Population Dynamics of Southwestern Willow Flycatchers on the LCR and Tributaries

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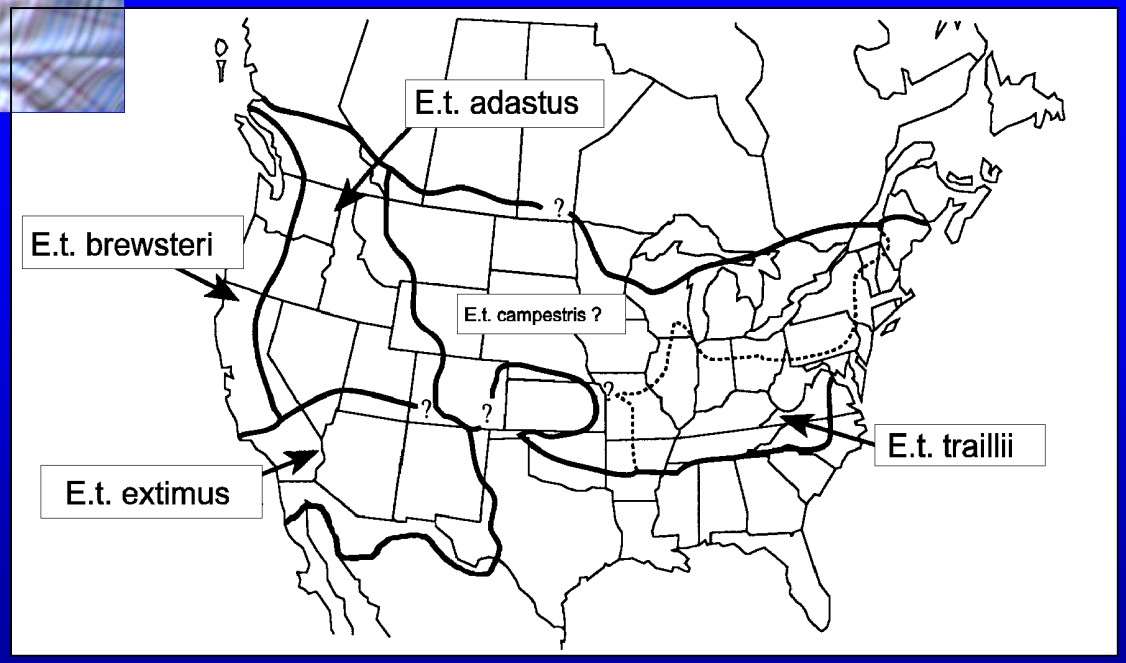
Lower Colorado River
Multi-Species Conservation Program

Empidonax traillii extimus

- One of 4 subspecies; breeding range AZ, NM, adjacent portions of neighboring states
- Neotropical migrant; winters in Central America



Adapted from Unitt (1987), Browning (1993), and Sogge et al. (1997)

Empidonax traillii extimus

- Breeds in dense, wet riparian habitats, both native and tamarisk
- Builds open-cup nests
- Listed as endangered in 1995

Along Virgin River at Mesquite

Beaver Dam Wash at Littlefield

Study Components

Territory/nest monitoring

- nest success rates
- causes of failure

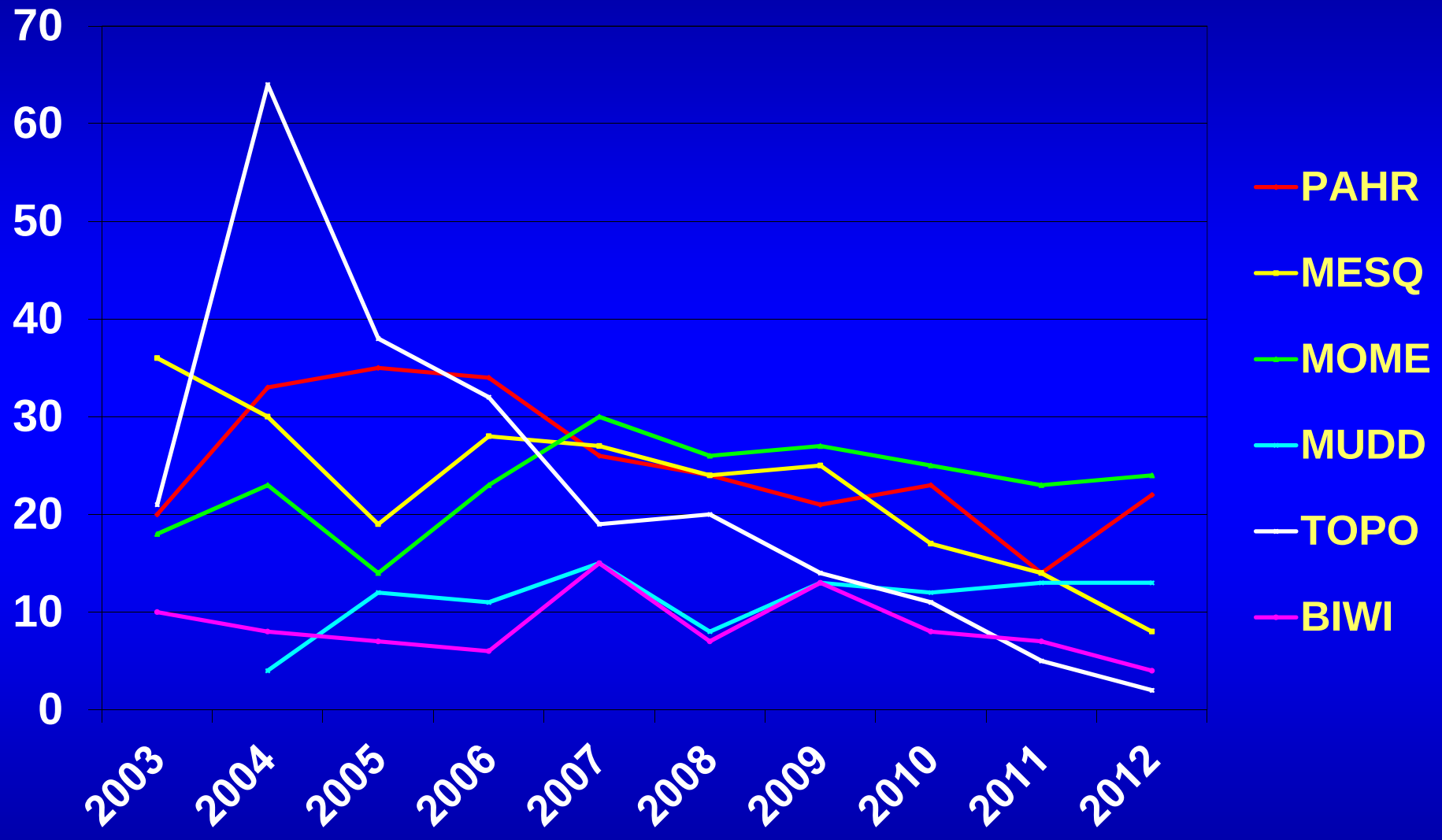
Banding/resighting

- survival
- site fidelity
- dispersal

Microclimate/vegetation

- characteristics at flycatcher nests
- habitat preferences

Resident Adult Flycatchers



No resident willow flycatchers recorded south of Bill Williams

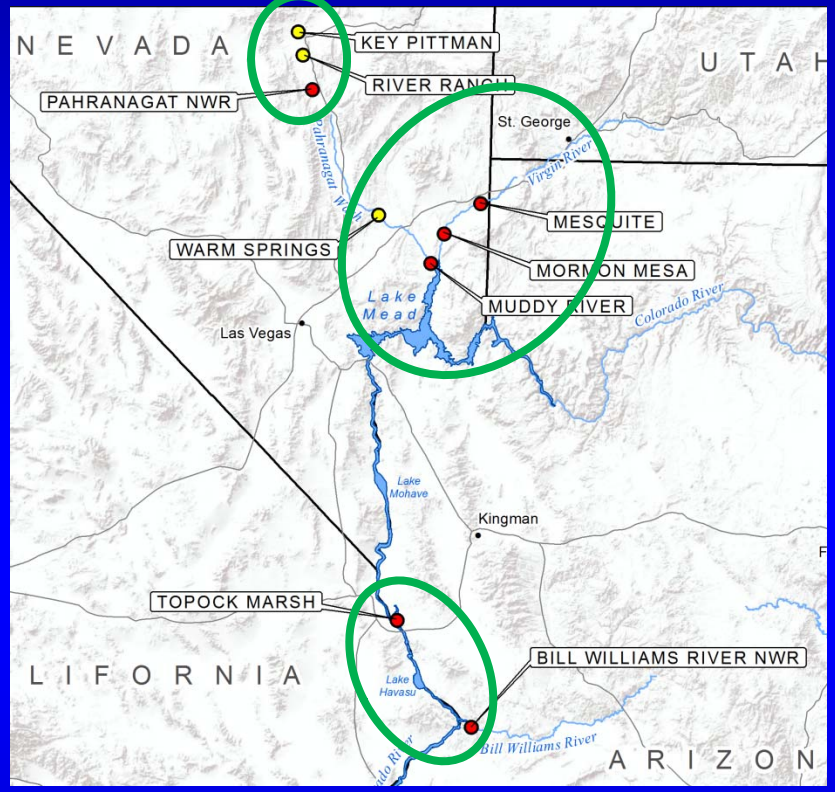
Adult Between-Year Returns 1997–2012

Study Area of Subsequent Detection	Study Area Detected											
	KEPI	RIRA	PAHR	STGE	LIFI	MESQ	MOME	MUDD	WMSP	GRCA	TOPO	BIWI
ASME			1									
KEPI	**50**	3	4				1					
RIRA								1				
PAHR	2	1	**163**		1	1						
STGE				**13**			1					
LIFI					**2**							
MESQ			1		1	**101**	7					
MOME						10	**101**	6		4	1	
MUDD						4	1	**19**	1		1	
WMSP									**4**		1	
GRCA										**2**		
TOPO										1	**60**	
BIWI							1	1				**16**

- 90% of returns to the same study area
- Half of all movements were 50 m or less
- < 20% of movements more than 1 km
- 98% of all returns were to the same drainage

Juvenile Dispersal 1997–2012

Study Area Detected	Study Area Banded								
	KEPI	PAHR	STGE	MESQ	MOME	MUDD	TOPO	BIWI	ROOS
KEPI	13	16			1	1			
RIRA	4	2							
PAHR	6	24		2	1				
STGE		1	2	1					
LIFI		1		3					
MESQ		1		21	14	1			
MOME	1	3	1	8	15	2	3		
MUDD			1	5	6	2			1
GRCA					1				1
TOPO					3		17	4	1
BIWI				1			1	1	
ISAB				1					

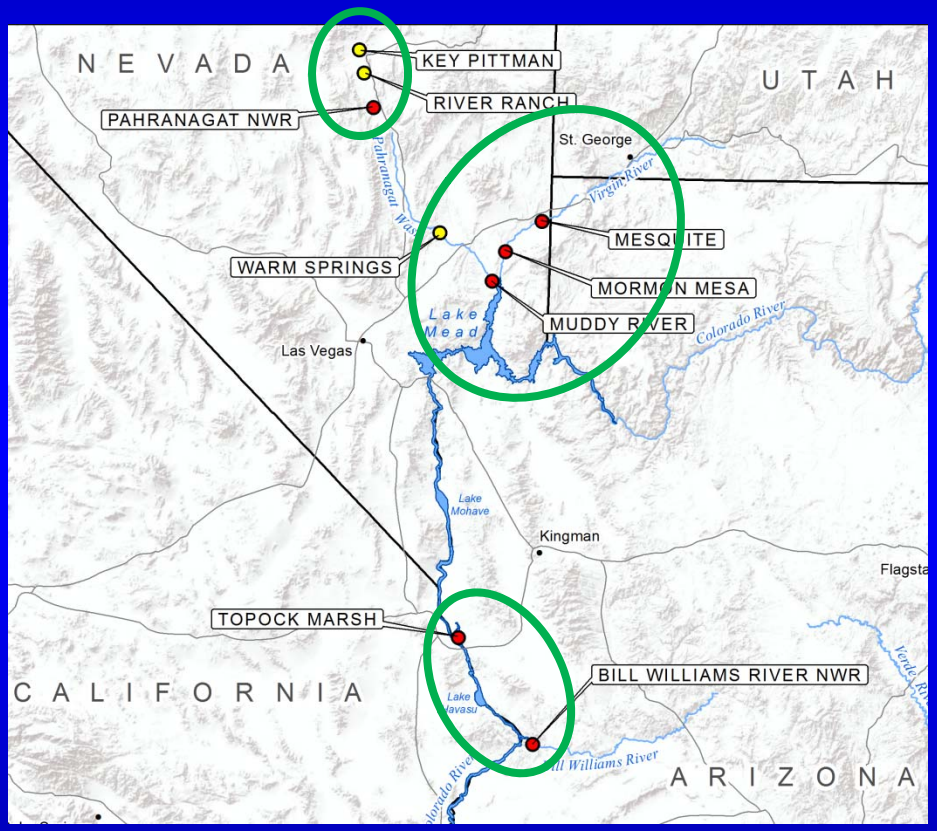


- 49% of juveniles returned to the same study area
- Half dispersed > 13.5 km
- > 70% of juveniles dispersed more than 1 km
- 10% dispersed to a different drainage

Survival and Detection Analyses

Based on observed movements, data grouped into 3 geographic regions:

- Pahranagat
- Virgin Valley
- Havasu



Survival and Detection Analyses

Survival

- Hypothesized differences by:
  - Age group (juvenile vs adult)
  - Year
  - Geographic region
- Varied by age, but not year

Pahranagat		**Virgin Valley**		**Havasu**	
Adult	Juvenile	Adult	Juvenile	Adult	Juvenile
61 (47–74)	30 (20–42)	61 (55–66)	32 (25–40)	45 (36–54)	24 (14–38)

Survival and Detection Analyses

Detection

- Hypothesized differences between Age groups (SY's, TY's, and all other Adults) and Contracts

	Adults		Juveniles		
Contract	Plastic Bands	Metal Bands	Full Combo	Plastic Bands	Metal Bands
1997–2002	X		X	X	
2003–2007		X			
2008–2012		X	X		X

Survival and Detection Analyses

Adult Detection Probability

Contract	Pahranagat	Virgin Valley	Havasu
1997–2002	65 (46–80)	65 (38–85)	71 (54–84)
2003–2007	86 (78–92)	84 (78–89)	71 (54–83)
2008–2012			

Juvenile (SY) Detection Probability

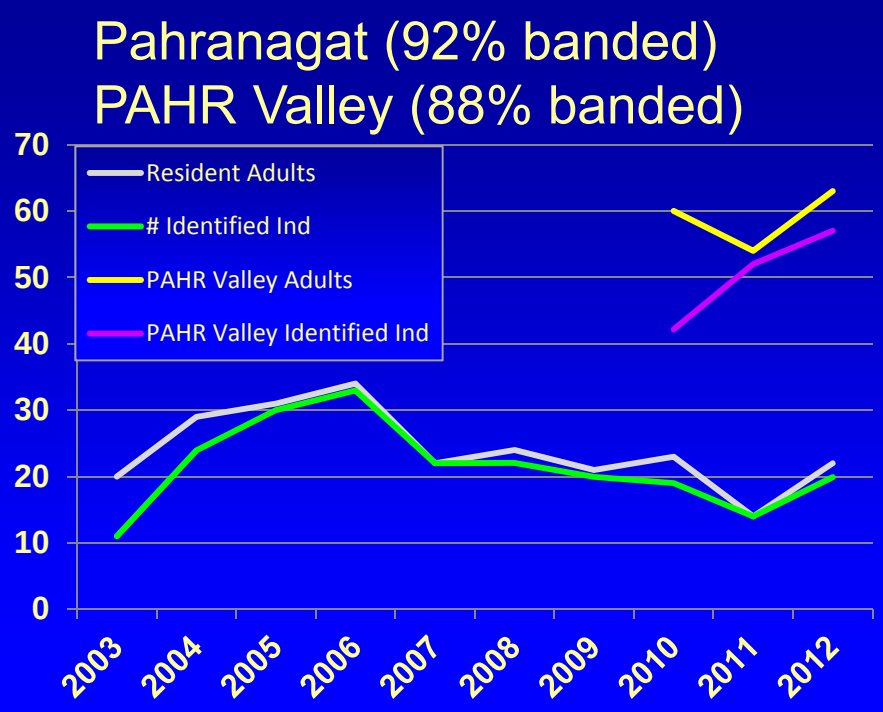
Contract	Pahranagat	Virgin Valley	Havasu
1997–2002	0	44 (28–61)	33 (14–59)
2003–2007	36 (21–53)	51 (34–68)	29 (14–51)
2008–2012	61 (42–77)	48 (32–64)	24 (6–60)

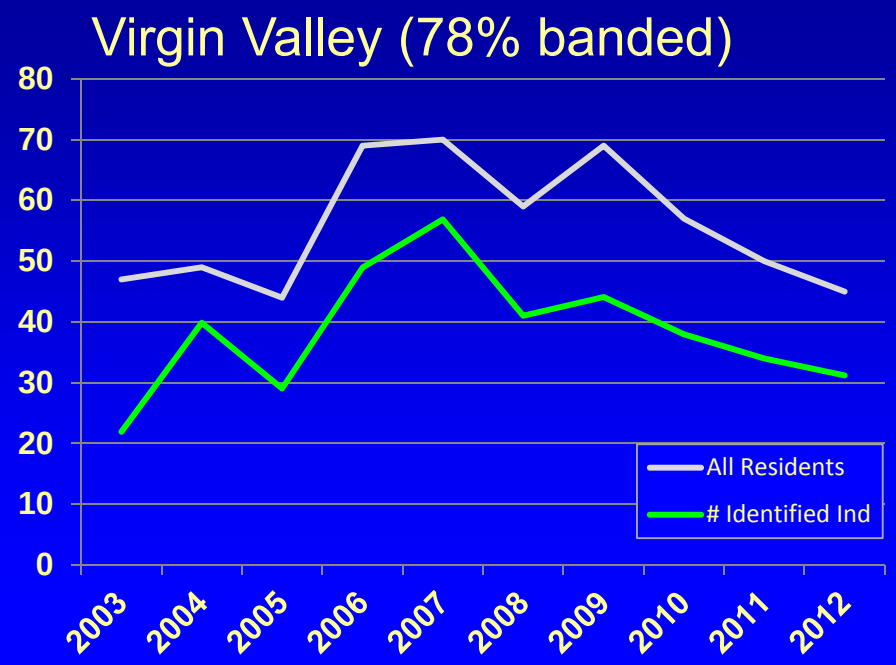
Population Growth Rate (λ)

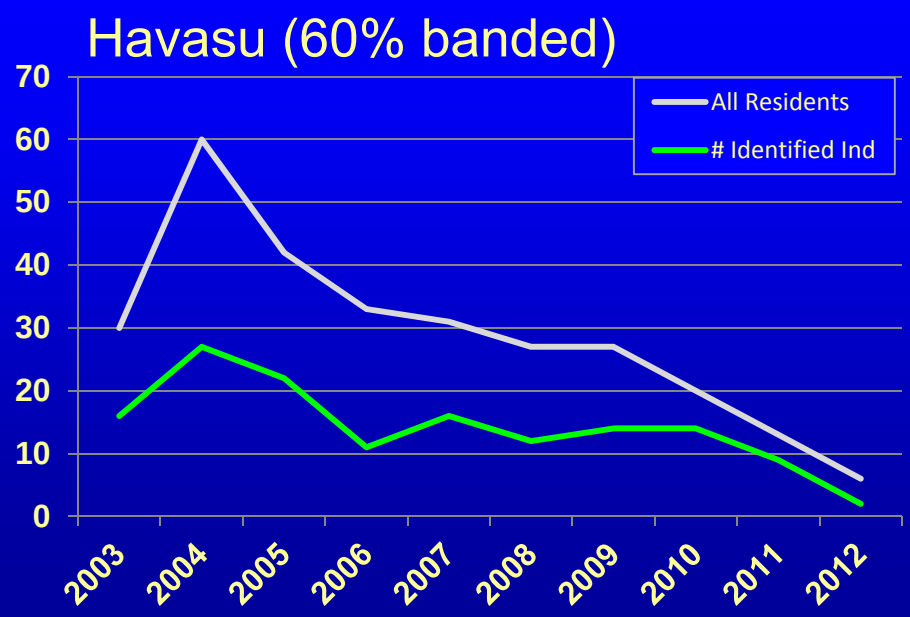
λ = adult survivorship ($S_{(ad)}$) + local recruitment ($f_{(local)}$)+ immigration ($f_{(imm)}$)

$f_{(local)}$ = juvenile survival * (# fledges per female/2)

	λ	$S_{(ad)}$	$f_{(tot)}$	$S_{(juv)}$ x	# fledges/2 =	$f_{(local)}$	$f_{(imm)}$
Pahranagat	1.11	0.61	0.49	0.30	1.09	0.33	0.17
Virgin Valley	1.12	0.61	0.51	0.32	0.46	0.15	0.36
Havasu	1.05	0.45	0.62	0.24	0.50	0.12	0.49

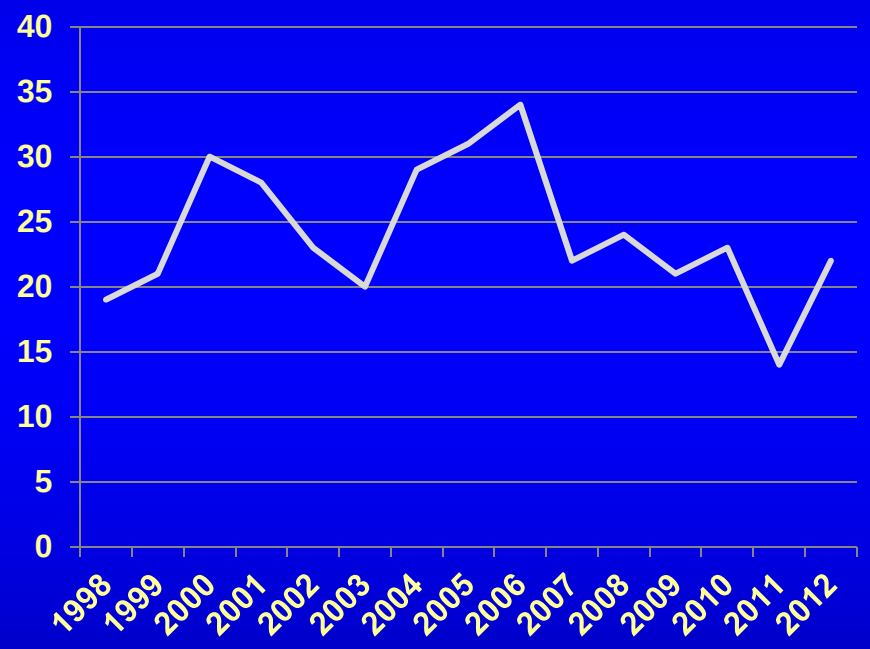

Pahranagat (92% banded)
PAHR Valley (88% banded)
Resident Adults
Identified Ind
PAHR Valley Adults
PAHR Valley Identified Ind
70
60
50
40
30
20
10
0
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012


Virgin Valley (78% banded)
All Residents
Identified Ind
80
70
60
50
40
30
20
10
0
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012

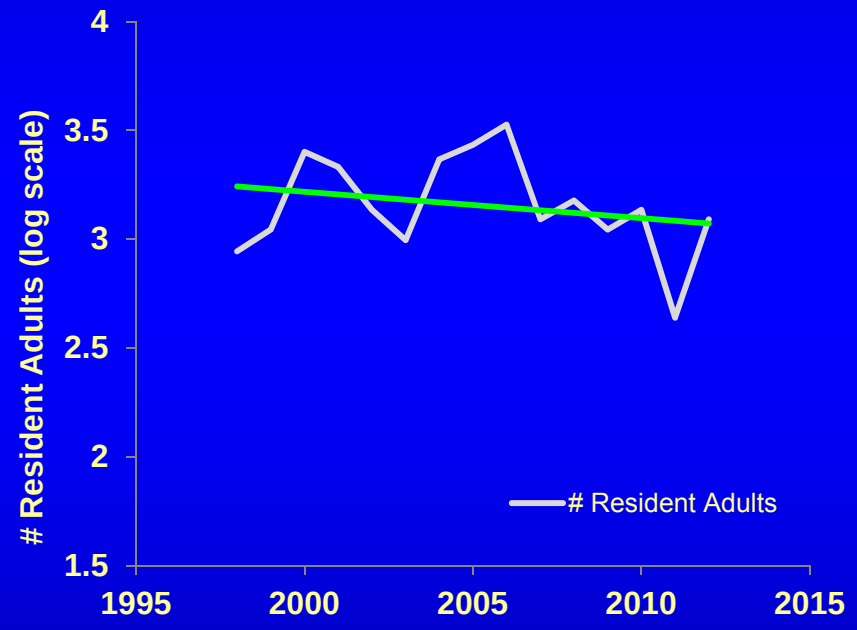

Havasu (60% banded)
All Residents
Identified Ind
70
60
50
40
30
20
10
0
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012

Pahranagat
Resident Adults 1998–2012

Average Annual
Rate of Change = -0.8%

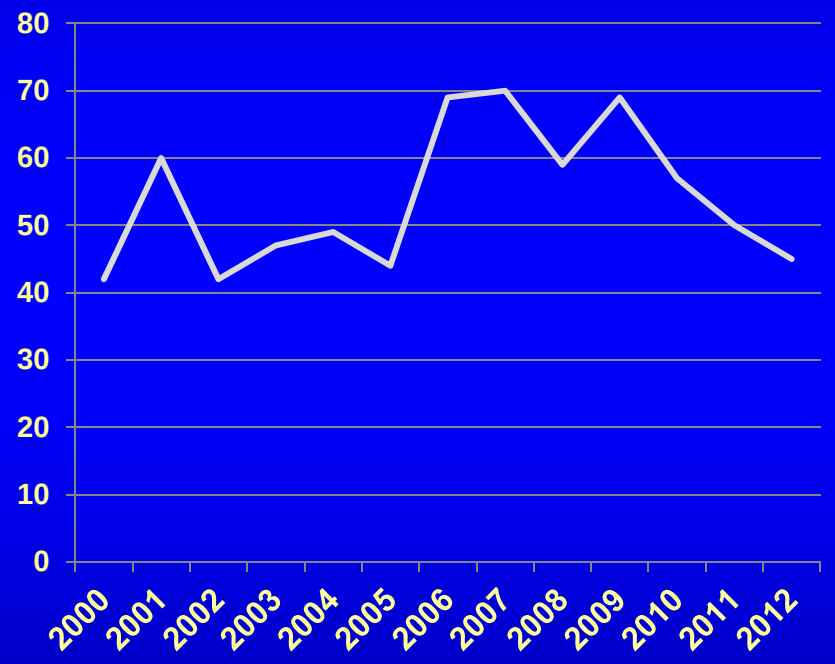


Slope = -0.012
r^2 = 0.057, df = 1, *P* = 0.390

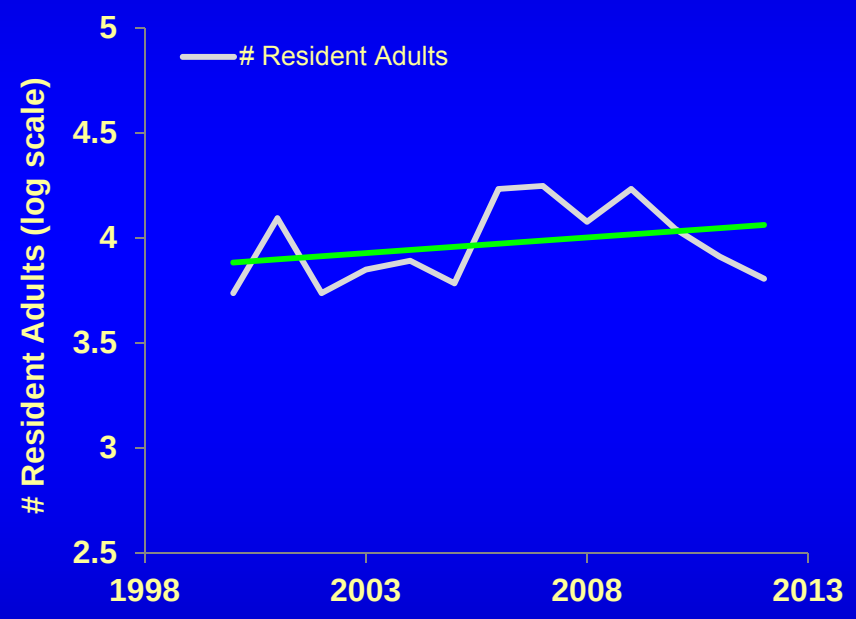


Virgin Valley
Resident Adults 2000–2012

Average Annual
Rate of Change = 0.9%

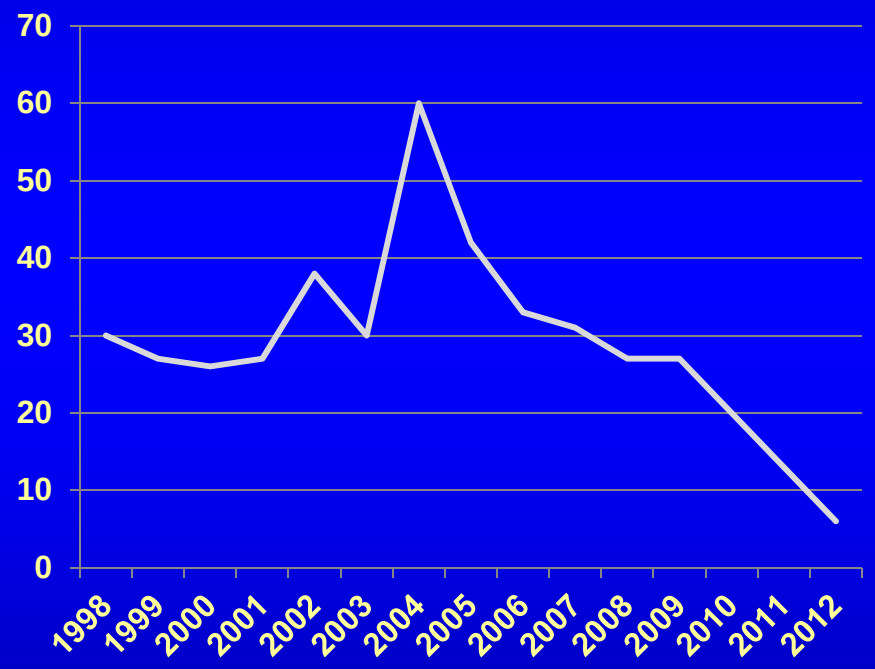


Slope = 0.015
r^2 = 0.009, df = 1, *P* = 0.316

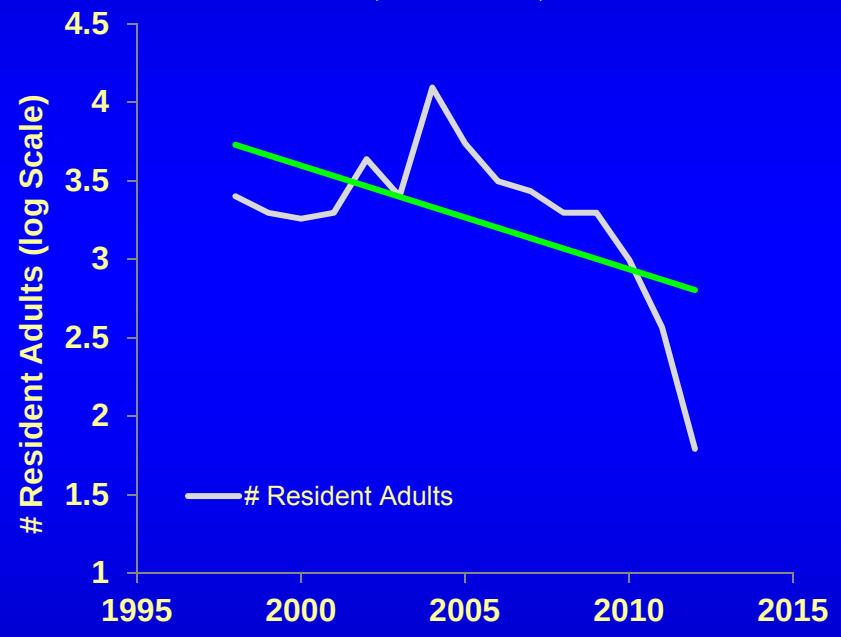


Havasu
Resident Adults 1998–2012

Average Annual
Rate of Change = -4.5%



Slope = -0.066
r^2 = 0.261, df = 1, *P* = 0.030*



Future of Flycatcher Populations on the LCR & Tributaries

Pahranagat Valley

- Stable, essentially self-sustaining
- Slight negative trend at Pahranagat of 1–2% per year; may reflect new lower population size

Virgin Valley

- Stable, but reliant on immigration due to low juvenile recruitment
- Slight positive trend of 1–2% per year; trend may change if population does not increase again

Future of Flycatcher Populations on the LCR & Tributaries

Havasu

- Population declining; largely reliant on immigration
- Experiencing a negative trend of 4–6% per year

Microclimate and Vegetation Results

Nest sites differ even from non-nest locations within territory (i.e., within 10 m of the nest)

Microclimate
- cooler
- more humid
- more thermally moderate

Vegetation
- denser canopy

Even on a very local scale, flycatchers are picky!

Microclimate and Vegetation Results

On a larger scale, use vs. non-use differences are small:

6–20% canopy closure

3–6°C max T

Tamarisk leaf beetles *Diorhabda* spp.

1987	Brought from Eurasia
1989-1998	Lab tests
1998-2000	Cage tests
2001	Open releases

Effect on tamarisk:

Defoliation

Repeated 2-3 times within a season

Repeated over many consecutive years

Reduced flowering

Reduced volume

Some mortality after many years

Microclimate and Vegetation Results

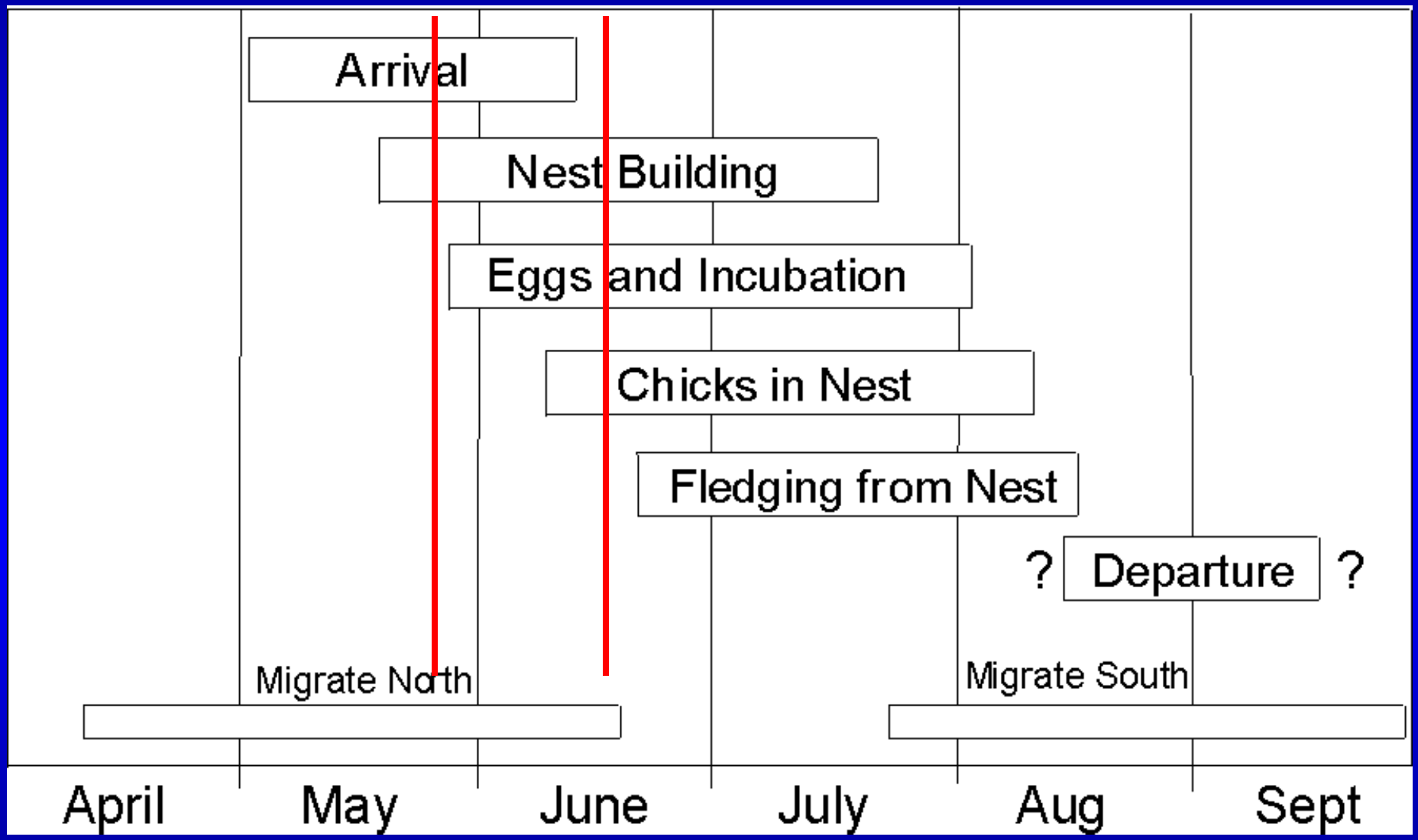
Microclimate
- cooler
- more humid
- more thermally moderate

Vegetation
- denser canopy

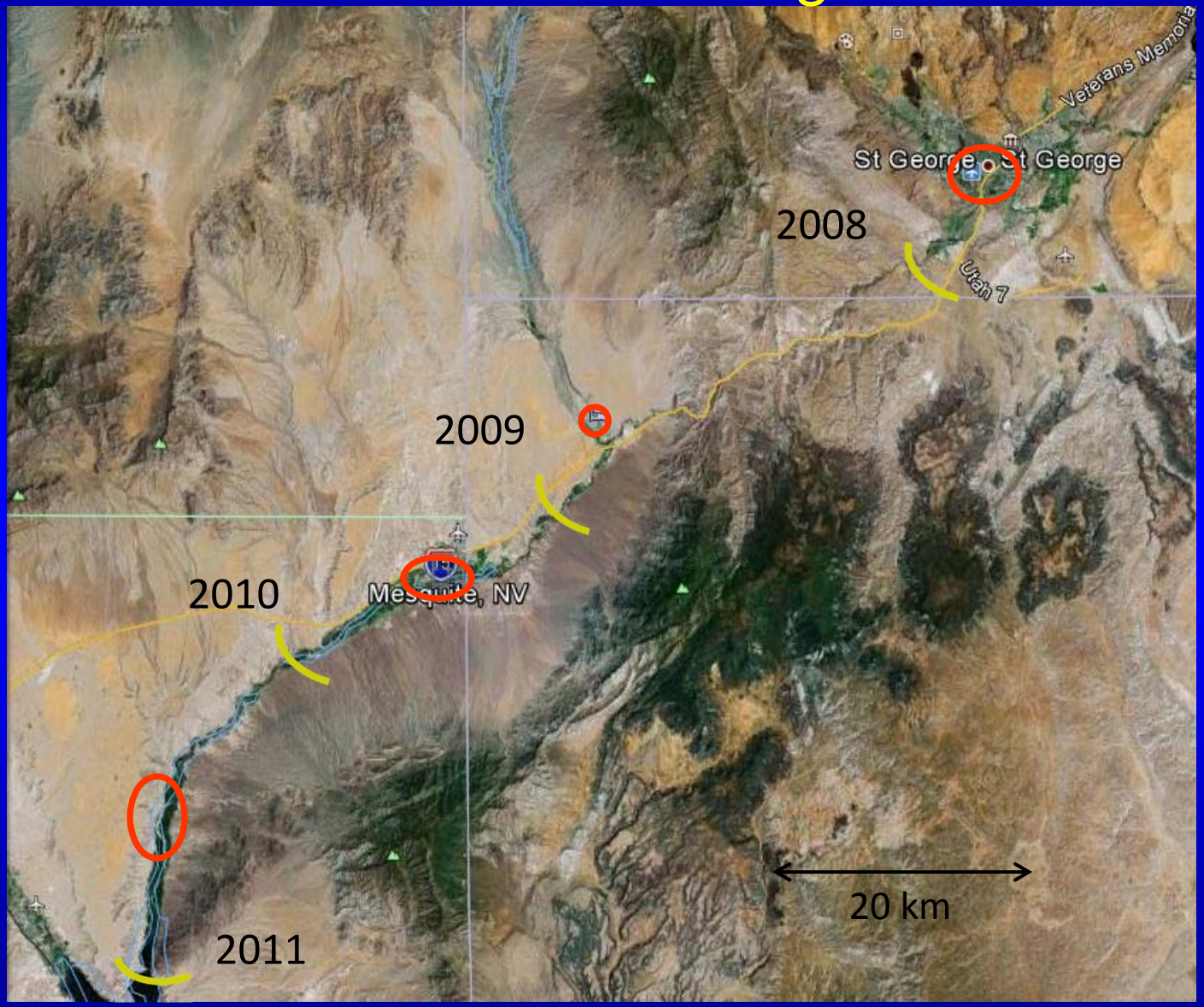
- Defoliation likely to shift conditions away from those preferred by flycatchers

- Vegetation does not have to be monotypic tamarisk for defoliation to have an effect

Nest chronology and timing of defoliation



Flycatcher locations and beetle expansion on the Virgin River



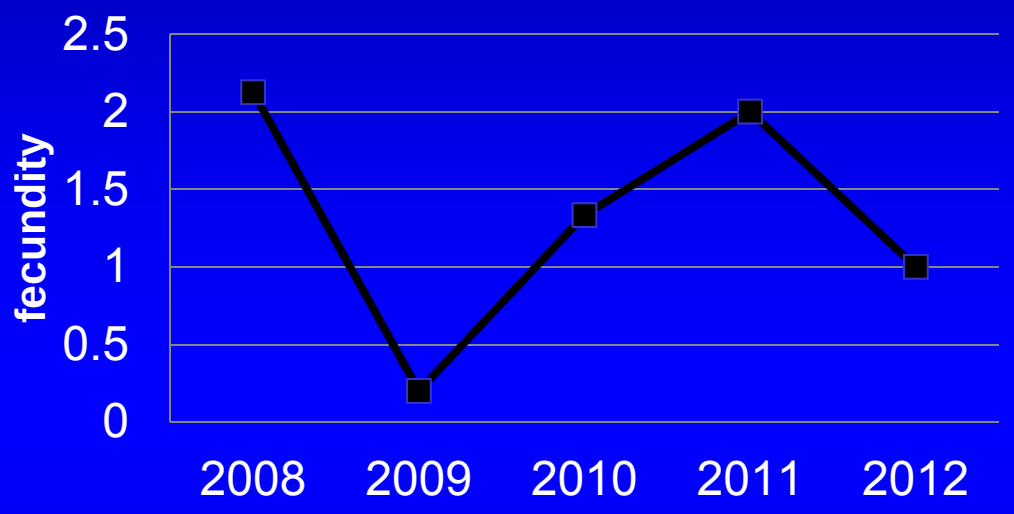
- This is a census, not a subsample!

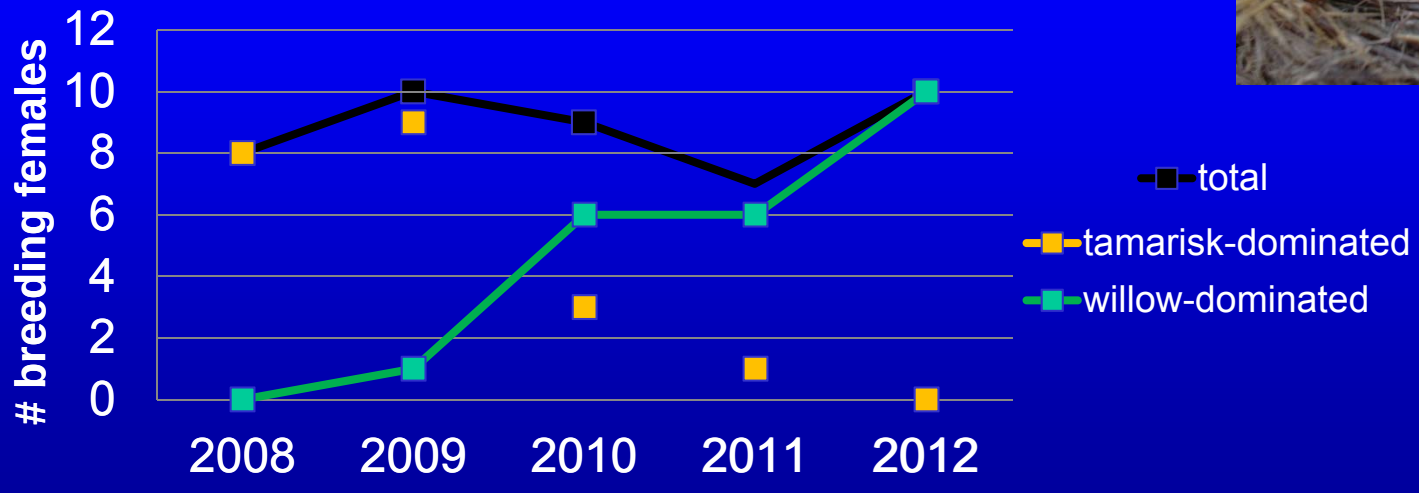
Expected effects of defoliation on flycatchers

- Increased visibility → risk of depredation and brood parasitism
- Unfavorable microclimate
  - Temperatures at unshaded nests may reach highs (41°C = 106°F) sufficient to kill embryos
  - Adults expend energy to moderate T at nest (shading) → attract attention to the nest

Documented flycatcher response to beetles

- St. George, UT (monitoring by UDWR)





Flycatcher site fidelity

Adult flycatchers typically show high site fidelity

- Median distance moved between years is 50 m

Fidelity is affected by

- nest success (Paxton et al. 2007)
- habitat conditions

Flycatchers show *local* plasticity in site selection

- most movements within 30 km
- ~1% of detected movements are to a different drainage

Juveniles more likely to disperse than adults

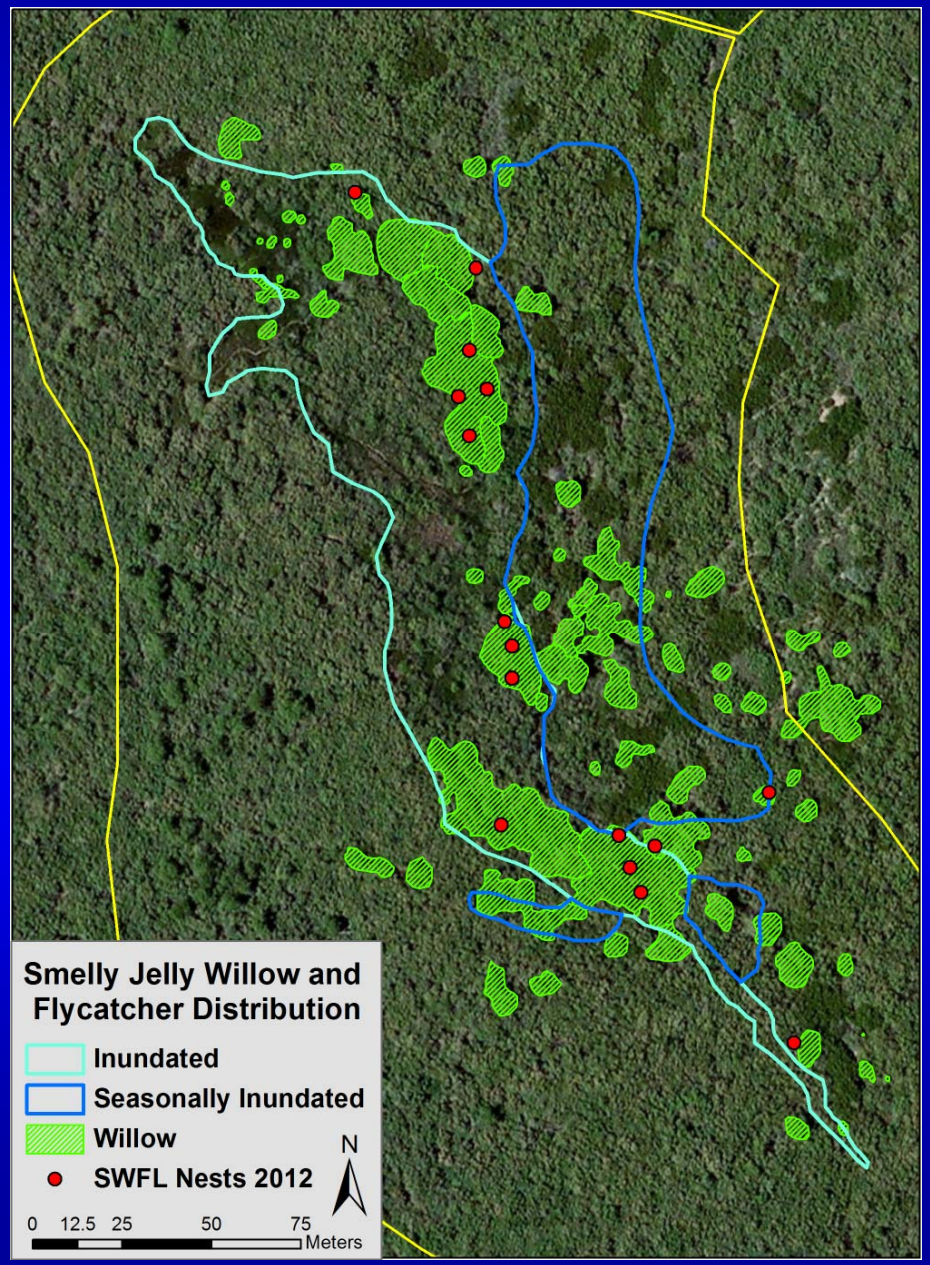
- ~10% of movements are outside the natal drainage

Beetles arrive at Mormon Mesa 2012

Documented flycatcher response to beetles

Mormon Mesa, NV

- mixed willow & tamarisk
- 2012 nests clustered in willow areas



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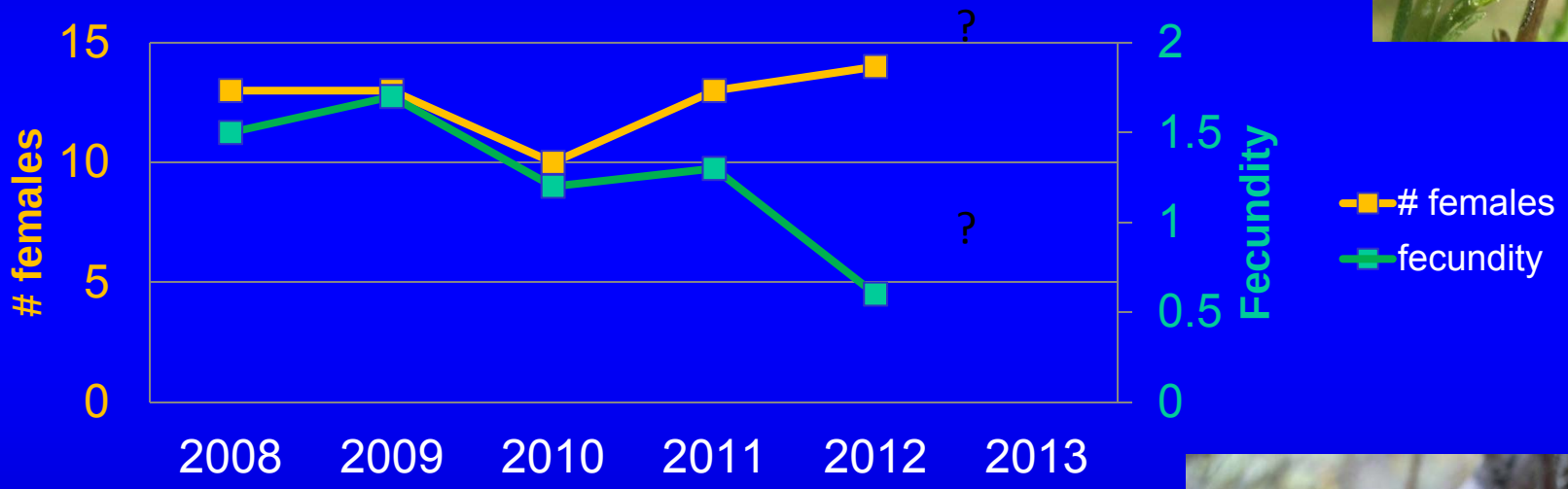


Nest desertion during laying

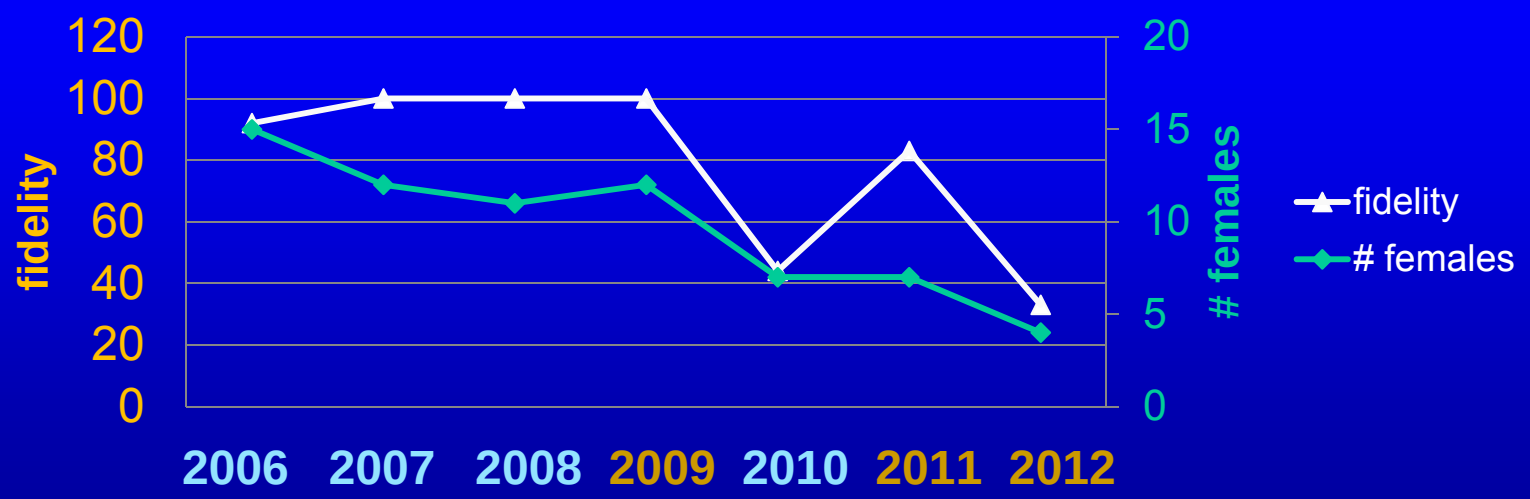
Fewer renests

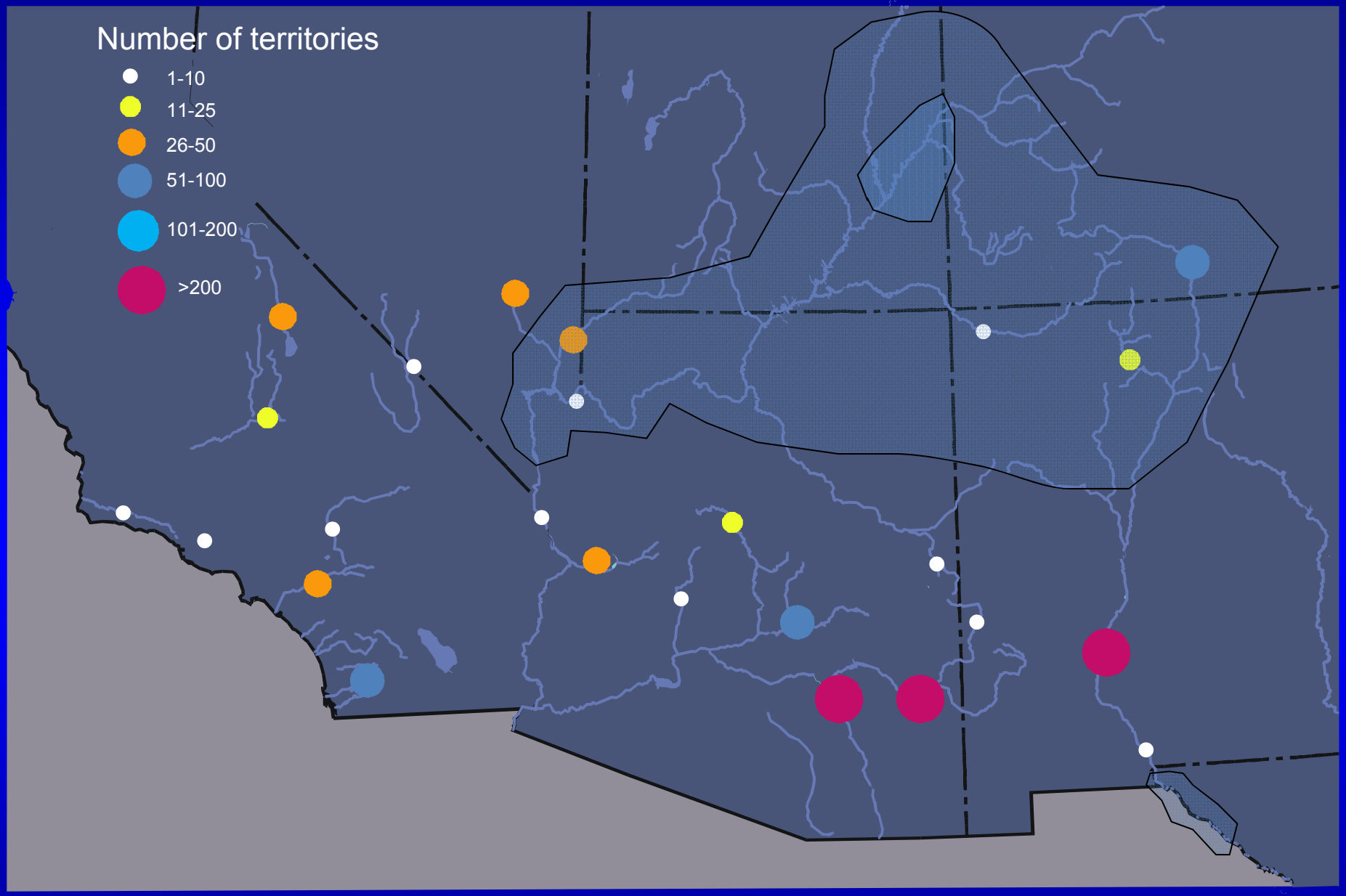
What about Mesquite?

What about Mesquite?

Flycatcher response to lack of water

- Mesquite, NV





SW Willow Flycatcher Distribution

Solutions?

- Important to have native sites locally available
  - protect existing sites, start restoration *ASAP!*

Restoration challenges

- Flycatchers are picky!
  - Dense shrub cover, with or without higher overstory
  - WATER!!!!
    - Surface water under nest or within a few meters

- Cattle
  - Major obstacle to restoration success with native vegetation

Questions?