Soil Hydrology and Microclimate Conditions in Occupied SWFL and YBCU Habitat

Colorado River Terrestrial and Riparian Meeting
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YB06 Bill Williams River
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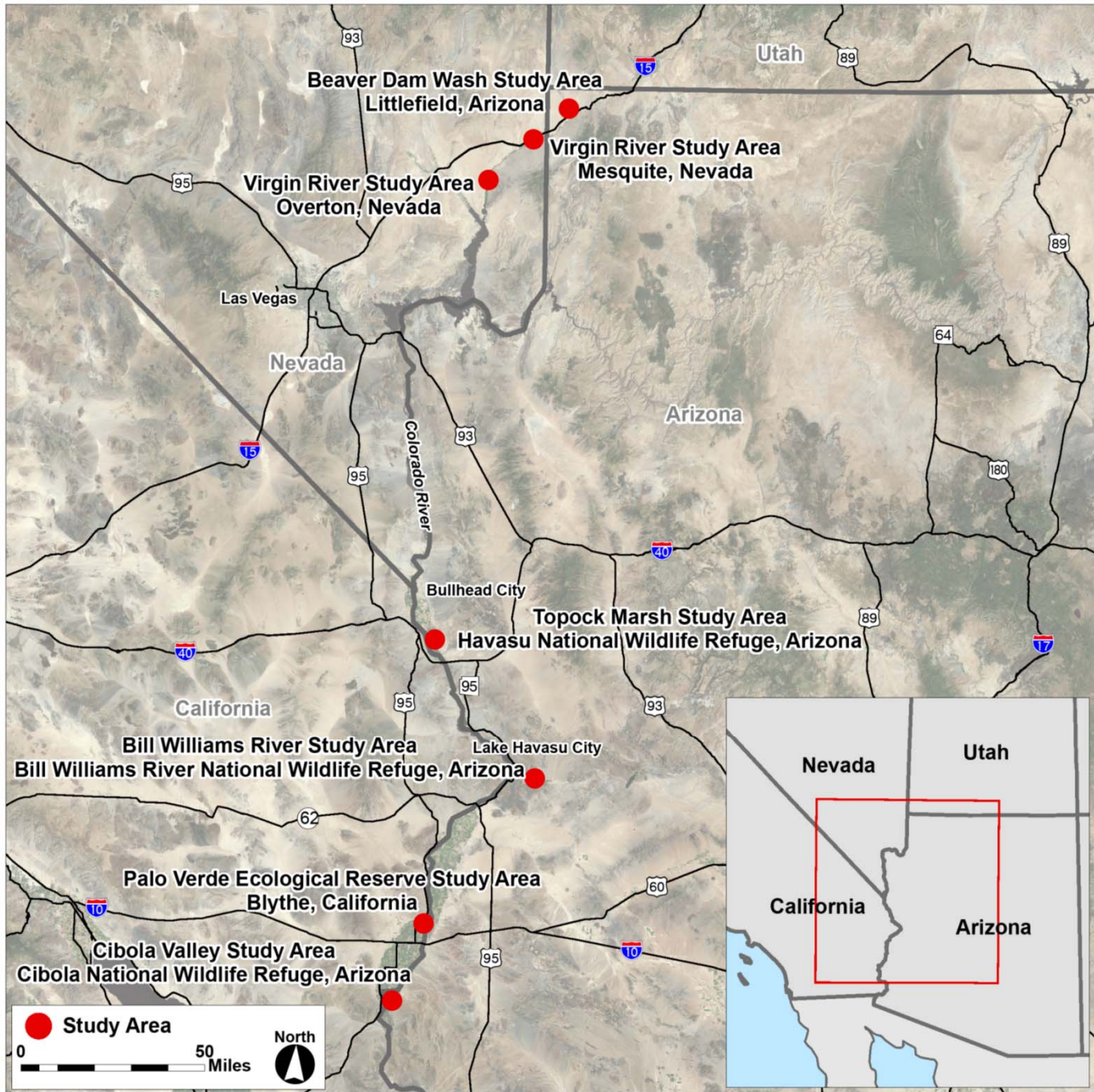# Research Purpose

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- ID and describe the range of soil hydrology and microclimate conditions that are present in occupied SWFL and YBCU habitat

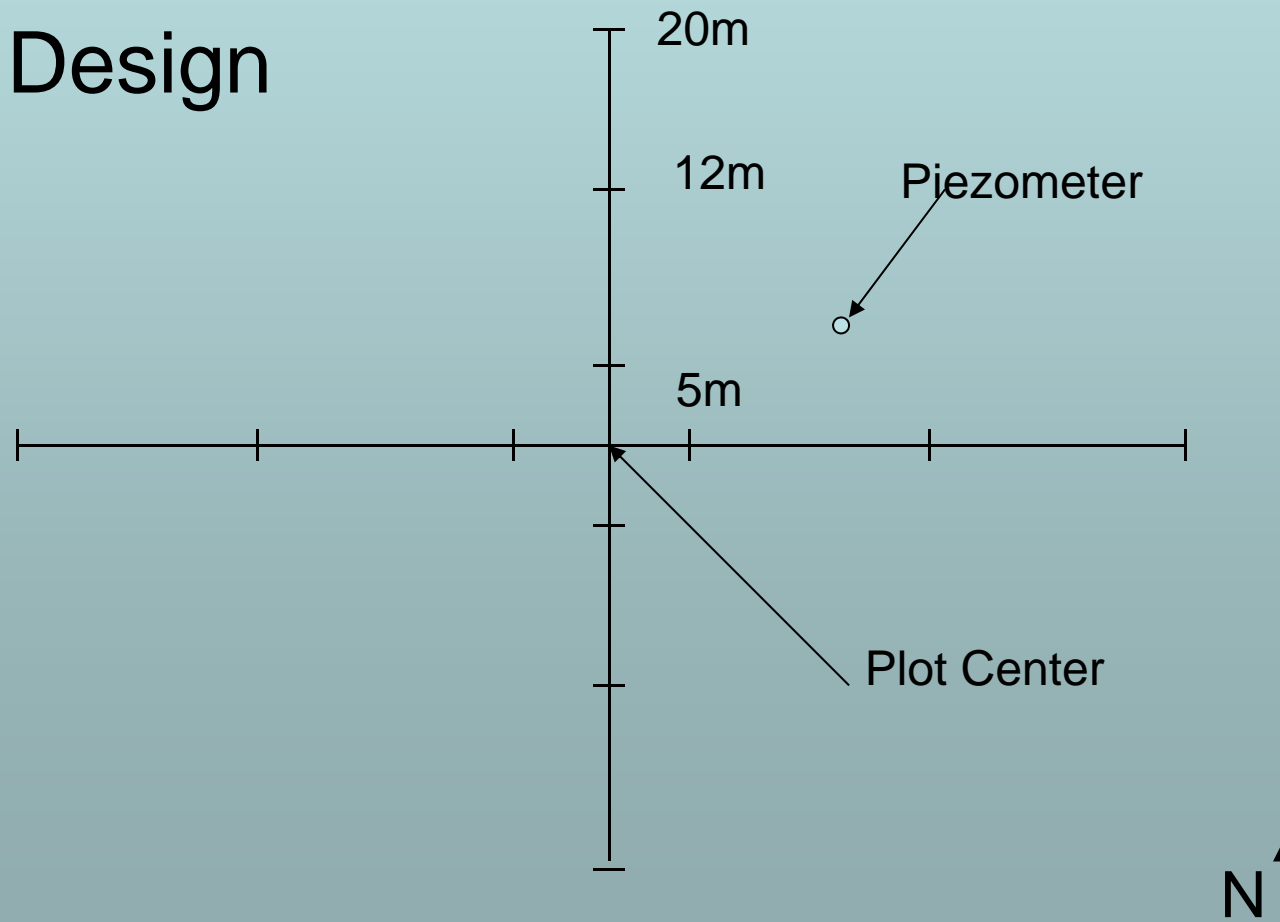- Contribute information to future efforts by Reclamation to create or restore habitat along the LCR

www.steamboatpilot.com

Methods

- 38 sites for each species over 2 years
- Site Design

20m

12m   Piezometer

5m

Plot Center

N

Subplot Methods

- **Measurements Taken at subplots:**
  - Soil Moisture
  - Litter Depth
  - Soil Texture
  - Air Temp
  - Relative Humidity

Measuring litter depth

Other Field Methods

Piezometer near site center

- Measurements taken within site:
  - Standing water (depth and area)
  - Depth to water table (select sites)
  - Surficial soil moisture (m^3/m^3) at a subgroup of sites
- Data collected electronically for analysis:
  - Distance of each site to flowing water
  - Vegetation and hourly temperature data
  - River discharge from nearest recording station
  - ET variables

Statistical Methods

MiniTab 15
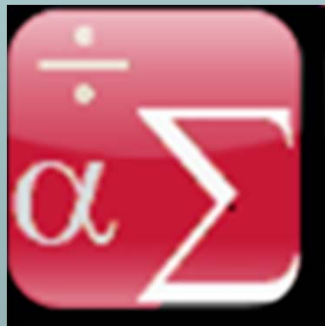
SPSS for Windows, Version 11.0.0

- Descriptive Statistics

- Correlation Analysis

- Multivariate Logistic Regression

- Analysis of Data Subgroups

SWFL Descriptive Results

- Standing Water: 76% (29 sites)

- Depth to groundwater: 0m to 3.1m

- Soil moisture: 2%-85% (μ=35%)

- Percent sand (texture): 16%-89% (μ=41%)

- Distance to flowing water: 0m-542m

SWFL Correlation Results

- % sand and % soil moisture (r=-0.63, p<0.01)

- Distance to flowing water and depth to the water table (r=0.433, p<0.01)

- These and additional correlation results indicate a high level of interdependence between variables

SWFL Subgroup Results

- Surficial soil moisture (4 sites)
  - Correlation between surficial soil moisture and % soil moisture at 2-foot depth (r=0.887, p<0.01) and % sand (r=-0.606, p=0.01)
- Bird presence (18 sites)
  - Similar to results of complete dataset
- Vegetation data (11 sites)
  - No significant relationship between canopy closure and RH or temperature
- PET data
  - Ranged from 0.1mm/day in July in Bill Williams River NWR to 6.9mm/day in May in Havasu NWR

YBCU Descriptive Results

YB19 CNWR

YB07 BWRNWR

- Standing water: 10% (4 sites); does not include irrigation

- Depth to ground water:0m-4.7m

- Soil moisture:0.5%-53.5% (μ=15%)

- Percent sand (texture): 23%-95% (μ=59%)

- Distance to flowing water:5m-2100m

YBCU Correlation Results

- % Sand (texture) and % soil moisture (r=-0.610, p<0.01)

- % Sand (texture) and depth to water table (r=-0.490, p<0.01)

- These and additional correlation results indicate a high level of interdependence between variables

YBCU Subgroup Results

- Surficial soil moisture (4 sites)
  - Correlation between surficial soil moisture and area of standing water (r=-0.511, p<0.03), negative measurements indicate potential source of error
- Vegetation data (26 sites)
  - No significant relationship between canopy closure and RH or temperature or canopy class and RH or temperature
- PET data (19 sites)
  - Ranged from 0.2mm/day August in Bill Williams River NWR to 8.9 mm/day in June in Havasu and Cibola NWRs

Logistic Regression Results

- Two-Sample T-tests used to identify variables with significant relationships for inclusion in logistic regression. SWFL sites had:
  - Higher soil moisture
  - Lower % sand
  - Shallower depth to ground water
  - Shorter distance to flowing water
  - More area of standing water
  - Lower average temperature
  - less organic matter
  - Lower stream discharge

Logistic Regression Results, Con't.

Strong results correctly distinguished SWFL sites from YBCU sites in 86.8% of cases (1=SWFL; 2=YBCU)

Logistic Regression Results, Con't

- Implied R^2=0.843

- Test of significance: z=14.07, p<0.001

- Wald Statistic indicates most influential variables:
  - Depth to ground water (Wald=45.361)
  - Soil texture (Wald=12.975)
  - Distance to flowing water (Wald=9.709)

Key Results

- Negative relationship between % sand and % soil moisture

- SWFL soil moisture more than twice as high as YBCU

- SWFL used less sandy sites

- SWFL had higher number of sites with standing water present (29) than YBCU (4)

WF02
Beaver
Dam Wash

YB04
BWRNWR

Key Results, Con't.

- SWFL sites had shallower depth to ground water than YBCU sites

- YBCUs utilized sites much farther from the nearest flowing water (up to 2100 m) than SWFLs (up to 542 m)

- Most influential variables in predicting SWFL vs. YBCU site: depth to ground water, soil texture, distance to flowing water

Recommendations

- **SWFL sites should be near flowing perennial water, preferably on floodplain**
- **If YBCU sites away from flowing perennial water, use maintenance (i.e. irrigation) to ensure a healthy stand**
- **Soil texture analysis recommended during site selection evaluation**
- **Further study comparing occupied and unoccupied habitat**

Beaver Dam near YB04 along Bill Williams River

Thank You!

- Bureau of Reclamation
  - Chris Dodge, Barbara Raulston, Theresa Olsen
- USFWS
  - Dick Gilbert, Andrew Hautzinger, Mike Oldham, Linda Miller, Brenda Zaun
- ADWR and NDWR
- SSRS, SWCA, and GSA

Beaver Pond near YB05 and WF15 along the Bill Williams River