Insect (Prey) Availability in Restoration Sites

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Our Lab

Professor Matt Kondolf:

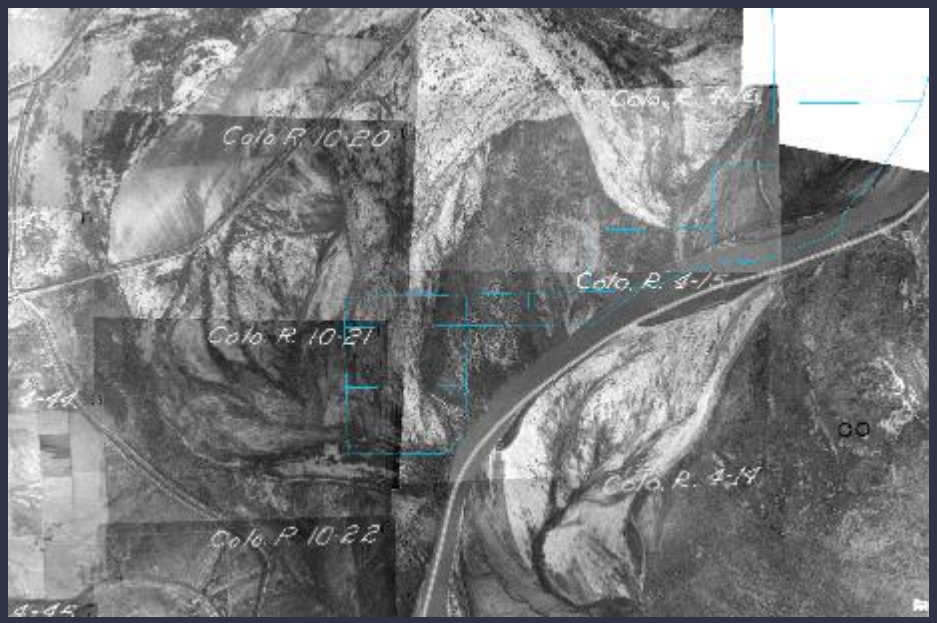
<u>Restoration Evaluations (20+ yrs):</u>

Colorado River
Trinity River
Middle Fork American River
Tassajara Creek
Sycan Creek
Redwood Creek
Cuneo Creek
Uvas Creek and others

Linking habitat and biological goals…

Conceptual Model

- Dynamic
- Connected
- Bare sediment
- Arguably less vegetation throughout basin (Webb, 2007)



Functions missing in riparian plantations?
- Emerging veg.
- Channel complexity
- Aquatic insects

Aquatic-Terrestrial Subsidies

Ecology, 67(3), 1986, pp. 629–638
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SECONDARY PRODUCTION, EMERGENCE, AND EXPORT OF AQUATIC INSECTS OF A SONORAN DESERT STREAM[1]

JOHN K. JACKSON[2] AND STUART G. FISHER
Department of Zoology, Arizona State University, Tempe, Arizona 85287 USA

Jackson and Fisher (1986): 97% of aquatic insect emergence biomass transferred to terrestrial habitat and prey for terrestrial consumers such as bats, birds, and ants (Sycamore Creek, AZ).

Sanzone et al (2003): isotope in Sycamore Creek, AZ. Web weaving spiders along the stream channel obtain almost 100% of their carbon and 40% nitrogen from instream sources. Ground-hunting spiders obtained ~68% of their carbon and 25 % nitrogen. Three times more spiders at the stream edge than at 25m from the bank.

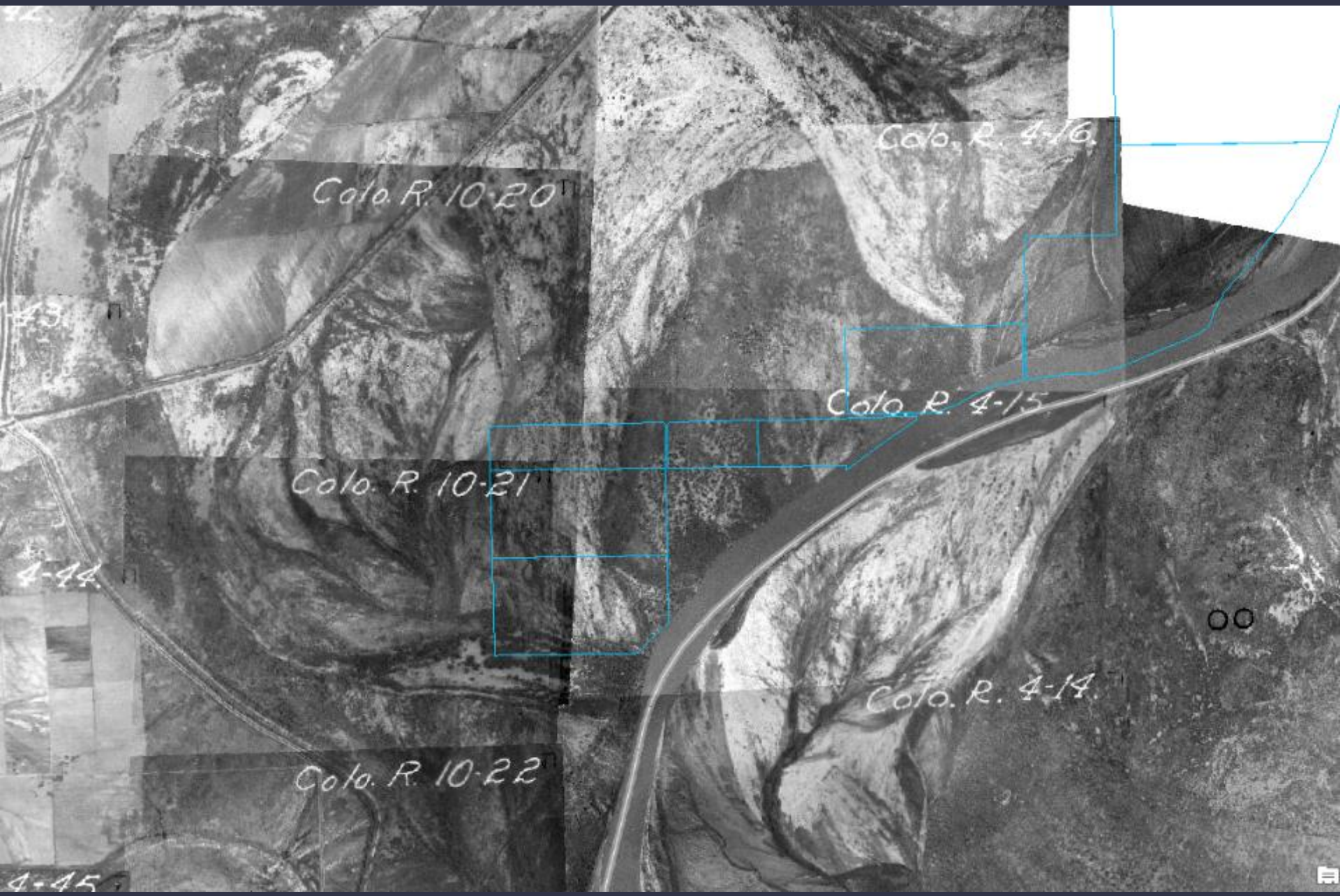
Aquatic-Terrestrial Subsidies

Acknowledged in the Habitat Conservation Plan:

Created cottonwood-willow designed to provide southwestern willow flycatcher habitat will be specifically managed to ensure that moist surface soil, slow-moving water, or ponded water conditions are present during the breeding season to ensure the production of the flycatcher's flying insect prey base.

Palo Verde Conservation Area

Palo Verde Conservation Area



Cibola Valley Conservation Area

Evaluation

Hypotheses:

- Aquatic insect abundance will decrease with distance from the river.
- The percentage of insects that are aquatic in origin will decrease with distance from the river.
- Total abundance of insects will decrease with distance from the river.
- Insect diversity will decrease with distance from the river.

Methods

Non-attracting sticky traps- each trap left for 48 hours. 3-6 stations along each transect with 8 sheets at each station. 3 visits (May, July, September). 0, 30, and 100 m from river's edge.

Methods

2 restoration sites:

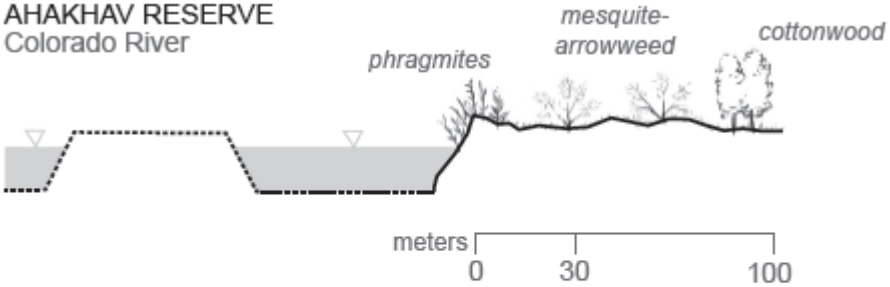
Ahakhav (A)

Cibola NWR (C)

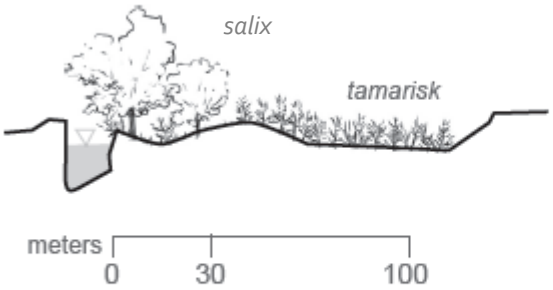
1 reference site:

Bill Williams River (B)

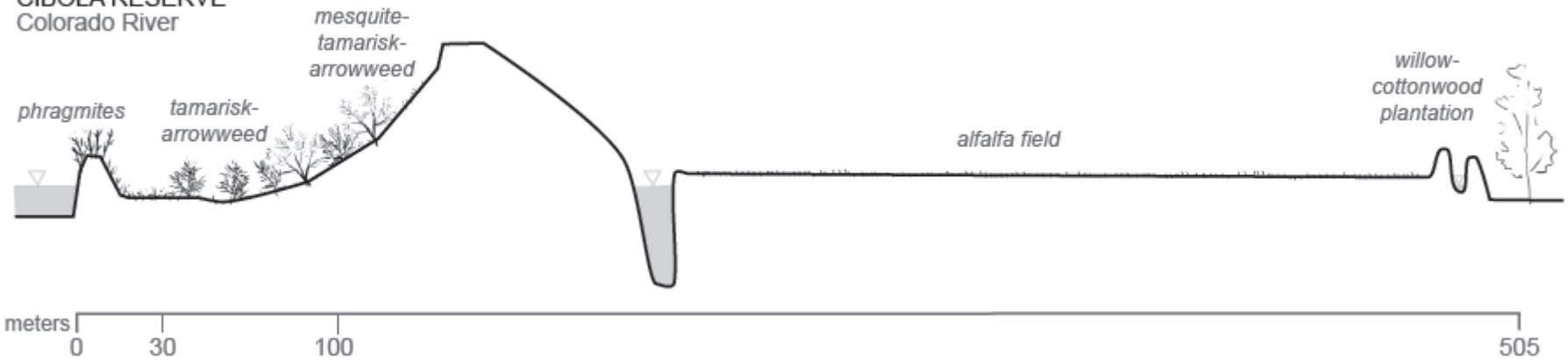
AHAKHAV RESERVE
Colorado River



BILL WILLIAMS RIVER



CIBOLA RESERVE
Colorado River



Ahakhav Tribal Preserve

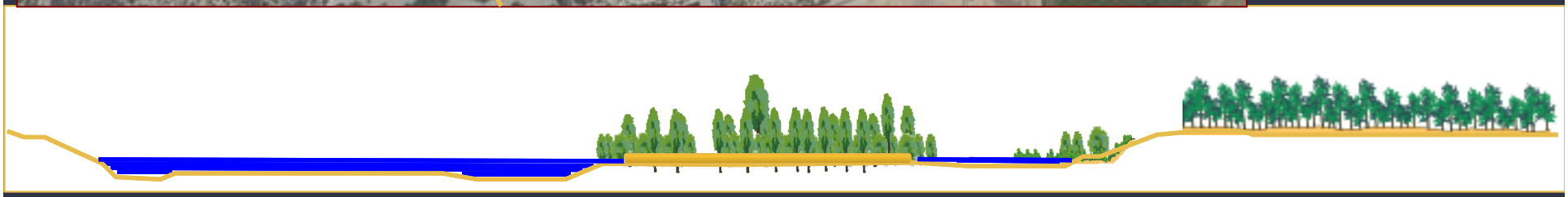
Sampling locations

0 120 240 480 Meters

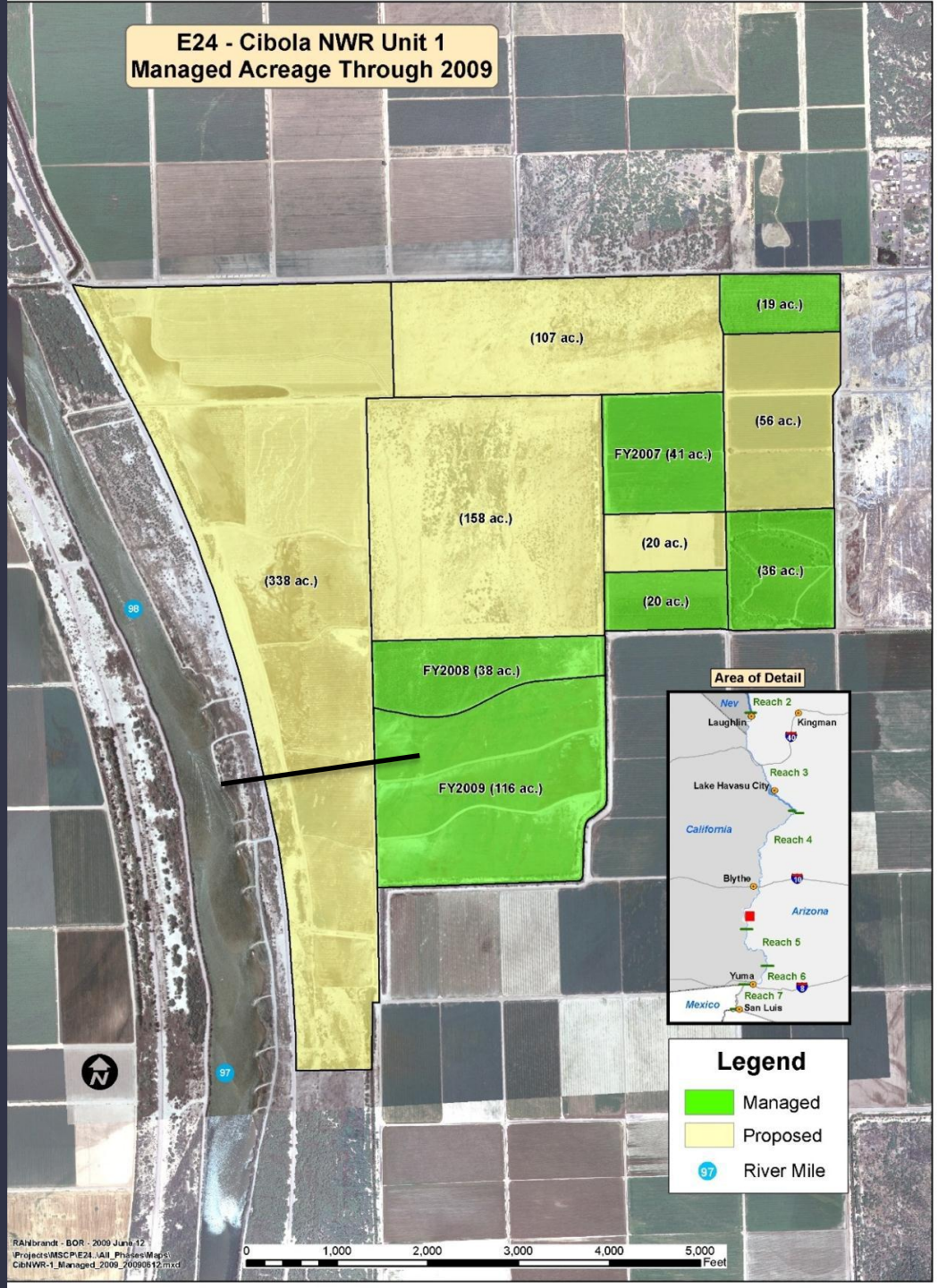
N

Ahakhav Tribal Preserve

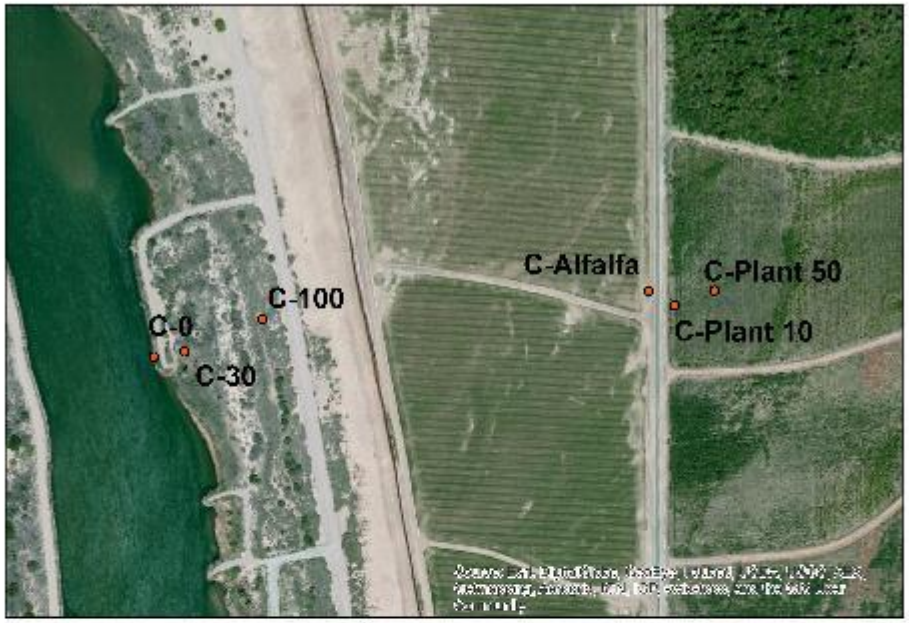
Built as a park, with willow, cottonwood, mesquite, and arroweed. Dredged and reconnected side-channel, minimally irrigated vegetation.

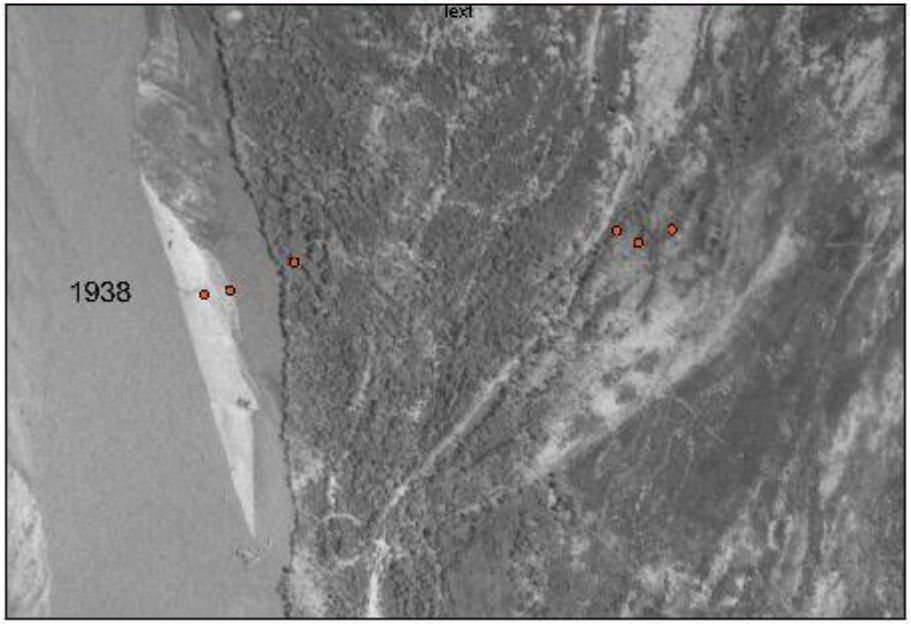


Cibola: Disconnected floodplain plantation


E24 - Cibola NWR Unit 1
Managed Acreage Through 2009
(19 ac.)
(107 ac.)
(56 ac.)
FY2007 (41 ac.)
(158 ac.)
(20 ac.)
(36 ac.)
(338 ac.)
(20 ac.)
FY2008 (38 ac.)
FY2009 (116 ac.)
98
97
Area of Detail
Nev
Reach 2
Laughlin
Kingman
Reach 3
Lake Havasu City
California
Reach 4
Blythe
Arizona
Reach 5
Yuma
Reach 6
Reach 7
Mexico
San Luis
Legend
Managed
Proposed
River Mile
0
1,000
2,000
3,000
4,000
5,000
Feet
RAhlbrandt - BOR - 2009 June 12
\Projects\MSCP\E24_\All_Phases\Maps\
CibNWR-1_Managed_2009_20090612.mxd

Cibola National Wildlife Refuge



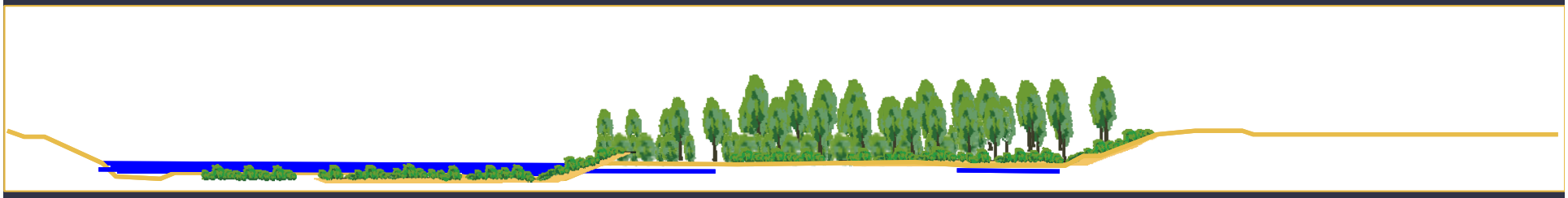


Sampling locations

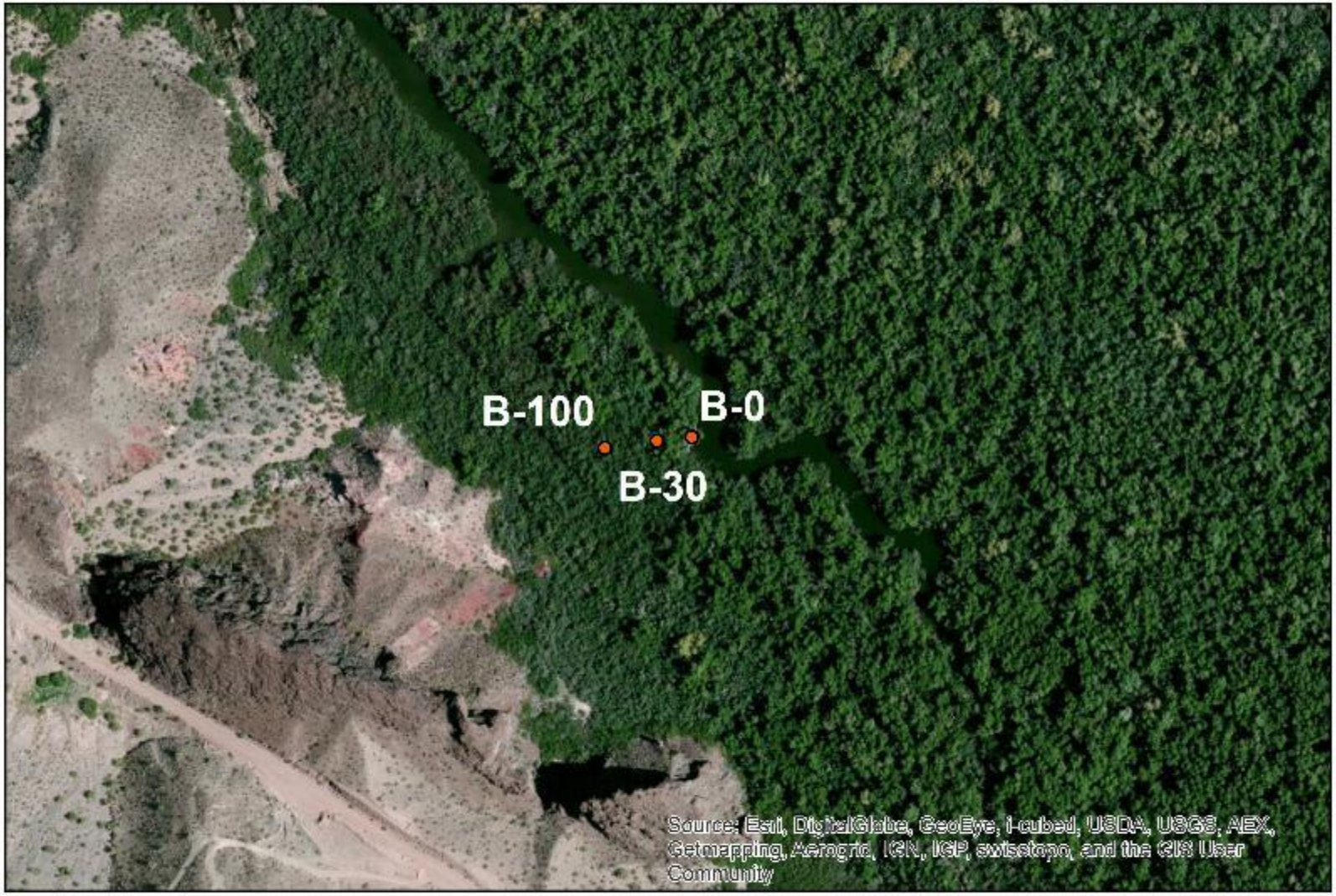
0 75 150 300 Meters

N

Bill Williams River: Connected Floodplain



Bill Williams River National Wildlife Refuge



Sampling locations

0 75 150 300 Meters

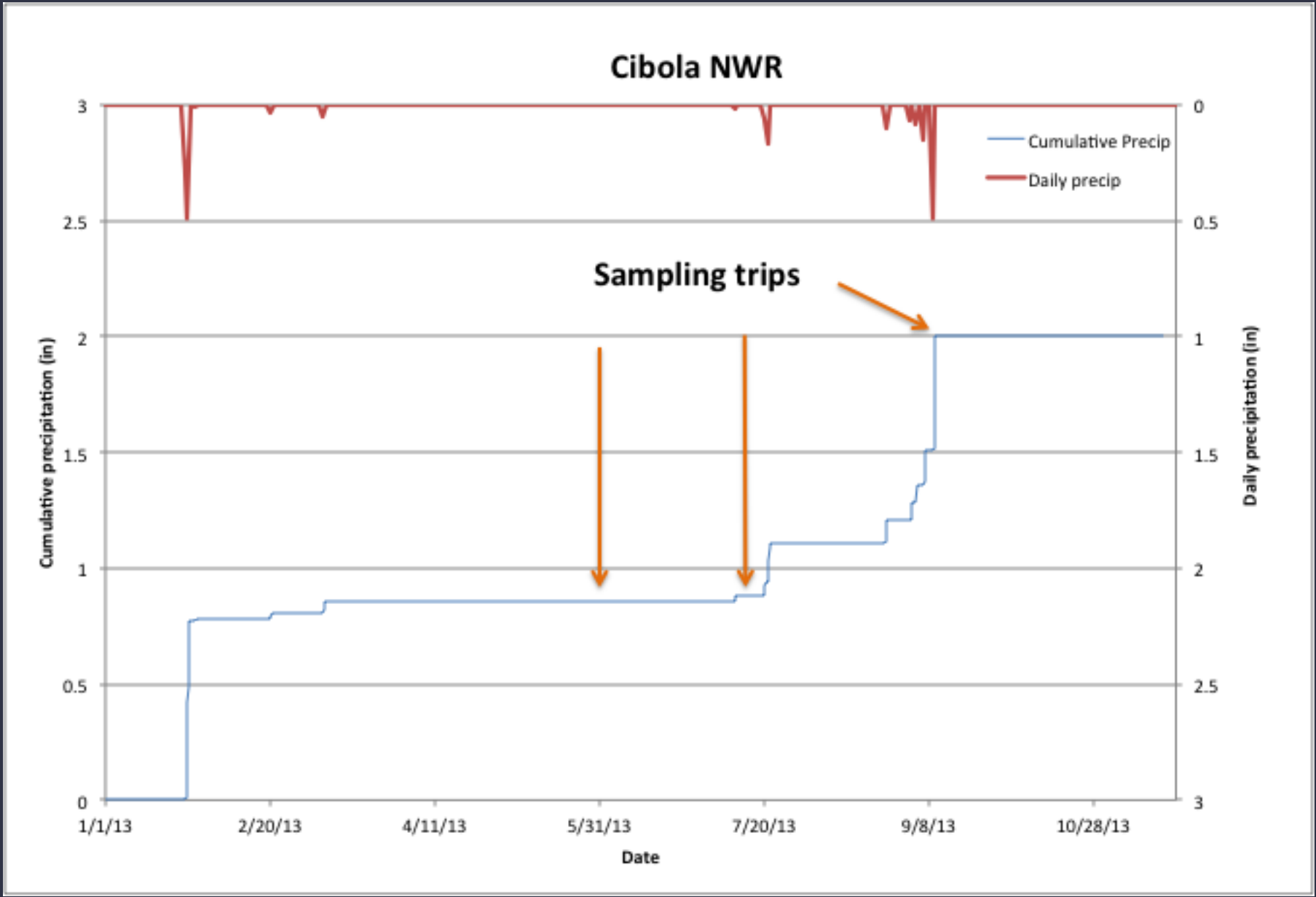
N

Bill Williams River: Connected Floodplain

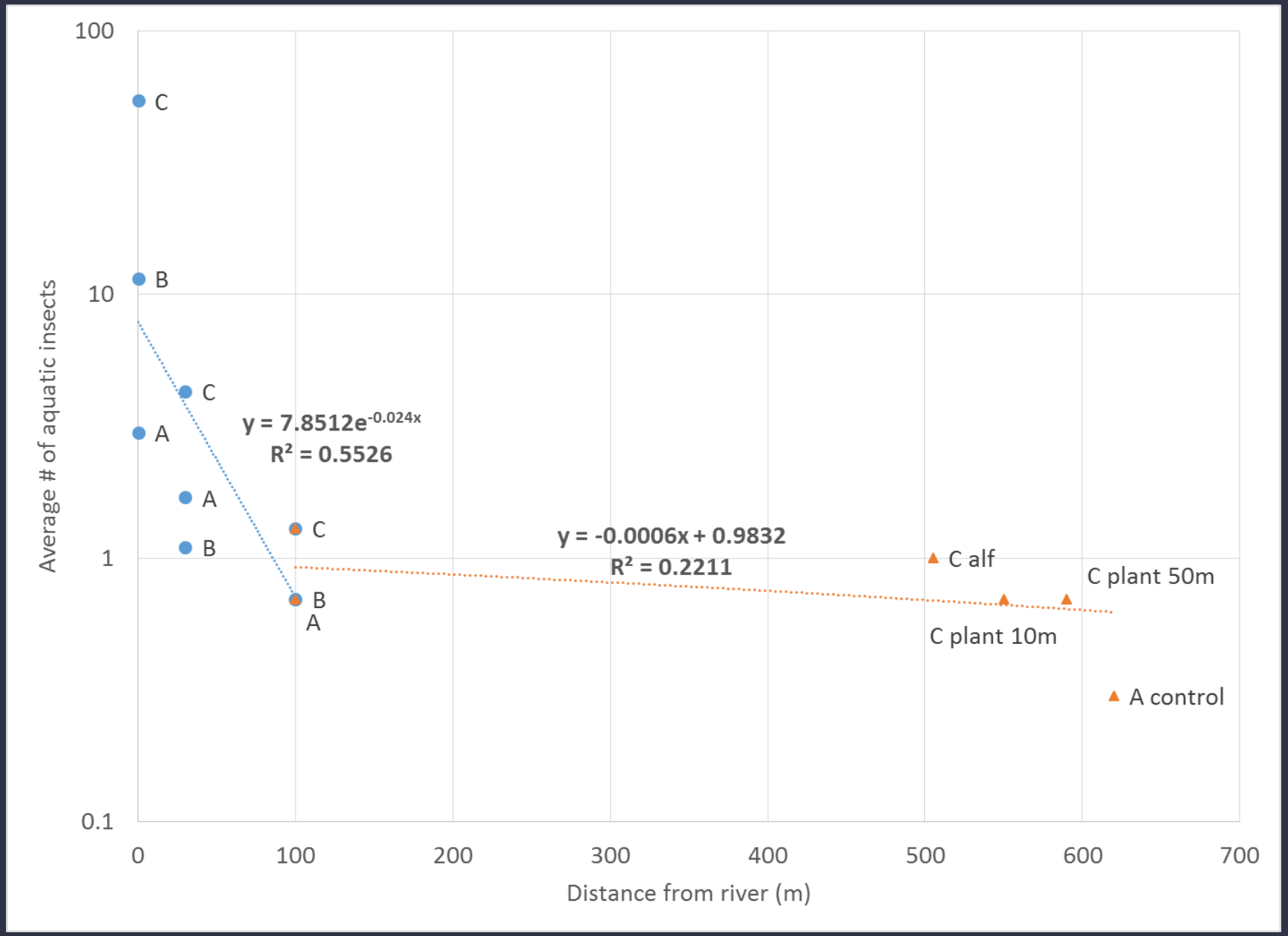
Methods

Each insect removed, identified to order or family level (sometimes to species) in order to distinguish aquatic from terrestrial insects, and counted. Dipterans, were not always identified as aquatic/terrestrial, though almost all other insects were.

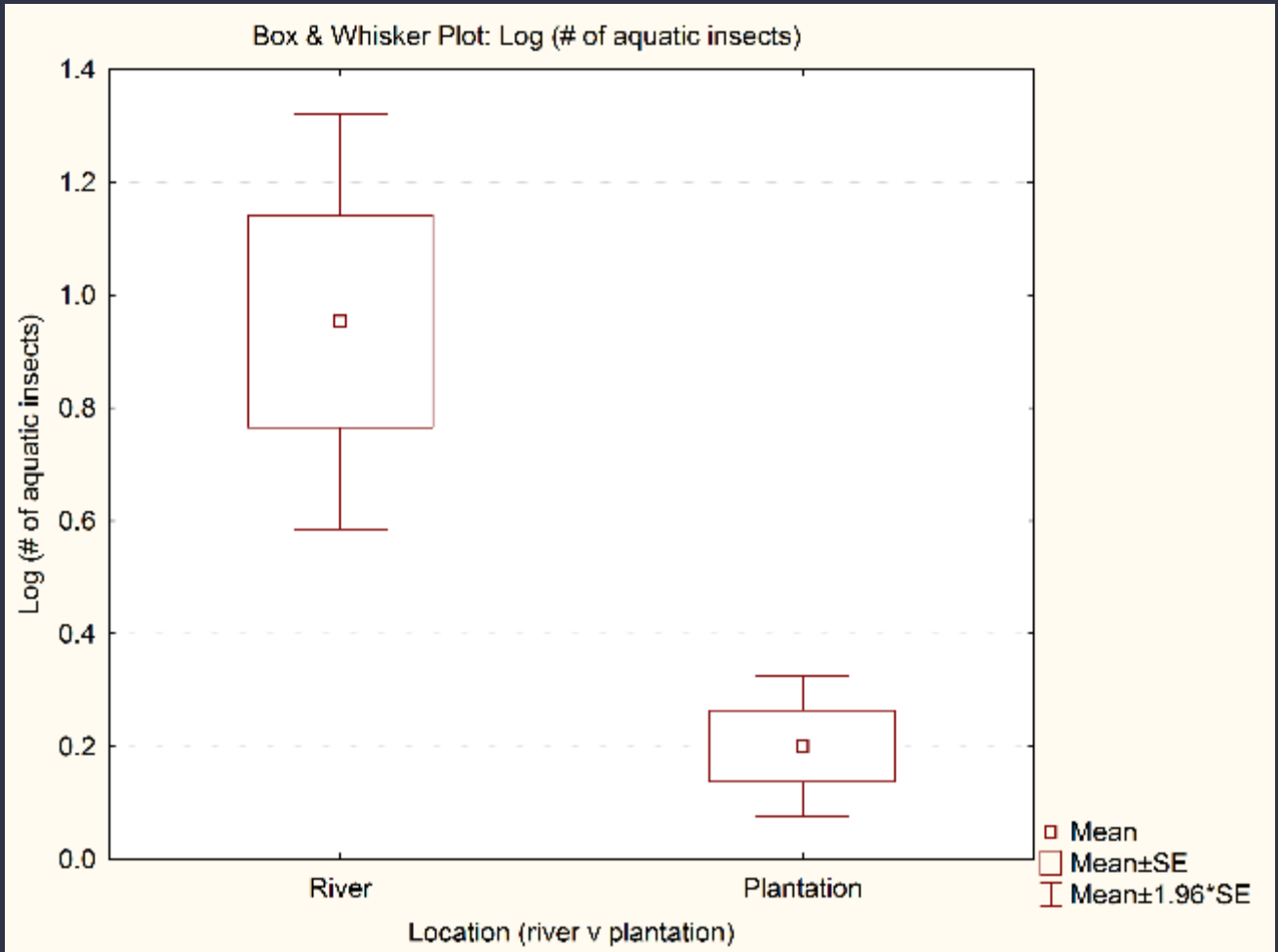
Results


Cibola NWR
Cumulative Precip
Daily precip
Sampling trips
Cumulative precipitation (in)
Daily precipitation (in)
Date
3
2.5
2
1.5
1
0.5
0
0
0.5
1
1.5
2
2.5
3
1/1/13
2/20/13
4/11/13
5/31/13
7/20/13
9/8/13
10/28/13

of Aquatic Insects

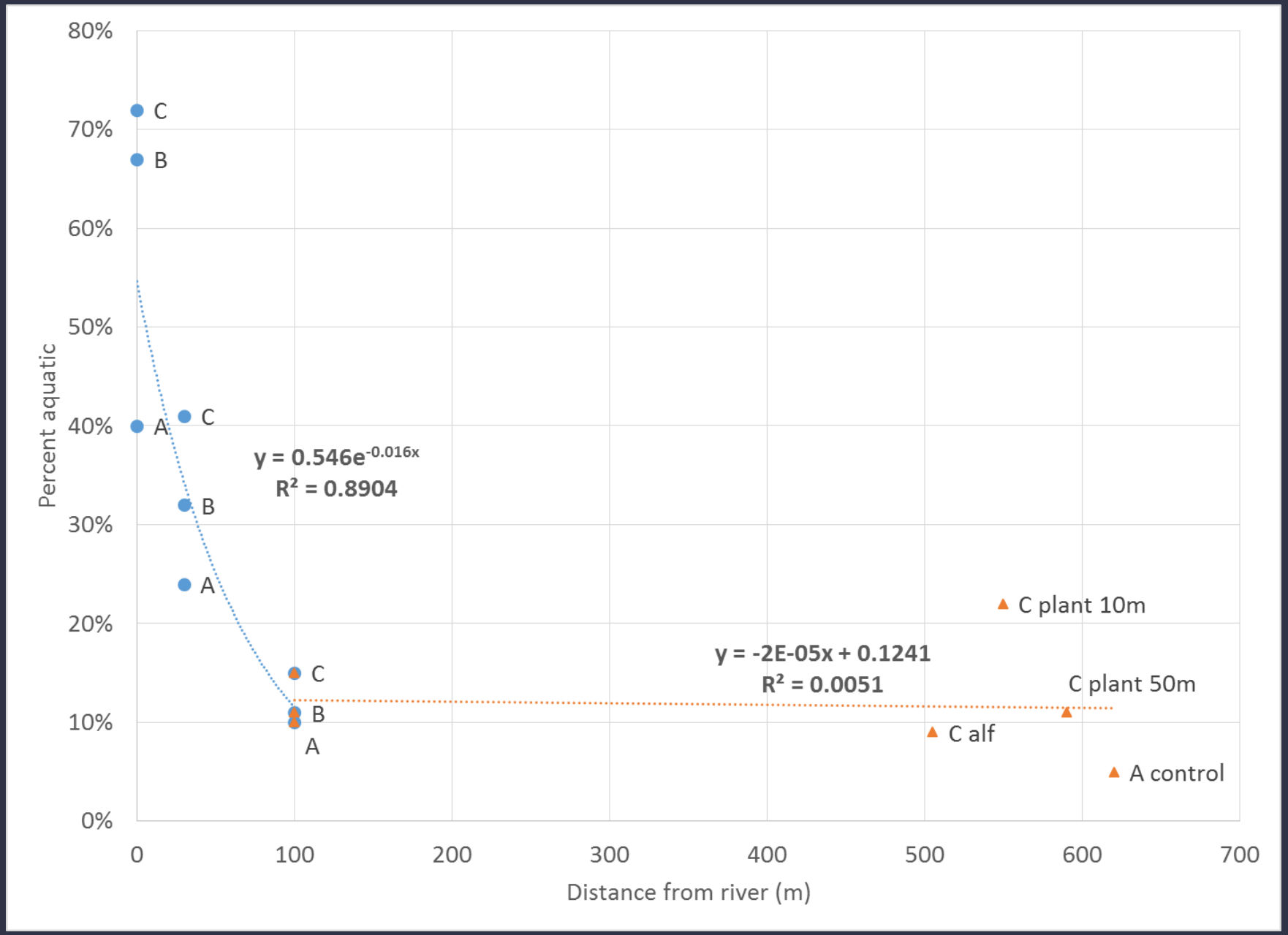


of Aquatic Insects

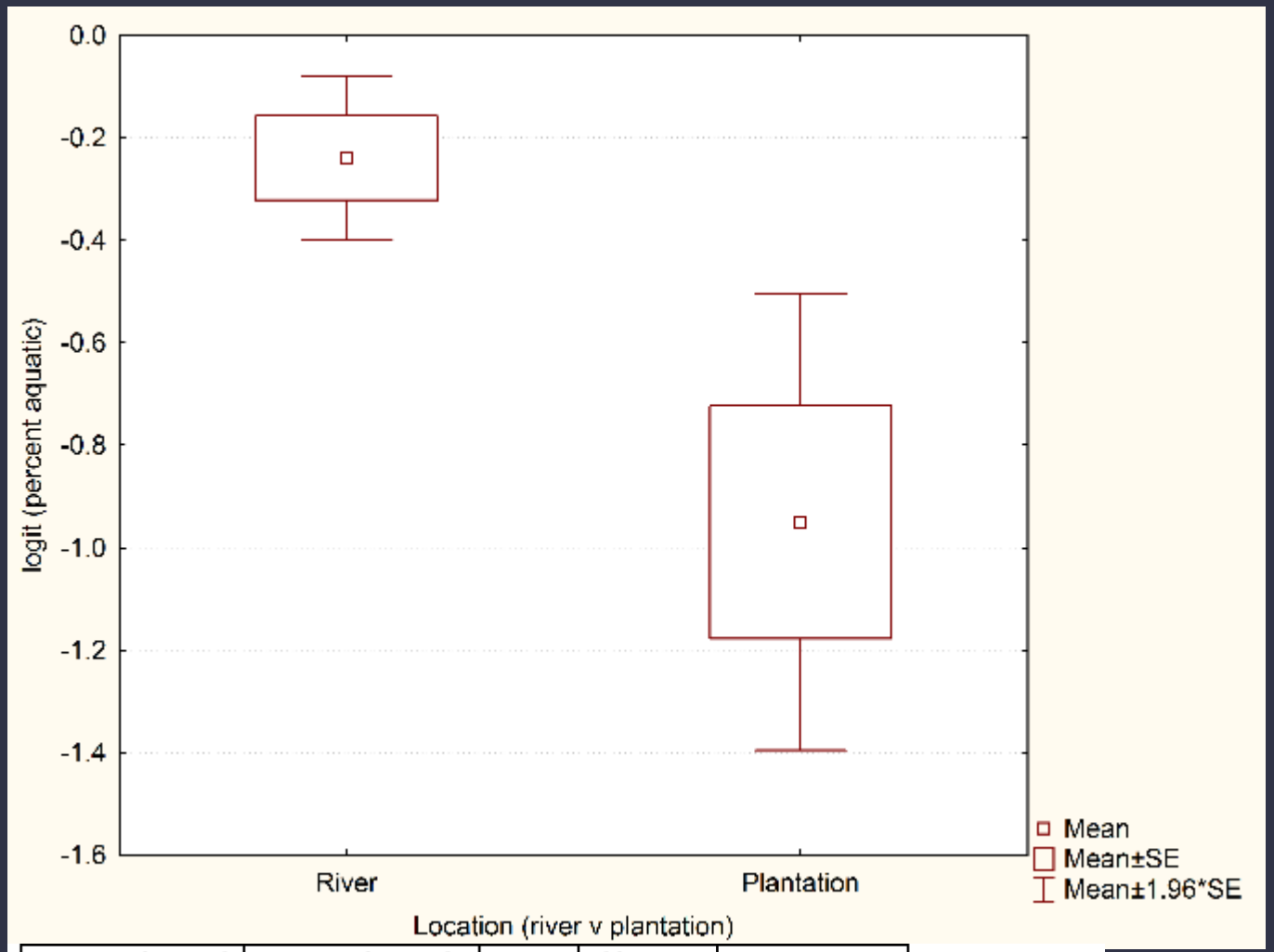


Untransformed mean (river)	Untransformed mean (plantation)	t-value	df	p
22.94	0.67	3.16	13	**0.008**

% Aquatic

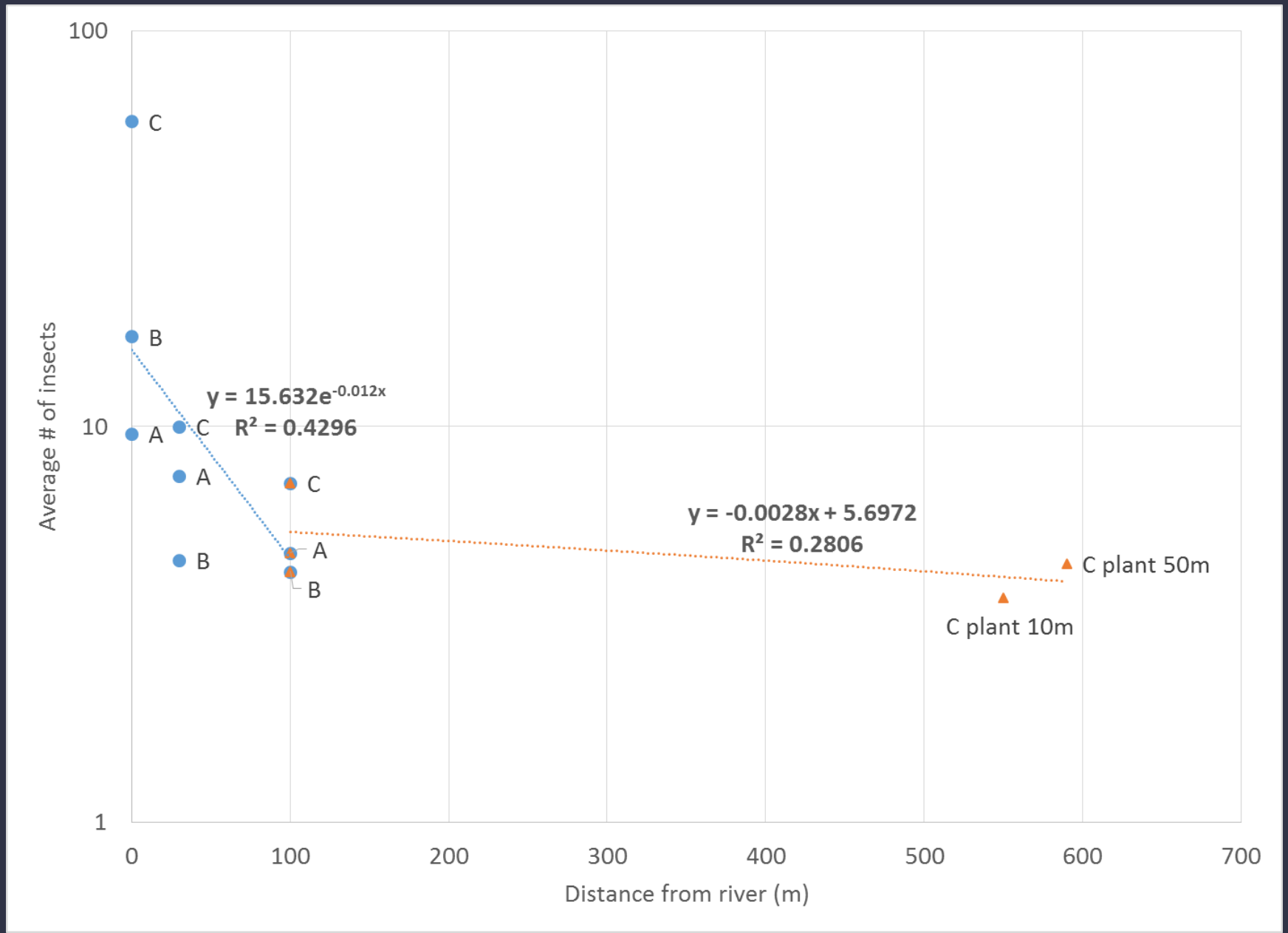

80%
70%
60%
50%
40%
30%
20%
10%
0%
Percent aquatic
0
100
200
300
400
500
600
700
Distance from river (m)
C
B
A
C
B
A
C
B
A
y = 0.546e-0.016x
R² = 0.8904
C plant 10m
y = -2E-05x + 0.1241
R² = 0.0051
C plant 50m
C alf
A control

% Aquatic

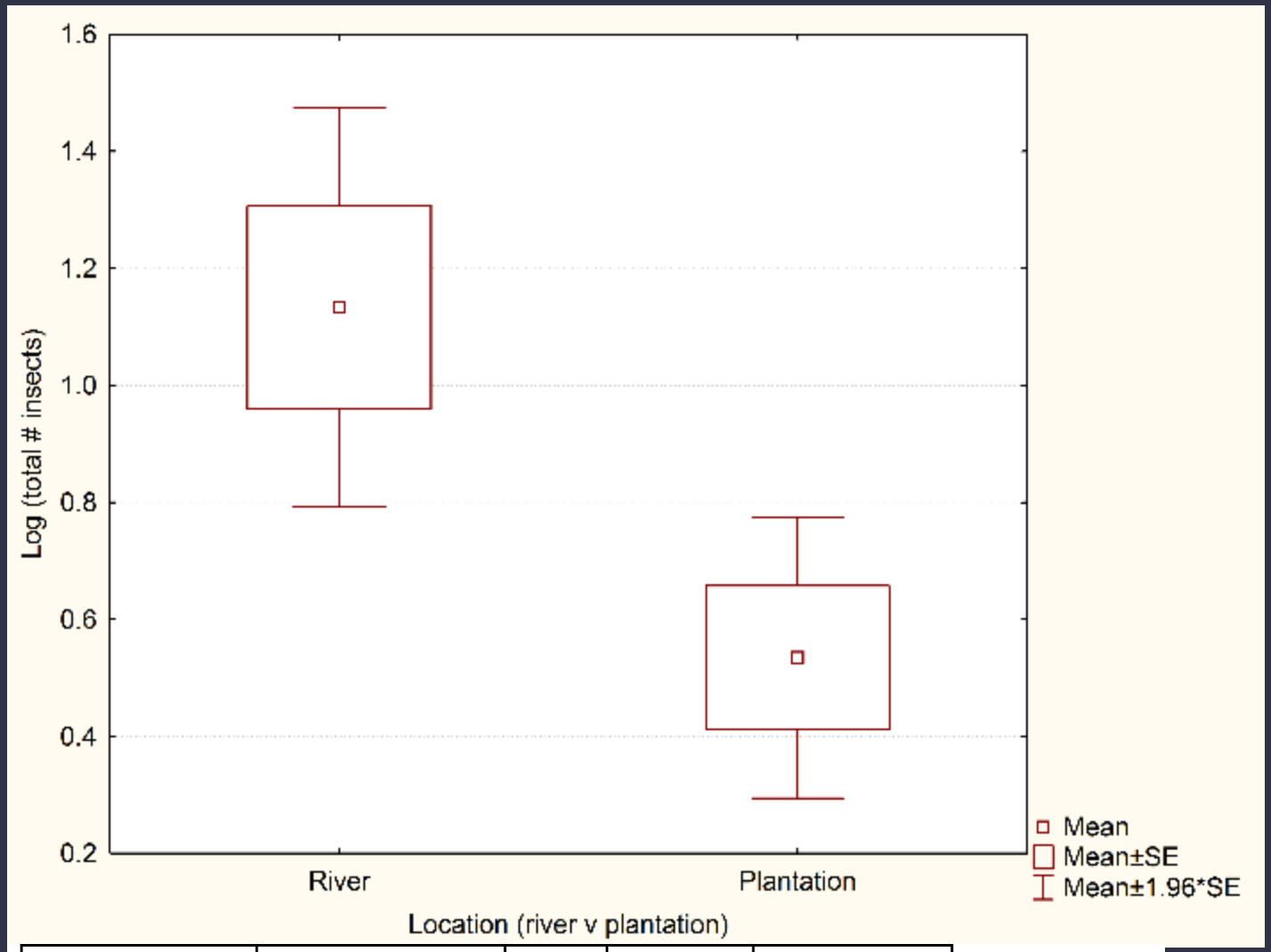


Untransformed mean (river)	Untransformed mean (plantation)	t-value	df	p
59.4%	16.3%	3.411	13	**.005**

Total # of Insects

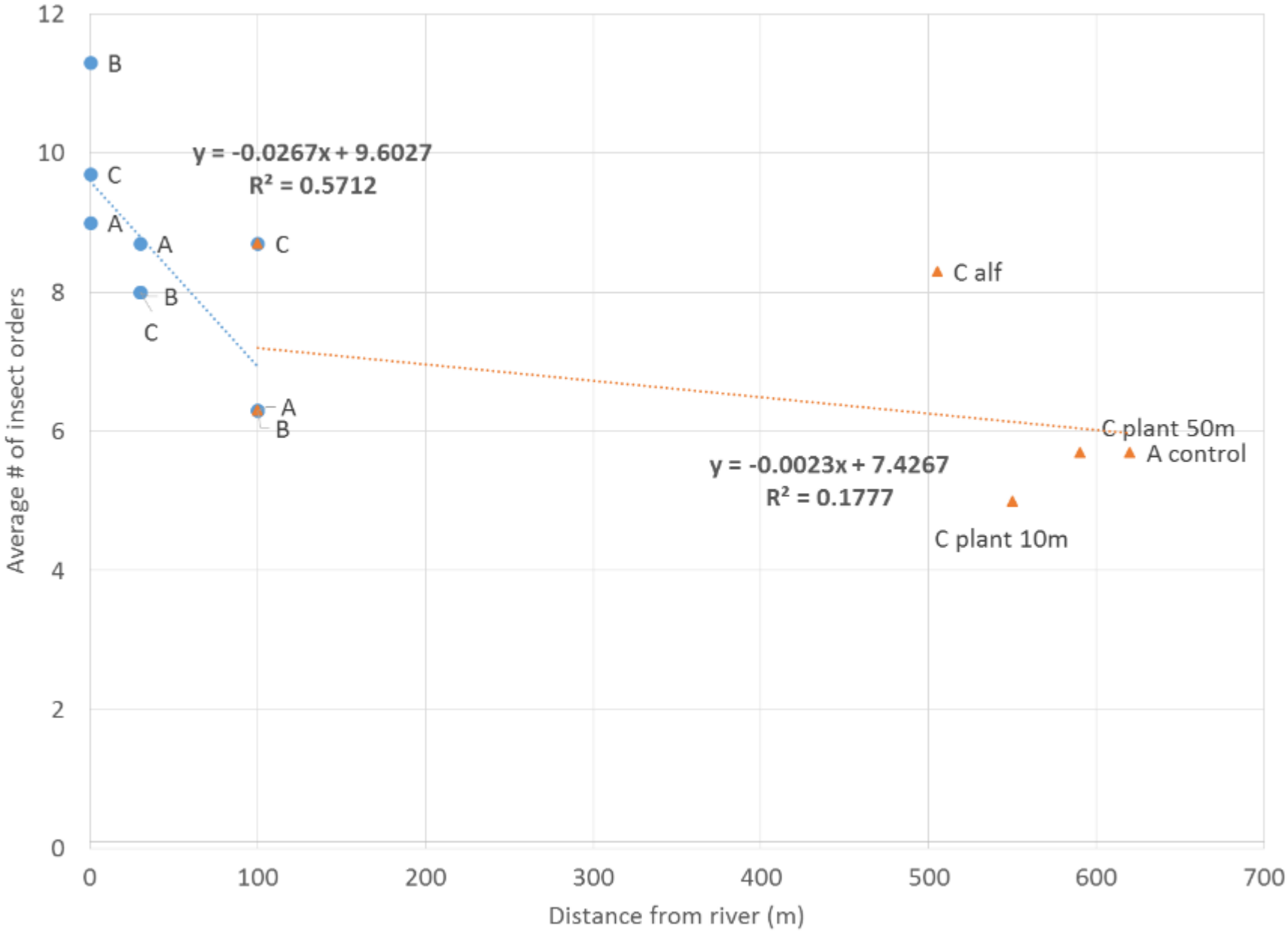


Total # of Insects

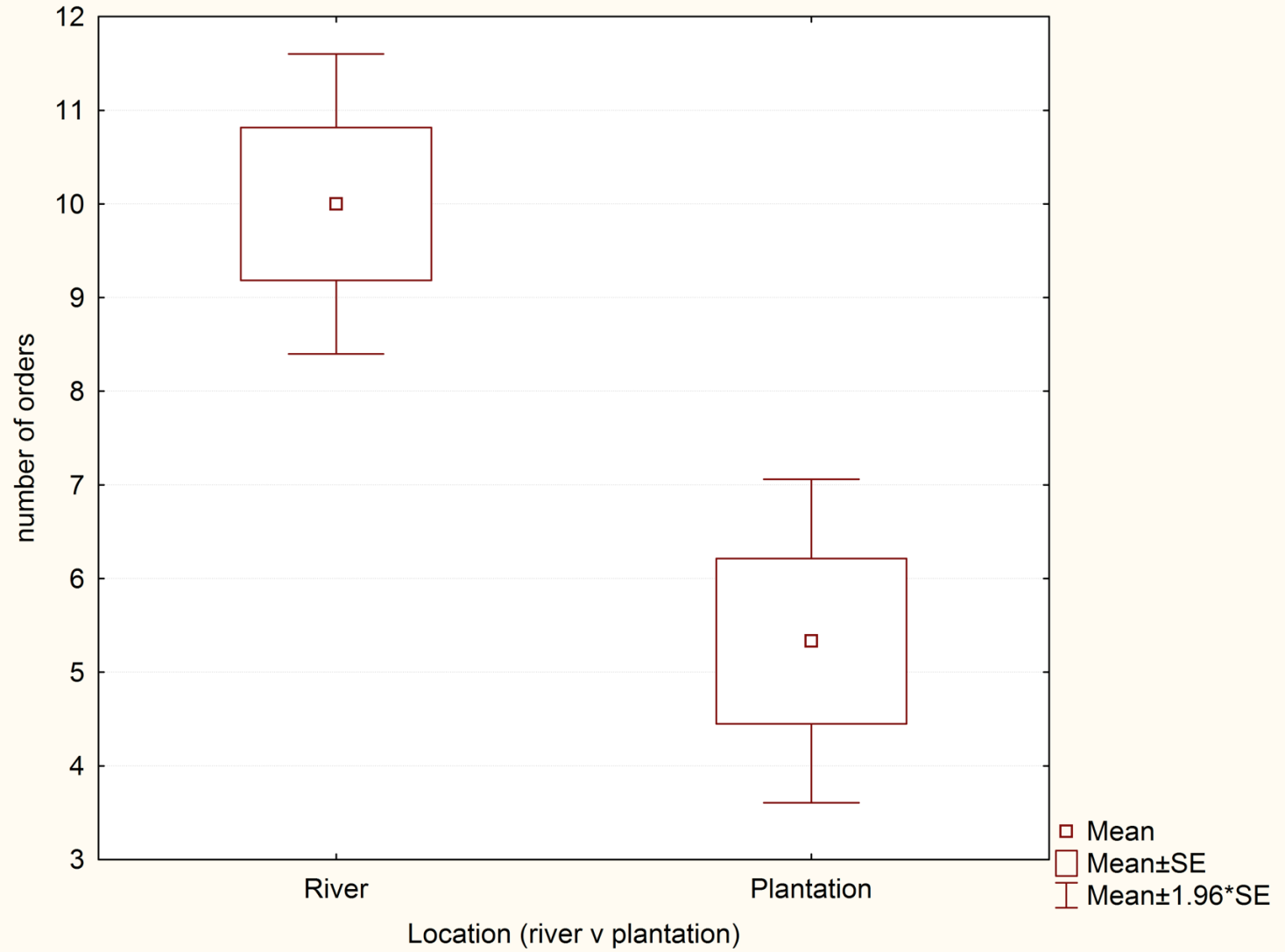


Untransformed mean (river)	Untransformed mean (plantation)	t-value	df	p
28.50	4.12	2.52	13	**0.025**

of Insect Orders



of Insect Orders



Mean (river)	Mean (plantation)	t-value	df	p
10.00	5.33	3.78	13	**0.002**

Recommendations

Insect availability may limiting SWFL nesting? Proximity to water preference related to aquatic insect availability?

Soil amendments/technologies for improving the "hydrology" of the restoration sites far from the river and far from the water table. Unlikely to function like a connected floodplain.

Connected sites such as Laguna are more likely to provide greater diversity and abundance of aquatic insects.

Intermediate functional metrics useful for evaluating restoration

Acknowledgements

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Questions?

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