Analyzing Impacts of CBNG Development on Nesting Raptors

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and

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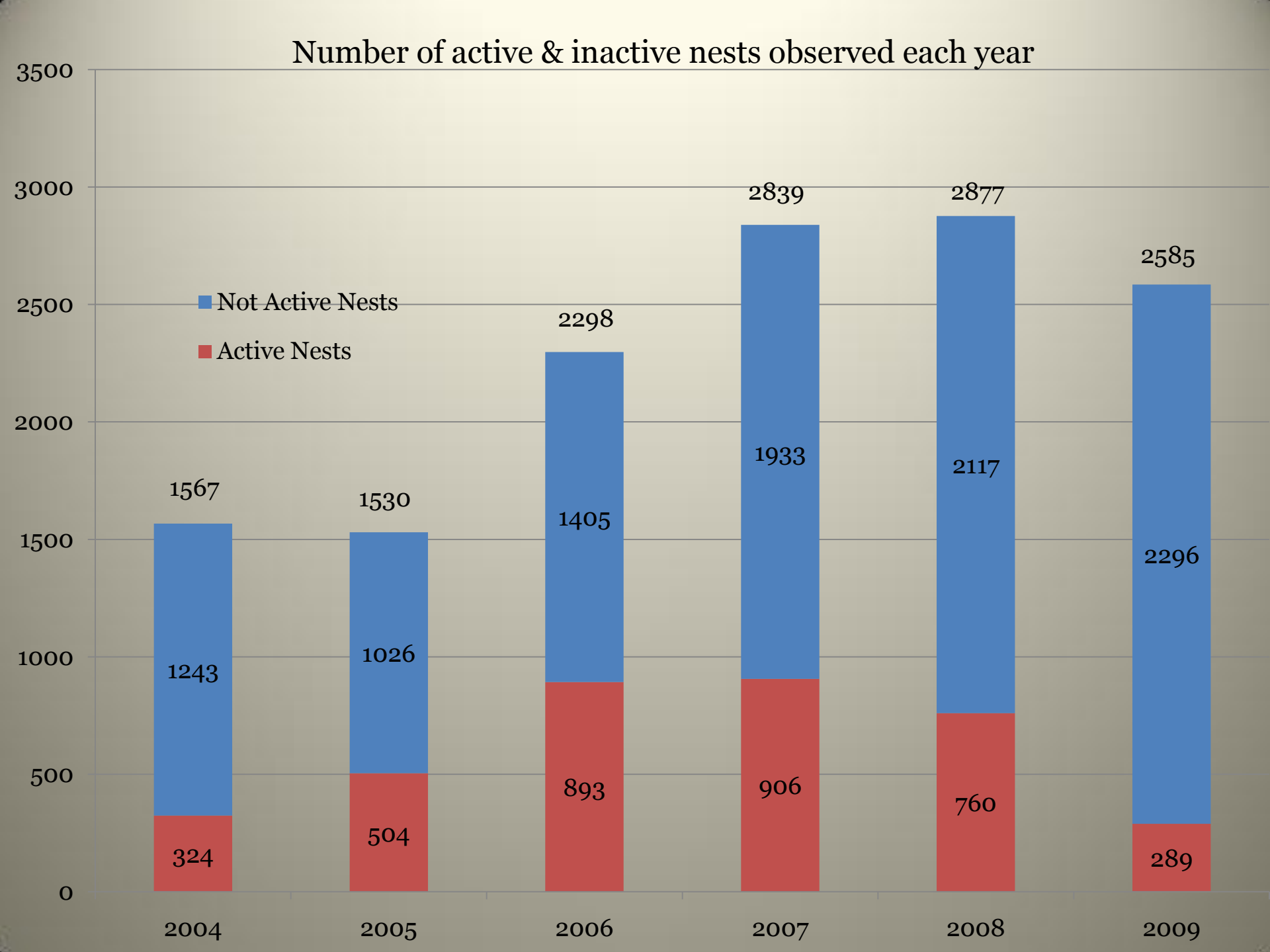
Raptor Nest Monitoring Requirements

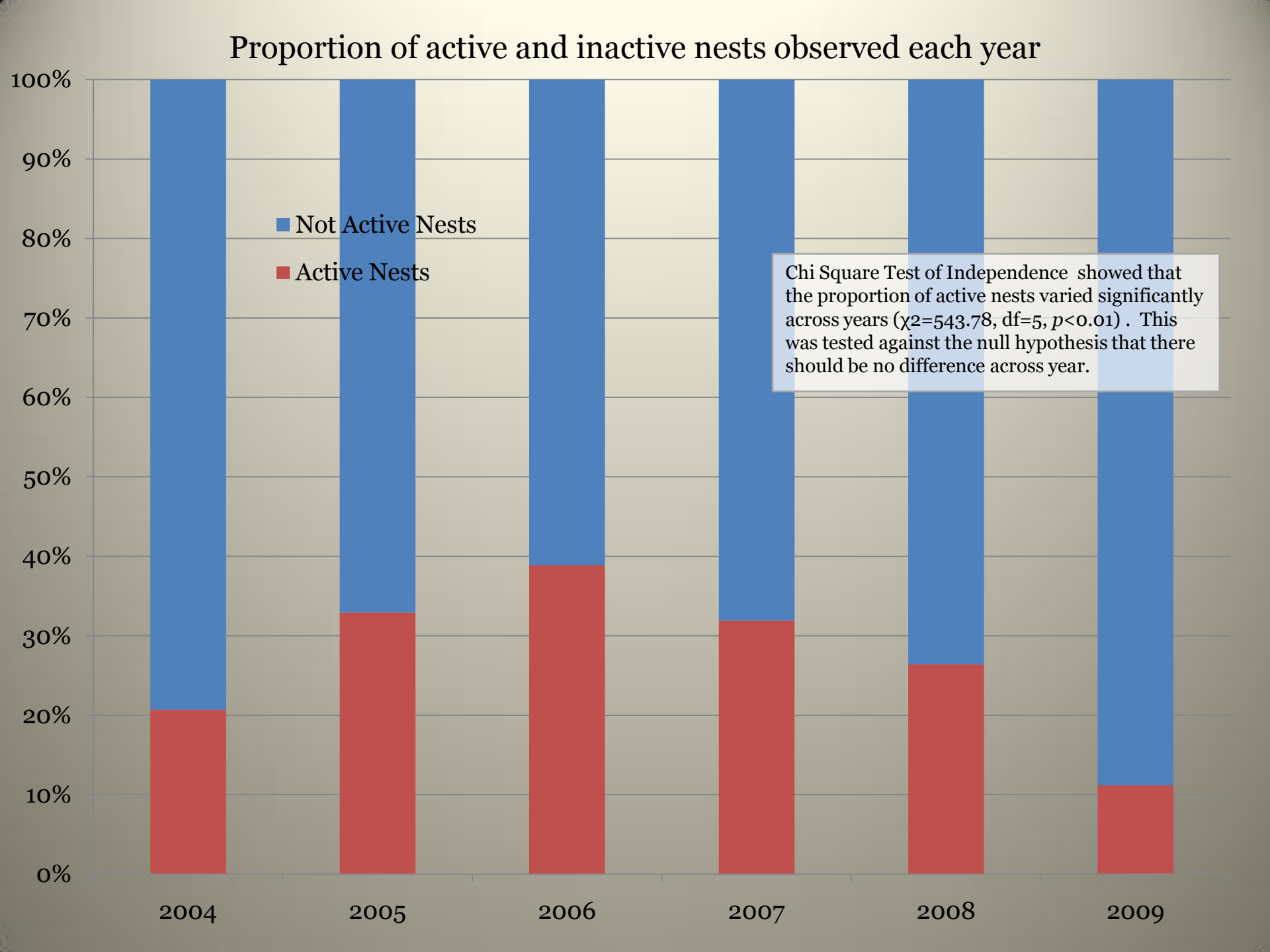
- Nest surveys required prior to POD approval
- Area within 0.5 miles of proposed projects is surveyed
- Survey information includes nest location, substrate, activity, and species (if active)
- After POD approval, surveys are required to verify that the terms of a COA have been met (always inactive) or if an exception to a COA is being requested (usually inactive)
- Long-term monitoring requirements have varied

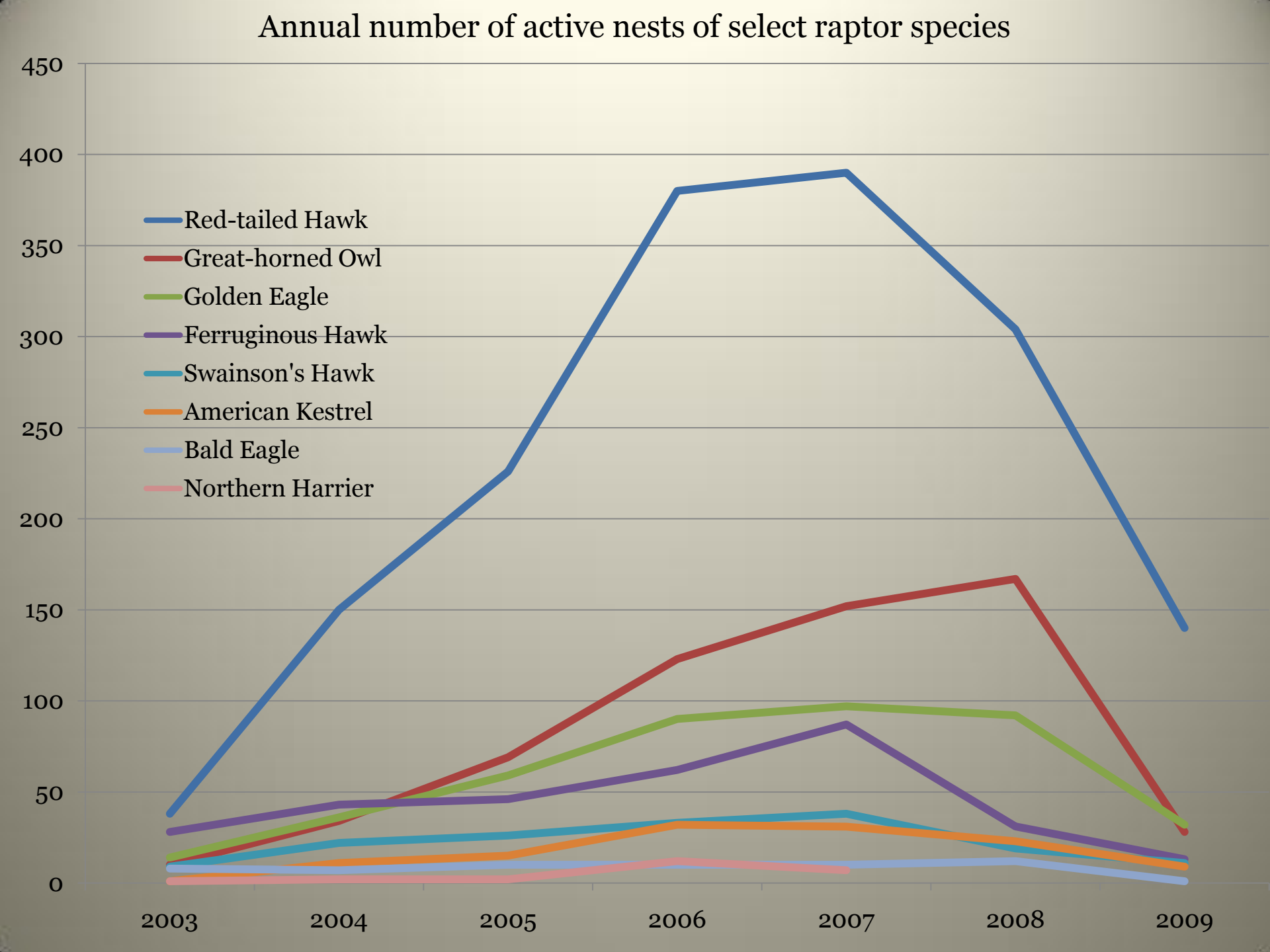
Considerations

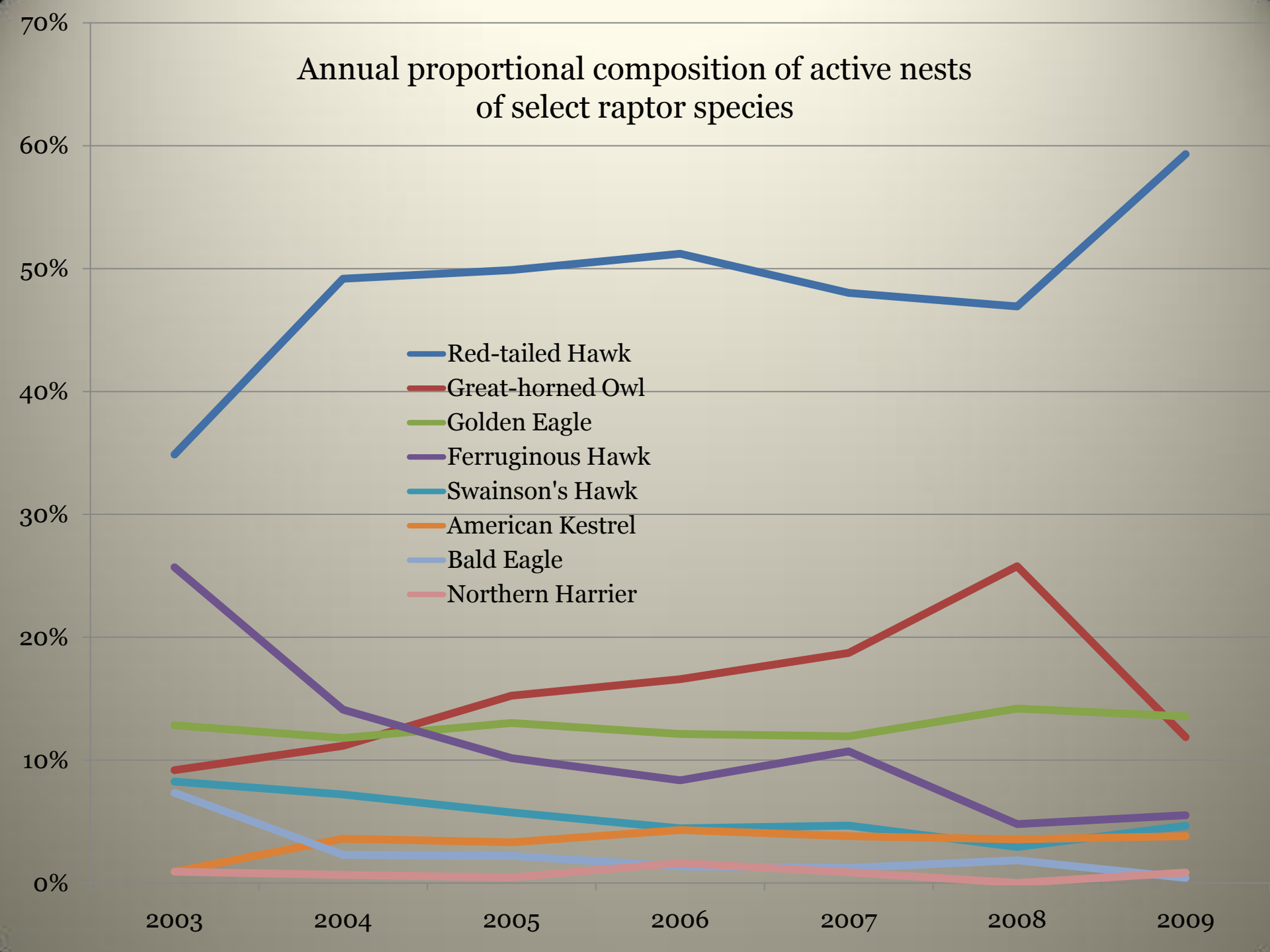
- The pool and number of nests surveyed varies each year
- The number of nests in proximity of development accumulates at a higher proportion each year
- Inactive nests are more often reported because of COA requirements

Characterizing the dataset


Number of active & inactive nests observed each year
3500
3000
2500
2000
1500
1000
500
0
Not Active Nests
Active Nests
1567
1530
2298
2839
2877
2585
1243
1026
1405
1933
2117
2296
324
504
893
906
760
289
2004
2005
2006
2007
2008
2009

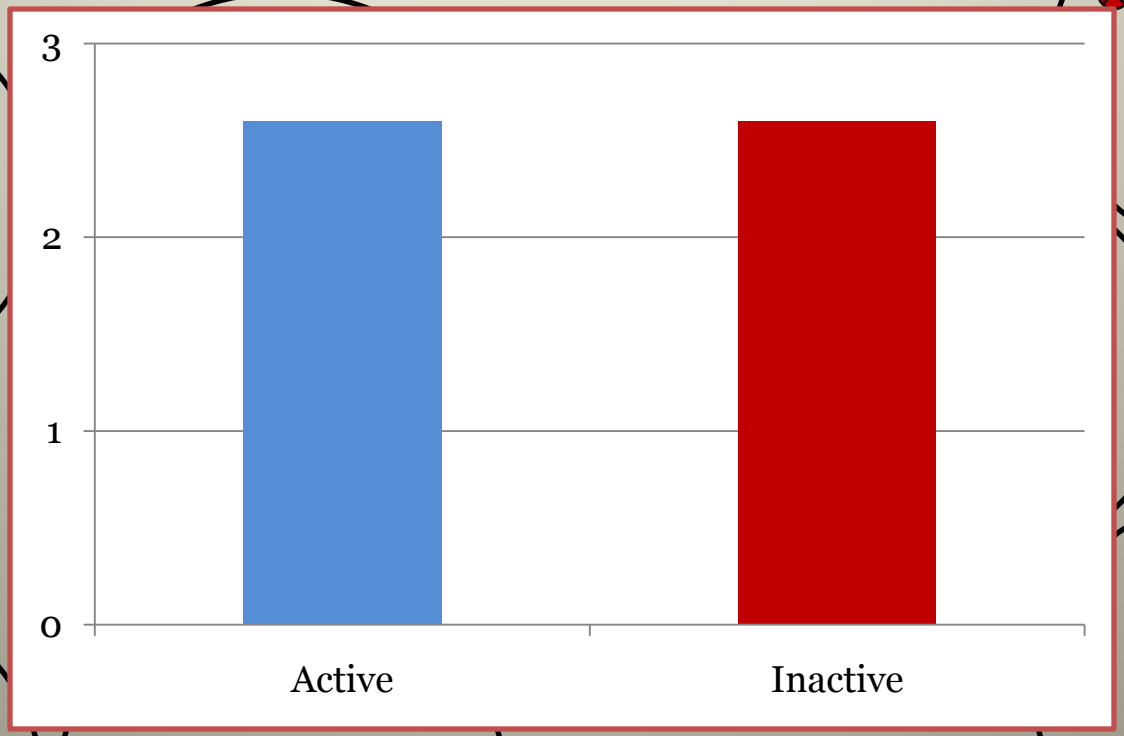

Proportion of active and inactive nests observed each year
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Not Active Nests
Active Nests
2004
2005
2006
2007
2008
2009
Chi Square Test of Independence showed that the proportion of active nests varied significantly across years (χ2=543.78, df=5, p<0.01) . This was tested against the null hypothesis that there should be no difference across year.


Annual number of active nests of select raptor species
450
400
350
300
250
200
150
100
50
0
2003
2004
2005
2006
2007
2008
2009
Red-tailed Hawk
Great-horned Owl
Golden Eagle
Ferruginous Hawk
Swainson's Hawk
American Kestrel
Bald Eagle
Northern Harrier

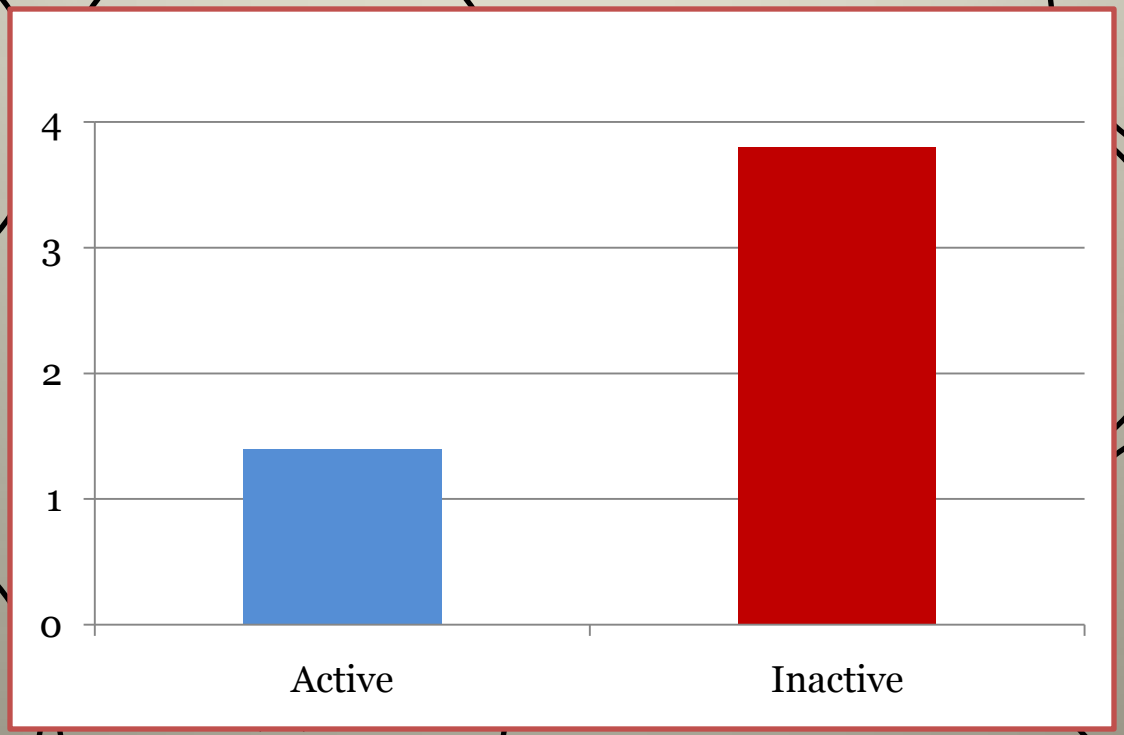

Annual proportional composition of active nests of select raptor species
70%
60%
50%
40%
30%
20%
10%
0%
2003
2004
2005
2006
2007
2008
2009
Red-tailed Hawk
Great-horned Owl
Golden Eagle
Ferruginous Hawk
Swainson's Hawk
American Kestrel
Bald Eagle
Northern Harrier

Does the number of wells within a certain proximity influence raptor nest site selection?

Average # wells w/in given distance
Active: 2.6
Inactive: 2.6



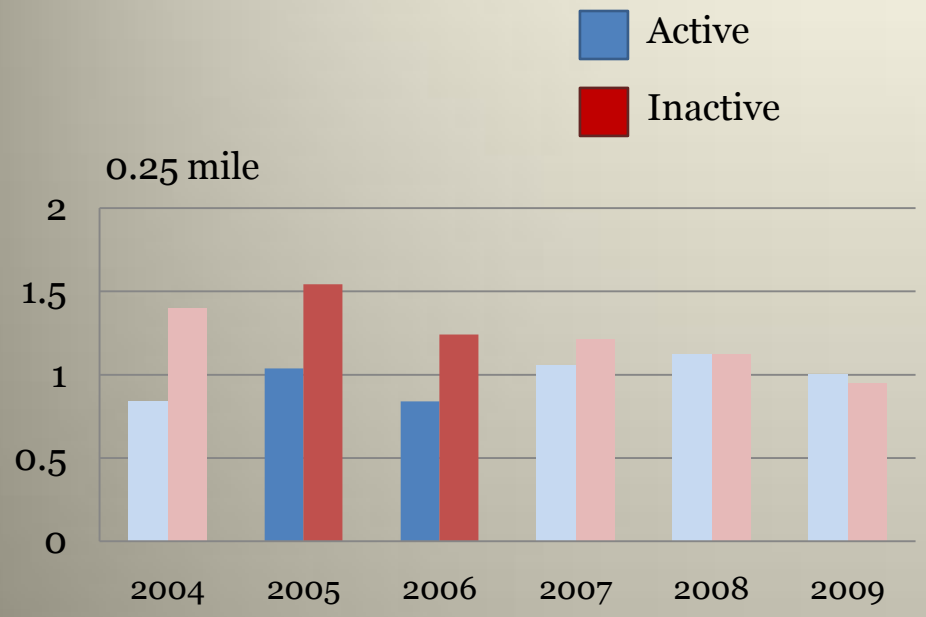
Average # wells w/in given distance
Active: 1.4
Inactive: 3.8

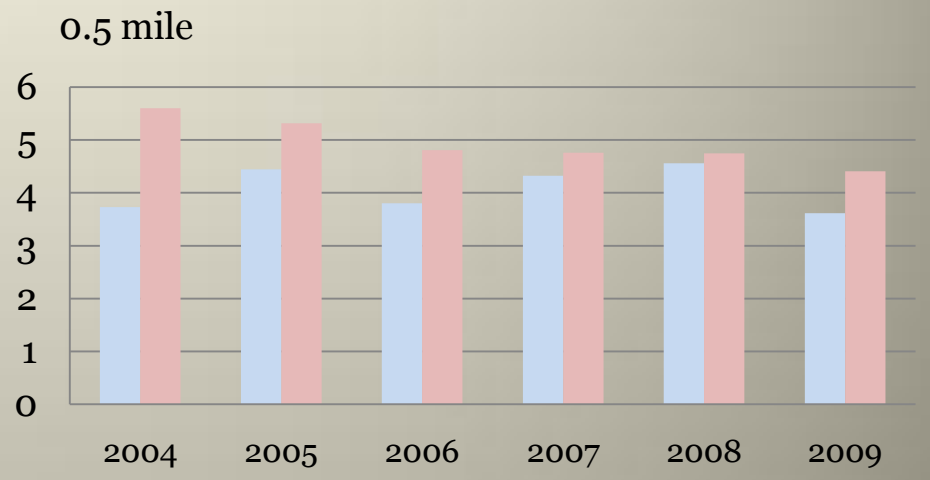


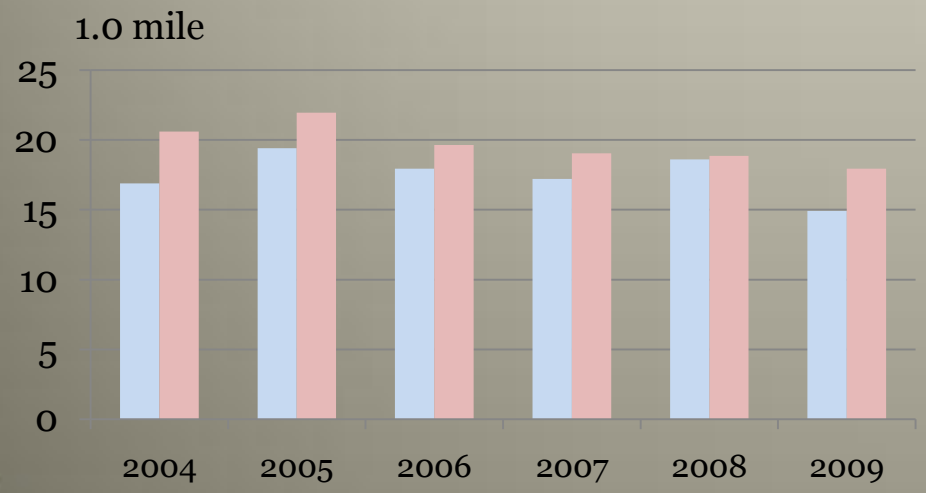
Average number of wells within indicated distances around active and inactive nests

Ferruginous Hawk

t-Test: Two-Sample Assuming Unequal Variances
Darker shades represent statistical significance where p <= 0.05

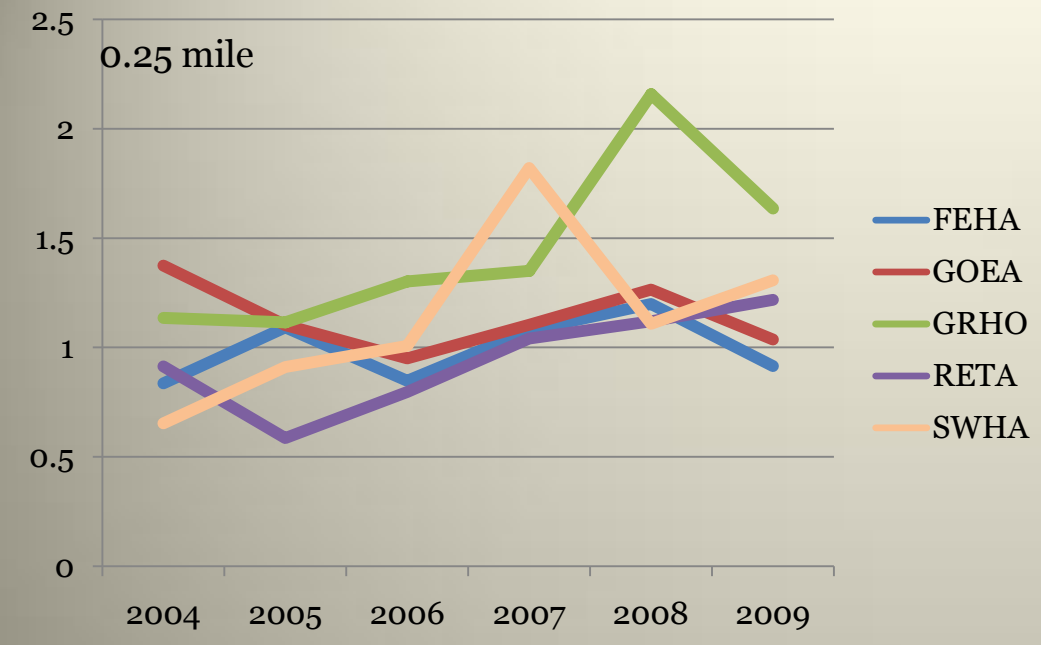


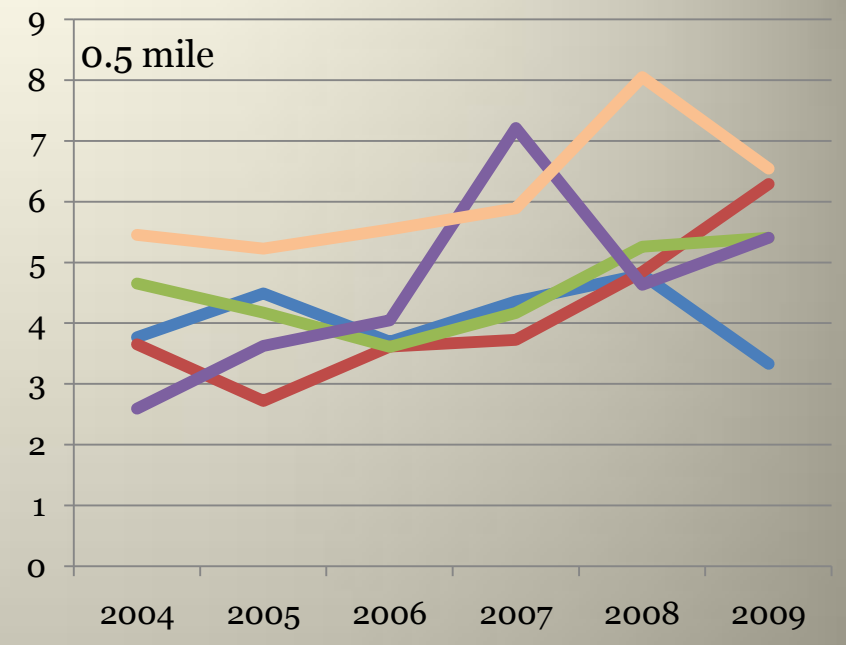


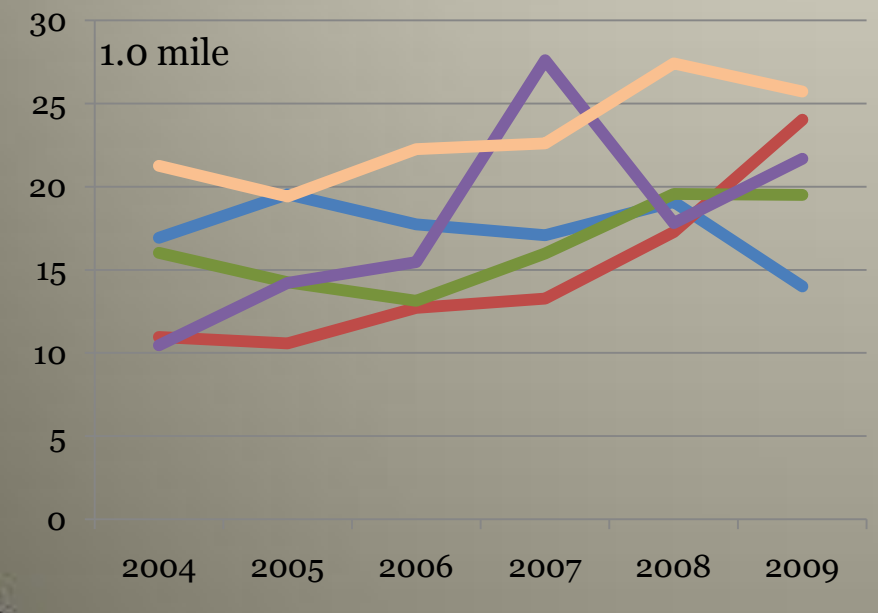


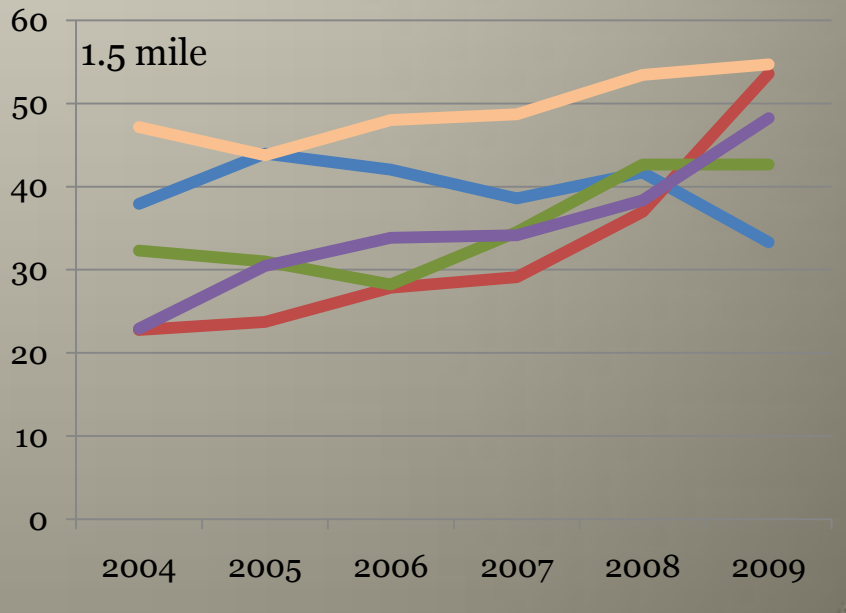
Year	Active	Inactive	TOTAL
2004	44	10	58
2005	54	35	89
2006	56	62	118
2007	89	99	188
2008	25	122	147
2009	13	103	116

Average number of wells within the indicated distance of active nests of five species of raptors

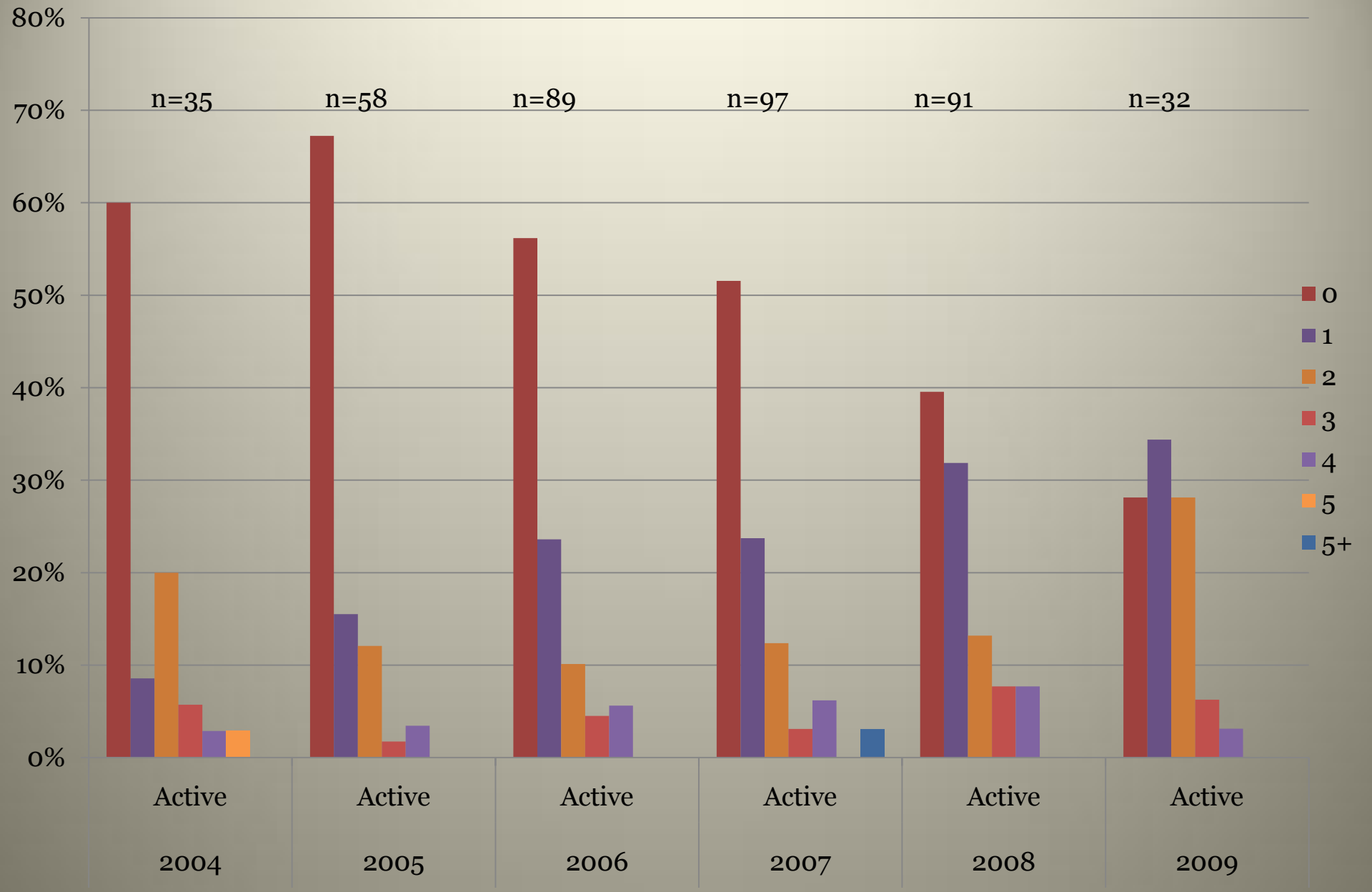








Percent of golden eagle nests with indicated number of wells within 0.25 miles that were active each year



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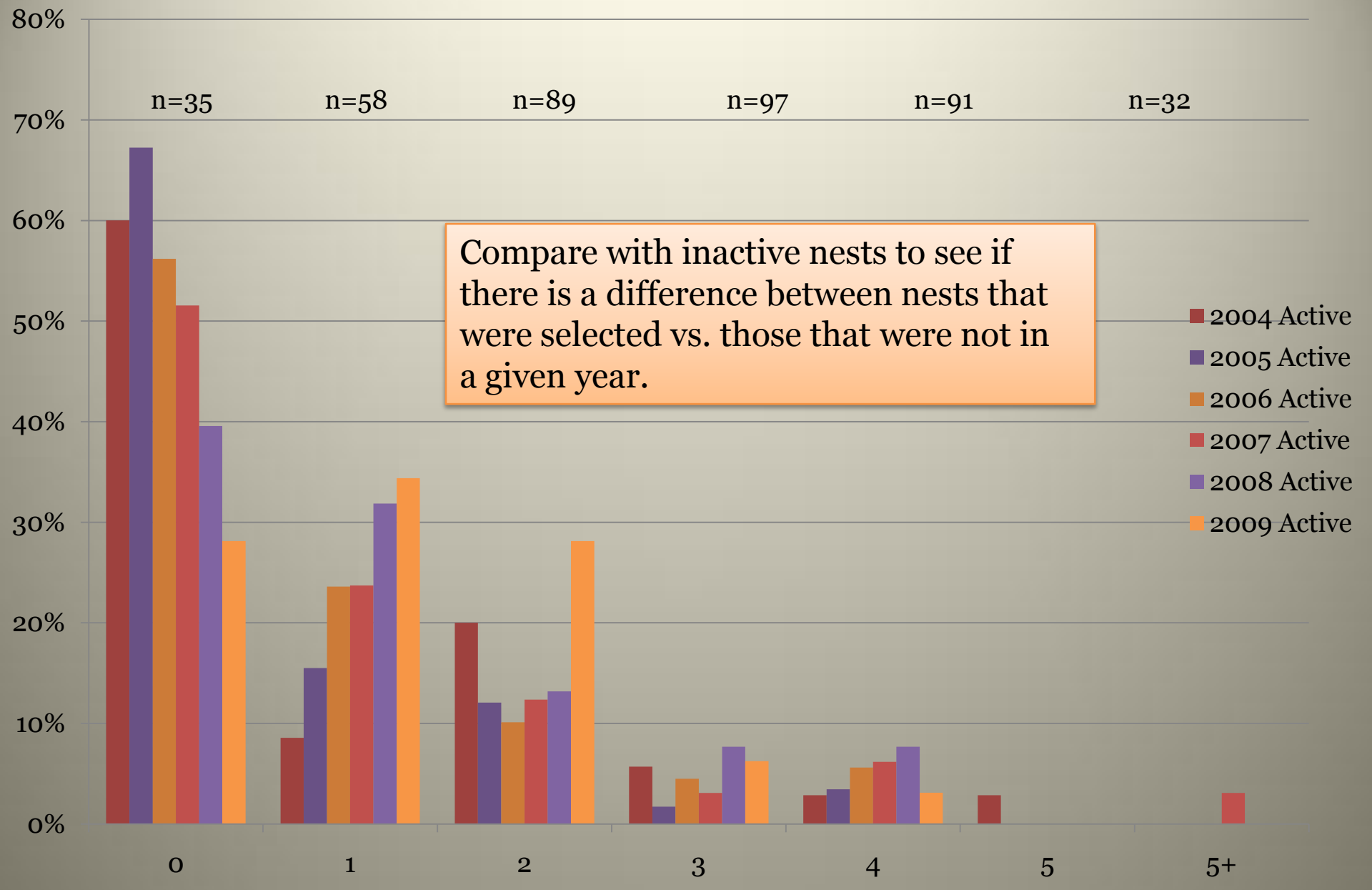
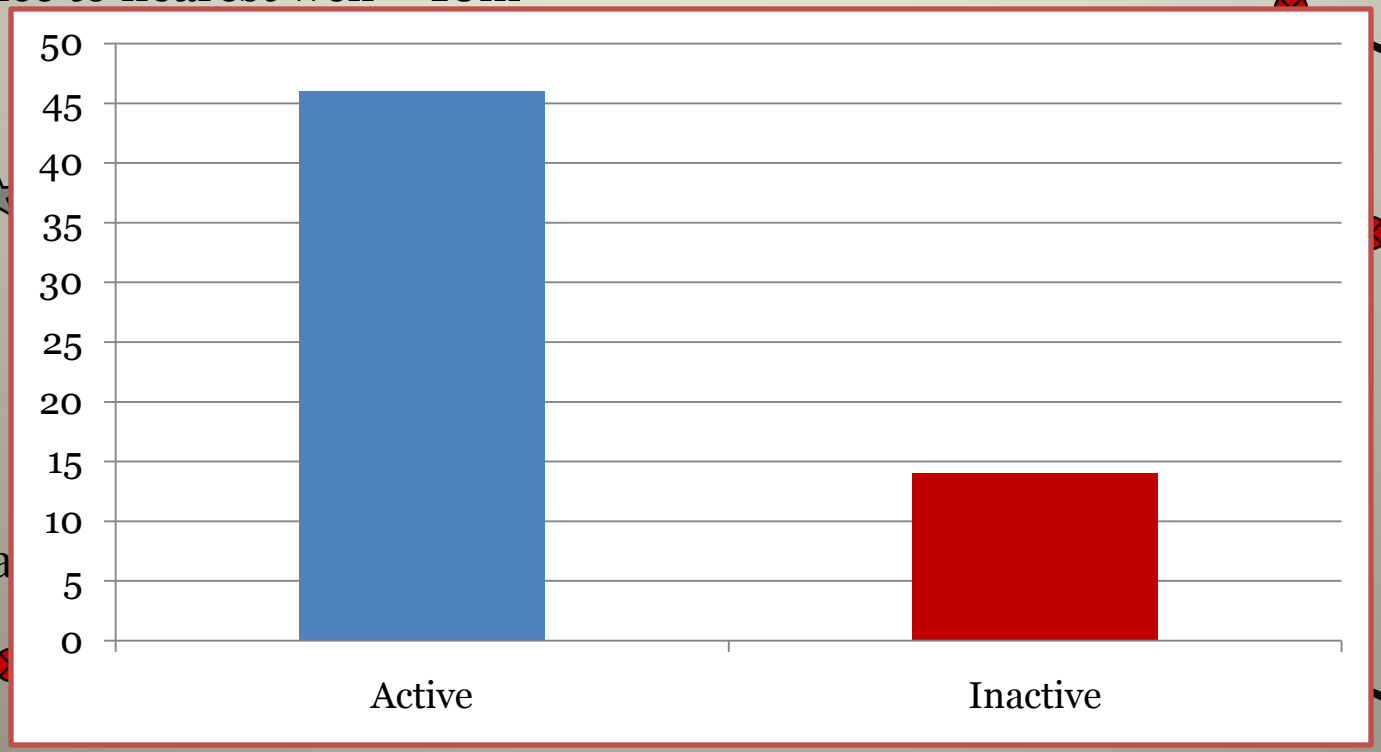


Compare with inactive nests to see if there is a difference between nests that were selected vs. those that were not in a given year.

Does distance to the nearest well influence nest site selection?

Average distance to nearest well
Active: 46m
Inactive: 14m

Distance to nearest well = 16m



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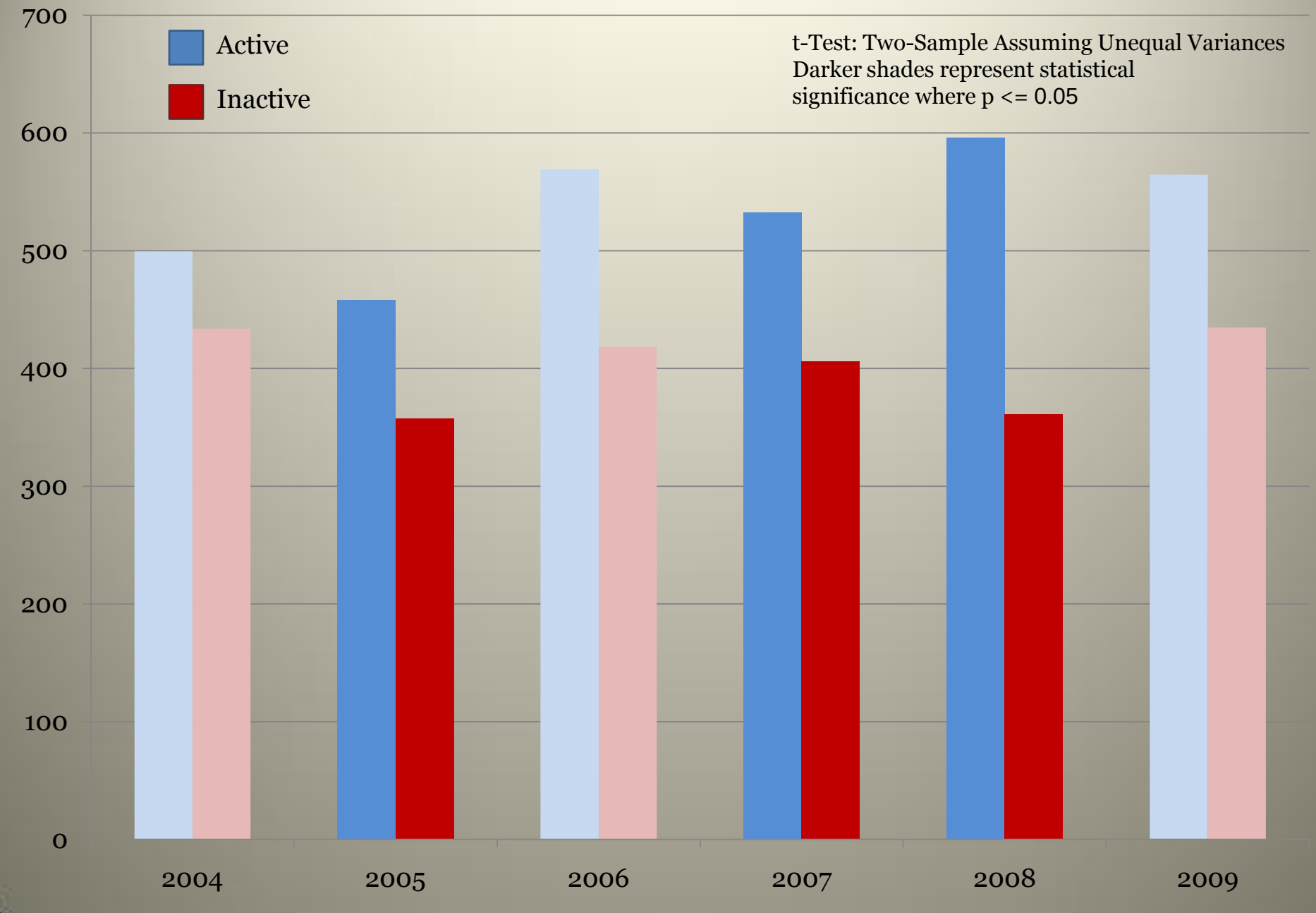
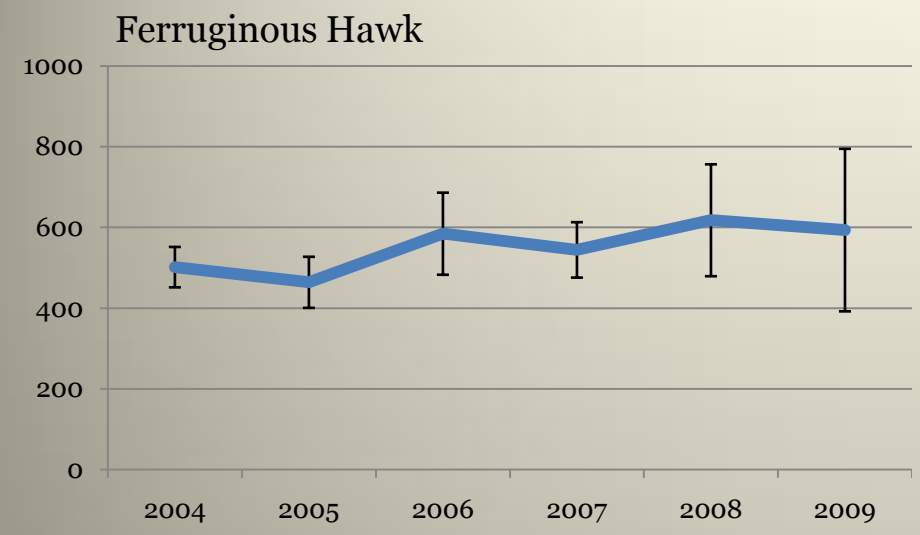
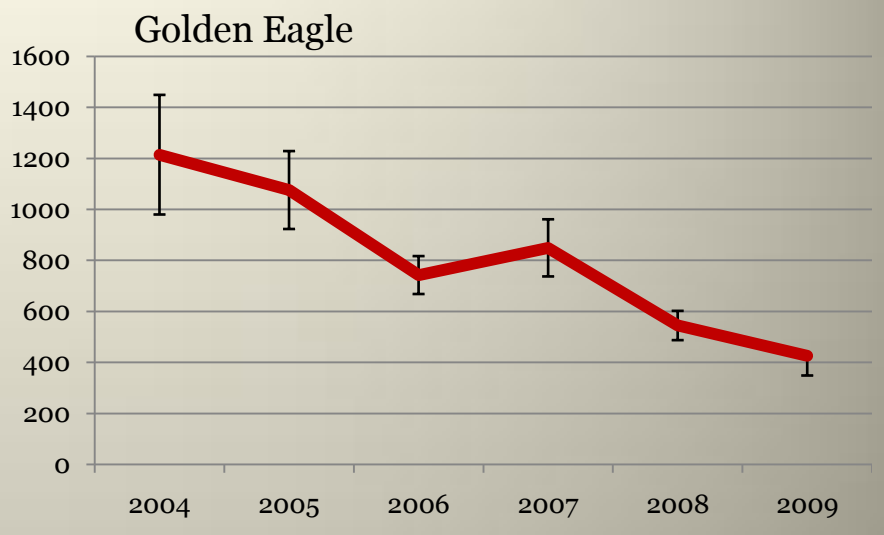
Distance to nearest well = 50m

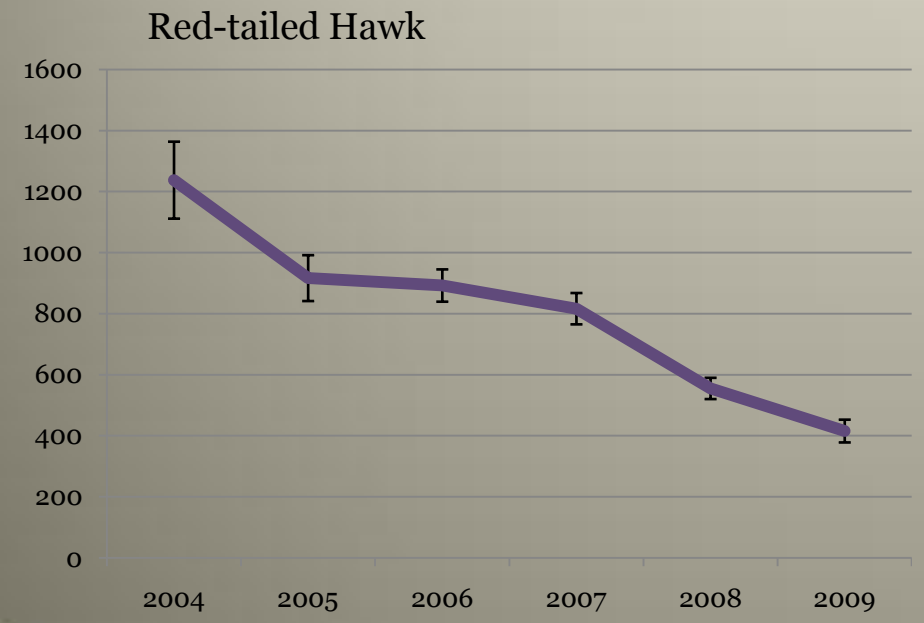
Annual average distance (m) of active and inactive ferruginous hawk nests to the nearest well

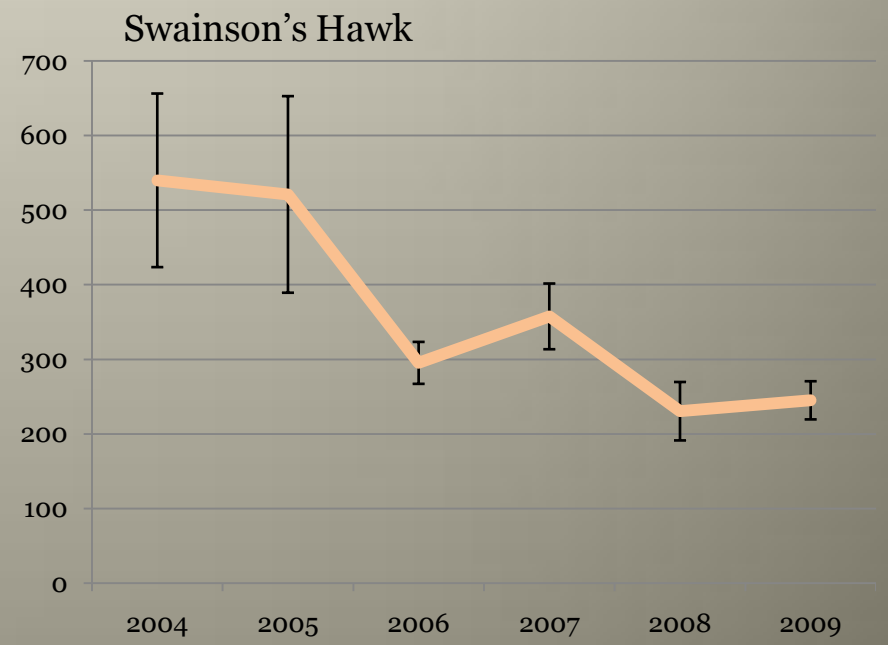


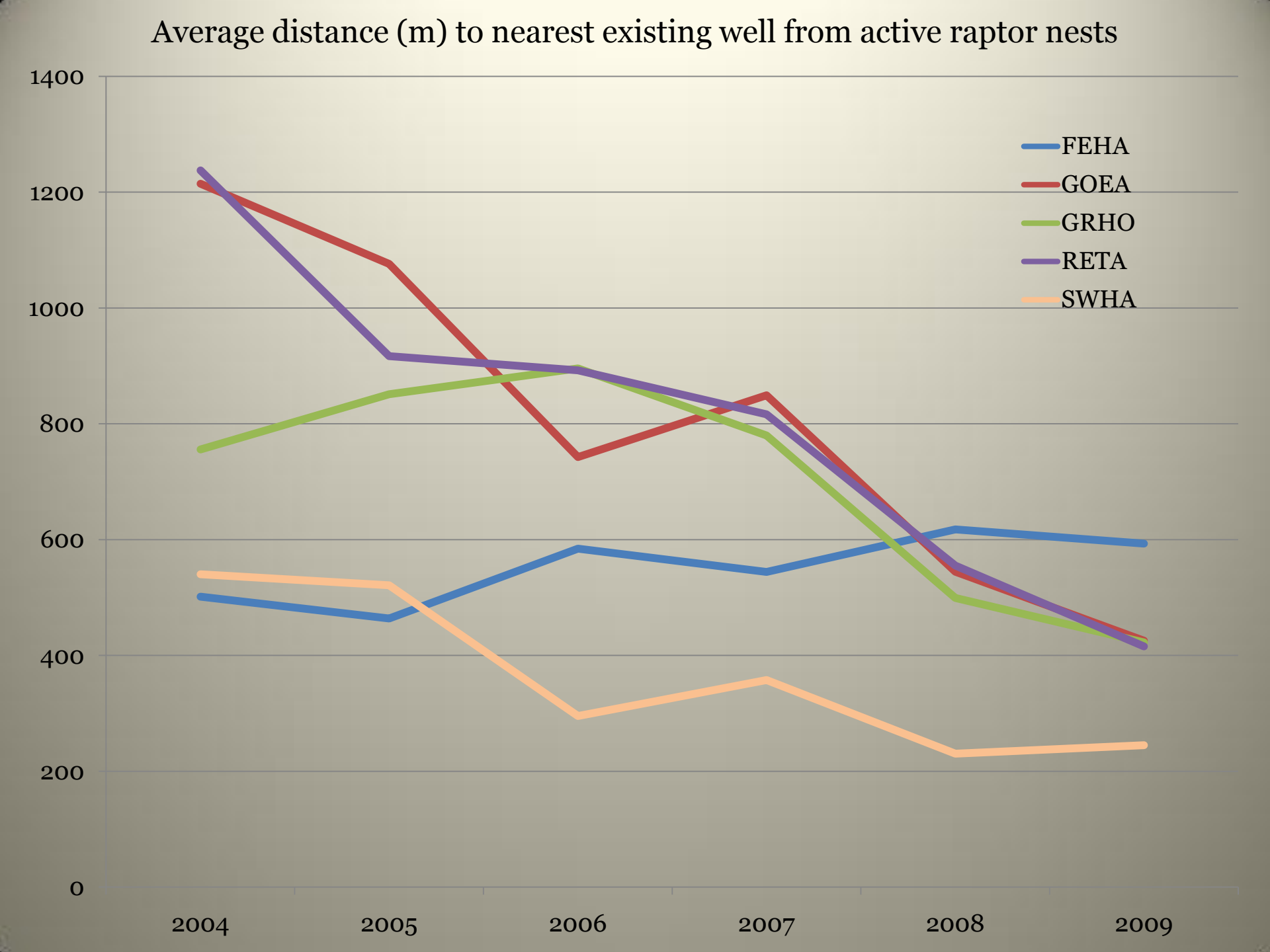
Average distance (m) to the nearest well from active nests of four raptor species



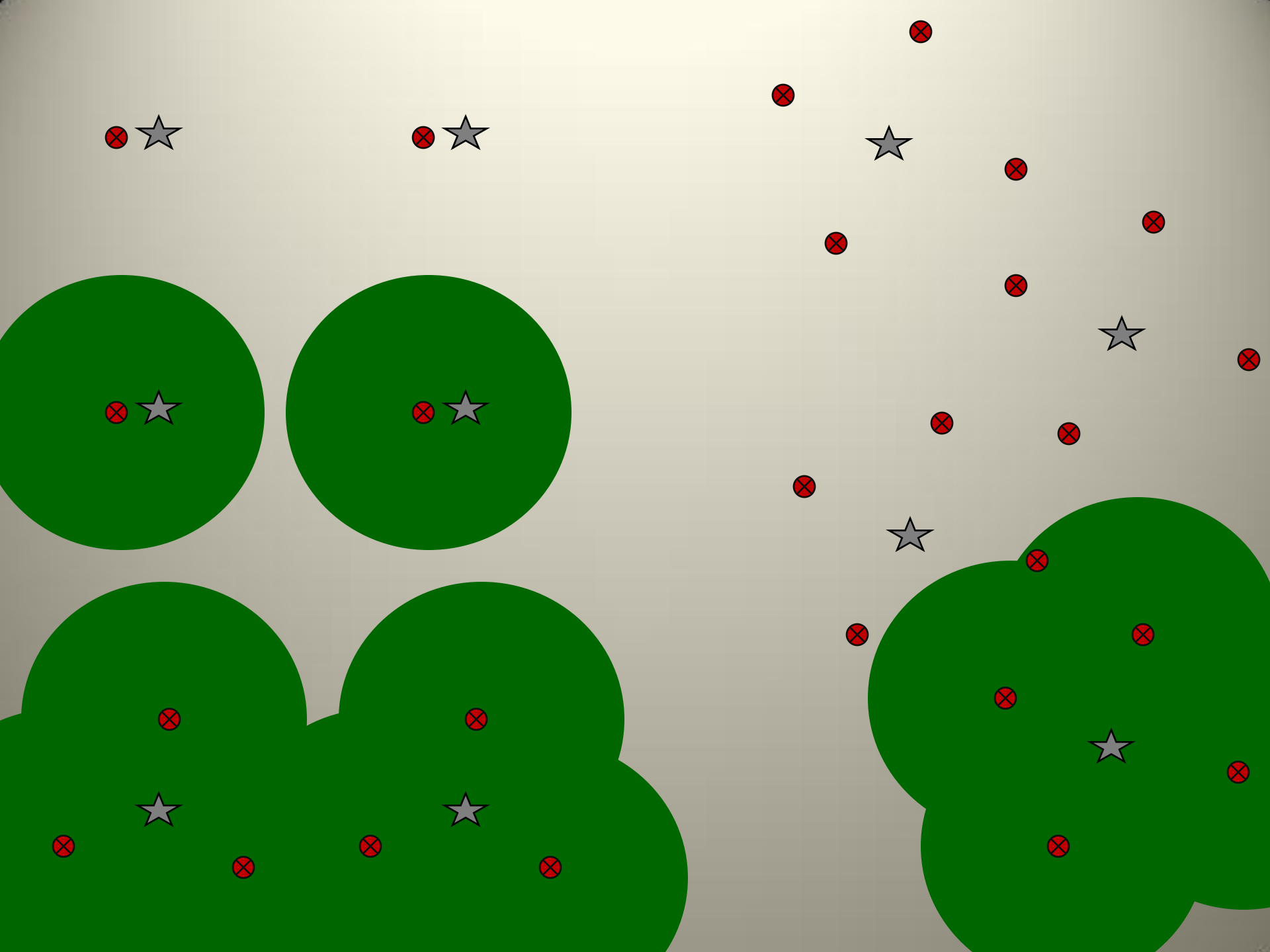




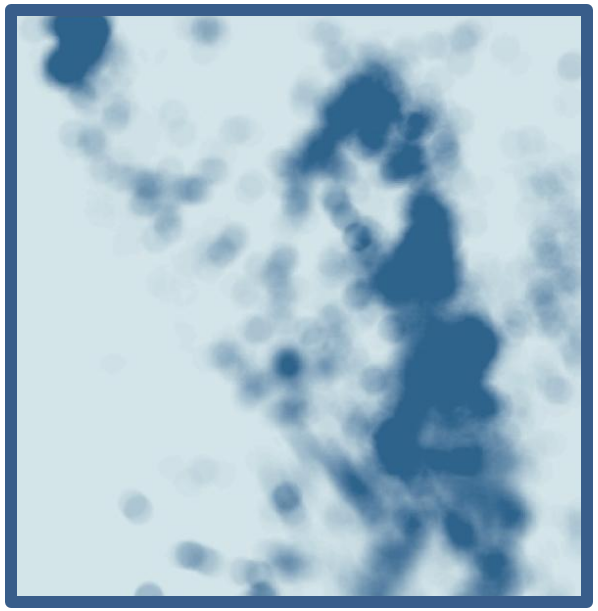



Average distance (m) to nearest existing well from active raptor nests
1400
1200
1000
800
600
400
200
0
2004
2005
2006
2007
2008
2009
FEHA
GOEA
GRHO
RETA
SWHA

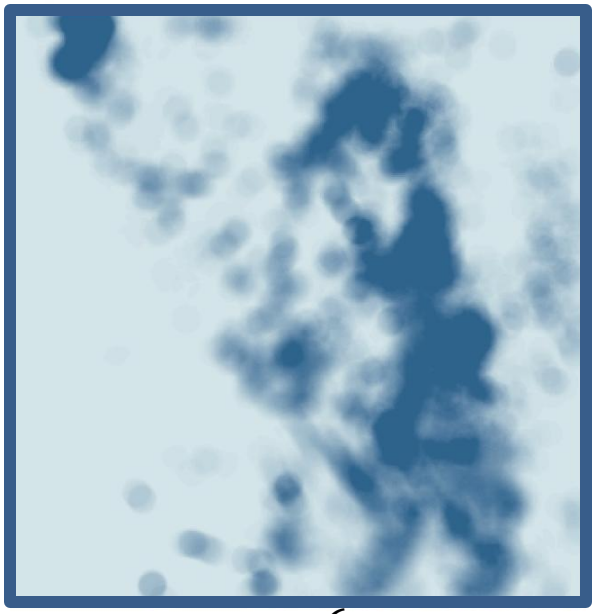
Does the amount of change in CBNG development in a given year influence nest site selection?



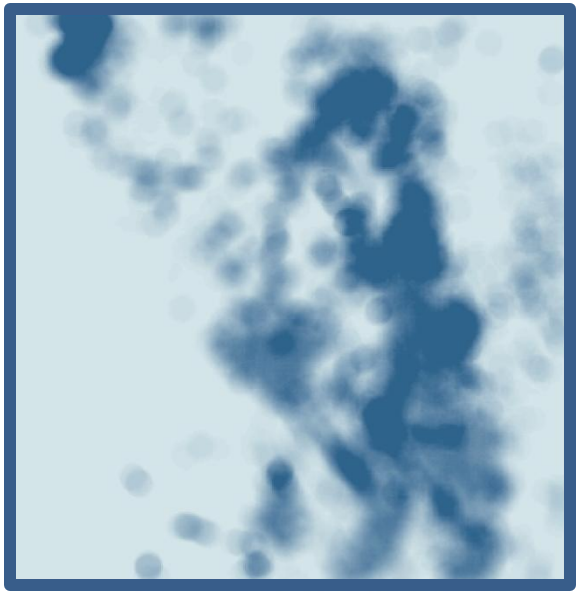
2004



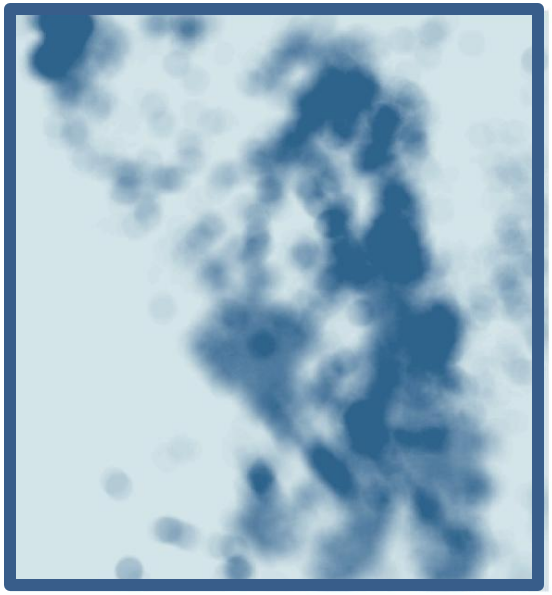
2005



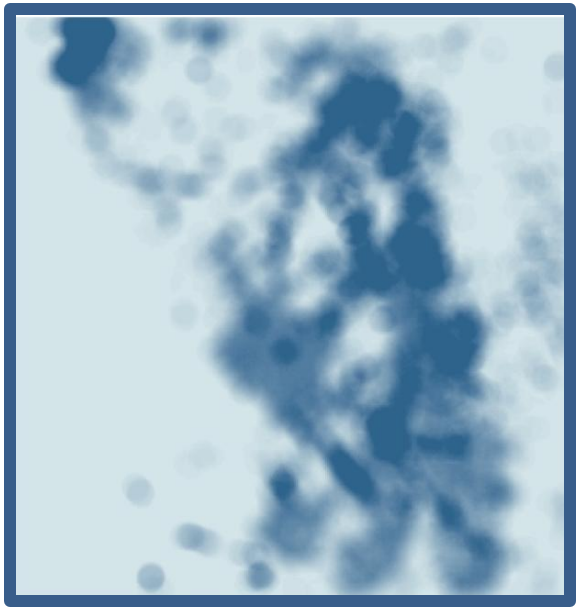
2006



2007



2008



2009

Measure of change from previous year

Further Analyses

- Incorporate productivity
- Seek a dataset to be used as a control for undeveloped areas - TBNG? MCFO?
- Subsample consistently reported nests
- Evaluate impacts from prey availability, proximity to water source, proximity to powerlines, others

Potential Management Implications

- Develop species-specific no-development buffers
- Develop species-specific minimum distances between nests and development
- Develop acceptable rates of change within specified buffers