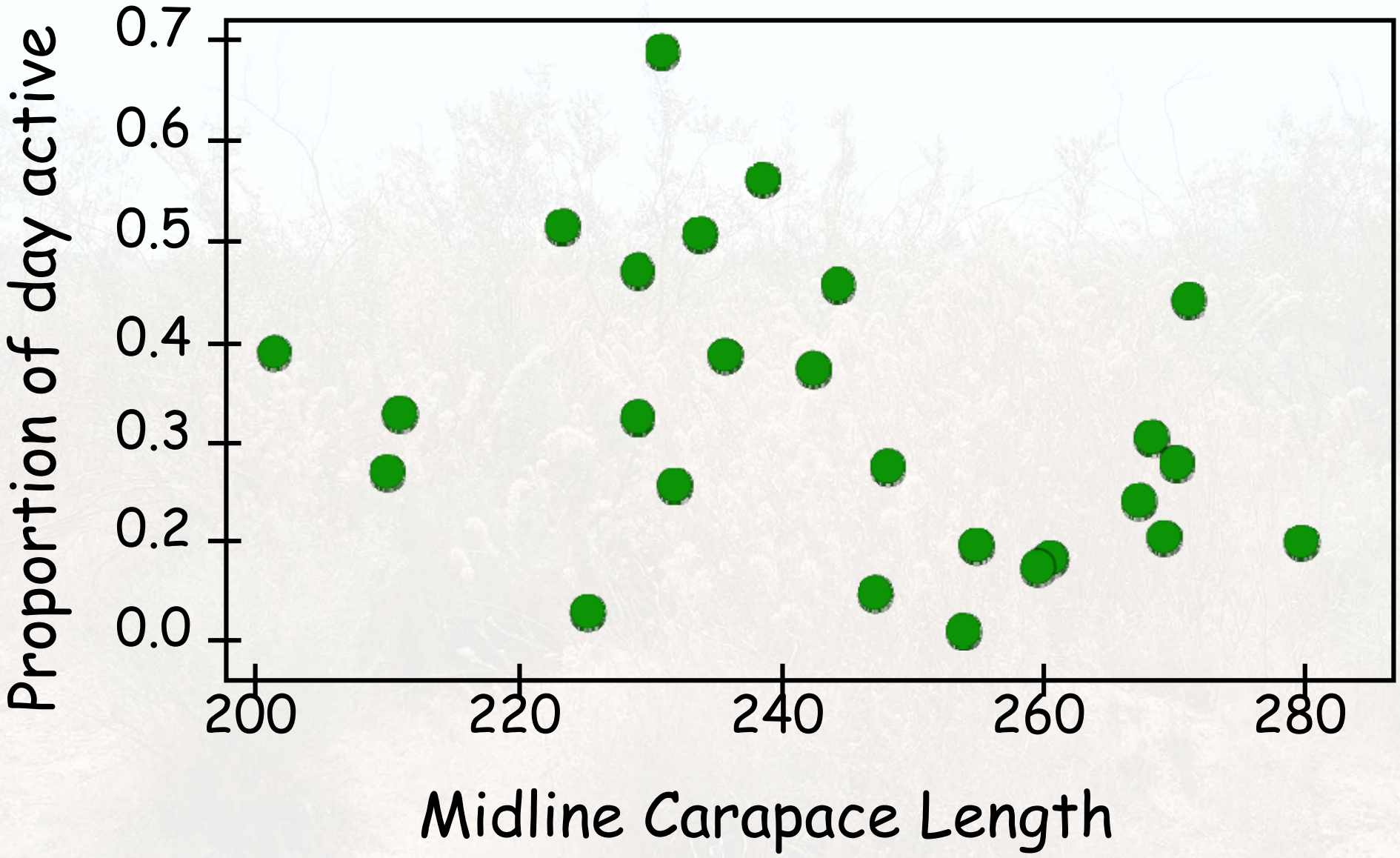
Humidity

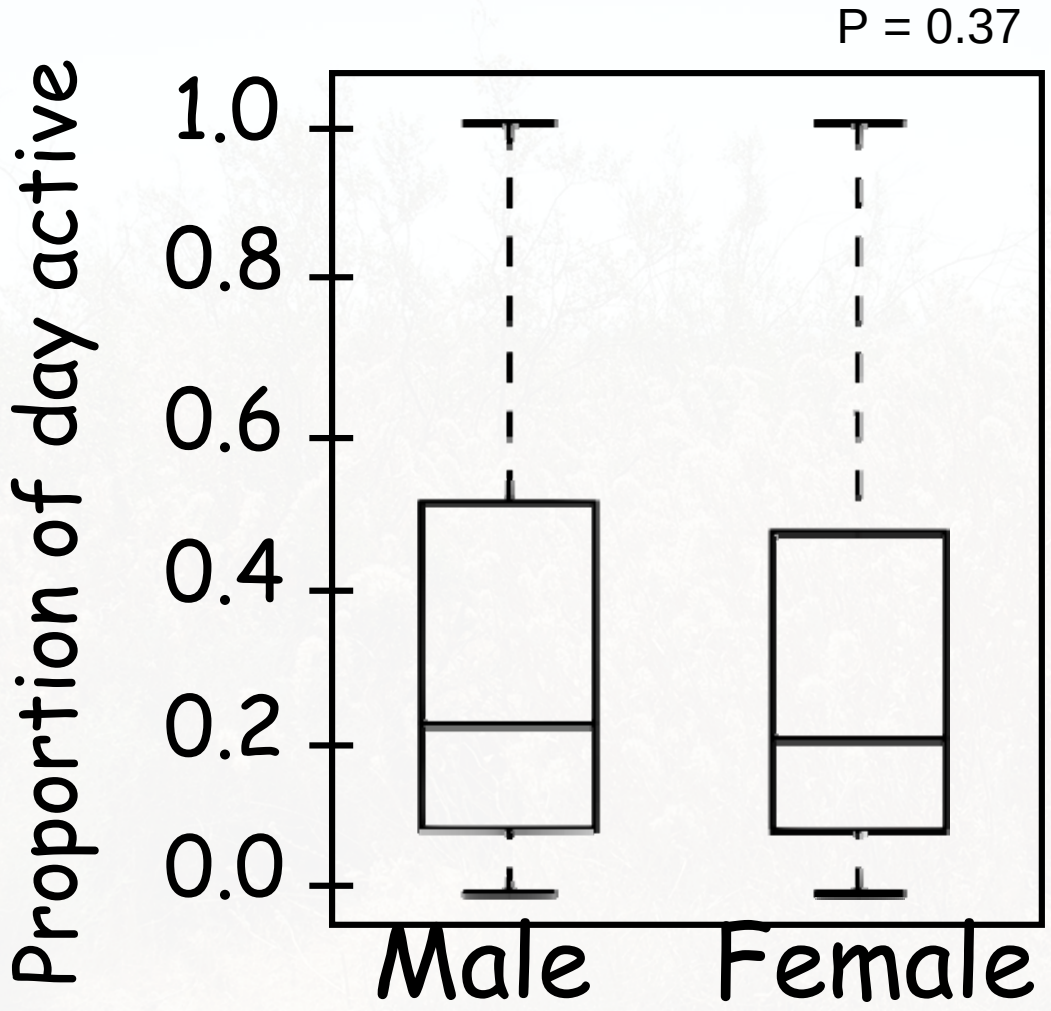
Illumination

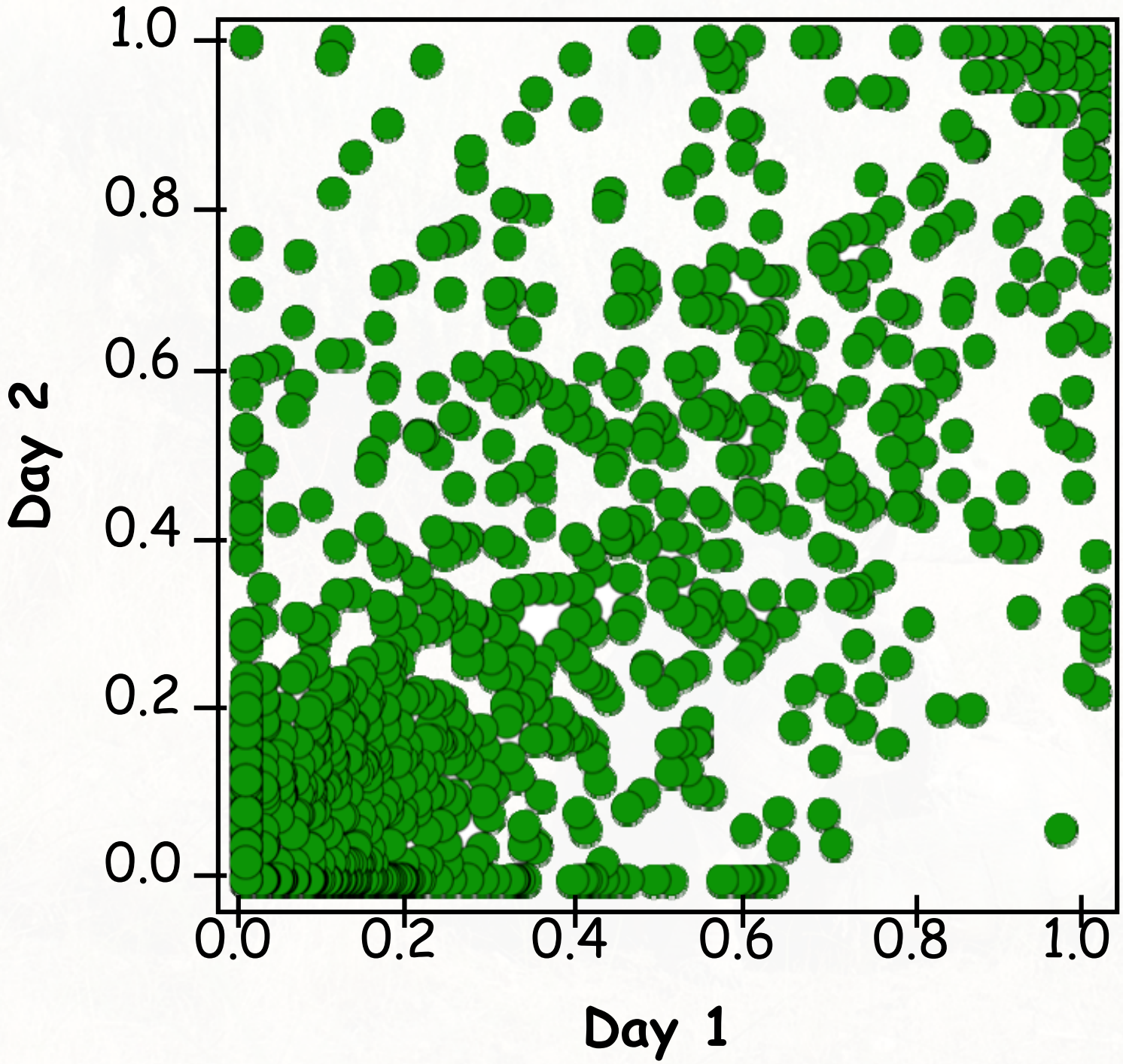
Estimating Behavior

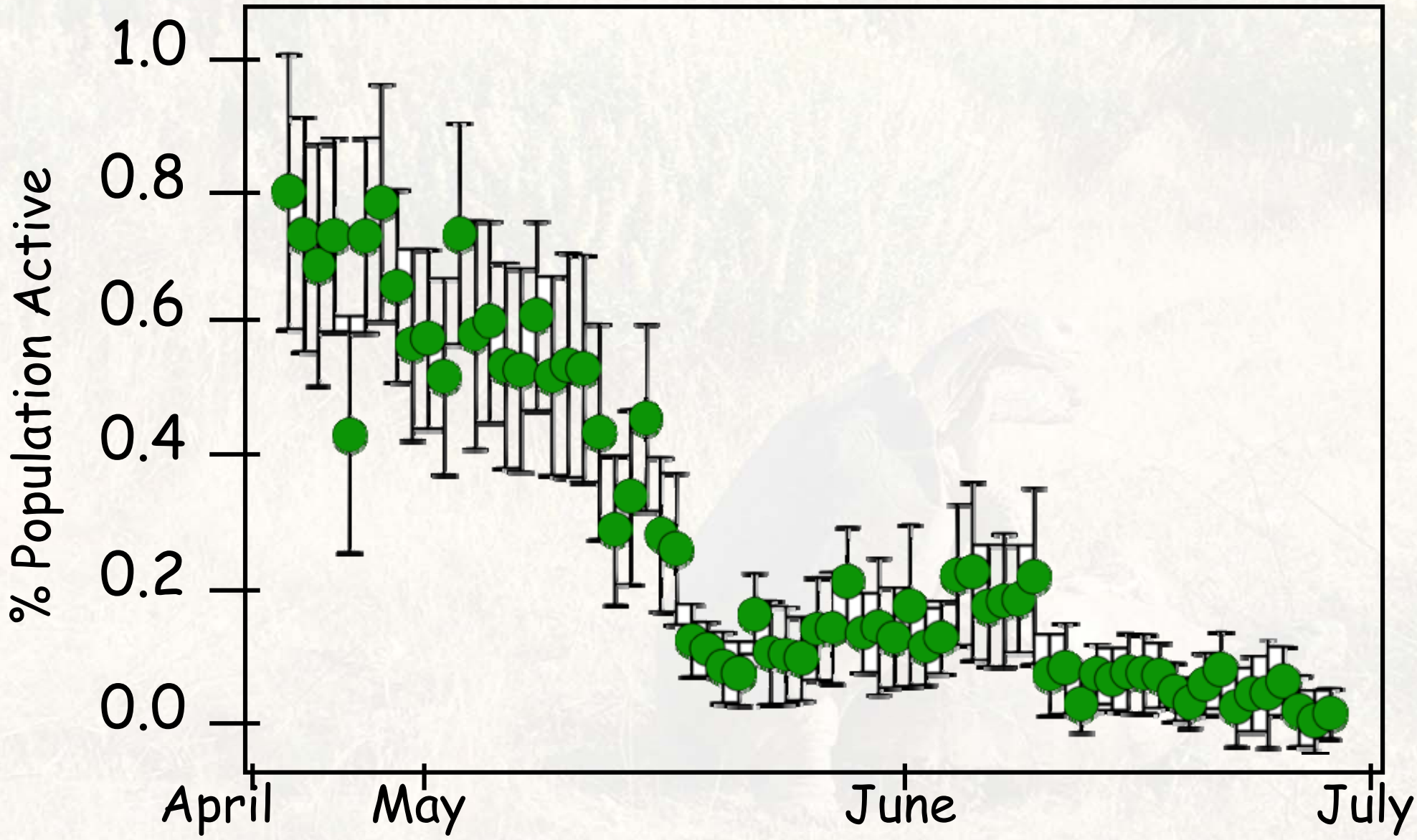


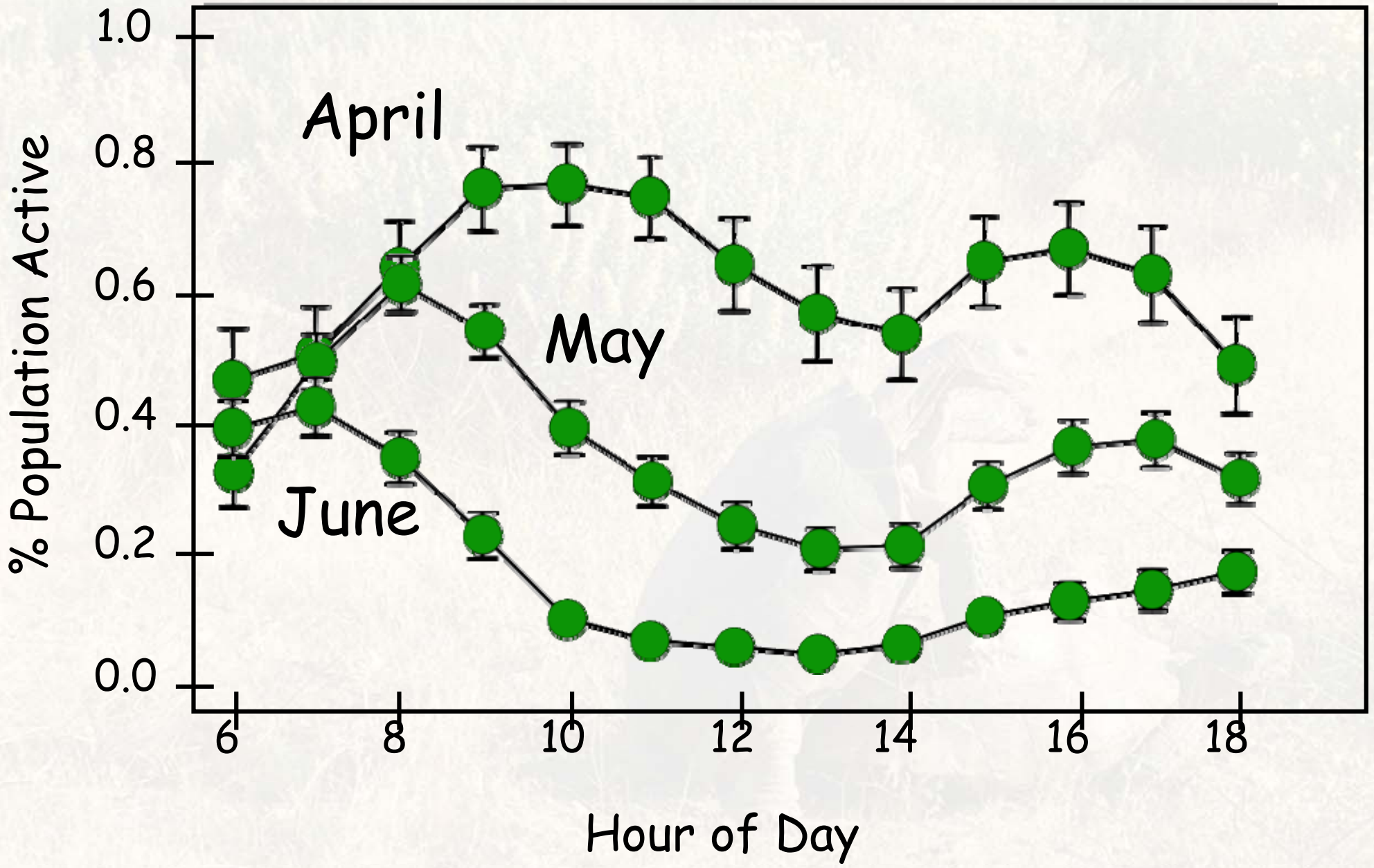

2006
APRIL
MAY
JUNE
1.0
0.5
0.0
Proportion of day active
Individuals

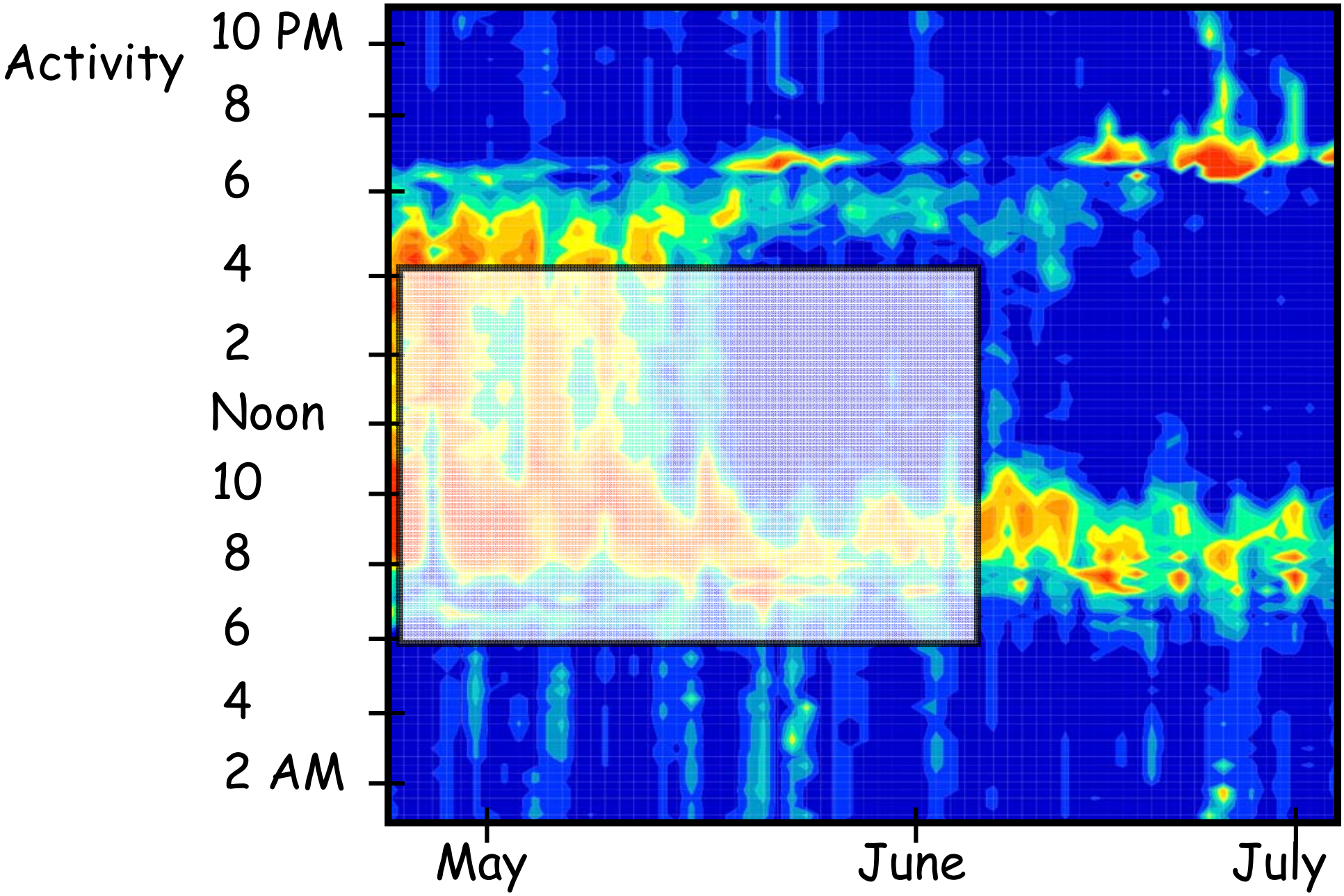

Proportion of day active
0.7
0.6
0.5
0.4
0.3
0.2
0.0
200
220
240
260
280
Midline Carapace Length

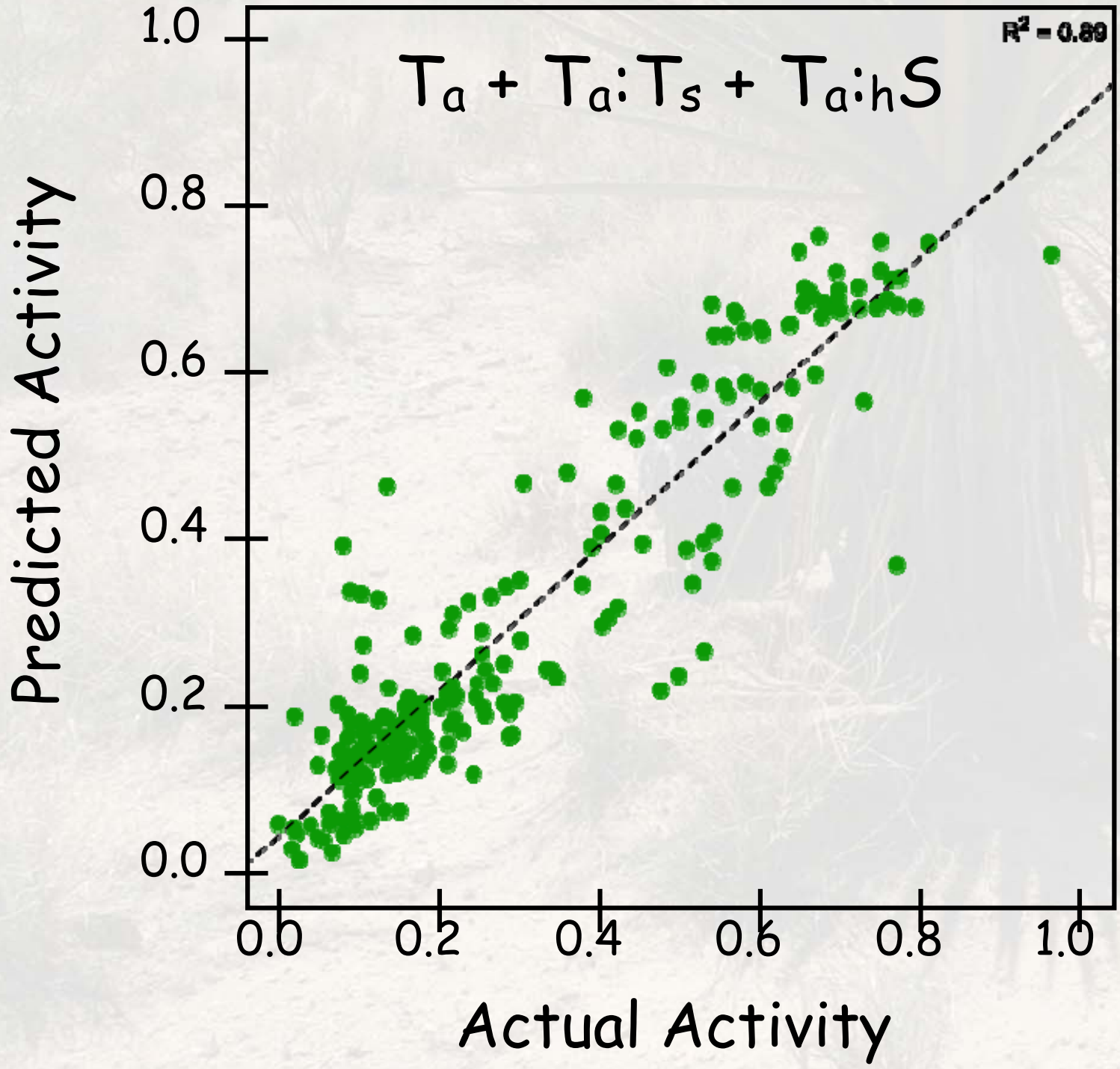

P = 0.37
Proportion of day active
1.0
0.8
0.6
0.4
0.2
0.0
Male
Female

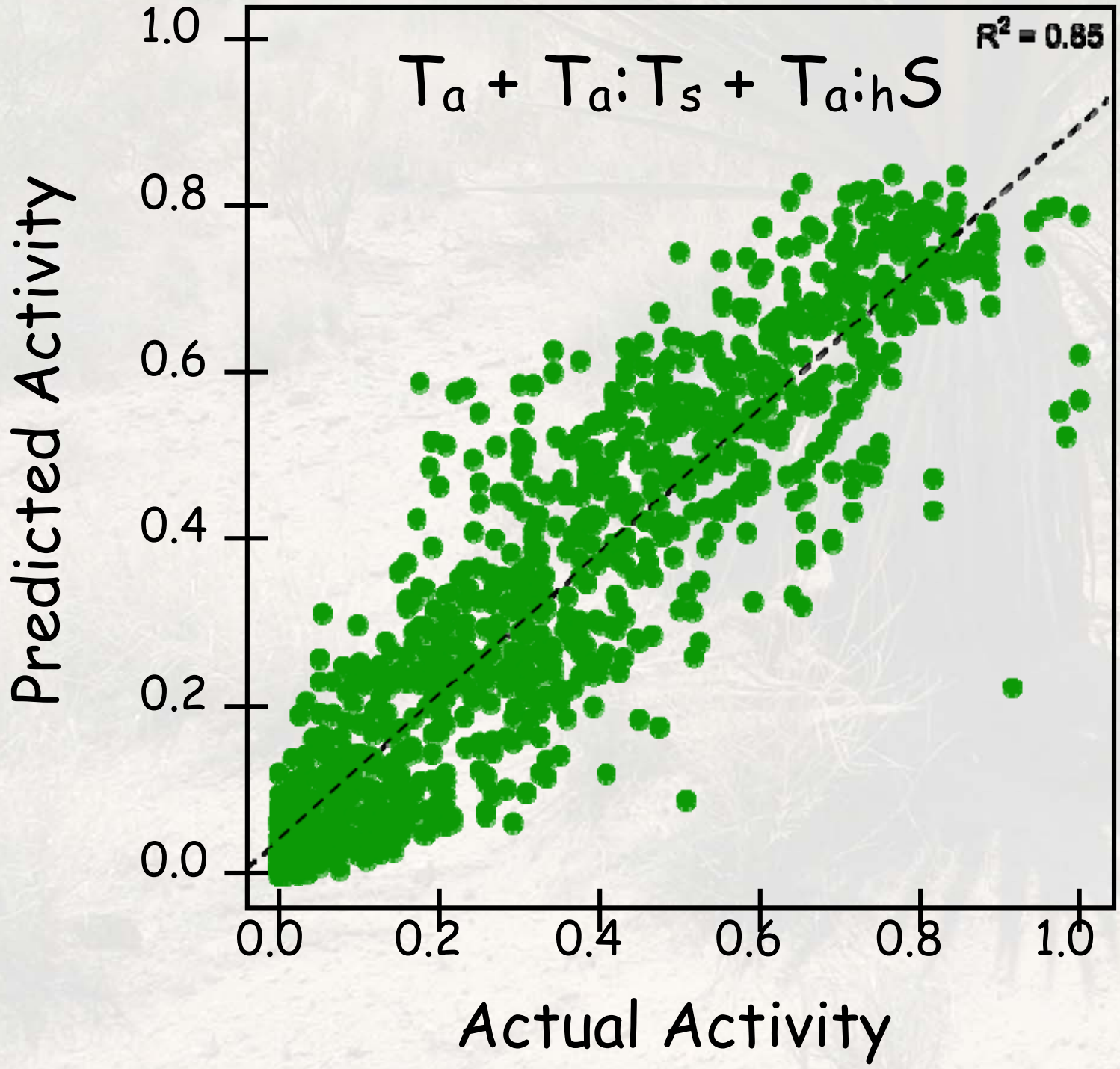

1.0
0.8
0.6
0.4
0.2
0.0
Day 2
0.0
0.2
0.4
0.6
0.8
1.0
Day 1

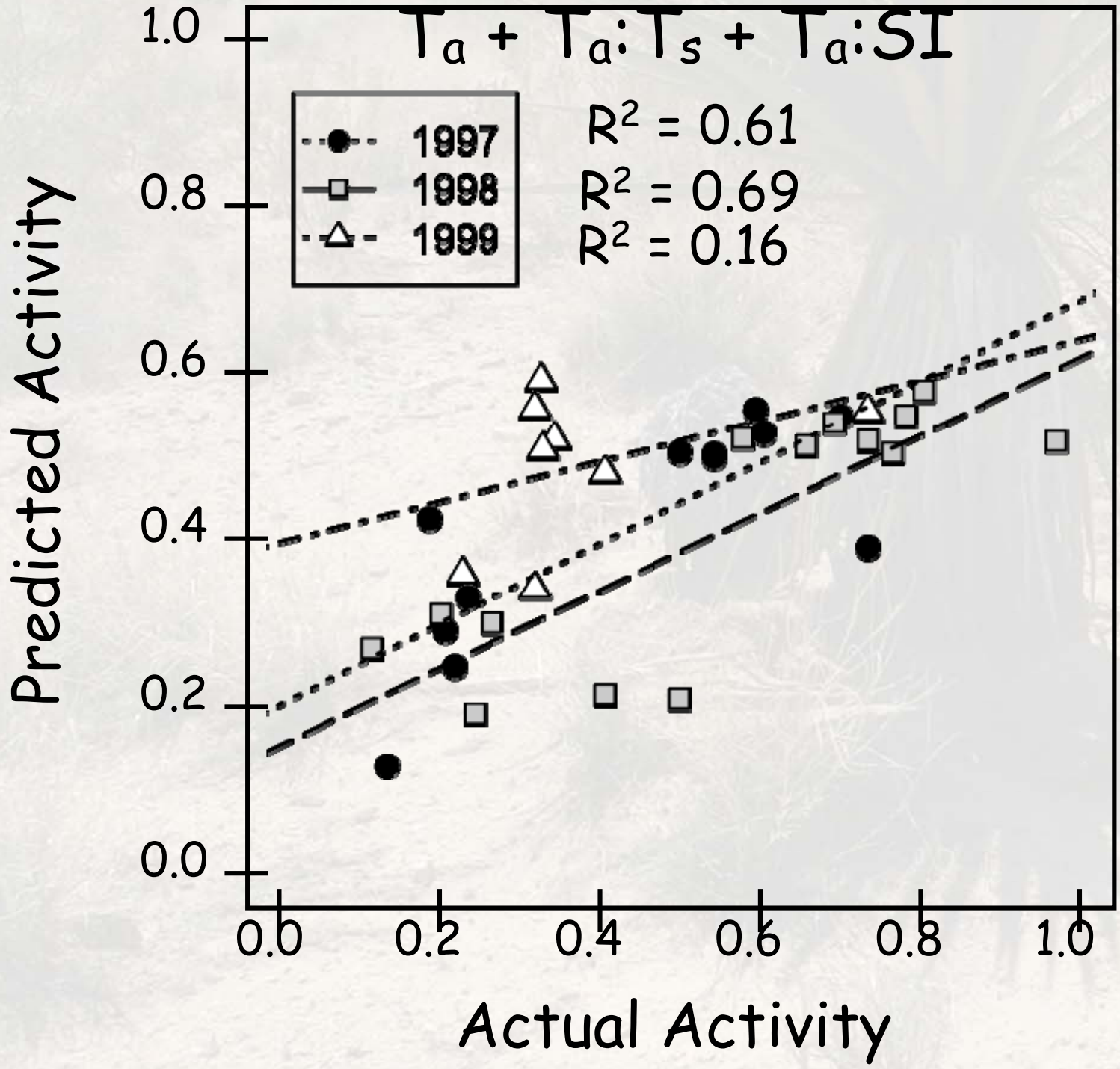

% Population Active
1.0
0.8
0.6
0.4
0.2
0.0
April
May
June
July

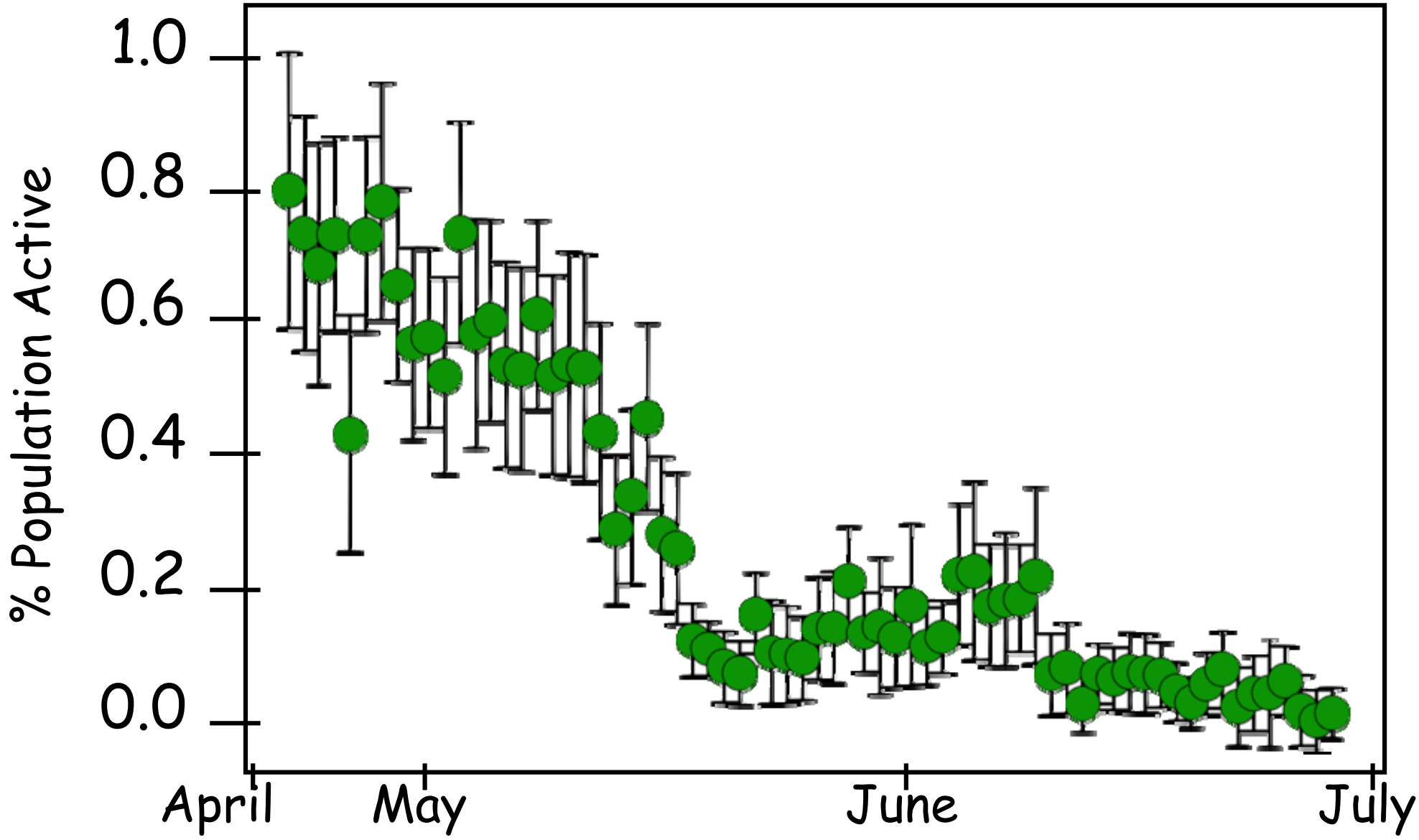

% Population Active
1.0
0.8
0.6
0.4
0.2
0.0
April
May
June
6
8
10
12
14
16
18
Hour of Day


Activity
10 PM
8
6
4
2
Noon
10
8
6
4
2 AM
May
June
July

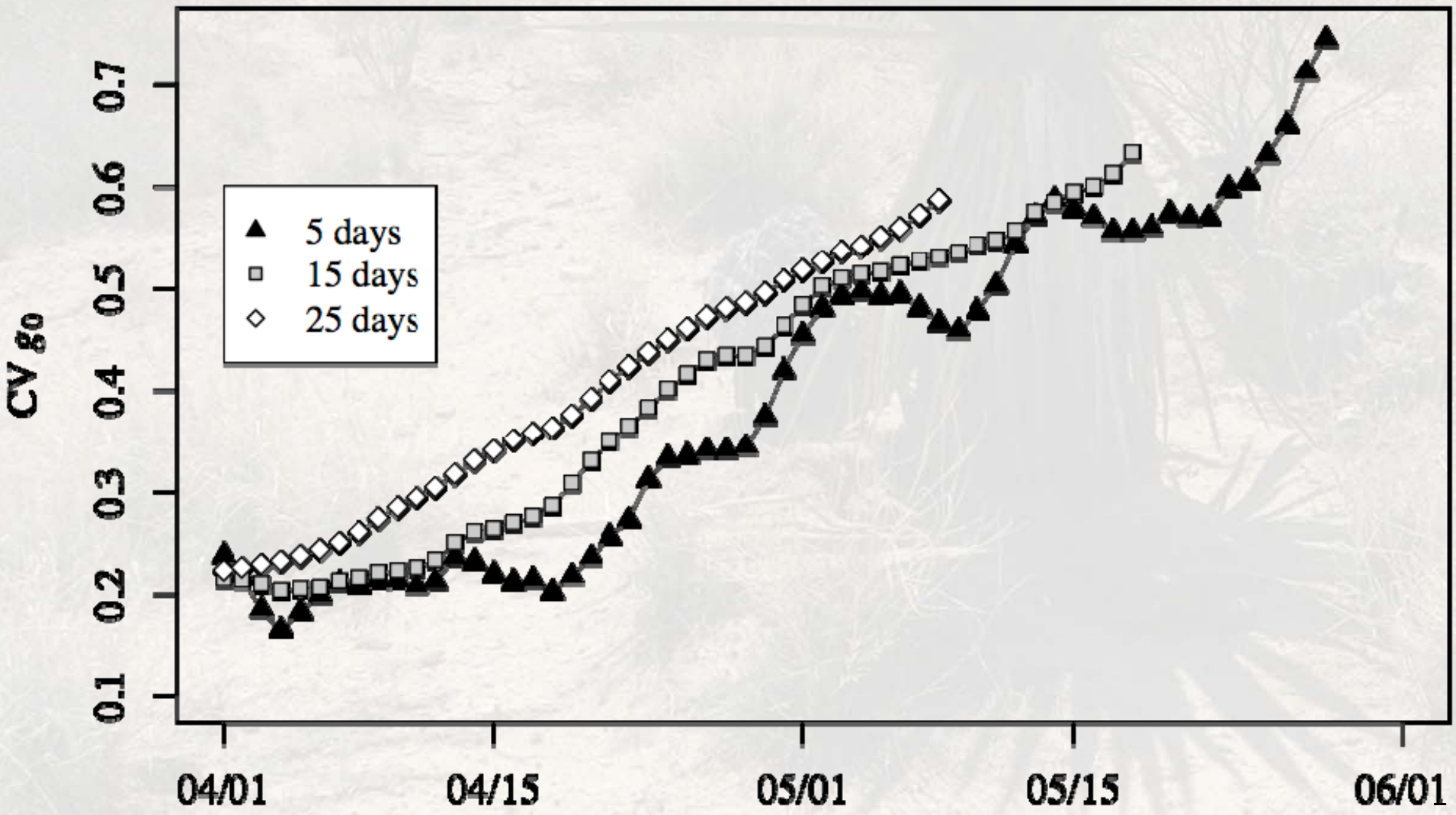

$R^2 = 0.89$
$T_a + T_a{:}T_s + T_a{:}hS$
Predicted Activity
Actual Activity
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.2
0.4
0.6
0.8
1.0


$T_a + T_a:T_s + T_a:hS$
$R^2 = 0.85$
Predicted Activity
Actual Activity
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.2
0.4
0.6
0.8
1.0


Ta + Ta:Ts + Ta:SI
1997
1998
1999
R2 = 0.61
R2 = 0.69
R2 = 0.16
Predicted Activity
Actual Activity
0.0
0.2
0.4
0.6
0.8
1.0


% Population Active
1.0
0.8
0.6
0.4
0.2
0.0
April
May
June
July

Precision of Estimates



Take Home Message

Conservation --> Population --> Individuals

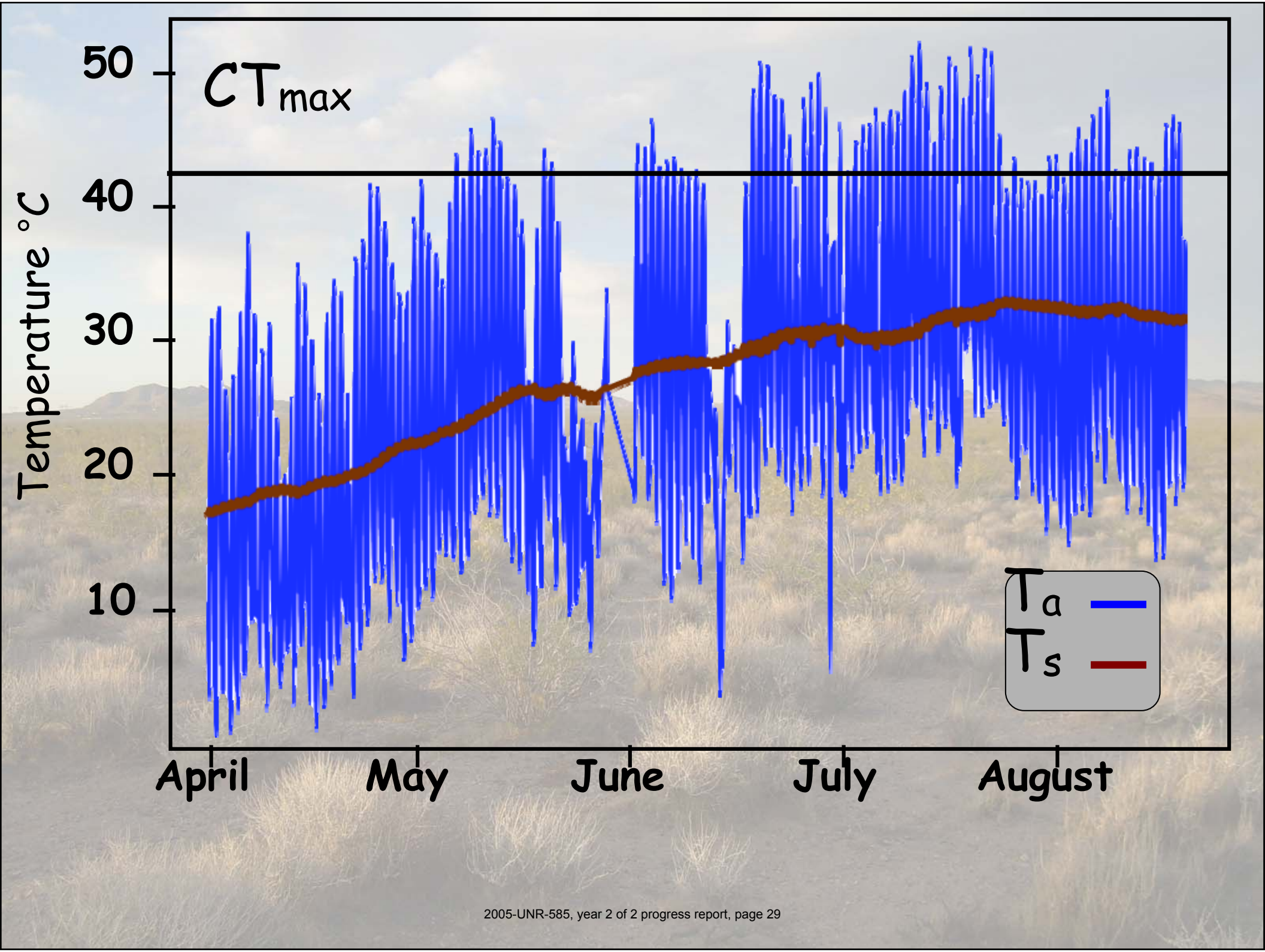
Individuals:

Not consistent
Not alike

Activity declines through season

Climate and 'Season' define periods of activity and inactivity.

Variability in tortoise behavior must be accounted for in density estimates.


CTmax
50
40
30
20
10
Temperature °C
April
May
June
July
August
Ta
Ts