Action Effectiveness Monitoring and Research Status Update

Science Work Group Meeting

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Overview

- 2017 AEMR Status
  - Programmatic AEMR Overview
  - Sites and Metrics
- 2016 Results
- AEM Discussion

Action Effectiveness Monitoring and Research (AEMR) Objective

- Determine the success of restoration actions at site, landscape, and estuary-wide scales in terms of improved ecosystem functionality

Programmatic Action Effectiveness Monitoring

Columbia Estuary Ecosystem Restoration Program (CEERP) Objectives*

- Obj. 1. Increase the capacity (quality) of estuarine and tidal-fluvial ecosystems
- Obj. 2. Increase the opportunity for access by aquatic organisms to and for export of materials from shallow water habitats
- Obj. 3. Improve ecosystem realized functions for juvenile salmonids

*From Draft 2014 CEERP Programmatic Plan for AEMR

Action Effectiveness Monitoring Levels

Level 1 – Intensive
E.g. fish density, growth, genetics, diet

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Level 2 – Extensive
E.g. channel cross-sections, salmonid prey, plant species composition

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Level 3 – Basic (or Standard) Measurements *E.g. water surface elevation, water temperature, sediment accretion, photo points*

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Monitored Metrics

Restoration Projects

Level 3 Monitoring (Basic)

- Before/After Sampling Design
- Metrics
  - Hydrology and Water Quality
    - Water surface elevation and water temperature (All Sites)
  - Sediment accretion (All Sites)
  - Photo points (All Sites)
- Frequency
  - 1 year pre-restoration
  - 1 through 5 year post restoration

Level 2 Monitoring (Extensive)

- Before/After Reference Impact Sampling Design
- Metrics
  - Vegetation Composition and Cover
  - Salmonid Prey – terrestrial and benthic macroinvertebrates
  - Channel Cross Sections
- Frequency
  - 1 year pre-restoration
  - 1, 3, 5, 10 year post restoration

Level 1 Monitoring (Intensive)

- Metrics
  - Chinook Diets
  - Chinook Genetics
  - Stable Isotopes
  - Fish Community
  - Fish condition index
  - Fish length/weight
  - Salmonid Prey (Neuston, Benthos, Terrestrial)
- Frequency
  - 2016 & 2017

Anticipated Action Effectiveness Monitoring in 2017

Level 2 Sampling Rotation

Site	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Kandoll Farm	Pre	Post		Post		Post					Post	
Kandoll Farm Reference	Pre	Post		Post		Post					Post	
Steamboat	Pre		Post		Post		Post					Post
Steamboat Reference	Pre		Post		Post		Post					Post
Sauvie Island North Unit P1	Pre	Post		Post		Post					Post	
Sauvie Island North Unit P1	Pre	Post		Post		Post					Post	
Dibblee	Post		Post		Post					Post		
Dibblee Reference	Post		Post		Post					Post		
Wallacut		Pre			Post		Post		Post			
Wallacut Reference		Pre			Post		Post		Post			
Sandy River		Post		Post		Post					Post	
Sandy River Reference		Post		Post		Post					Post	
Sauvie Island North Unit P2		Pre	Post		Post		Post					Post
Sauvie Island North Unit P2		Pre	Post		Post		Post					Post
La Center			Pre	Post		Post		Post				
La Center Reference			Pre	Post		Post		Post				
Wallooskee-Youngs			Pre			Post		Post		Post		
Wallooskee-Youngs Reference			Pre			Post		Post		Post		

Equipment and Technical Support

- Technical and Field Support
  - Site sampling design
  - Data management
  - Methods
- Hydrology Monitoring Equipment
  - Hobo Onset pressure & temperature data loggers (long-term)
  - Hobo Onset temperature (only) data loggers (long-term)
  - Flow/discharge meter and rod (short-term)
- Survey and Mapping
  - RTK ProMark 200 survey and mapping units (base and rover) including tripod and monopod (short-term)
  - Auto Level including tripod (short-term)
  - Small unmanned aerial vehicle

2016 Level 2 Results

2016 AEM Objectives

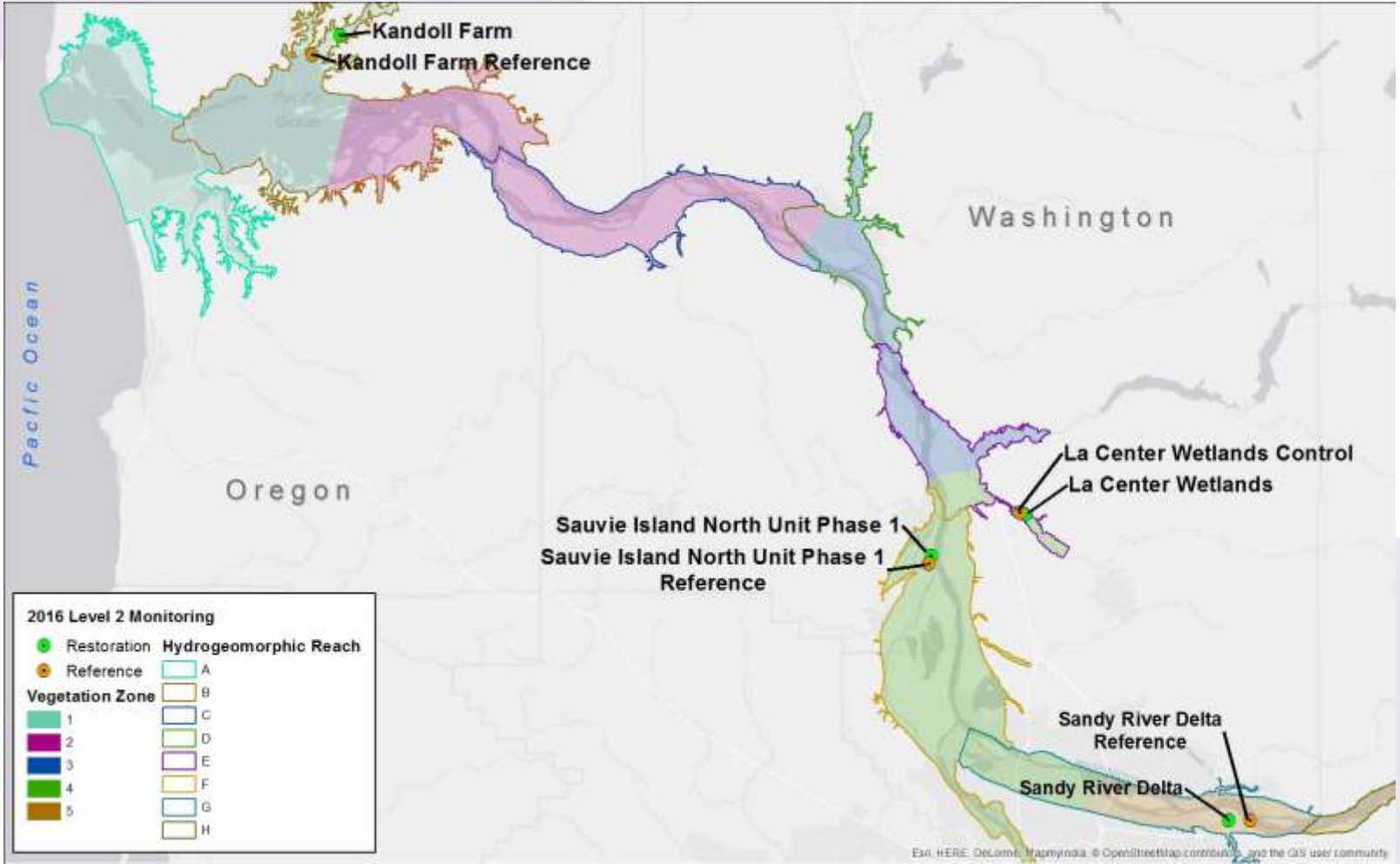
Reach Scale

- Determine similarity of restoration and reference sites within the same vegetation zone

Site Scale

- Quantify changes to vegetation related to changes in marsh elevation lowering
- Determine impacts to existing wetlands within restoration sites
- Quantify salmonid prey at restoration sites

2016 Level 2 AEM



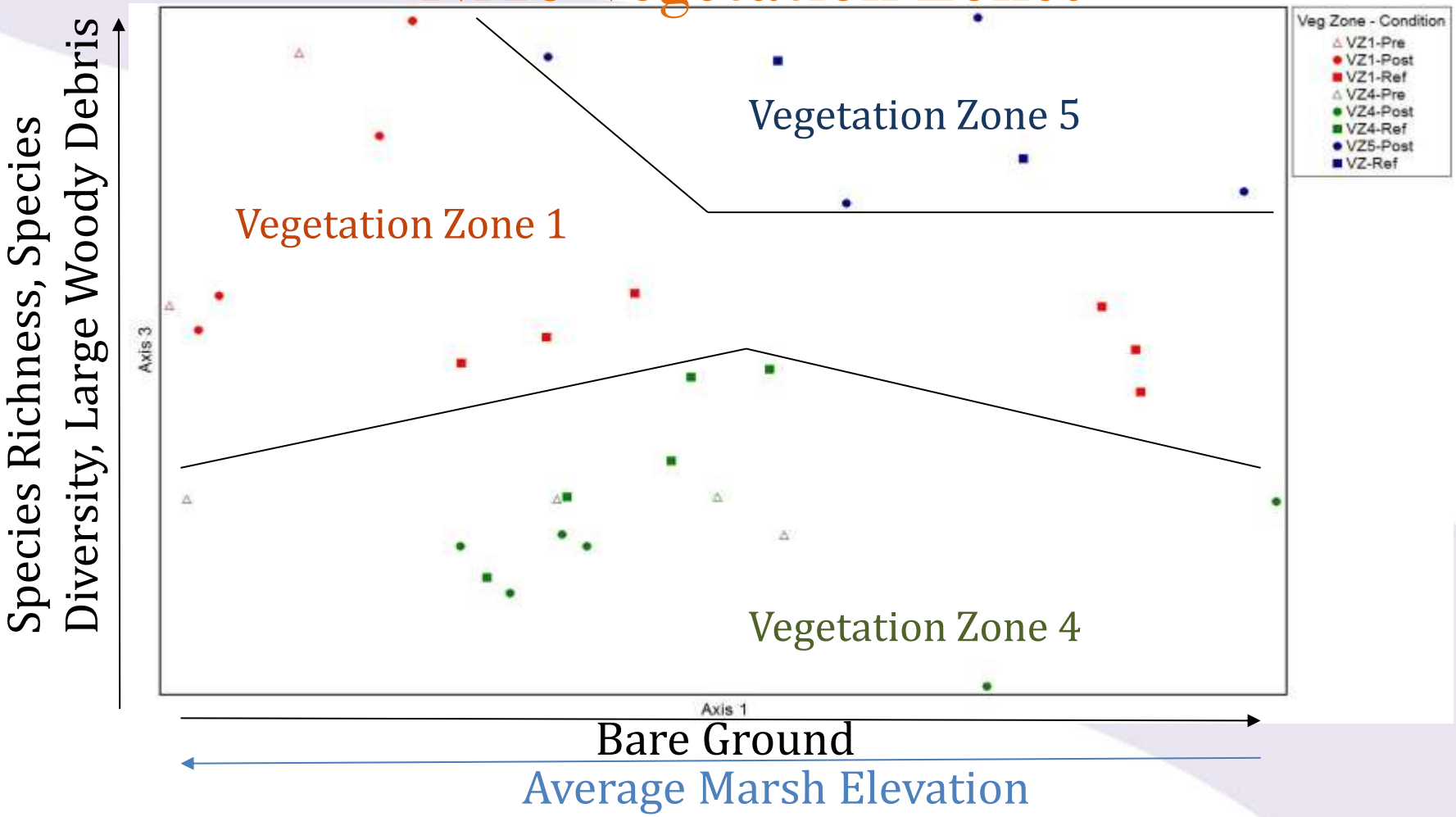
2016 AEM

- Level 2 Metrics
  - Vegetation Community and Composition
  - Salmonid Prey – Benthic and Terrestrial Macroinvertebrates

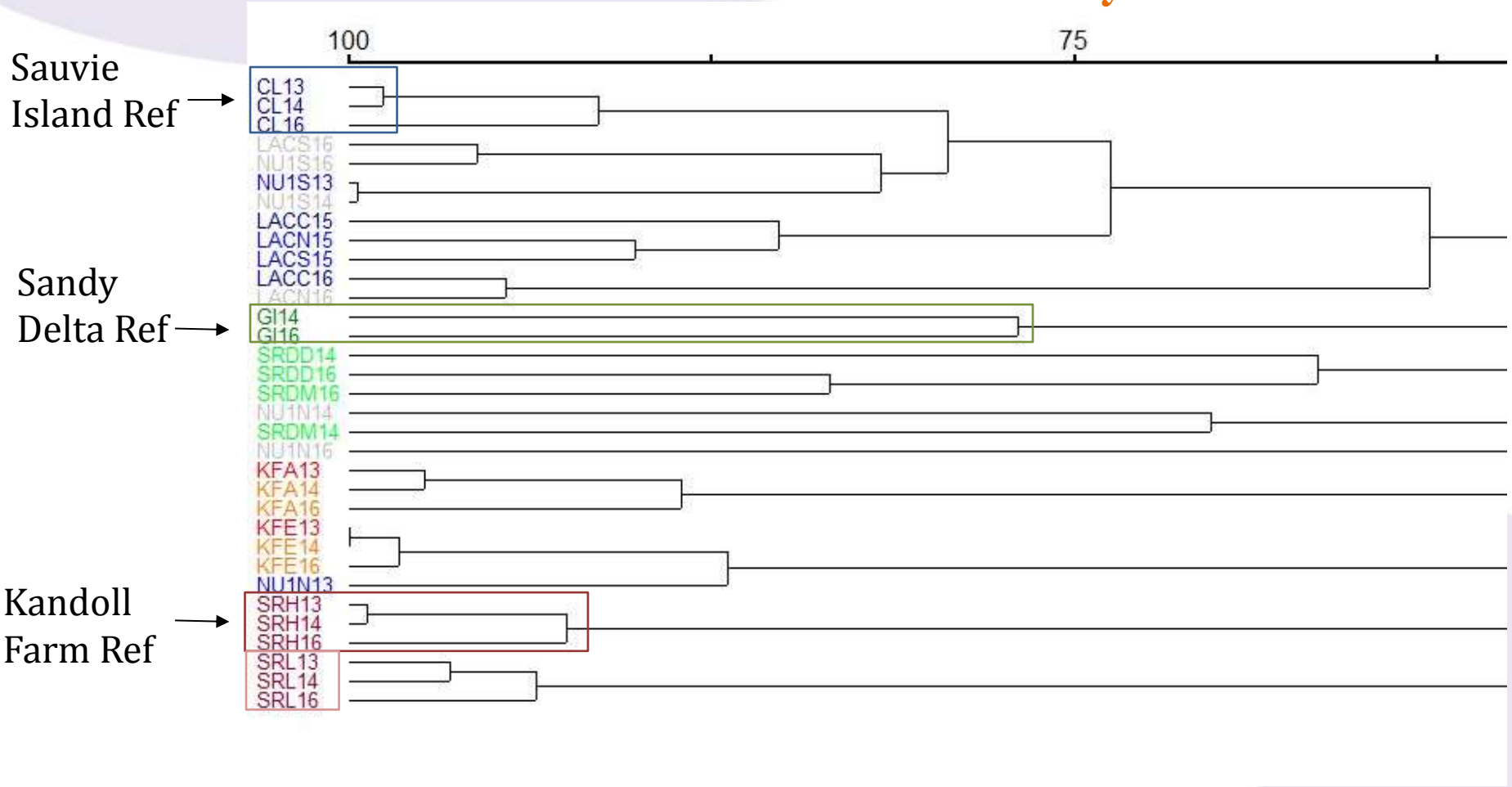
Analysis

- Summary Metrics
  - Composition, Abundance, Species Richness, Species Diversity, Average Marsh Elevation
- Percent similarity
  - Non-Metric Multidimensional Scaling (Ordination) (McCune and Grace 2002)
    - Well suited to data that are non-normal or on arbitrary, discontinuous, or otherwise questionable scales
    - Avoids the assumption of linear relationships

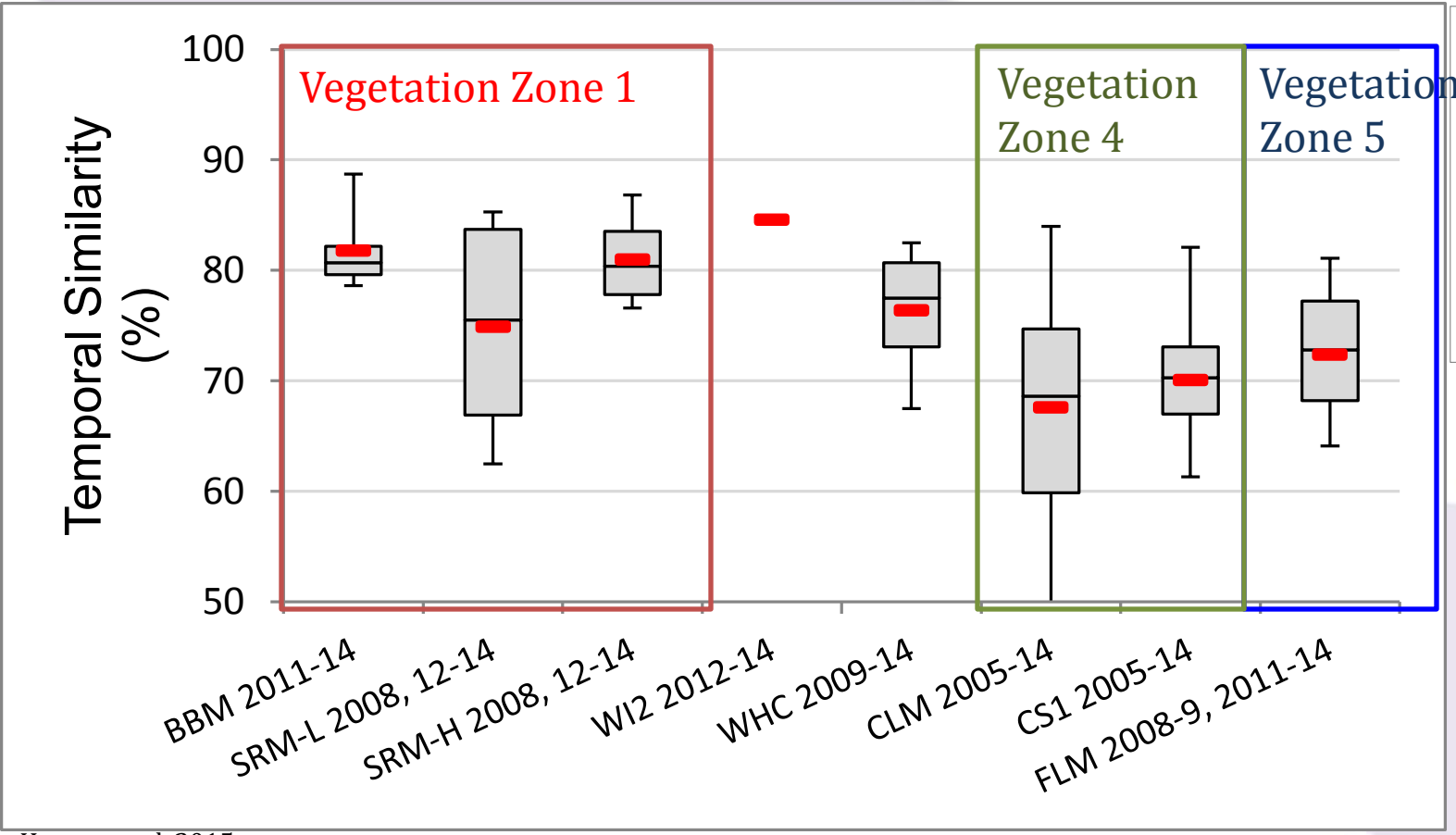
NMS Vegetation Zones

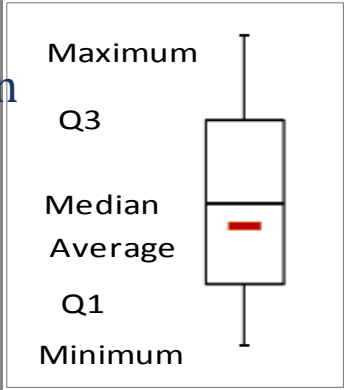


Reference Site Similarity



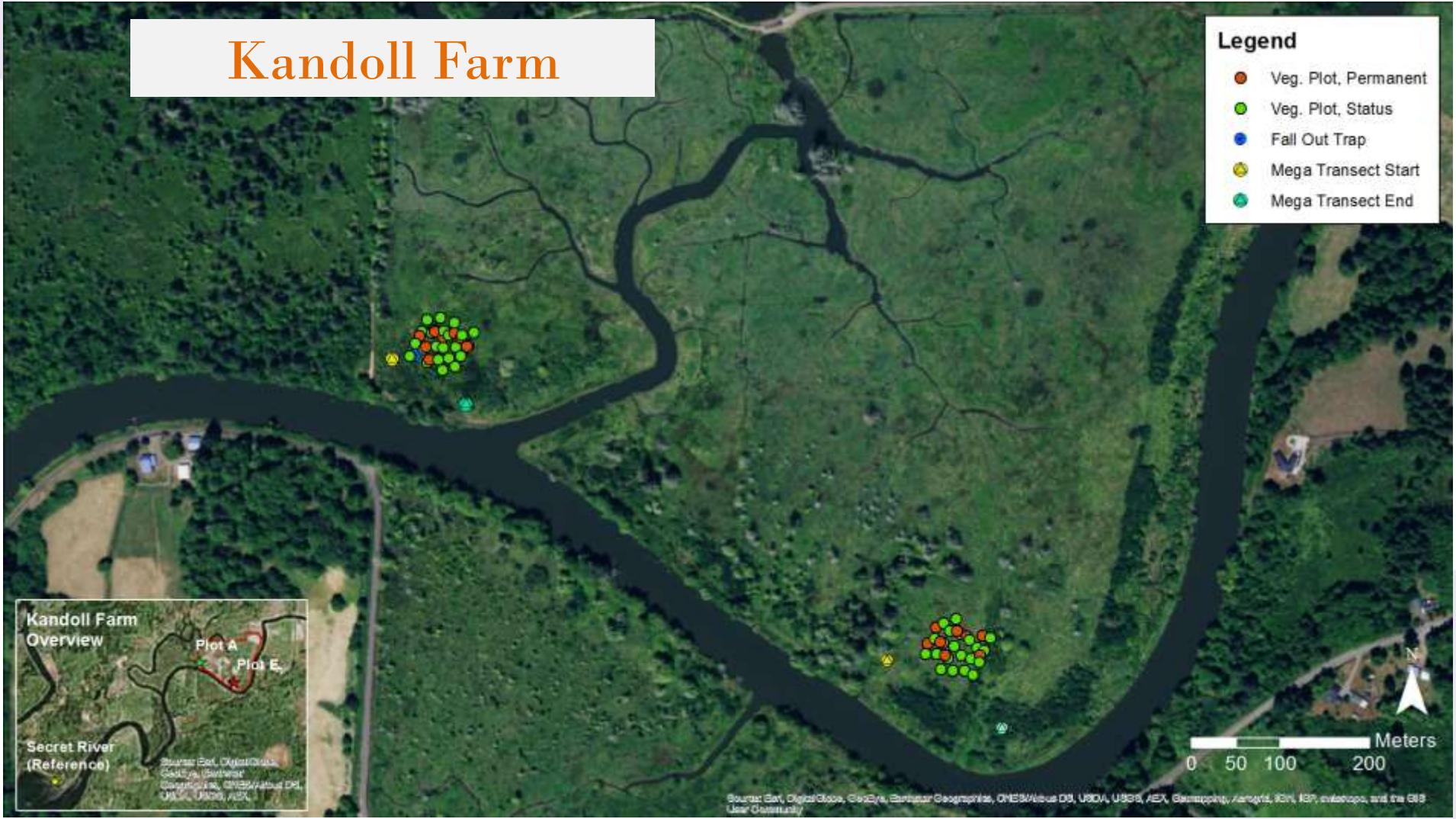
EMP Percent Similarity



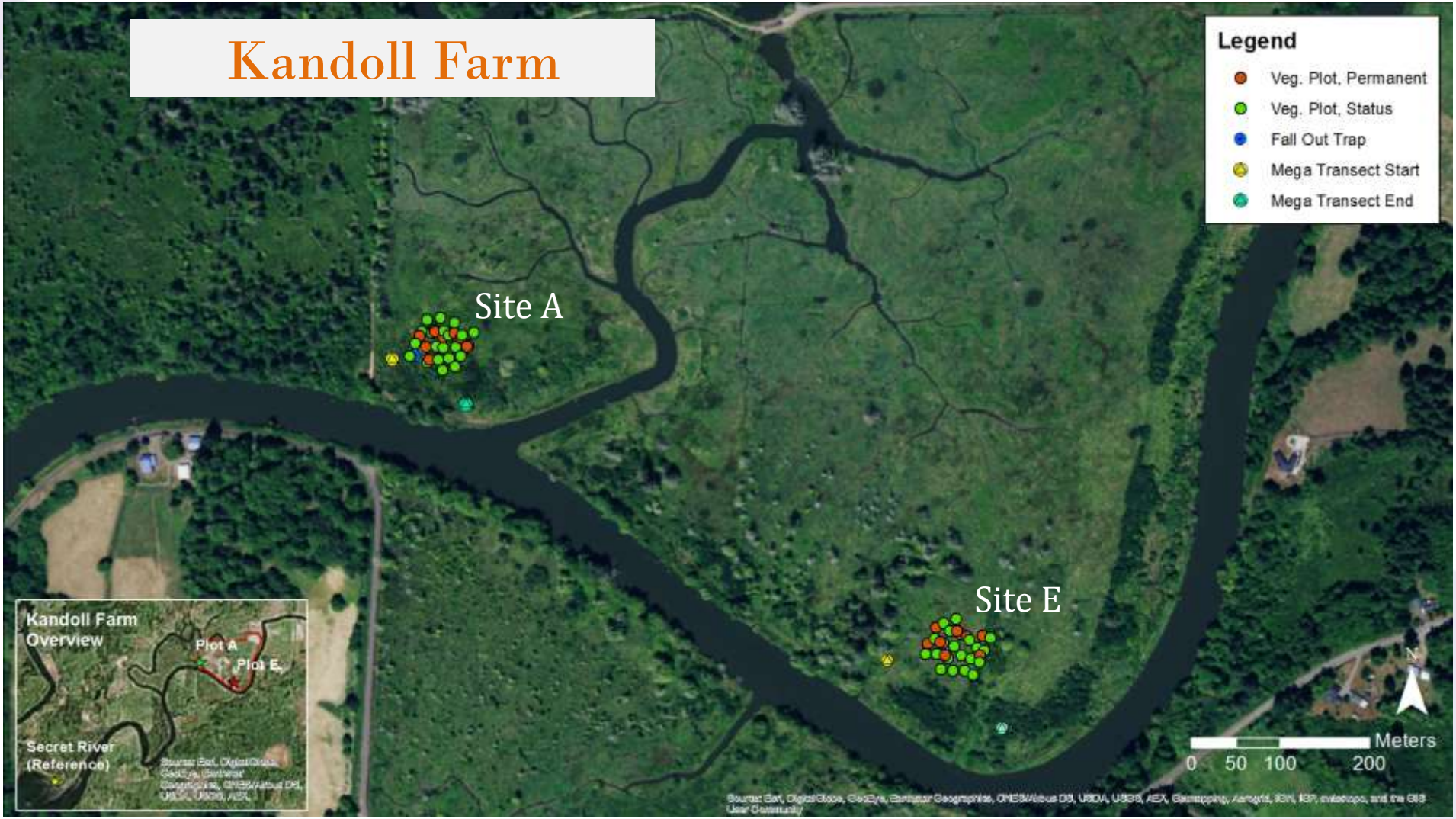


Hanson et al. 2015

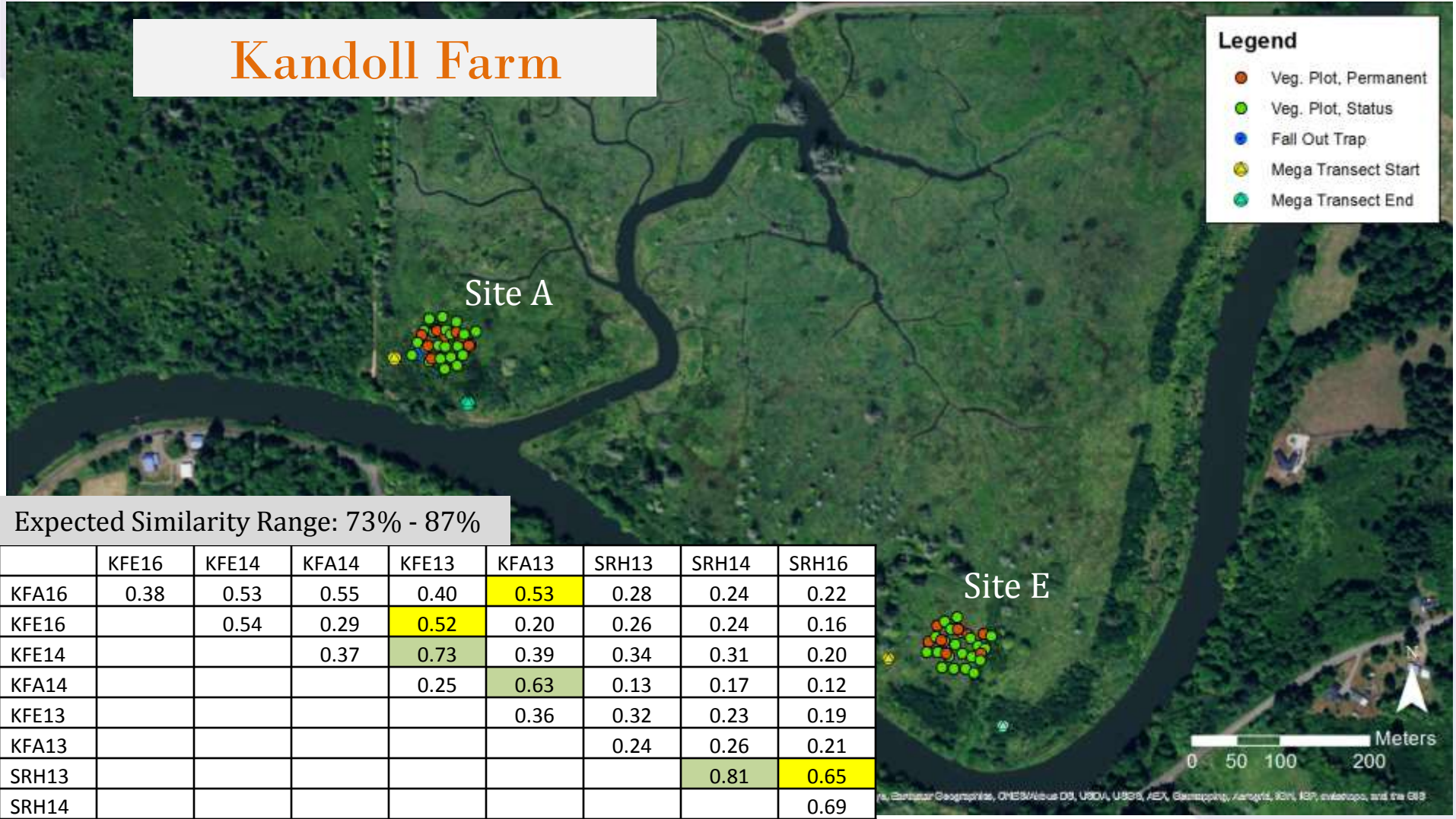
Kandoll Farm



Kandoll Farm



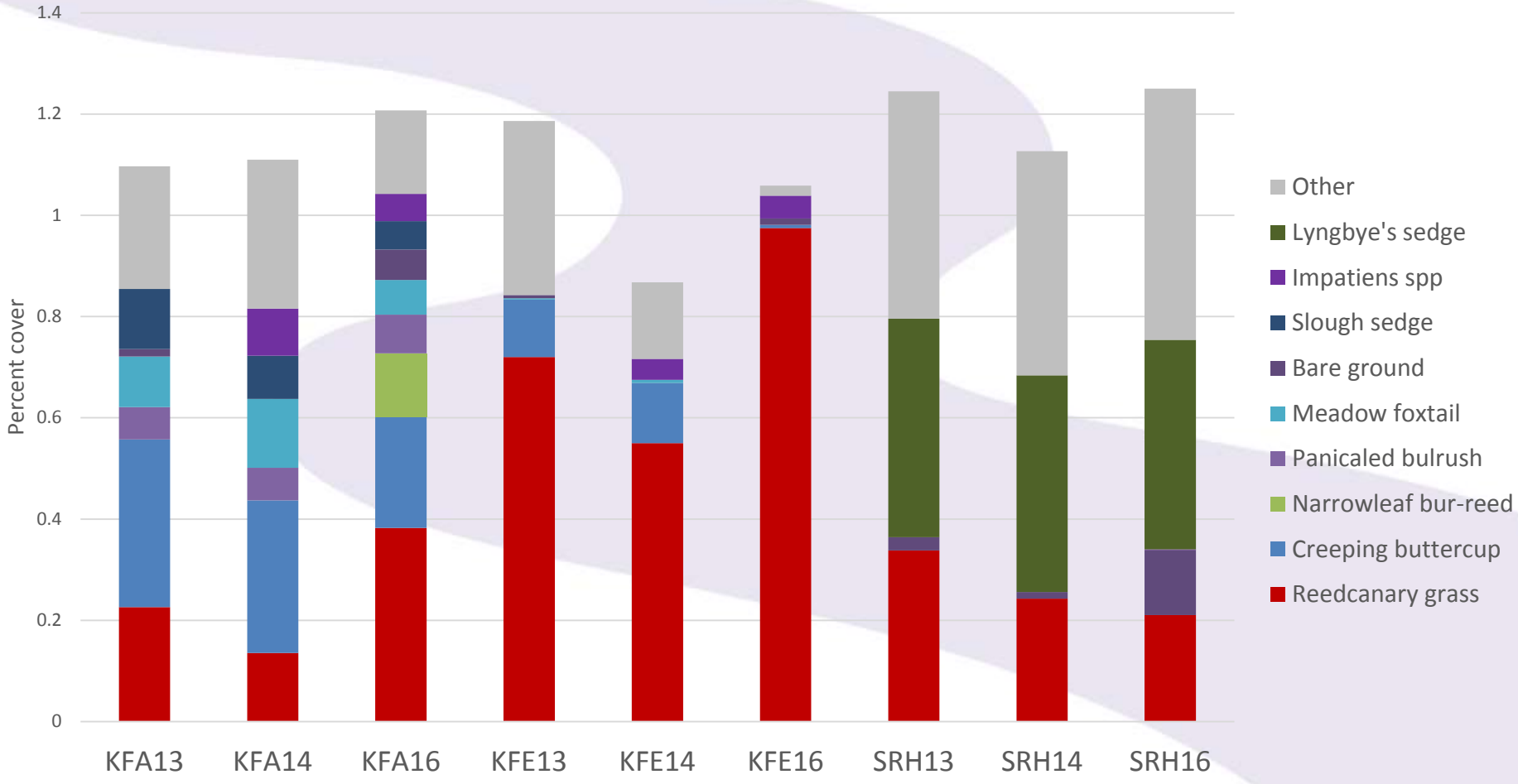
Kandoll Farm



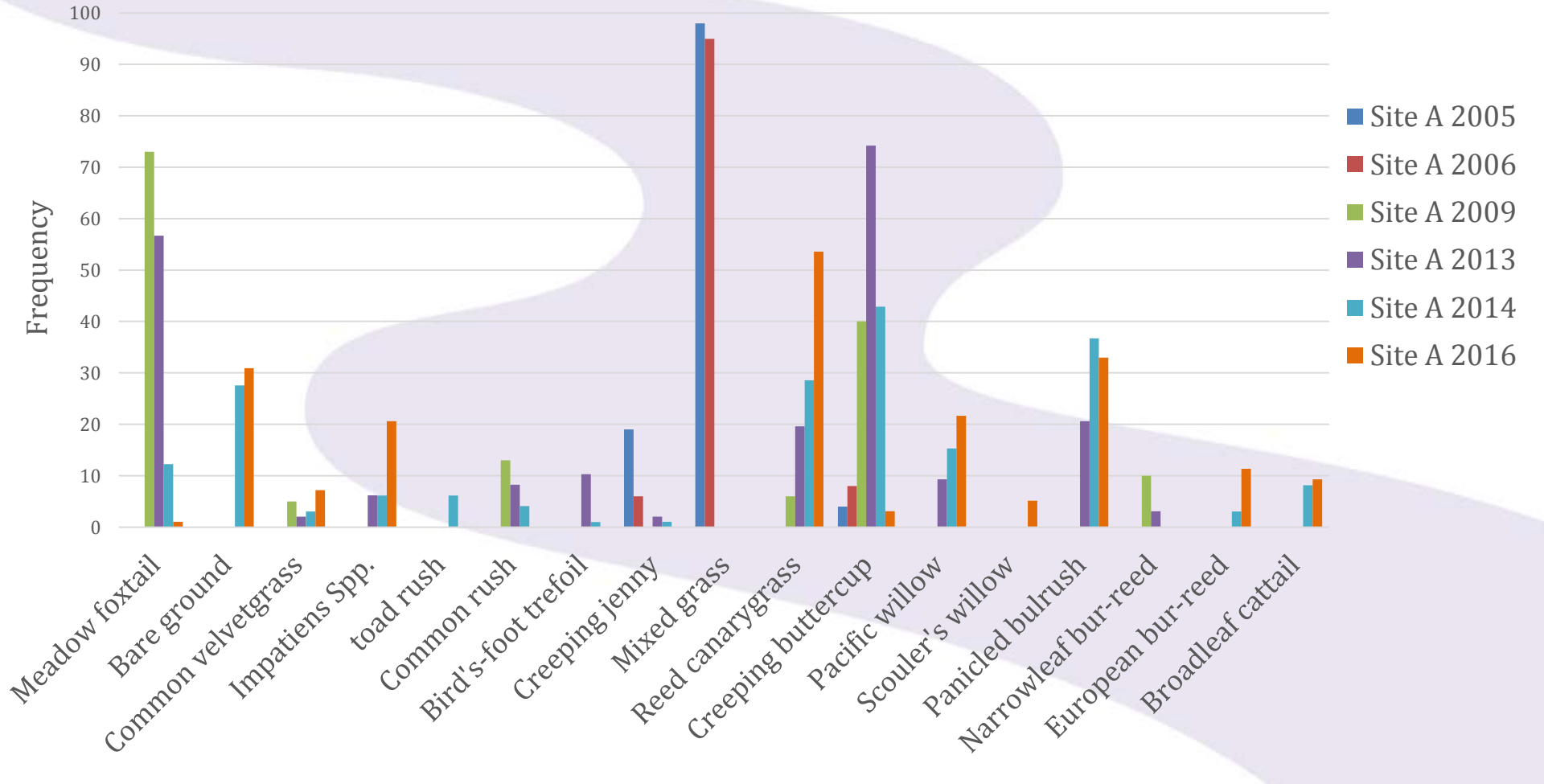
Expected Similarity Range: 73% - 87%

	KFE16	KFE14	KFA14	KFE13	KFA13	SRH13	SRH14	SRH16
KFA16	0.38	0.53	0.55	0.40	0.53	0.28	0.24	0.22
KFE16		0.54	0.29	0.52	0.20	0.26	0.24	0.16
KFE14			0.37	0.73	0.39	0.34	0.31	0.20
KFA14				0.25	0.63	0.13	0.17	0.12
KFE13					0.36	0.32	0.23	0.19
KFA13						0.24	0.26	0.21
SRH13							0.81	0.65
SRH14								0.69

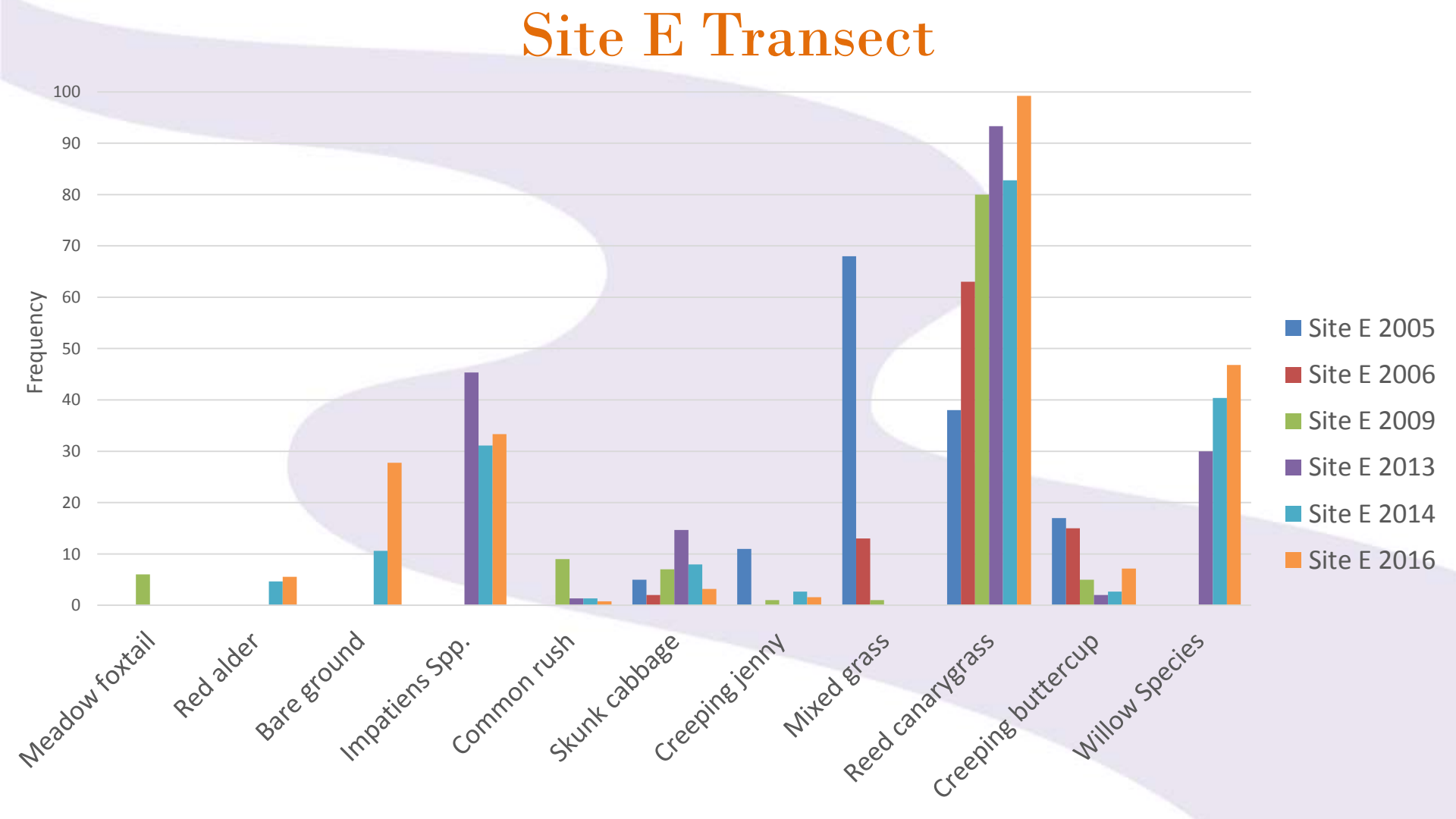
Kandoll Farm Vegetation



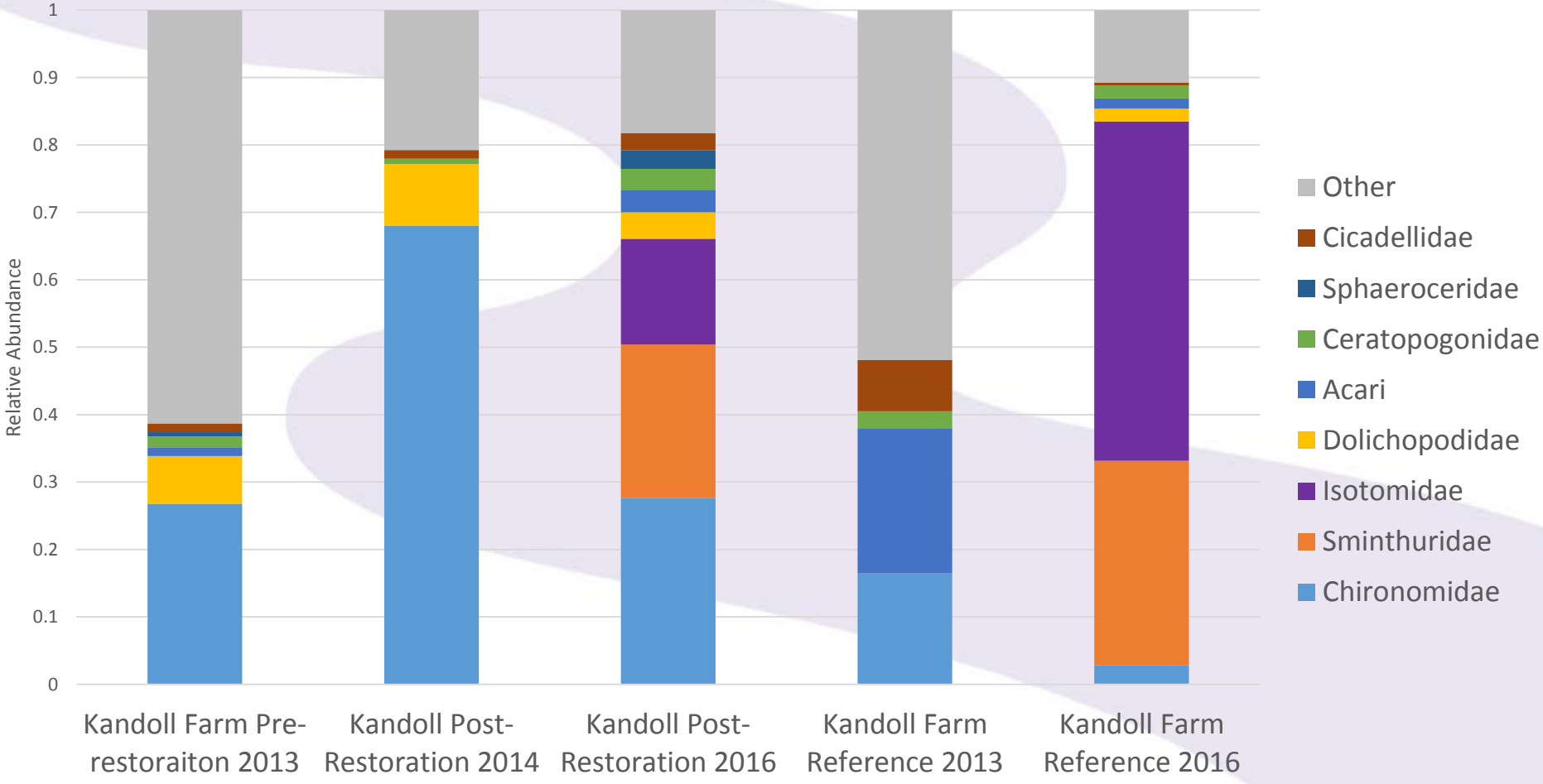
Site A Transect



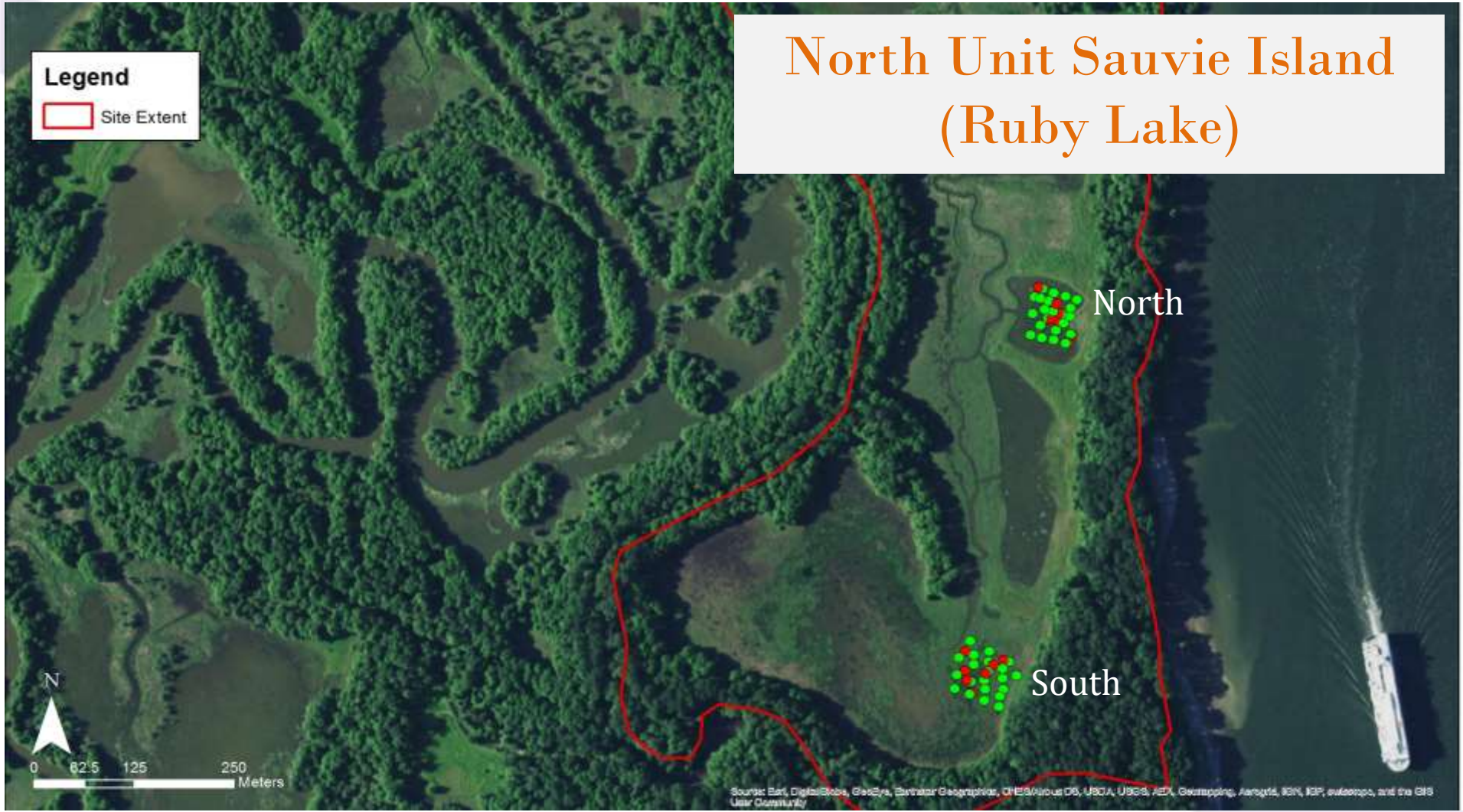
Site E Transect



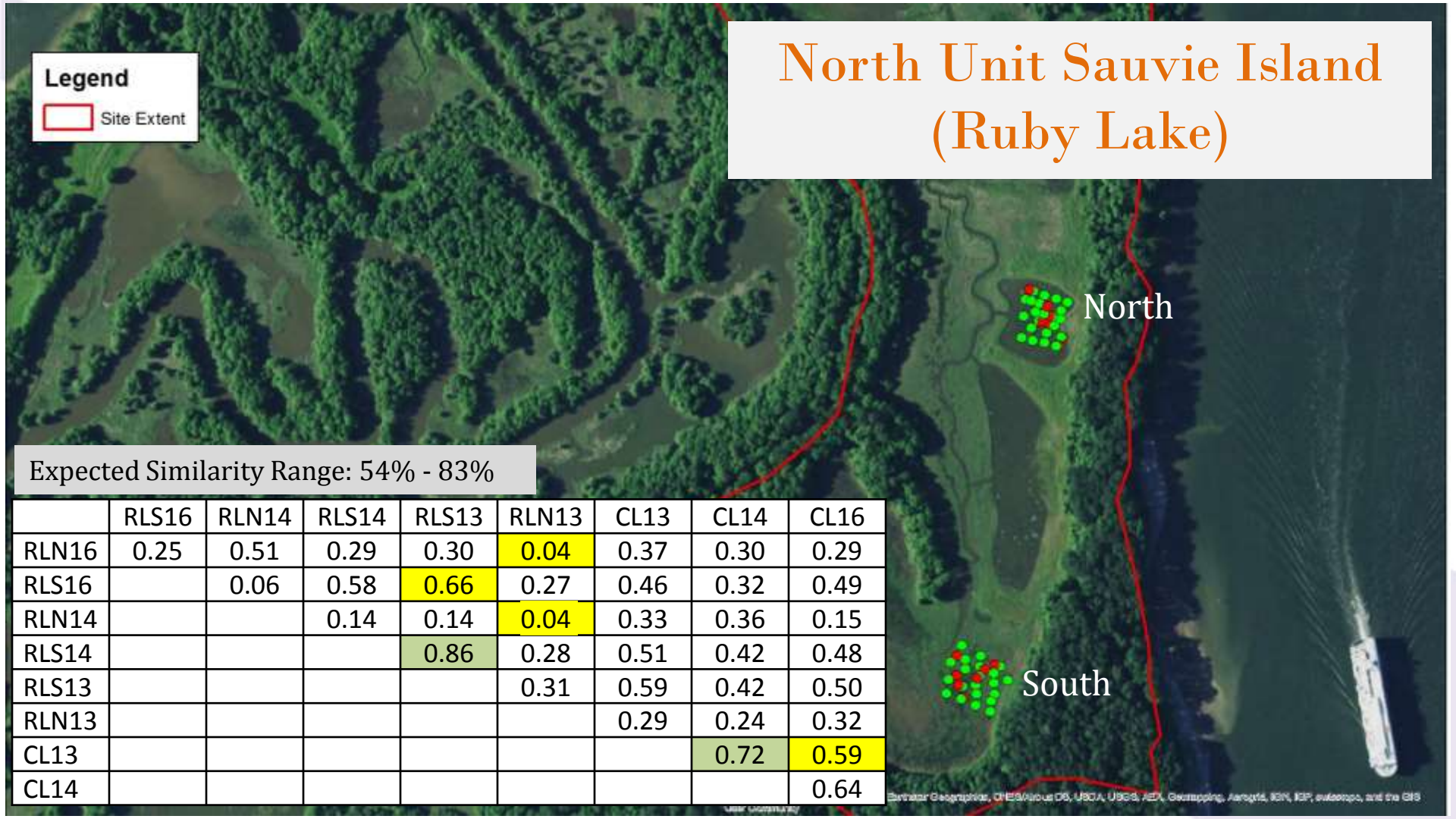
Kandoll Farm Terrestrial Macroinvertebrates



North Unit Sauvie Island (Ruby Lake)



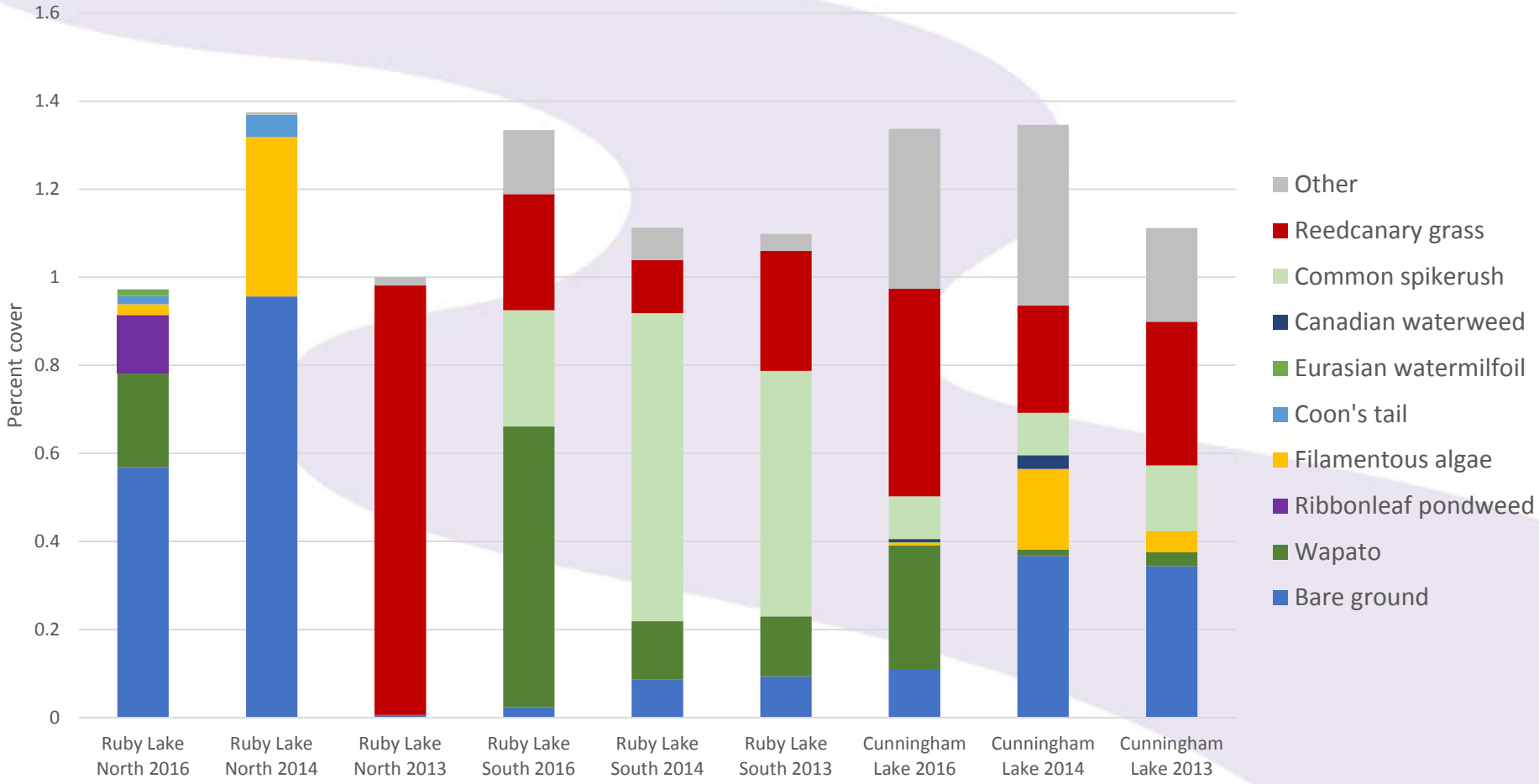
North Unit Sauvie Island (Ruby Lake)



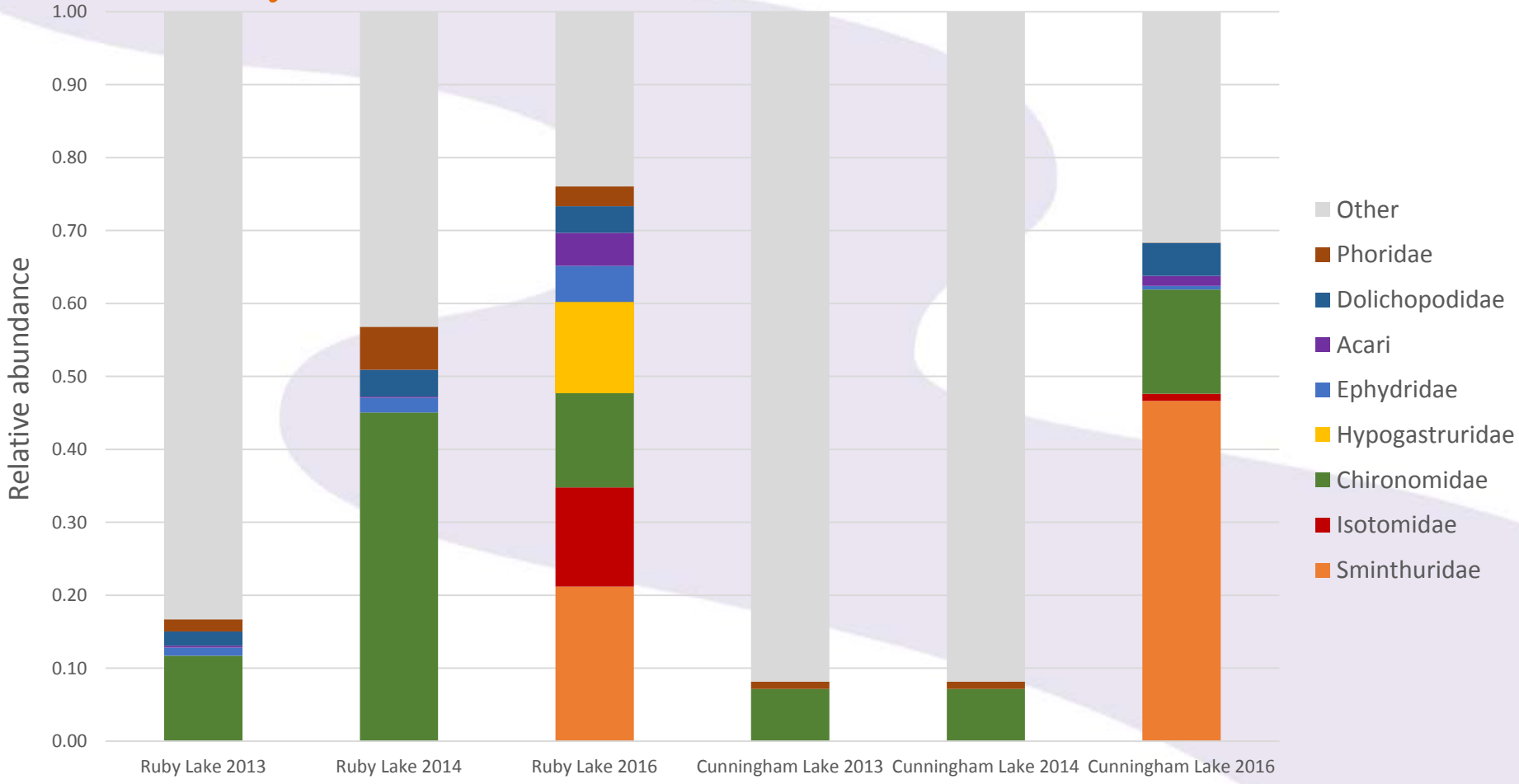
Expected Similarity Range: 54% - 83%

	RLS16	RLN14	RLS14	RLS13	RLN13	CL13	CL14	CL16
RLN16	0.25	0.51	0.29	0.30	0.04	0.37	0.30	0.29
RLS16		0.06	0.58	0.66	0.27	0.46	0.32	0.49
RLN14			0.14	0.14	0.04	0.33	0.36	0.15
RLS14				0.86	0.28	0.51	0.42	0.48
RLS13					0.31	0.59	0.42	0.50
RLN13						0.29	0.24	0.32
CL13							0.72	0.59
CL14								0.64

Ruby Lake Vegetation

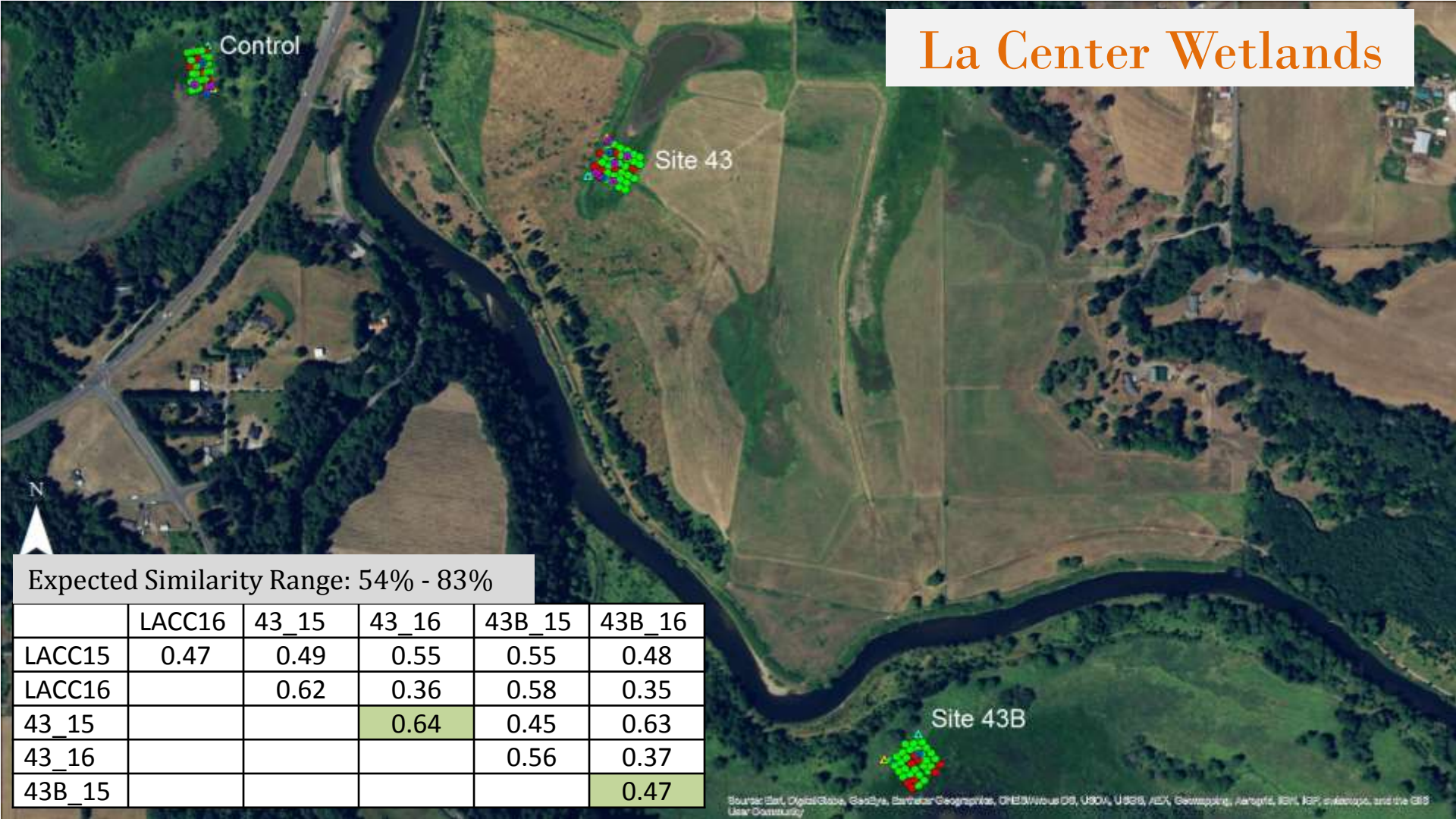


Ruby Lake Terrestrial Macroinvertebrates



La Center Wetlands

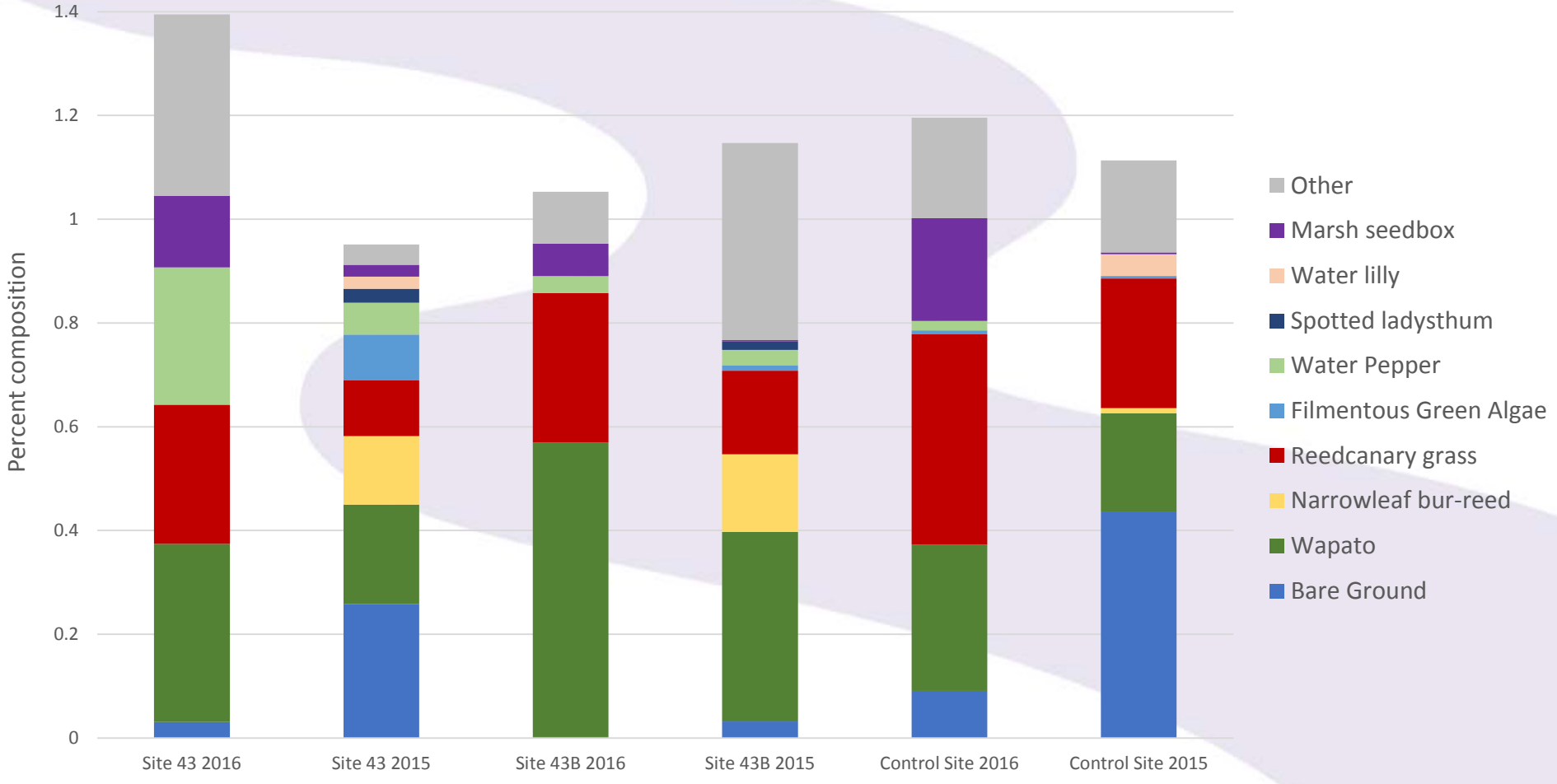
La Center Wetlands



Expected Similarity Range: 54% - 83%

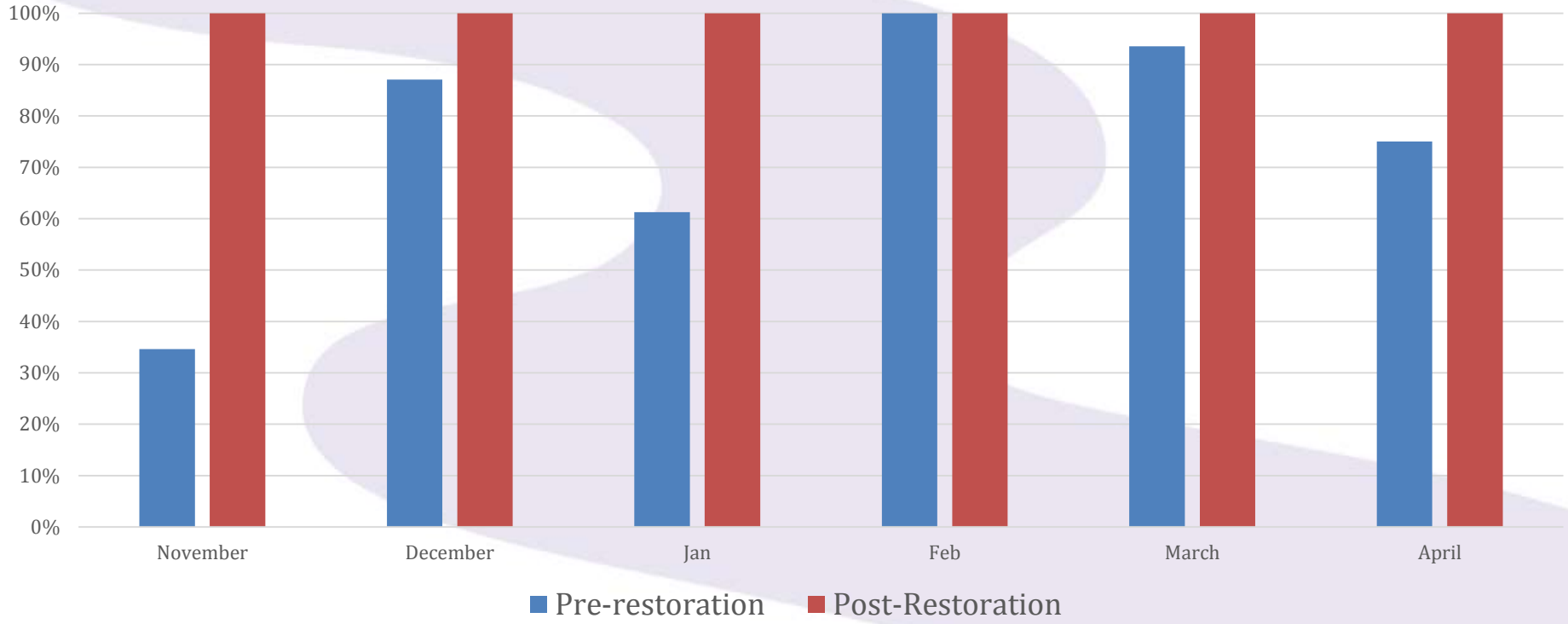
	LACC16	43_15	43_16	43B_15	43B_16
LACC15	0.47	0.49	0.55	0.55	0.48
LACC16		0.62	0.36	0.58	0.35
43_15			0.64	0.45	0.63
43_16				0.56	0.37
43B_15					0.47

La Center Wetlands Vegetation



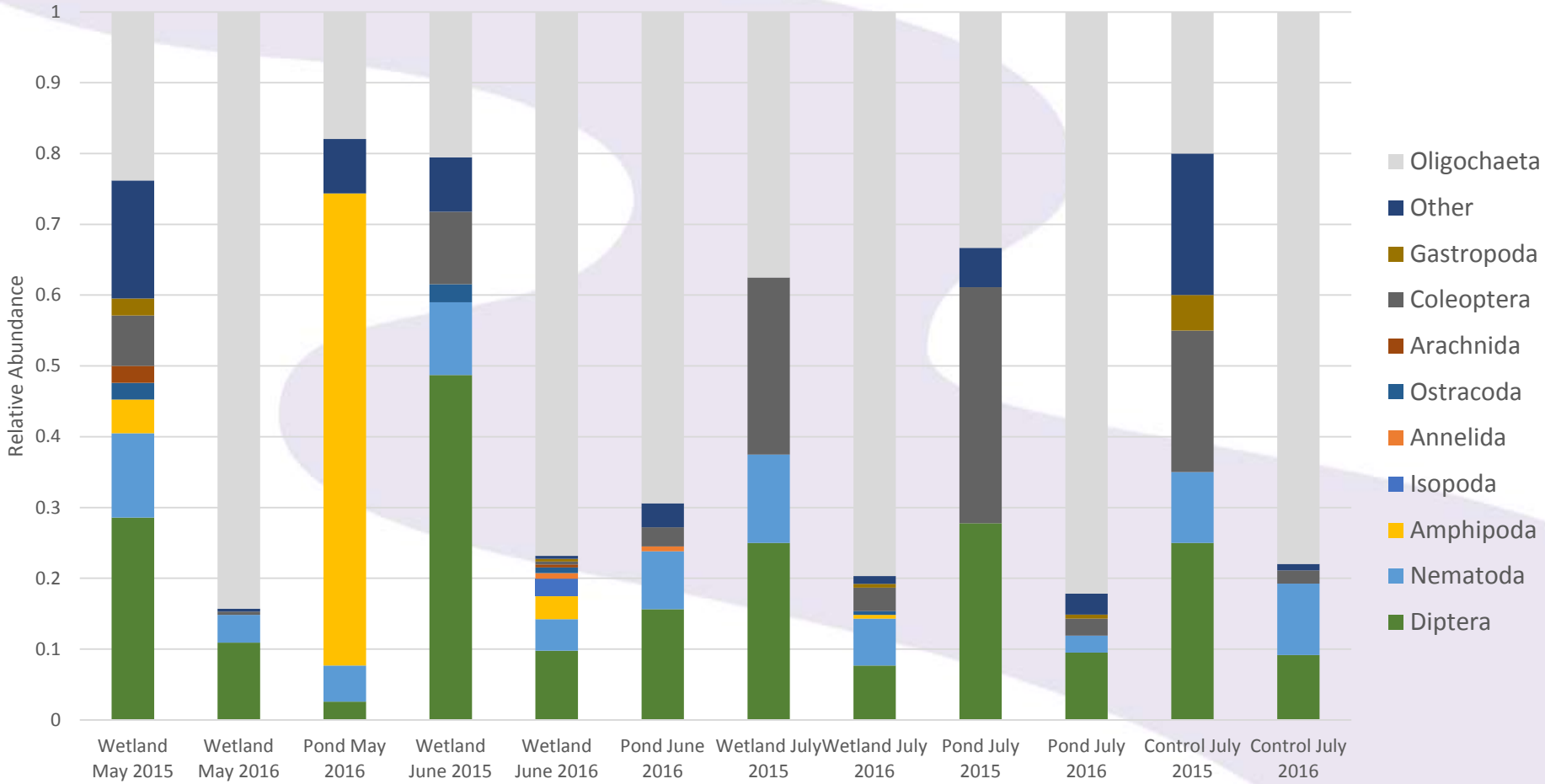
La Center Water Surface Elevation

La Center Water Surface Elevation

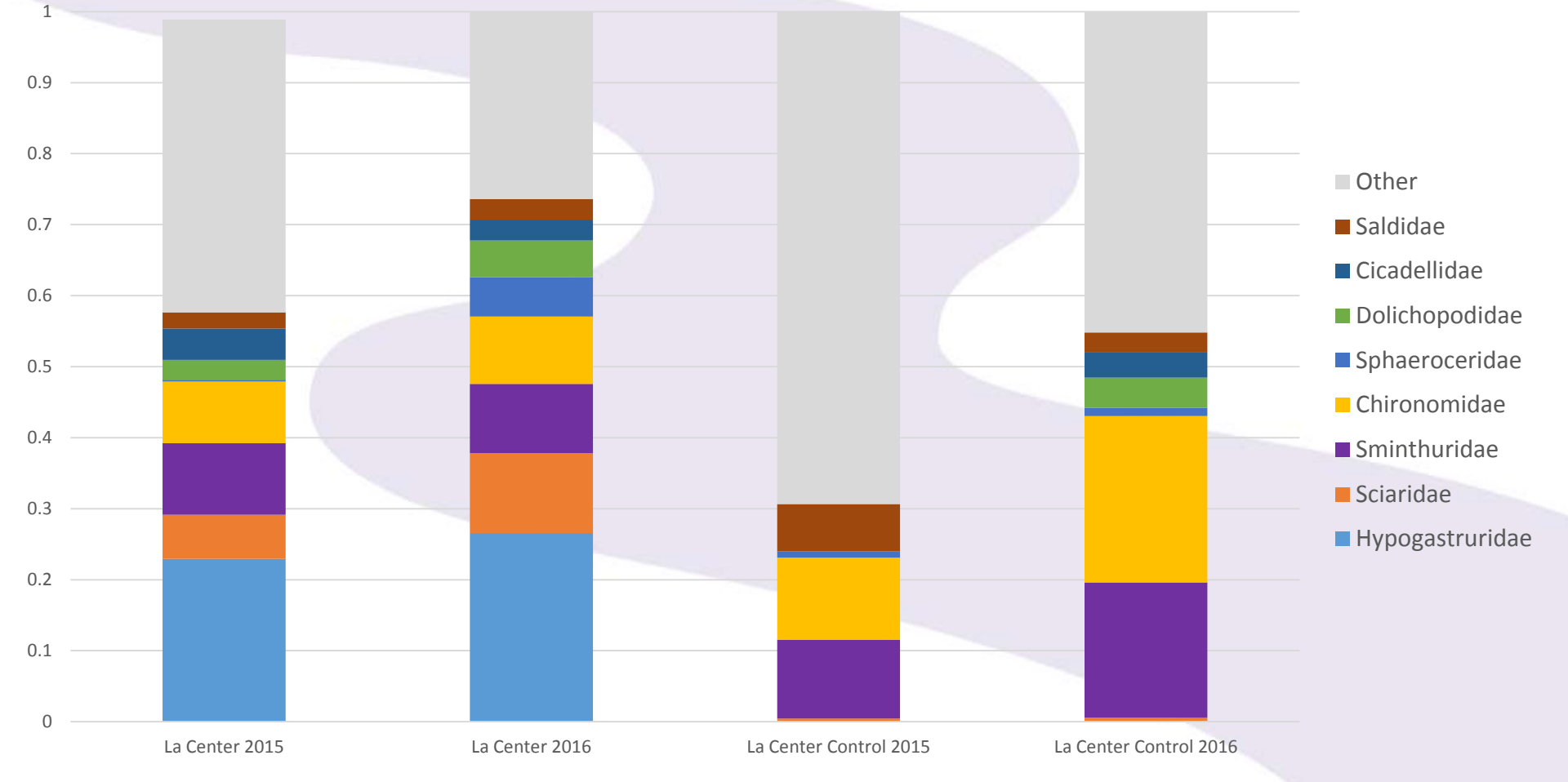


- Percent days post restoration average water surface elevation exceeded pre-restoration control elevations (3.5m NAVD88) and post-restoration control elevations (3.0m NAVD88)

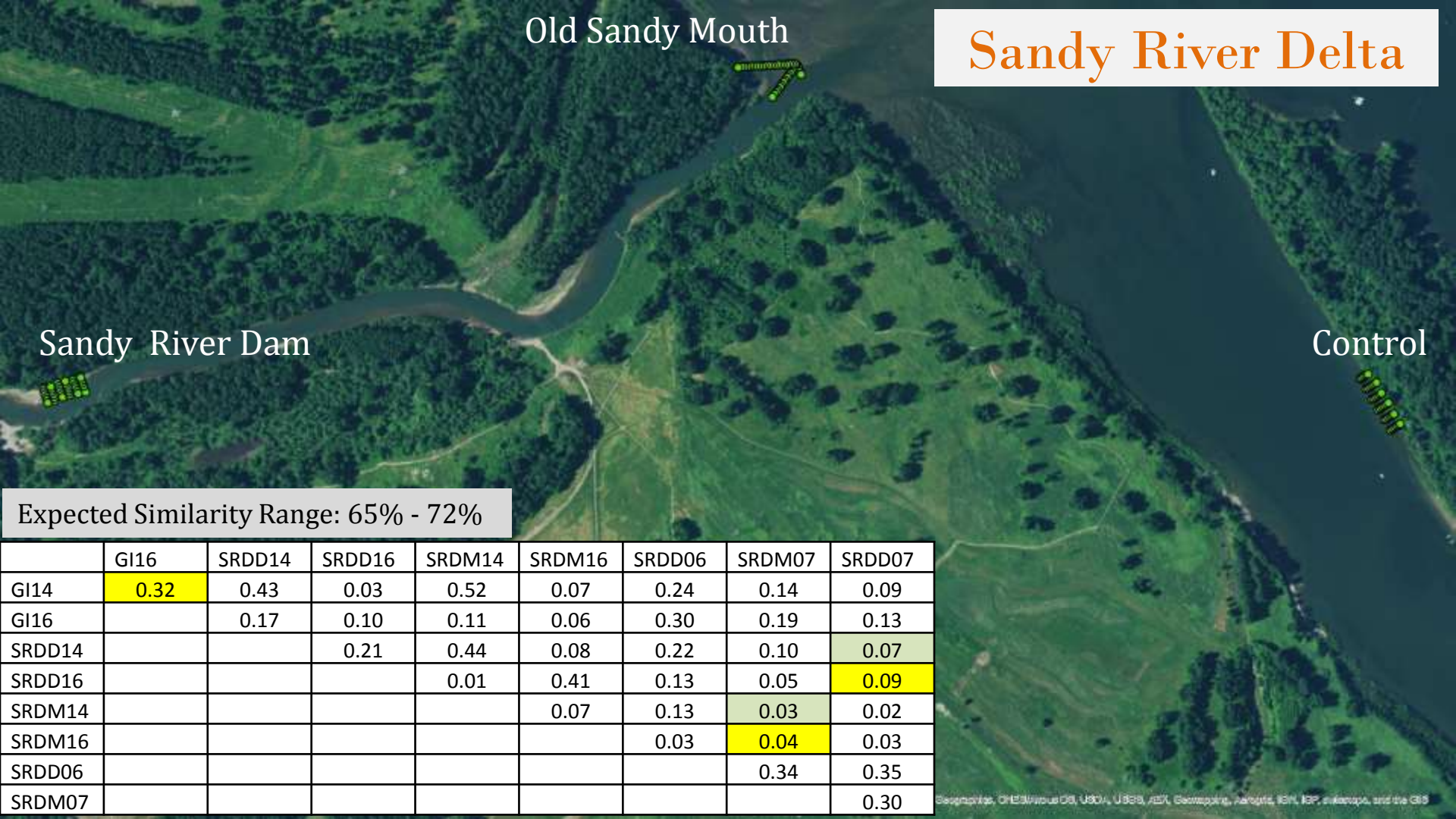
La Center Benthic Macroinvertebrates



La Center Terrestrial Macroinvertebrates



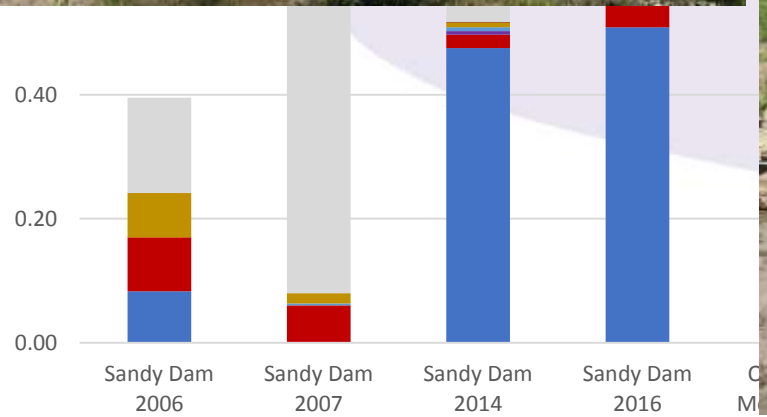
Sandy River Delta



Expected Similarity Range: 65% - 72%

	GI16	SRDD14	SRDD16	SRDM14	SRDM16	SRDD06	SRDM07	SRDD07
GI14	0.32	0.43	0.03	0.52	0.07	0.24	0.14	0.09
GI16		0.17	0.10	0.11	0.06	0.30	0.19	0.13
SRDD14			0.21	0.44	0.08	0.22	0.10	0.07
SRDD16				0.01	0.41	0.13	0.05	0.09
SRDM14					0.07	0.13	0.03	0.02
SRDM16						0.03	0.04	0.03
SRDD06							0.34	0.35
SRDM07								0.30

Sandy R



- Other
- LWD
- Common spikerush
- Pacific willow
- Rice Cutgrass
- Water horsetail
- Rough cocklebur
- Reedcanary Grass
- Bare Ground

Horsetail Creek PIT tag Array

- Operating Pre and Post Restoration
- Identify fish/life stage
- Determine if fish transit culvert

AEM Questions and Discussion

- What other types of analyses might be helpful for project sponsors?
- How can we improve dissemination of results?