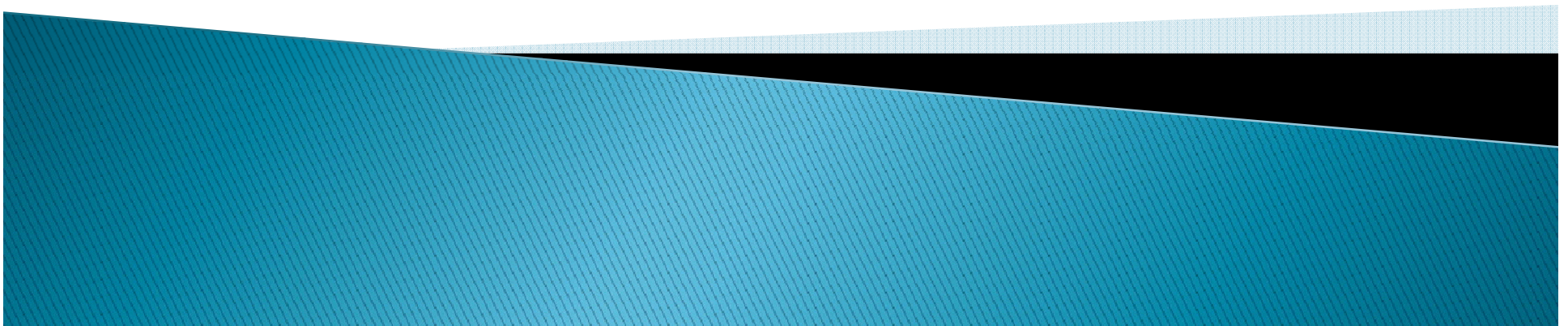


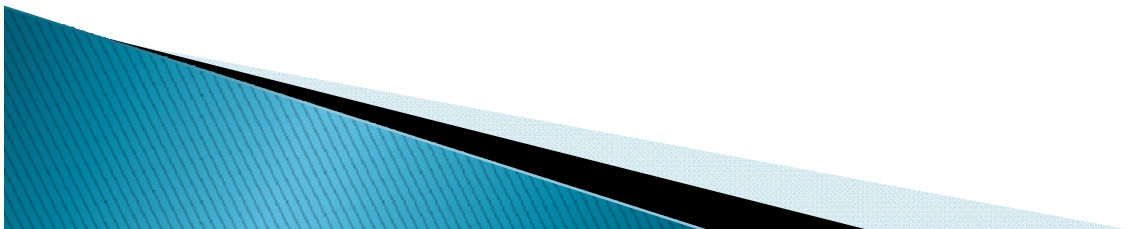
Long-term Inventory and Monitoring on the Bill Williams River National Wildlife Refuge

10 years x 4 seasons x 3 days x 6+3 habitats = 24,917
birds + 1,274 mammals + 987 herps + innumerable
plants and anabat files (approximately).....

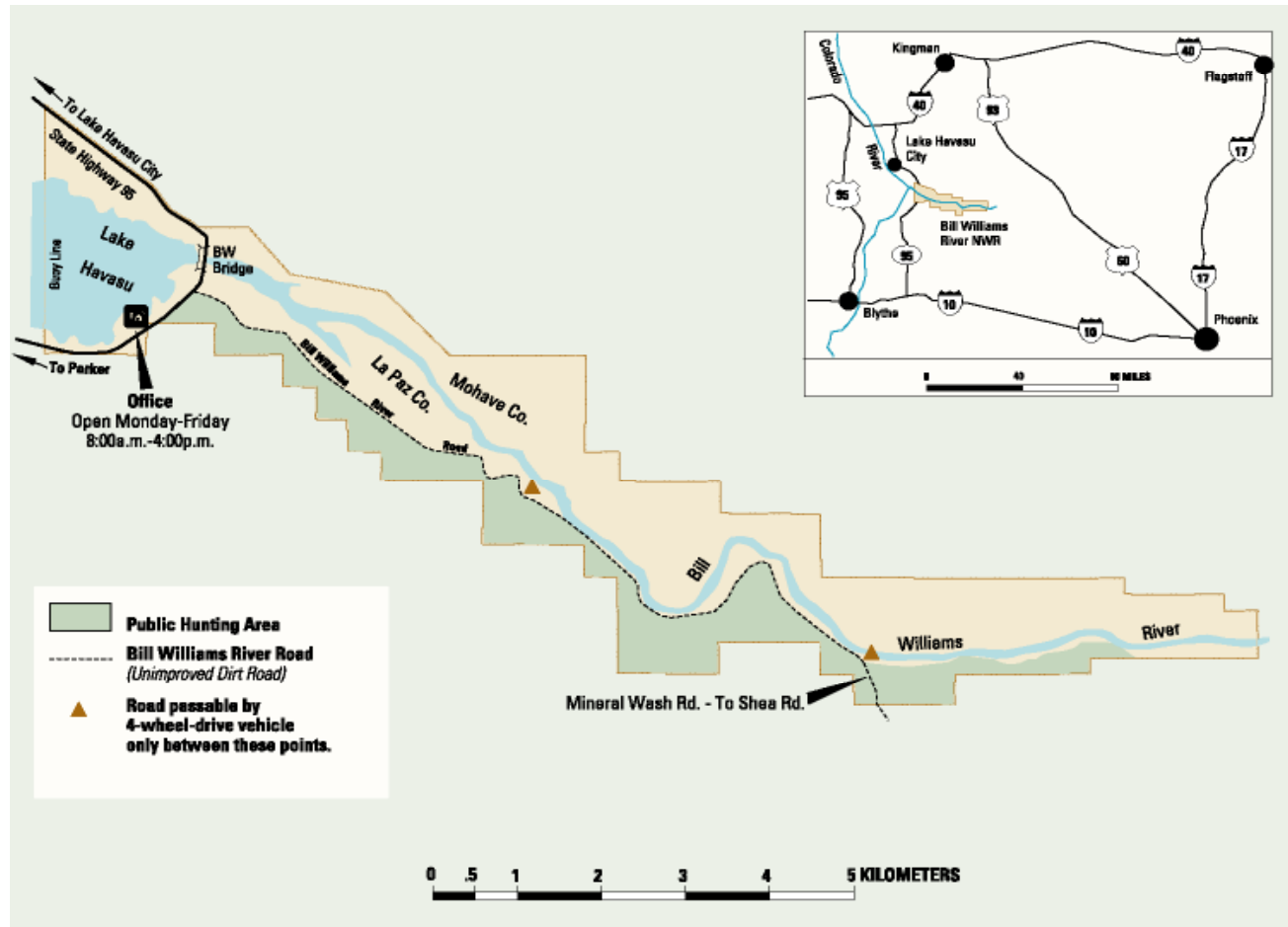


BWRNWR

- ▶ 6,105 acre national wildlife refuge on the Bill Williams River from the confluence with the Lower Colorado and 10 miles upstream.
- ▶ Created in 1941.
- ▶ Largest remaining stand of native dominated riparian forest on the LCR and the only one still flood regenerated.
- ▶ BWR flows controlled in amplitude and timing by Alamo Dam and local weather conditions.



Bill Williams River National Wildlife Refuge



Complex mosaic of dynamic habitats



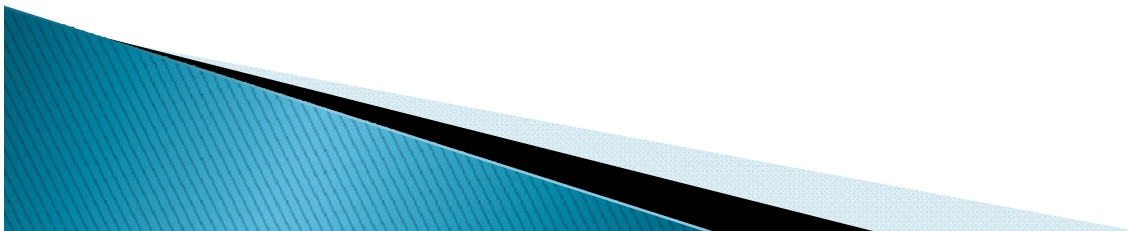
Intent:

- ▶ **Baseline Inventory for refuge by habitat type and seasons:**
 - Species
 - Relative Abundances
 - Community Parameters (diversity, trophic levels, guilds, interactions)
- ▶ **Change over time comparisons**
 - Responses to specific events – weather, floods, fires, management actions, other impacts not foreseen at time
 - Longer term processes – trends, succession, climate change, changing species distributions
- ▶ **Guide management decisions and plans**
- ▶ **Contribute to other refuges and agencies data**



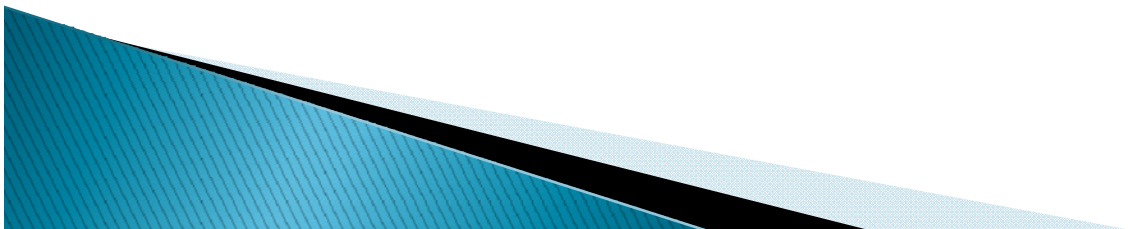
Rules:

- 1) Average refuge biologist or skilled volunteer
- 2) Minimum time commitment for maximum data
- 3) If comparing habitats most limiting habitat sets conditions
- 4) Maximize species detectability in all seasons
- 5) Overlay other data sets and techniques where possible but not duplicate research
- 6) **If it takes more than a few hrs, it won't last!**



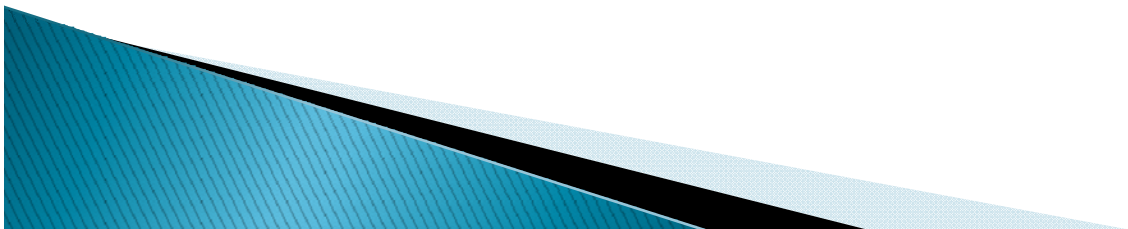
Strip Transects

- ▶ 400 m long x 20 m wide with 20 stations 20m apart = .8 hectare, 3 minutes per station run 3 consecutive days. In effect, 20 contiguous plots.
- ▶ 4 times per year beginning solstices and equinoxes start 30 min after sunrise except winter.
- ▶ Vegetation including woody and herbaceous species – canopy, relative abundance and density in plot, and 100 pt line intercept for densometer.
- ▶ Min max temp, start temp, humidity, wind, moon, precipitation, etc.



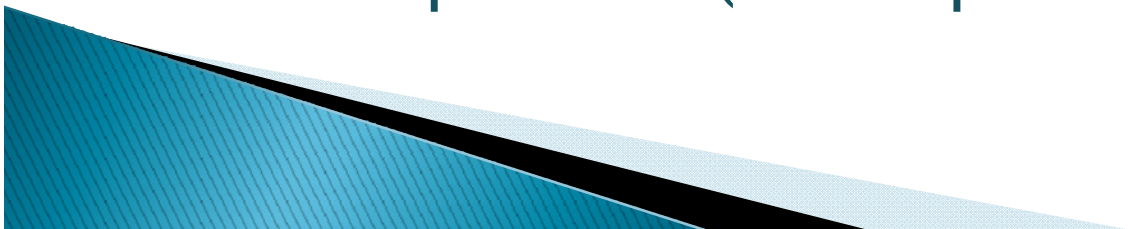
Data

- ▶ **On-transect** – within the transects area and sampling time. Required for relative abundances.
- ▶ **Off-transect** – within the habitat type but outside the transect area or sampling time. Used for habitat species list only.
- ▶ **“Unknowns”** contribute to total individuals count.
- ▶ **All vertebrates encountered**



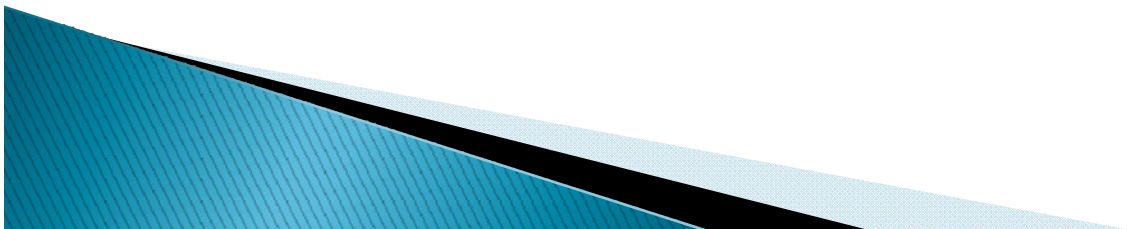
On-Transect Vertebrates

- ▶ All birds by sight or song in each 20x20 plot (area small enough to see most for ID and avoid double counting)
- ▶ Includes all flyovers (species can be later removed if irrelevant)
- ▶ 2 Sherman live-traps per station (toe-clip small mammals for mark-recap population data).
- ▶ Tracks, scats.
- ▶ 2 anabats per transect centrally located.
- ▶ All herps seen (some pitfall traps).



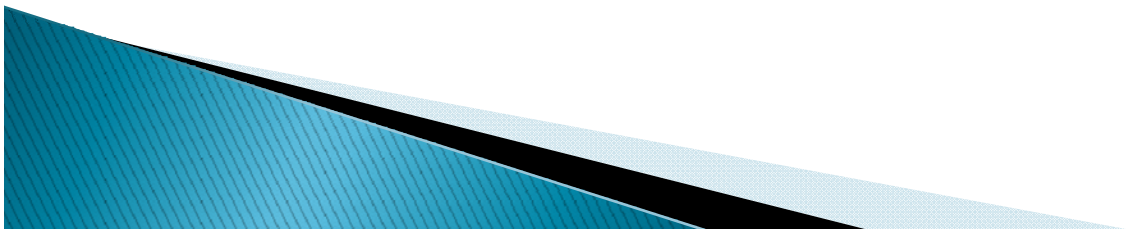
Habitats

- ▶ **Riparian**
 - R1 – Native canopy; dense Tamarisk understory; intermittent flow
 - R2 – Native canopy; open gallery understory; permanent flow
- ▶ **Abandoned Agriculture**
 - A1 – narrow mixed riparian edge; Honey Mesquite with dense Bermuda grass; intermittent flow
 - A2 – narrow mixed riparian edge; Honey Mesquite with annual grasses and forbs (most native); permanent flow
 - A1 / A2 – last 10 plots of each combined (plots well beyond present floodplain with mixed riparian consisting of mature mesquite)
- ▶ **Upland**
 - U1 – cross section of wash
 - U2 – bajada
- ▶ **Others added**
 - ▶ – B1 – 2006 fire
 - ▶ – D1 & R3 – 2008 – Dam proposal
 - ▶ – A3 – 2009 mesquite reveg



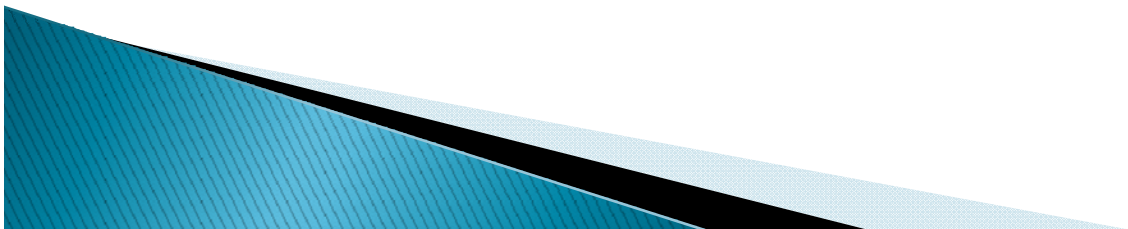
Results – general

- ▶ 682 transect runs
- ▶ 1,274 mammal records of 24 species
- ▶ 987 herp records of 23 species
- ▶ 24,917 birds of 239 species (have added 17 to refuge master list)

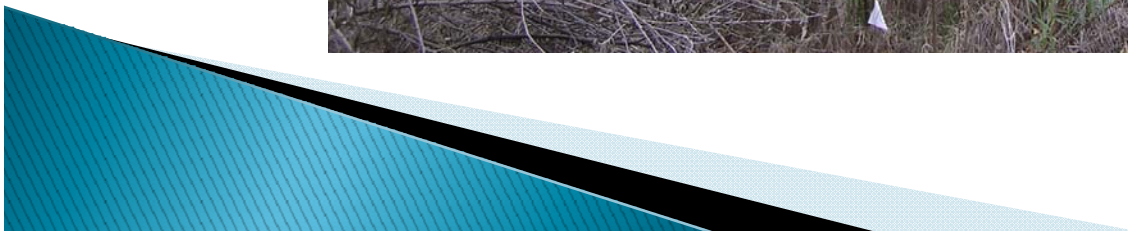


Results – specific examples

- ▶ Species use and productivity in riparian habitats before and after major flood
- ▶ Projected response of communities to 20 acre Mesquite re-veg project
- ▶ Documentation of losses from fire and resultant insurance claim (paid!) tracking community development after a fire.



Floods and Re-veg



Long-term transects community parameters comparing Terrace Abandoned Ag habitats for birds.

HABITAT	Year	Transects	N on Tran	Mean N	SppOnTran	FirstRecordSpp	D	H'	J%
Abandoned Ag 1	98/99	12	381	31.75	57	57	0.931	1.413	0.805
(Mesquite/ Bermuda)	2000	12	202	16.83	35	7	0.946	1.354	0.877
Intermittent	1	12	216	18	46	10	0.952	1.452	0.874
Stream	2	9	176	19.55	43	5	0.96	1.474	0.902
	3	9	183	20.33	41	6	0.956	1.427	0.885
	4	12	224	18.66	42	4	0.952	1.414	0.871
winter flood 05/06	5	0							
75% wetted	6	3	222	74	28	2	0.942	1.447	0.897
habitat conversion	7	12	514	42.83	65	12	0.957	1.517	0.837
Total	9	81	2118	26.14	103	103			

HABITAT	Year	Transects	N on Tran	Mean N	SppOnTran	FirstRecordSpp	D	H'	J%
Abandoned Ag 2	98/99	12	403	33.58	58	58	0.945	1.445	0.819
(Mesquite/Annuals)	2000	12	349	29.08	55	14	0.947	1.458	0.838
Permanent	1	12	409	34.68	57	19	0.9223	1.384	0.789
Stream	2	9	308	34.22	54	10	0.959	1.534	0.886
	3	9	269	29.88	52	7	0.964	1.533	0.893
	4	9	202	22.44	41	1	0.955	1.446	0.897
winter flood 05/06	5	6	145	24.16	26	0	0.863	1.106	0.782
25% wetted	6	9	401	44.55	47	2	0.882	1.263	0.756
no conversion	7	6	146	24.33	30	1	0.924	1.265	0.855
Total	9	81	2632	31.33	112	112			

Mesquite to Cottonwood



Species first recorded after 2005/6 flood on Terrace Ag Transects

▶ Terrace Ag 1 (new cw/w)

Black-throated Gray Warbler (3)
Dusky Flycatcher (1)
Gilded Flicker (1)
Gray Flycatcher (4)
MacGillivray's Warbler (8)
Nashville Warbler (4)
Red-winged Blackbird (2)
Cassin's Vireo (1)
Tennessee Warbler (1)
Townsend's Warbler (1)
"Western" Flycatcher (7)
Wilson's Warbler (2)
White-throated Swift (3)

▶ Terrace Ag 2 (no cw/w)

Crissal Thrasher (3)
Hammond's Flycatcher (1)

Long-term transects community parameters comparing Riparian Floodplain habitats for birds.

HABITAT	Year	Transects	N on Tran	Mean N	SppOnTran	FirstRecordSpp	D	H'	J%
Riparian 1	98/99	12	354	29.5	49	49	0.95	1.432	0.847
<i>Salt Cedar</i>	2000	9	229	25.44	36	6	0.946	1.354	0.87
<i>Understory</i>	1	12	297	24.75	45	10	0.955	1.459	0.882
<i>Intermittant</i>	2	9	209	23.22	37	5	0.946	1.366	0.871
<i>Stream</i>	3	9	348	38.66	43	7	0.948	1.384	0.848
	4	12	313	26.08	40	5	0.953	1.426	0.89
winter flood 05/06	5	6	336	56	43	7	0.92	1.314	0.804
90% wetted	6	12	605	50.41	57	9	0.954	1.49	0.849
	7	12	508	42.33	51	5	0.952	1.45	0.85
Total		93	3199	34.39	103	103			

HABITAT	Year	Transects	N on Tran	Mean N	SppOnTran	FirstRecordSpp	D	H'	J%
Riparian 2	98/99	12	421	35.08	59	59	0.956	1.522	0.86
<i>Open/Native</i>	2000	12	207	17.25	41	5	0.957	1.437	0.891
<i>Understory</i>	1	12	320	26.66	48	11	0.958	1.504	0.895
<i>Permanent</i>	2	11	342	31.09	54	8	0.969	1.574	0.909
<i>Stream</i>	3	6	228	38	36	1	0.95	1.383	0.889
	4	9	213	23.66	47	4	0.955	1.459	0.873
winter flood 05/06	5	6	253	42.16	39	2	0.947	1.377	0.866
90% wetted	6	9	467	51.88	55	7	0.954	1.463	0.841
	7	12	446	37.16	47	2	0.934	1.335	0.799
Total	9	81	2897	32.55	99	99			

Riparian flood response



Riparian flood response



R2 June 2006



R2 June 2007

Species first recorded after 2005/6 flood on Riparian transects.

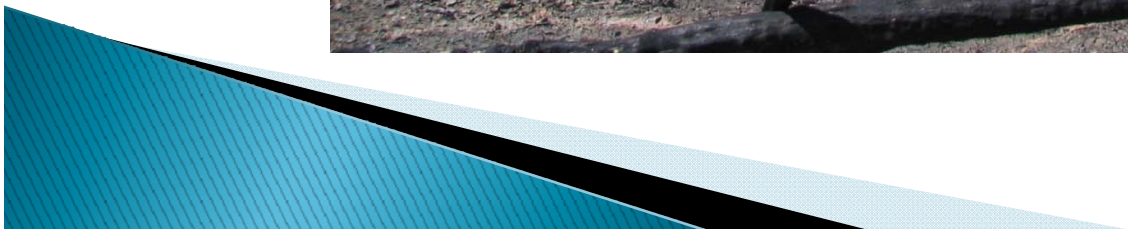
▶ Riparian 1

American Coot (5)
Black Throated Blue Warbler (1)
Black-throated Gray Warbler (1)
Chipping Sparrow (3)
Double-crested Cormorant (2)
Green Winged Teal (12)
Marsh Wren (6)
Nashville Warbler (2)
Northern Waterthrush (2)
Pacific-slope Flycatcher (1)
Red-winged Blackbird (7)
Townsend's Warbler (3)
White-breasted Nuthatch (1)
White-throated Swift (1)

▶ Riparian 2

Blue-gray Gnatcatcher (1)
Black-throated Sparrow (1)
Cliff Swallow (7)
Dusky Flycatcher (2)
Green Heron (2)
Killdeer (2)
Pacific-slope Flycatcher (2)
Red-naped Sapsucker (6)
Western Wood Pewee (1)

Fires



Comparison of birds from B1 and R1 for 2008 (all seasons)

▶ Transect Burn 1

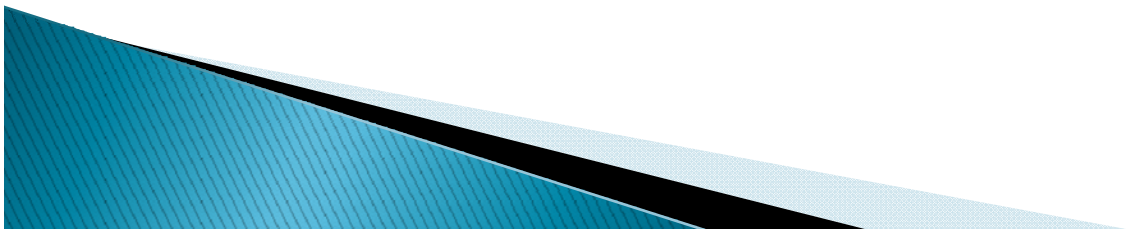
- ▶ 211 individuals
- ▶ 39 species
- ▶ 5 Most Common
 - ▶ Wht-throated Swift (32)
 - ▶ YR Warbler (19)
 - ▶ Gila Woodpecker (11)
 - ▶ Orange-Cr Warbler (11)
 - ▶ BrnHeaded Cowbird (10)

▶ Transect Riparian 1

- ▶ 535 individuals
- ▶ 45 species
- ▶ 5 Most Common
 - ▶ YR Warbler (117)
 - ▶ RubyCr Kinglet (45)
 - ▶ Gamble's Quail (46)
 - ▶ Song Sparrow (44)
 - ▶ Wht-throated Swift (30)

Much analysis yet to do...

- ▶ Species specific changes between and within habitats
- ▶ Community level analysis of habitats before and after specific events
- ▶ Small mammal population dynamics
- ▶ Affects of climate change
- ▶ Correlations with veg data and other species
- ▶ and many more.....any volunteers out there?



Critical Take Home Message....

Data does not grow on desks! Biologists boots need to be in the dirt.



Questions?

