Assessing Coastal Dune Lake Health

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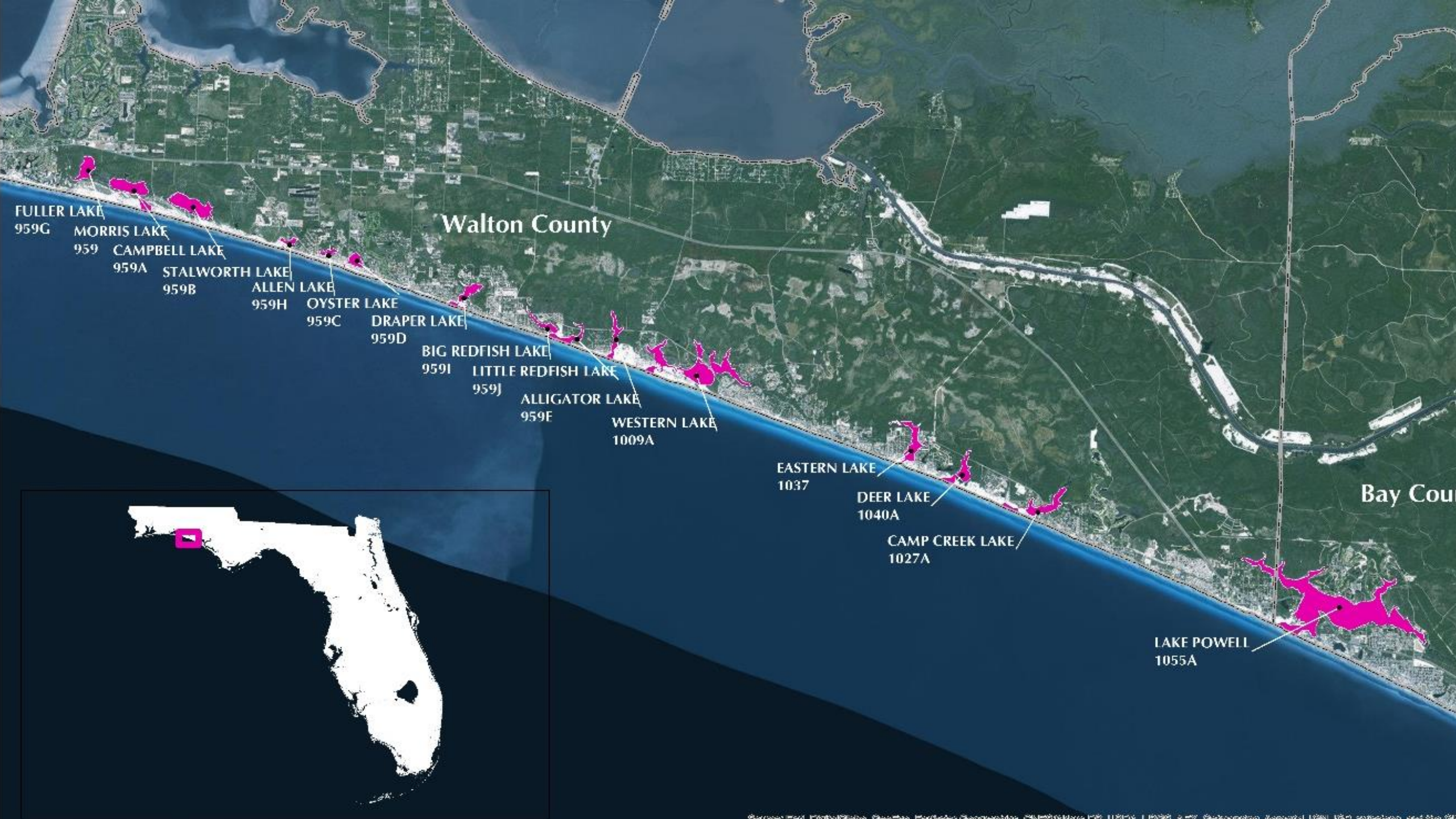
JONES EDMUNDS

Walton County Coastal Dune Lakes

- Globally Rare
- Dynamic
  - Rainfall
  - Connections to Gulf
- Aesthetically Pleasing
  - Tourism
  - Residences

Partnered with Jones Edmunds and Janicki Environmental


FULLER LAKE
959G
MORRIS LAKE
959
CAMPBELL LAKE
959A
STALWORTH LAKE
959B
ALLEN LAKE
959H
OYSTER LAKE
959C
DRAPER LAKE
959D
BIG REDFISH LAKE
959I
LITTLE REDFISH LAKE
959J
ALLIGATOR LAKE
959E
WESTERN LAKE
1009A
EASTERN LAKE
1037
DEER LAKE
1040A
CAMP CREEK LAKE
1027A
LAKE POWELL
1055A
Walton County
Bay Cou

Origin of Study

- Walton County promulgated Coastal Dune Lake Protection Ordinance
- Best Management Practices designed to protect ecology and water quality
- Lawsuit filed claiming the BMPs were not sufficient to protect lakes

Data Collection/Analysis Objectives

- Evaluate effectiveness of BMPs by assessing the current range of human disturbance across the lakes

- Measure a biological endpoint that is sensitive to the type of disturbance the BMPs are designed to mitigate
  - Physical disruption
  - Nutrients/water quality issues

Biological Condition Gradient Model

Natural structural, functional, and taxonomic integrity is preserved.

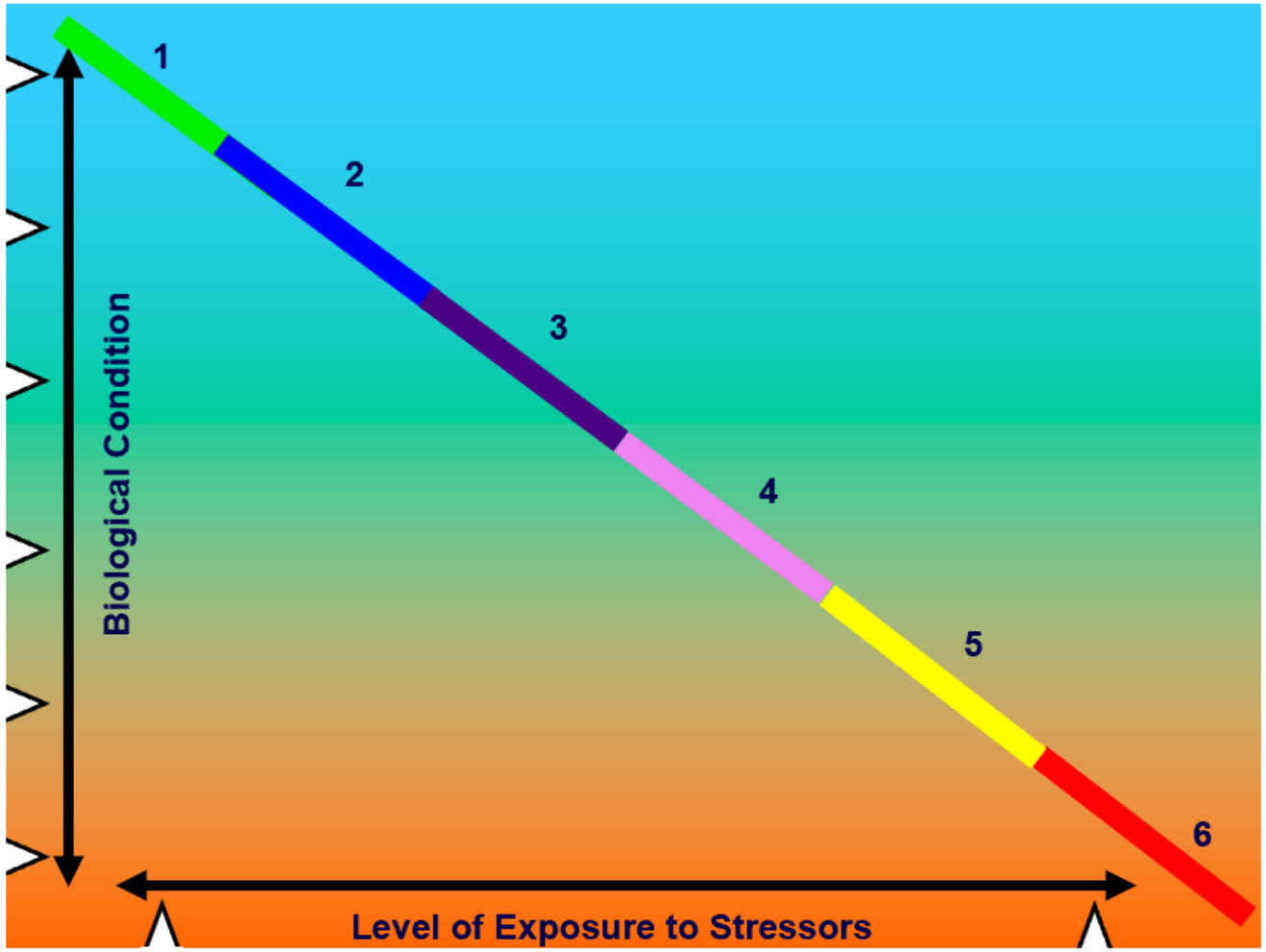
Structure & function similar to natural community with some additional taxa & biomass; ecosystem level functions are fully maintained.

Evident changes in structure due to loss of some rare native taxa; shifts in relative abundance; ecosystem level functions fully maintained.

Moderate changes in structure due to replacement of sensitive ubiquitous taxa by more tolerant taxa; ecosystem functions largely maintained.

Sensitive taxa markedly diminished; conspicuously unbalanced distribution of major taxonomic groups; ecosystem function shows reduced complexity & redundancy.

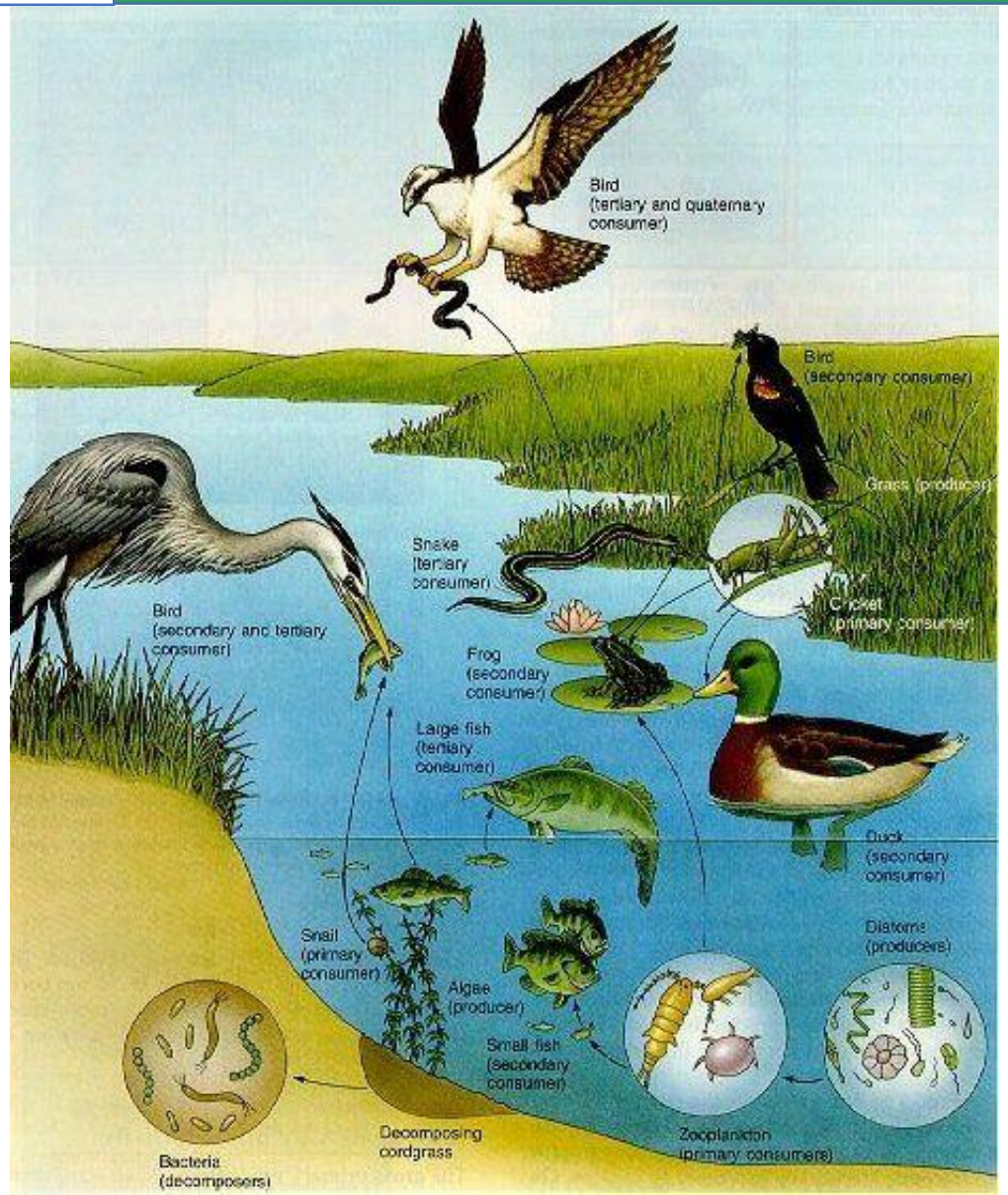
Extreme changes in structure and ecosystem function; wholesale changes in taxonomic composition; extreme alterations from normal densities.



Watershed, habitat, flow regime and water chemistry as naturally occurs.

Chemistry, habitat, and/or flow regime severely altered from natural conditions.

Parameter Selection



- Biological Communities
  - Phytoplankton: covered in modeling exercises
  - Invertebrates: confounded in colored lakes
  - Fish/vertebrates: not sensitive enough
  - **Lake plants: early responders to landscape disturbance and nutrients**

Data Collection

- CDLs sampled for:
  - Lake Habitat Assessment
  - Vascular plant communities
  - Physical/chemical parameters
- May 8 – 11, 2017

Access thanks to Susan Pallidini, Mebane Cory-Ogden, Jim Bob Sellars, Bill Crane, Matthew Allen, Patrick Hartsfield

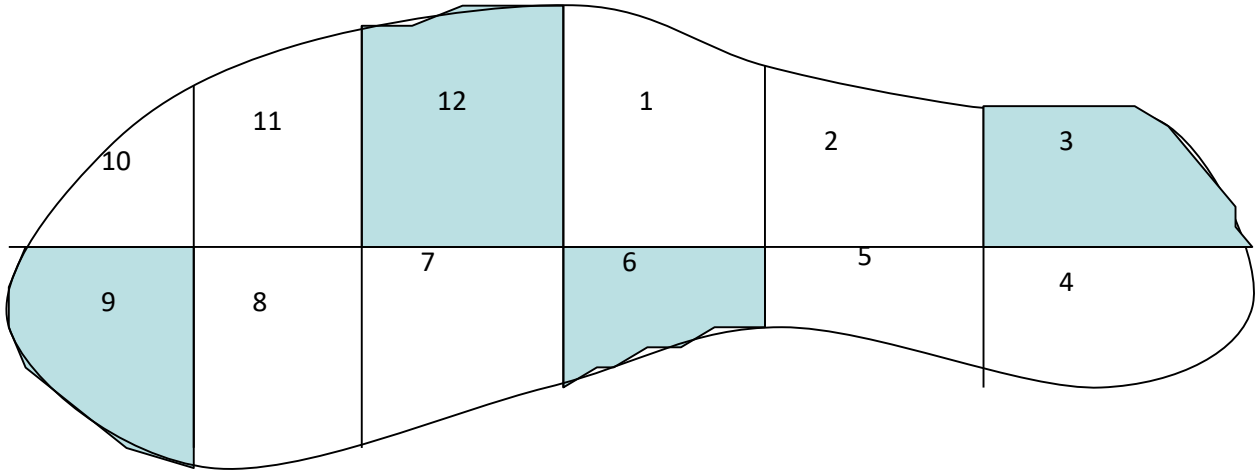
FDEP Lake Habitat Assessment

- FDEP SOP FT 3200
- Lake-wide score based on assessing:
  - Stormwater inputs
  - Bottom substrate quality
  - Adverse lakeside alterations
  - Upland buffer zone
  - Adverse human watershed land use

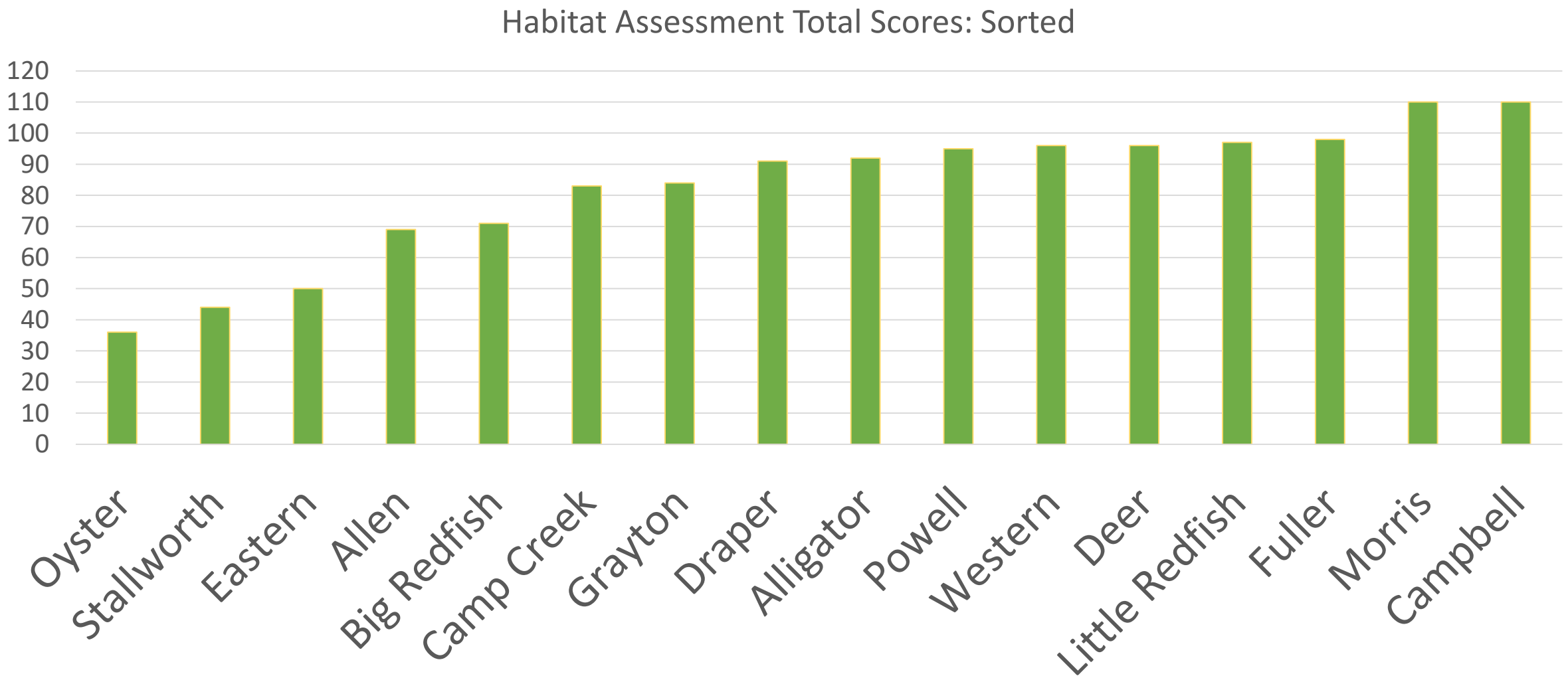
Walton County Lake Protection BMP	Related Lake Habitat Assessment Measure
Septic tanks drain fields 100 feet away	Upland Buffer Zone. A buffer zone of >18 m (59 ft) is considered optimal.
Untreated stormwater runoff should not enter the lake.	Stormwater Inputs. Sheet flow over an uncultivated vegetated buffer zone is considered optimal
Erosion control	Stormwater Inputs. Good BMPs (buffers, swales, retention areas, etc.) score high
No hazardous wastes	Stormwater Inputs. Adverse Watershed Land Use
Seawalls, bulkheads, stc. not permitted	Lakeside Adverse Human Alterations. Perimeter of the lake assessed for human structure
Endangered species habitat	Upland Buffer Zone. Width of vegetated zone
No new point or NPS	Adverse Watershed Land Use
Setback required = 100 feet	Upland Buffer Zone. Lakeside vegetated zone, >18 m
Preserve 60 % within 300 feet	Upland Buffer Zone. Lakeside vegetated zone, >18 m

Vascular Plant Sampling

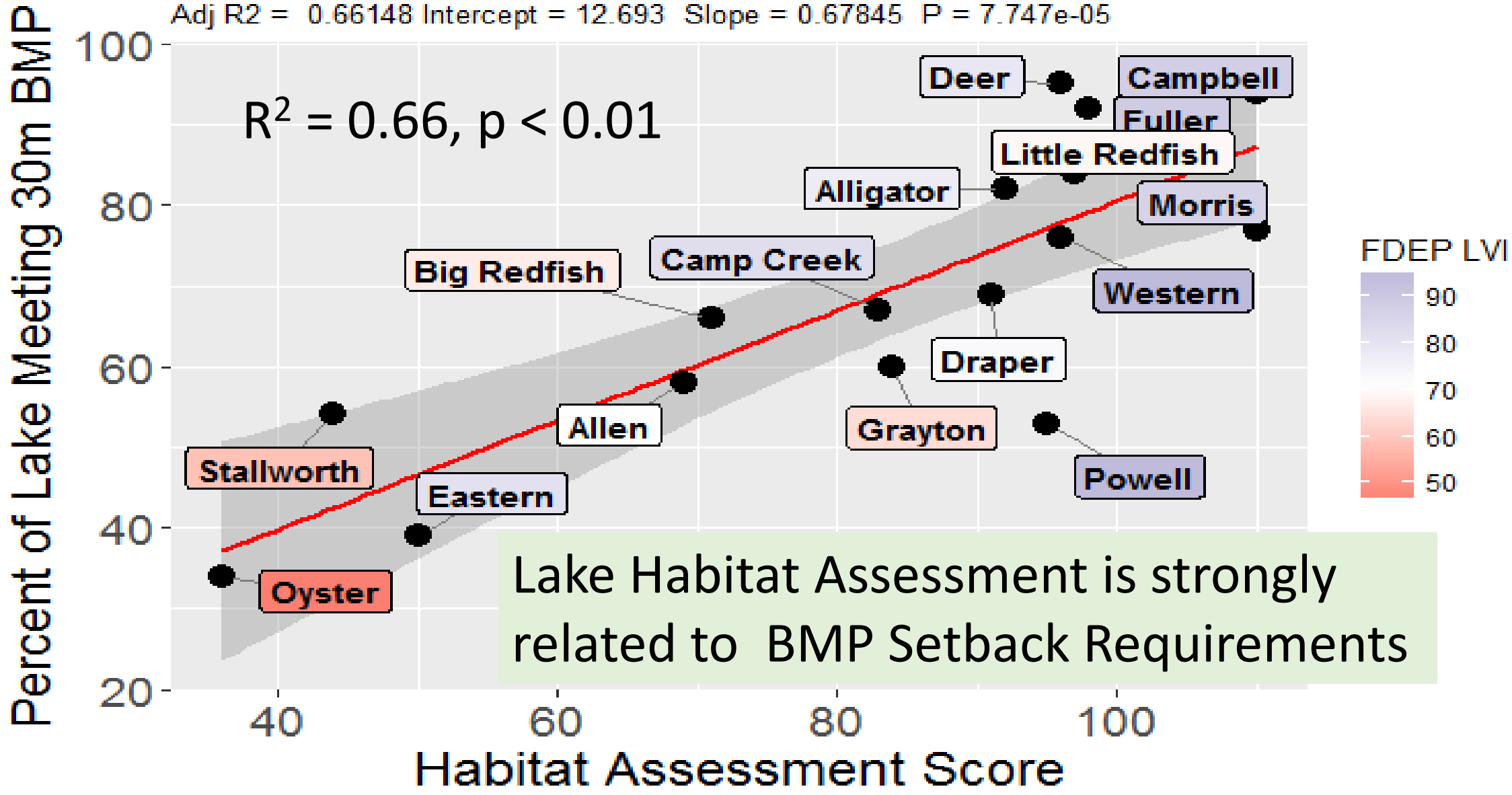
- FDEP SOP LVI 1000
- Lake divided into 12 total sections. Four sampled for plants in a pattern, with random start
  - 4 species lists generated per lake, identified to lowest practical taxonomic level
  - Community attributes calculated from taxa lists



Habitat Assessment Results



Habitat Assessment Score Regressed Against 30 m BMP Attainment



Lake Habitat Assessment is strongly related to BMP Setback Requirements

Vascular Plant Community Results

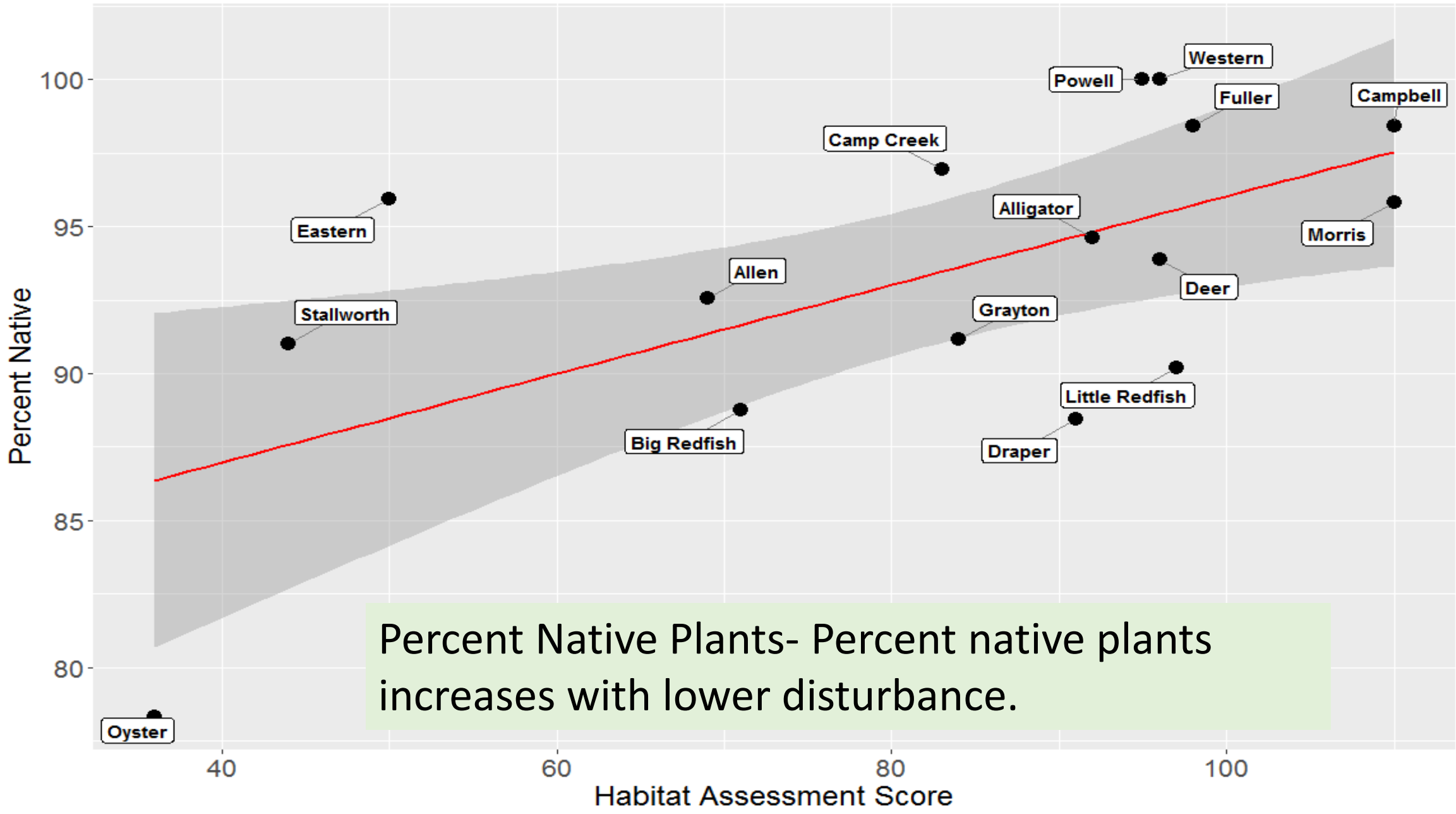
Metrics:

Measures of **biological community health** that respond to **human disturbance** (Habitat Assessment) in a predictable manner

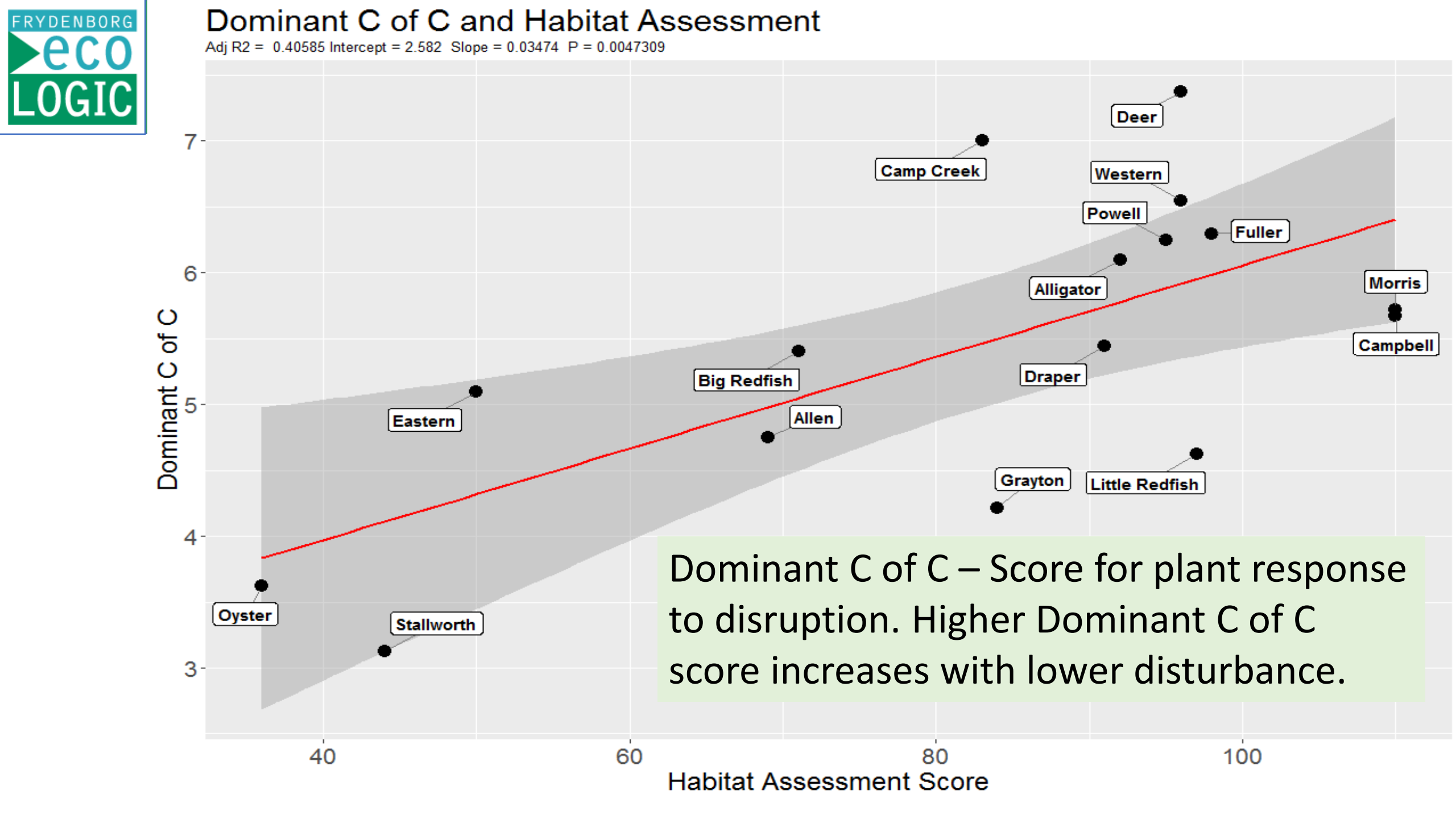
Explored use of metrics previously found to be effective

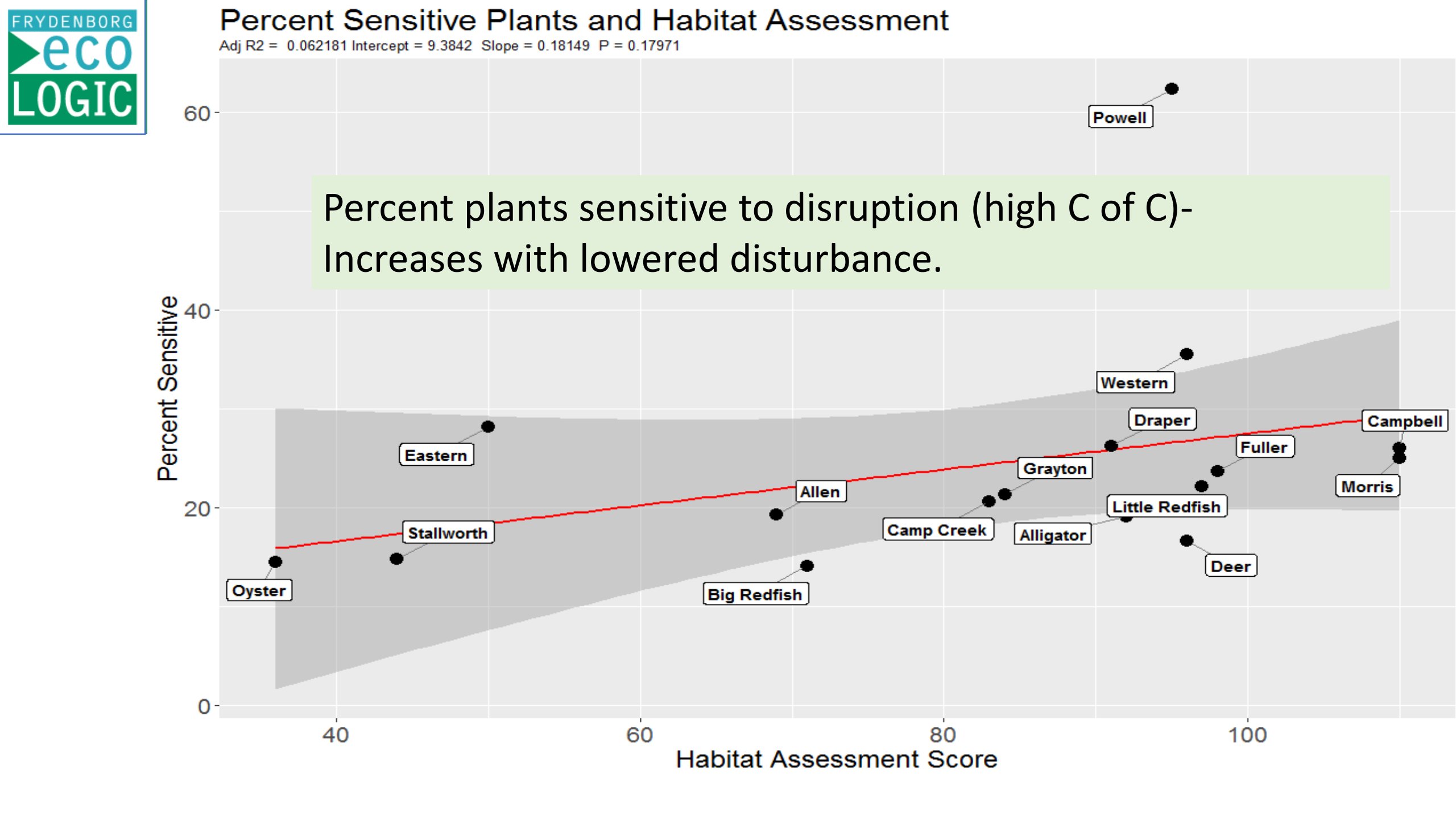
Percent Native Plants and Habitat Assessment

Adj R2 = 0.33572 Intercept = 80.939 Slope = 0.15092 P = 0.010986



Percent Native Plants- Percent native plants increases with lower disturbance.

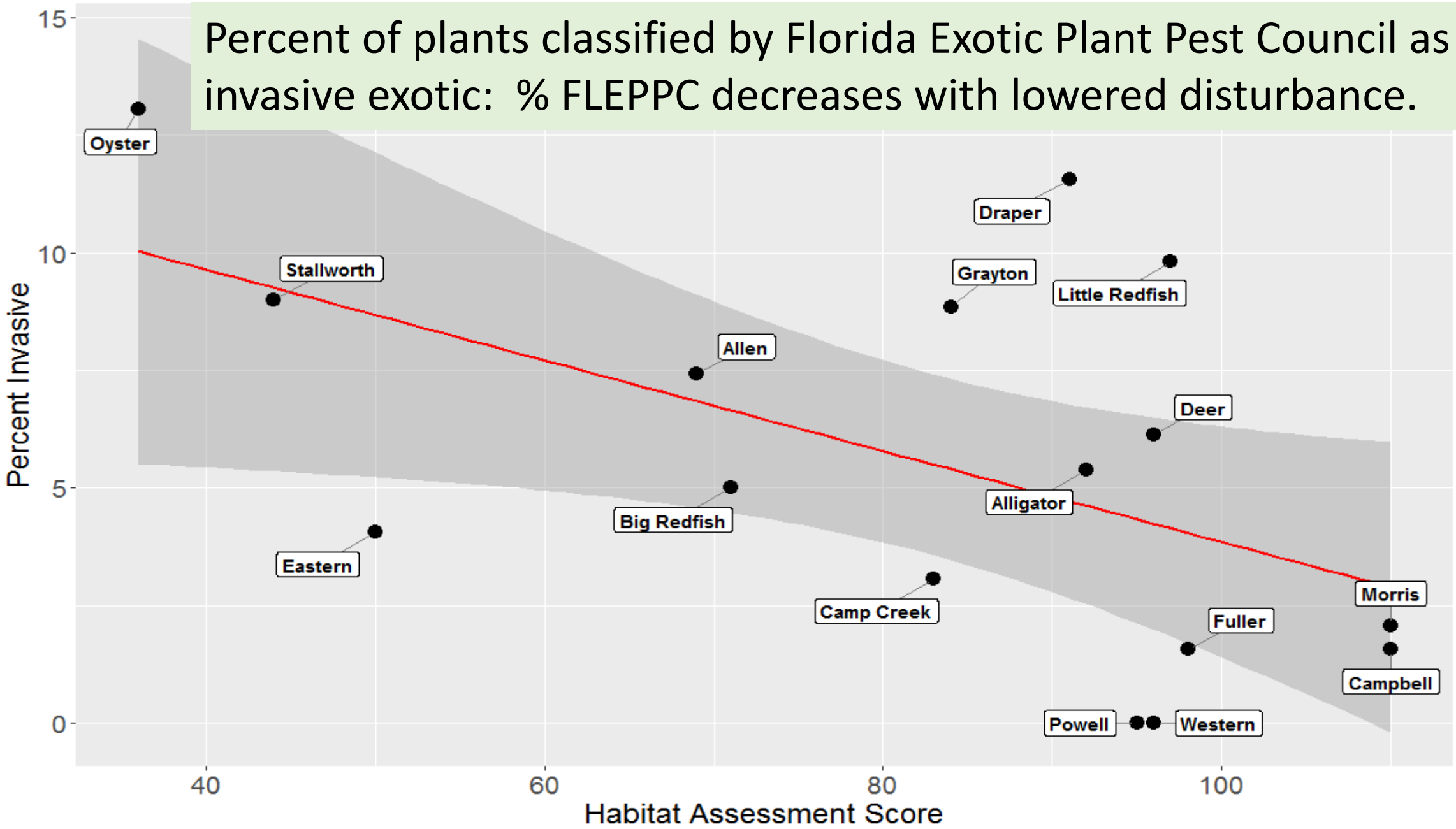

Dominant C of C and Habitat Assessment
Adj R2 = 0.40585 Intercept = 2.582 Slope = 0.03474 P = 0.0047309
Dominant C of C
Habitat Assessment Score
7
6
5
4
3
40
60
80
100
Deer
Camp Creek
Western
Powell
Fuller
Alligator
Morris
Campbell
Big Redfish
Draper
Eastern
Allen
Grayton
Little Redfish
Oyster
Stallworth
Dominant C of C – Score for plant response to disruption. Higher Dominant C of C score increases with lower disturbance.


Percent Sensitive Plants and Habitat Assessment
Adj R2 = 0.062181 Intercept = 9.3842 Slope = 0.18149 P = 0.17971
Percent plants sensitive to disruption (high C of C)- Increases with lowered disturbance.
Percent Sensitive
Habitat Assessment Score
0
20
40
60
40
60
80
100
Powell
Western
Draper
Campbell
Fuller
Grayton
Morris
Eastern
Allen
Little Redfish
Camp Creek
Alligator
Stallworth
Deer
Oyster
Big Redfish

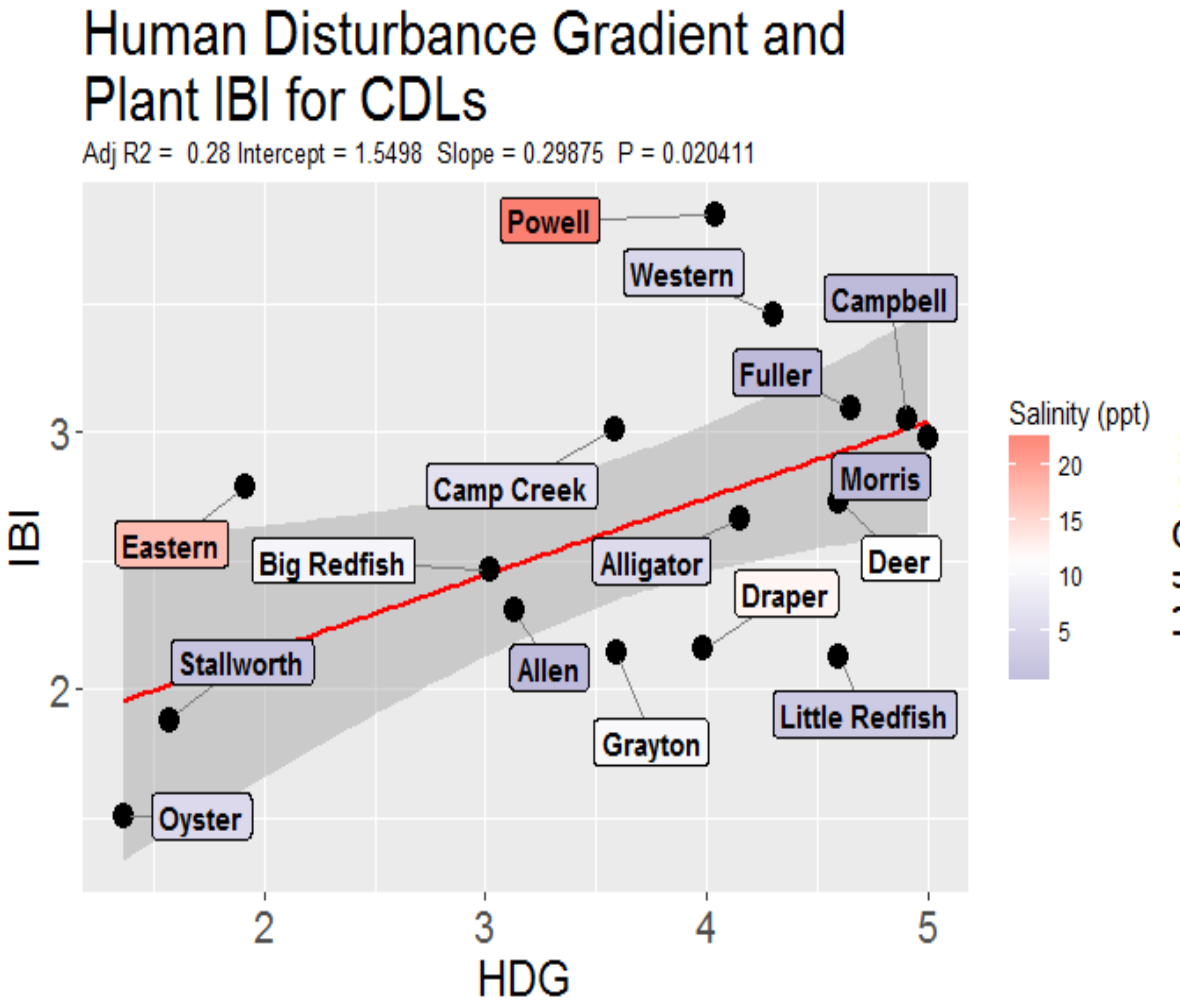
Percent Invasive species and Habitat Assessment

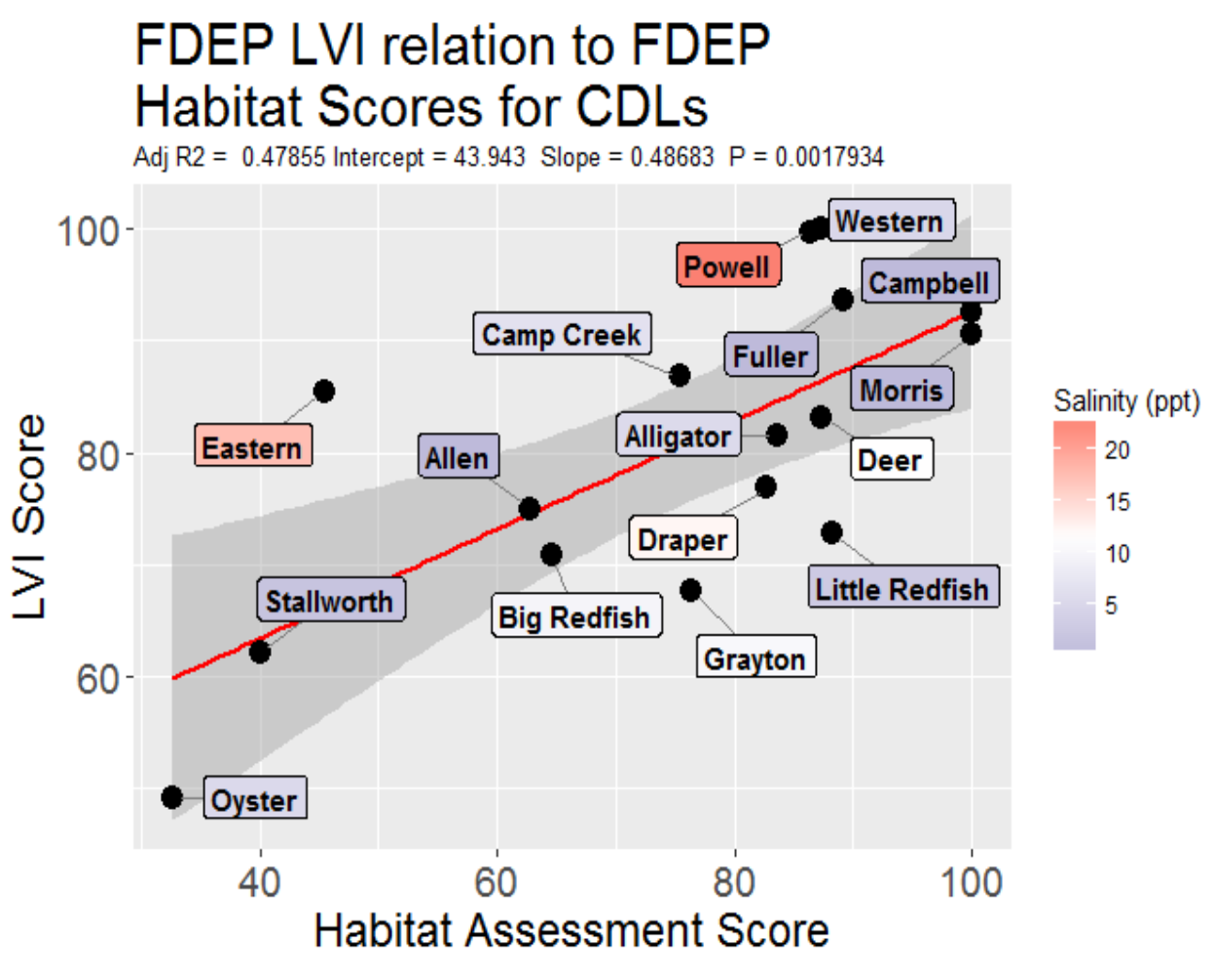
Adj R2 = 0.23263 Intercept = 13.5 Slope = -0.096442 P = 0.033625

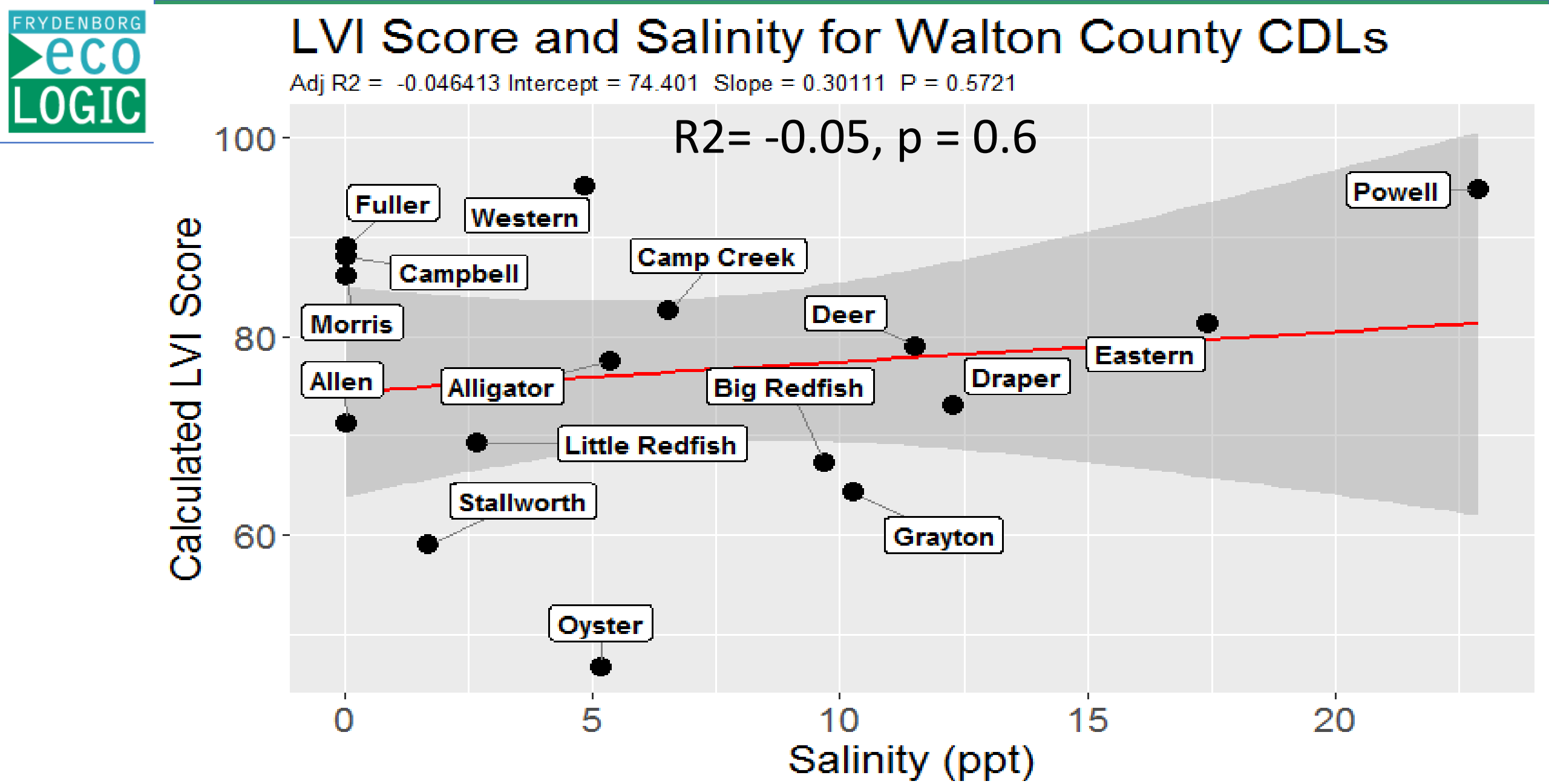
Percent of plants classified by Florida Exotic Plant Pest Council as invasive exotic: % FLEPPC decreases with lowered disturbance.



CDL Plant Index and Lake Vegetation Index

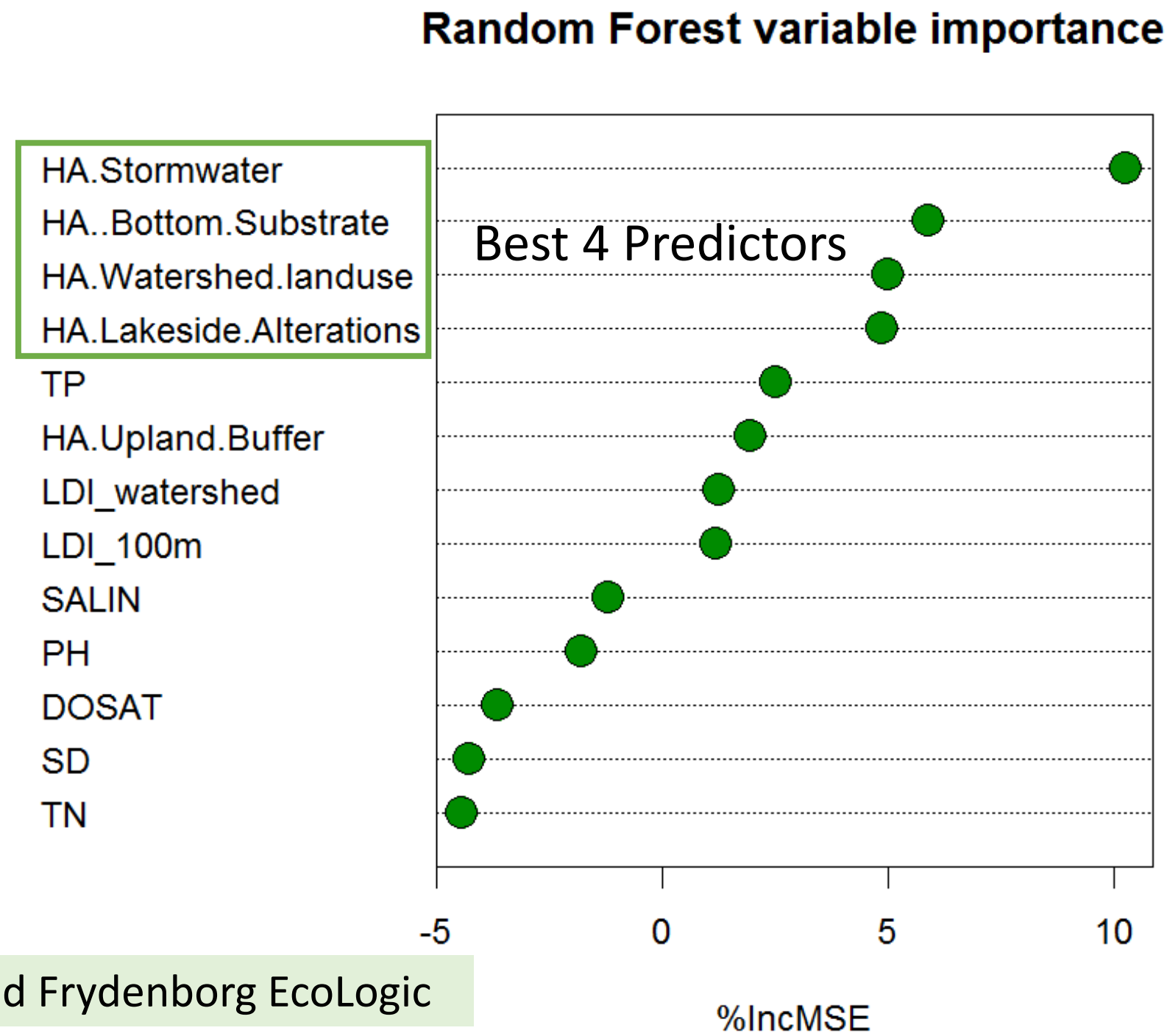






Human Disturbance Appears to be Stronger Influence Than Salinity

- Quantifies the relative importance of physical and water quality variables influencing plant community response



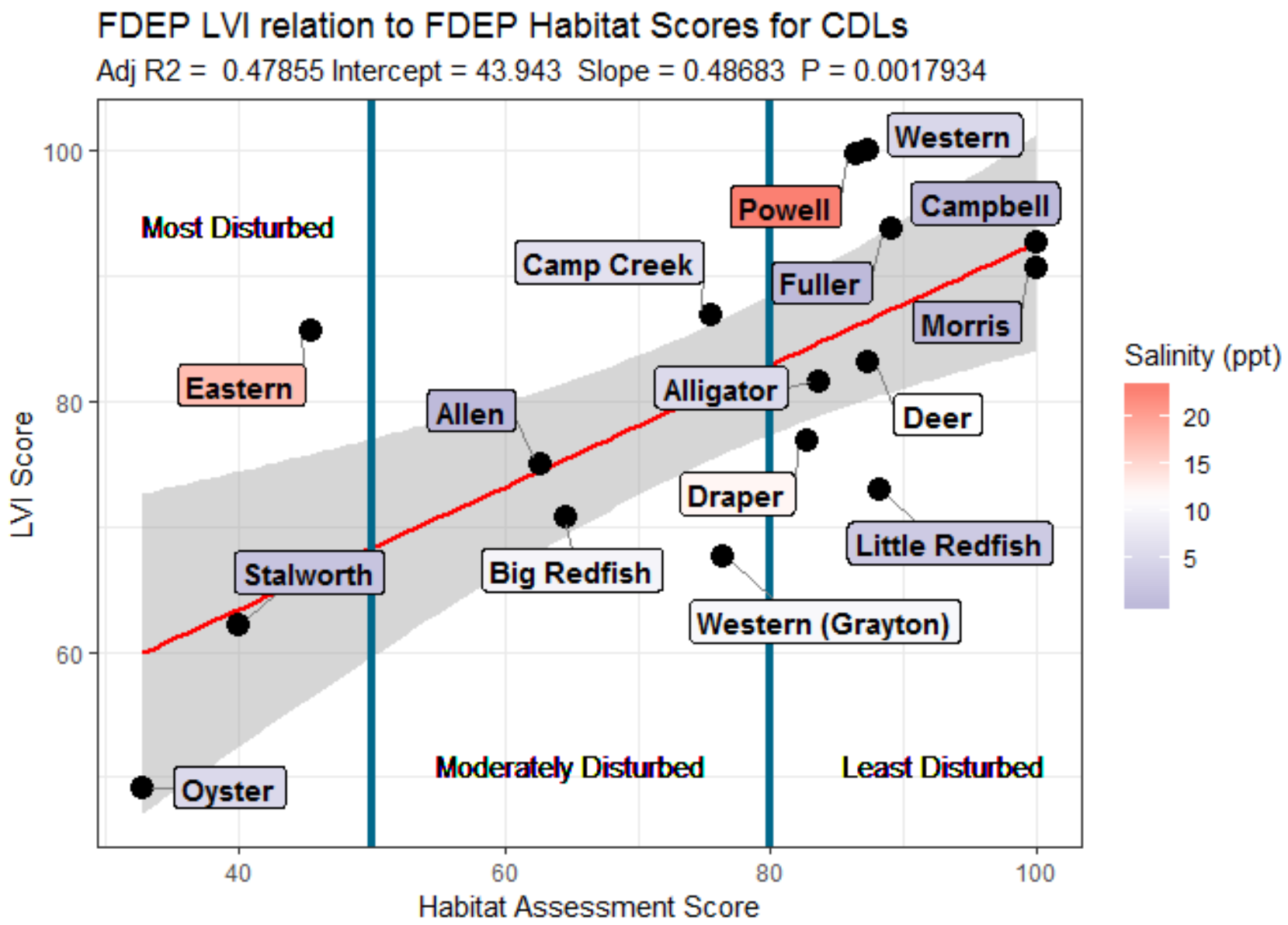
Input data collected by CBA and Frydenborg EcoLogic

Conclusions

- Lake Habitat Assessment is relevant for gauging conditions consistent with the BMPs in these lakes despite potential confounders

- Walton County lake protection BMPs are expected to be effective in the future for maintaining and/or restoring biological health in the CDLs

Future Management of Lakes



Questions?