Avian and Small Mammal Community Responses to Flooding on the Bill Williams River

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Havasu National Wildlife Refuge Complex, Parker, AZ.

Bill Williams River NWR

- 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. Joined with Havasu NWR in 2010 to form the Havasu NWR Complex.

- Largest remaining stand of native dominated riparian forest on the LCR and the only one still flood regenerated but includes both Desert and Riparian habitats.

- BWR flows controlled in amplitude and timing by Alamo Dam and local weather conditions.

The refuge has a complex mosaic of dynamic habitats

In 1998 long-term monitoring surveys began...

‣ Baseline Inventory for refuge by habitat type and seasons:
  ◦ Species across many taxa (plants, herps, birds, mammals)
  ◦ 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

Survey Protocol

- Strip transects 400m X 20m with 20 contiguous plots. Most constrained habitat dictated size. Woody vegetation % upper canopy cover and % plot cover at 1 m.

- Each habitat surveyed for 3 consecutive days each of 4 seasons, 3 minutes per plot or 1 ½ hrs per transect run for birds; 2 traps per station 2-3 nights for small mammals in spring and fall with mark-recapture.

- All birds within plot including flyovers (irrelevant species later removed from analysis) are On Transect, those outside plot but within habitat are Off Transect (data used differently).

- Due to limited area, detectability and identification high, and double counting low for birds, Mark-recap controlled for double counting small mammals.

Overall Avifauna comparison between pre- and post flooding riparian woodlands:
(8 years, 2 habitats, Spring and Summer = T = 48 transects each)

Pre-flood 2001-2004

- S = 69 in analysis
- N = 1,727
- N/T = 35.97
- Unique Species= 7
- Simpson's Diversity (D) =.9572
- Shannon's Diversity (H')=1.5244
- Evenness (J%)=.8290

Post-flood 2006-2009

- S = 72 in analysis
- N = 2,413
- N/T = 54.18
- Unique Species=16
- Simpson's Diversity (D) =.9532
- Shannon's Diversity (H')= 1.4667
- Evenness (J%)=.7897

Avian species changes pre/post flood

- 11 species had more detections before the flood than after.

- 6 species with more than 10 detections were at least 10% higher before the flood than after.

- (eg. Bell's Vireo, Brown-crested Flycatcher, Hooded Oriole, Phainopepla, Black-tailed Gnatcatcher, Blue Grosbeak)

- 30 species had more detections after the flood than before.

- 25 species with at least 10 detections were at least 10% higher after the flood than before (many were over 50% higher)

- (eg. Abert's Towhee, Ash-throated Flycatcher, Cliff Swallow, Brown-headed Cowbird, Gambel's Quail, Gila Woodpecker, Common Yellowthroat, Summer Tanager)

N for selected species before and after flooding

Pre-flood 2001-2004		Post-flood 2006-2009	
Abert's Towhee	51	Abert's Towhee	155
Bell's Vireo	119	Bell's Vireo	73
Brown-headed Cowbird	43	Brown-headed Cowbird	132
Gila Woodpecker	54	Gila Woodpecker	105
Summer Tanager	47	Summer Tanager	78
Yellow Warbler	120	Yellow Warbler	124

Paired T-test for differences between Pre and Post flood number of contacts on transect.

SPECIES	T	P-value	DF
Abert's Towhee	4.81	.0002	15
Bell's Vireo	-1.65	.1204	15
Brown-headed Cowbird	1.90	.0770	15
Gila Woodpecker	2.27	.0382	15
Summer Tanager	1.54	.1439	15
Yellow Warbler	.04	.9711	15

Birds

Overall numbers....

Sig. difference between pre and post flood contacts (p=.0330, df 30) with post flood higher.

No Sig. difference between habitats although R1 (salt cedar 66.4%, native 46.9% canopy; floods at 5,000+ cfs) higher than R2 (salt cedar 19%, native 71%; floods at 1,000 cfs) (p=.1066, df 30).

No Sig. differences between seasons although summer higher than spring (p = .1233, df 30).

- A few more species after flood than before (72/69).
- 7 species found only before flood, 16 found only after.

- Total individuals 28% higher after flood than before (2,413/1,727)

- Diversity Indices very similar.
- Eveness slightly higher before flood than after.

- Morisita's Index .8682 between Pre and post flood; .9093 between R1 and R2. Greater difference from flooding than habitat type.

Overall Small Mammal comparison between pre- and post flooding riparian woodlands:
(8 years, 2 habitats, Spring and Fall data = T = 36 transects pre; 34 transects post)

Pre-flood 2001-2004

- S = 8 in analysis
- N = 157
- Unique Species= 0
- Simpson's Diversity (D) = .5949 (Dmax =.8806)
- Shannon's Diversity (H')= .5589 (Hmax =.9030)
- Evenness (J%)=.6189
- Mean Trapping Success= 10.535 for *Peromyscus*.

Post-flood 2006-2009

- S = 8 in analysis
- N = 271
- Unique Species=0
- Simpson's Diversity (D) = .6756 (Dmax.878)
- Shannon's Diversity (H')= .6178 (Hmax.9030)
- Evenness (J%)= .6841
- Mean Trapping Success= 16.967 for *Peromyscus*.

Small Mammals

Overall trapping success of *Peromyscus* spp...

No sig. difference between pre and post flood (p=.1429, df 27).

Sig. difference between habitats with R1 (salt cedar 66.4%, native 46.9% canopy; floods at 5,000+ cfs) higher than R2 (salt cedar 19%, native 71%; floods at 1,000 cfs) (p=.0127, df 27).

Sig. differences between seasons with fall higher than spring (p.=.0282, df 27).

- Same 6 species before as after.
- 7 of 8 species increased after flood though not statistically significant.

- Total individuals 42% higher after flood than before (271/157) though not statistically significant.
- Trapping success higher after flood than before but not statistically significant.

- Diversity Indices (D, H') higher after flood than before.
- Eveness slightly higher after flood than before.

- Morisita's Index .9629 between pre and post flood.

In summary....

- Terrestrial birds showed a significant difference in pre- and post- flood community -- Small mammals did not.

- Small mammals showed a significant difference between habitats R1 and R2 and between seasons – Terrestrial birds did not overall although individuals species did.

Questions?