Long-term changes in species composition & channel morphology following passive restoration in the Middle Fork John Day River, Oregon

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(previously U. Oregon)

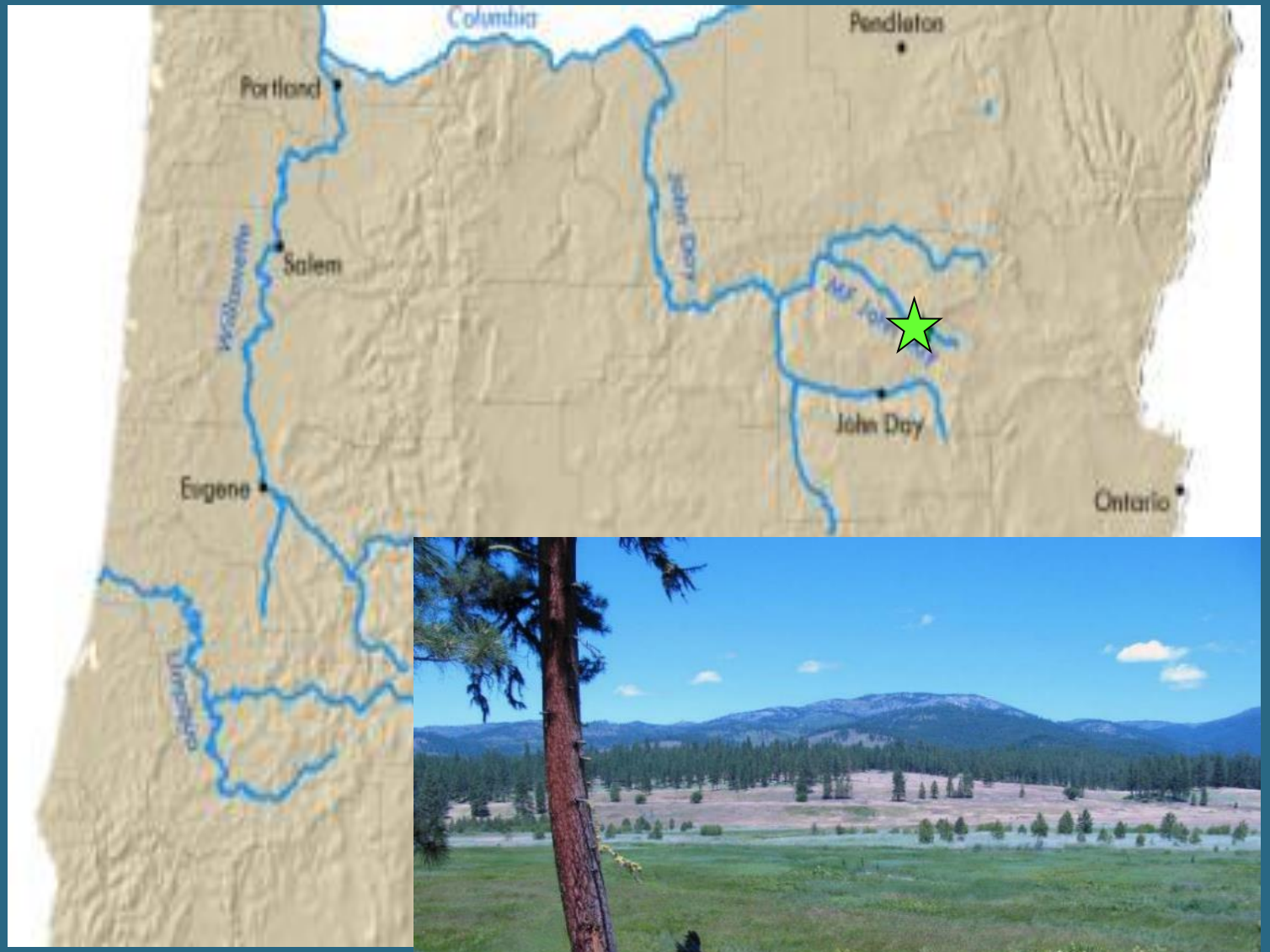
Long-term monitoring as part of the toolbox

Long-term monitoring allows tracking of processes that don't respond in short time-frames

This study:
Using historic data to evaluate long-term change at watershed scale

Long-term monitoring rare

- Lack of historic datasets
- Lack of utilization of historic datasets that do exist
- Lack of funding for long-term monitoring



Middle Fork John Day River (MFJDR) – Recent History

The Nature Conservancy

Dunstan Conservation area

- 1990 (TNC) -> 2019 (CTWS)
- 1200 acres
- 2.5 river miles + tribs

Confederated Tribes of the Warm Springs (CTWS)

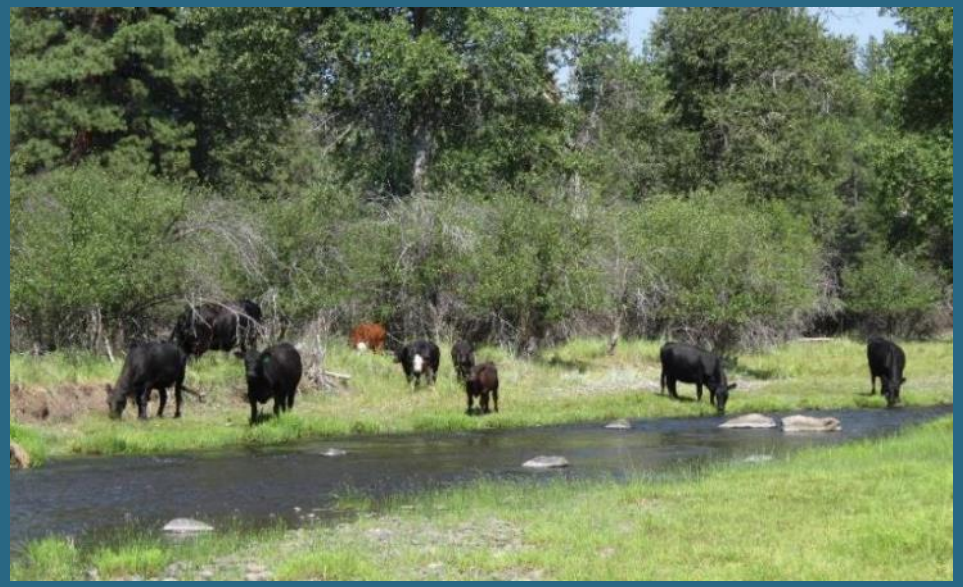
Oxbow & Forrest Conservation Areas

- 2001-2002
- 1810 acres
- 7.9 river miles + tribs

Matrix of USFS land w other private ranches

Historic Impacts:

- Cattle grazing
- Dredging for gold
- Timber harvest/
  Floodplain tree removal

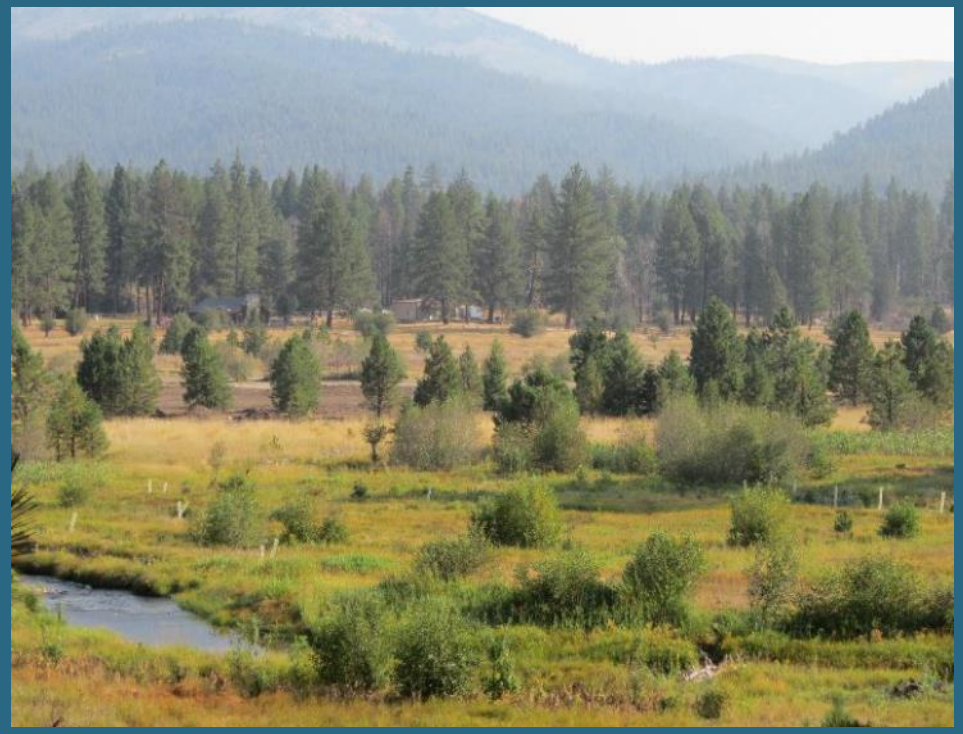


→ **Simplified channels**
little shade

Dredge tailings

Key Restoration Activities – Active & Passive

- Tree / shrub planting (> 2006) -- starting w 75,000 plantings
- Engineered log structures (> 2008)
- Channel reconstruction (> 2012) -- focused on dredged channels
- Cattle grazing removed from banks (2000) – Full Passive
- Reformed grazing (shortened timing) on USFS lands – Partial Passive



Previous Watershed Scale Studies

2008-2018 Intensively Monitored Watershed (IMW)

Focused on monitoring effectiveness of active restoration

1996-1997

Hydrologic, Geomorphic and Ecological Connectivity in Columbia River Watersheds: Implications for Endangered Salmonids

Oregon State U. – PIs: Hiram Li, Judy Li, Boone Kauffman, Bob Beschta, Bruce McIntosh

University of Oregon – PI: Pat McDowell

+ many OSU/UO graduate students!

Chris Torgersen, Kris Wright, Kate Dwire, Rick Hopson, Steven Jett, Colden Baxter

Let’s take advantage of historic data!

2018-2020

Long-term ecological effects of **passive restoration** in the Middle Fork John Day River - Oregon Watershed Enhancement Board (OWEB)

Matthew Goslin – Greenline Vegetation & Vegetation-Geomorphology Interactions

Pat McDowell (UO) -- Geomorphology

Lisa Ellsworth (OSU) – Floodplain Vegetation

Seth White (Columbia River Intertribal Fish Commission) – Macroinvertebrates

Joe Lemanski (Confederated Tribes Warm Springs/ODFW), Emily Davis (CTWS/King Co.)

w consultation from original investigators:
Boone Kauffman & Bob Beschta (OSU) & Kris Wright (OSU/UWisc-Platteville)

Management Classes ("Treatments") & Methods

1. **Adaptive Management**
   - managed primarily for economic objectives (Private)
2. **Partial Passive Restoration**
   - cattle grazing reduced (USFS)
3. **Full Passive Restoration (Only)**
   - cattle grazing removed (Conservation Areas)
4. **Passive + Active Restoration**
   - cattle grazing removed + active projects (Conservation Areas)

Methods: Resurveys of Historic Data + Aerial Imagery Analysis

This presentation

Vegetation

- **Greenline vegetation -** Resurveys **(1996-2018)**

Geomorphology

- **Greenline-Greenline channel widths -** Aerial imagery **(1989-2017)**
- ***Carex nudata* (torrent sedge) island census -** Aerial imagery **(1989-2013)**
  - from Goslin dissertation
- **Habitat Unit Surveys (ODFW) -** Resurveys **(1990s-2018/19)**
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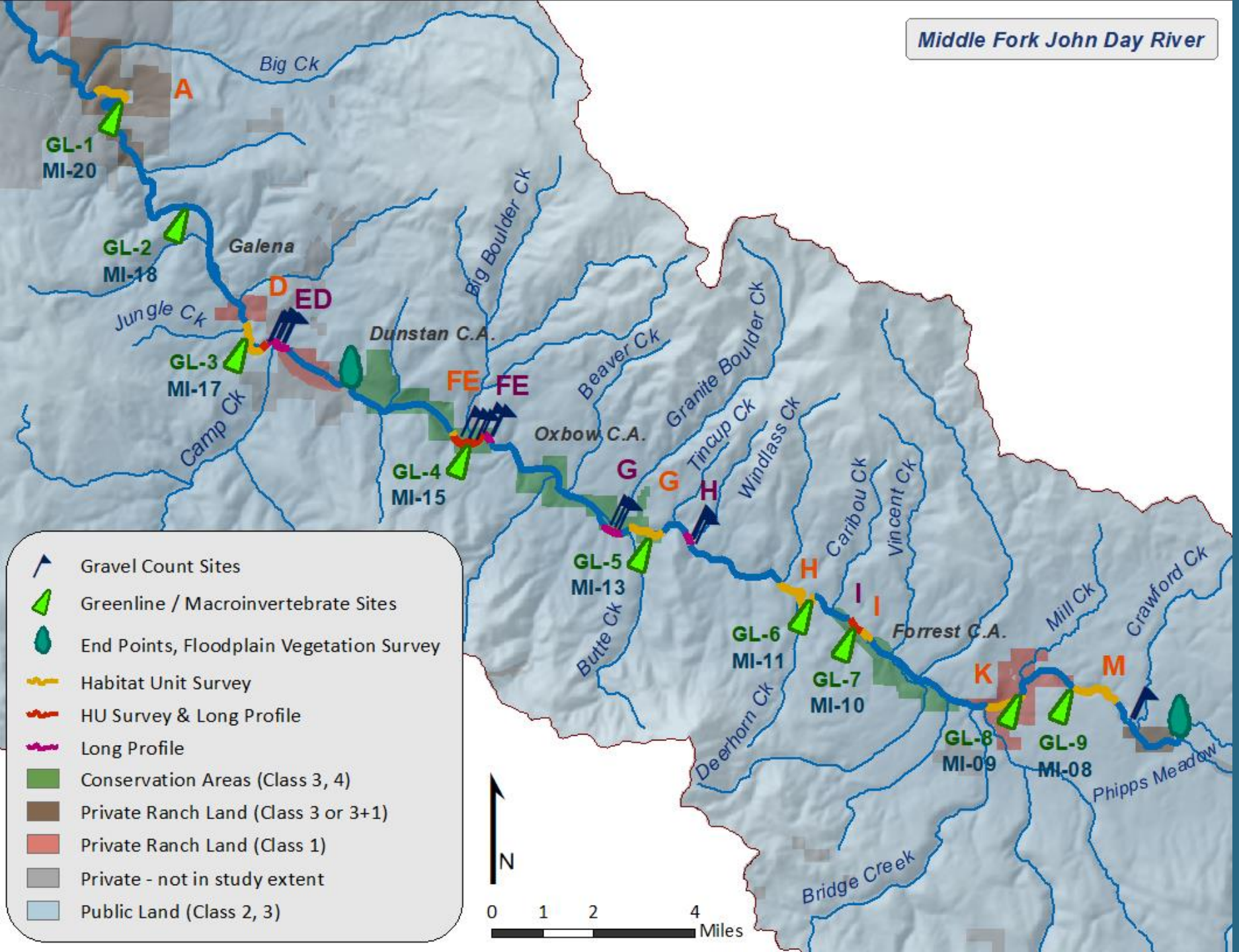


Land Management, Survey Sites, Data Types

1994-96 baseline

2018-19 resurvey

Greenline Surveys

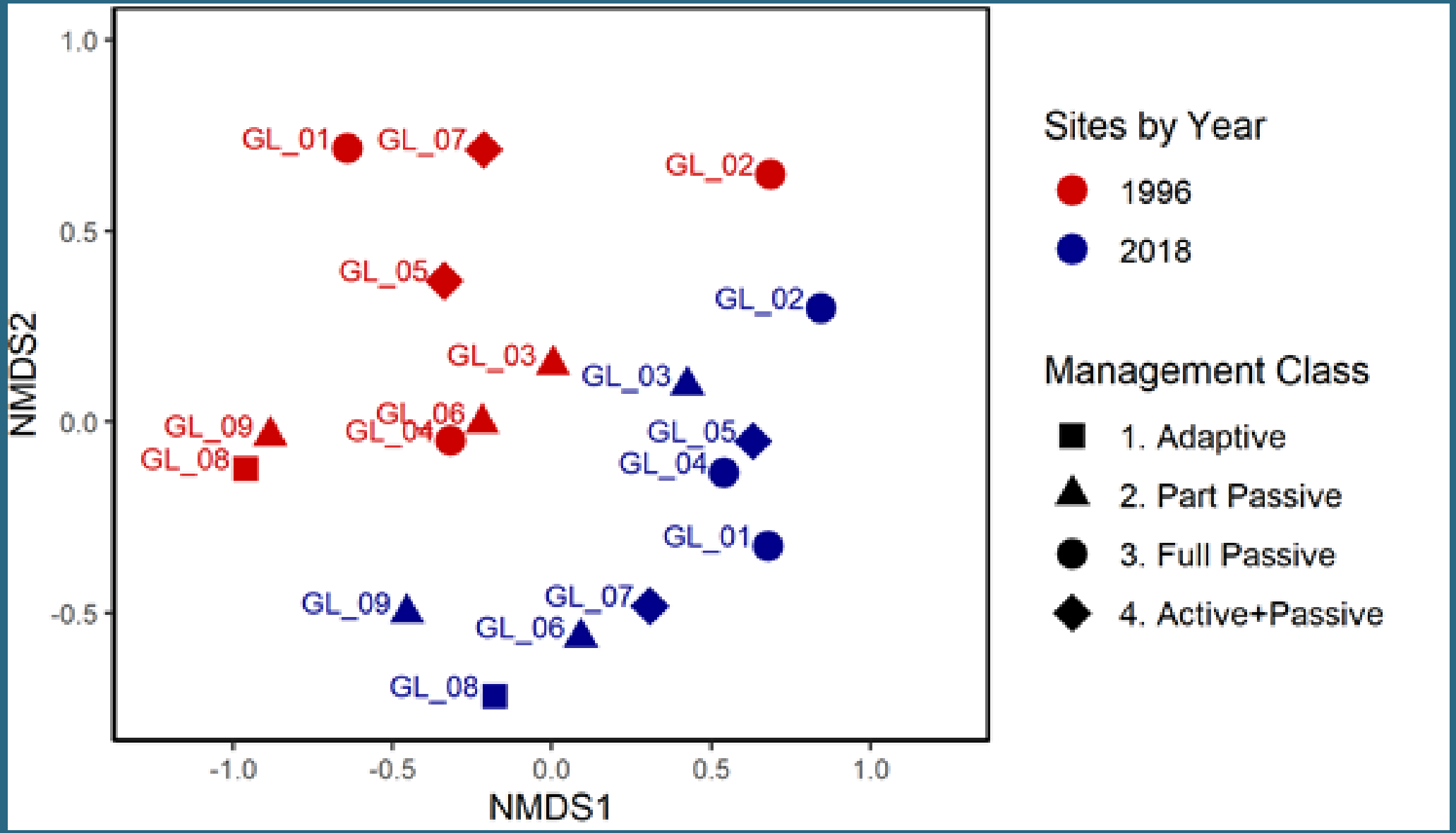
Greenline Vegetation Methods – Re-surveys (1996-2018)

- Greenline = first continuous line of vegetation near water
- 9 sites
- 100 m transects (50 m both banks)
  - Nearest species (all types) sampled at points every 1 m (100 total occurrences)

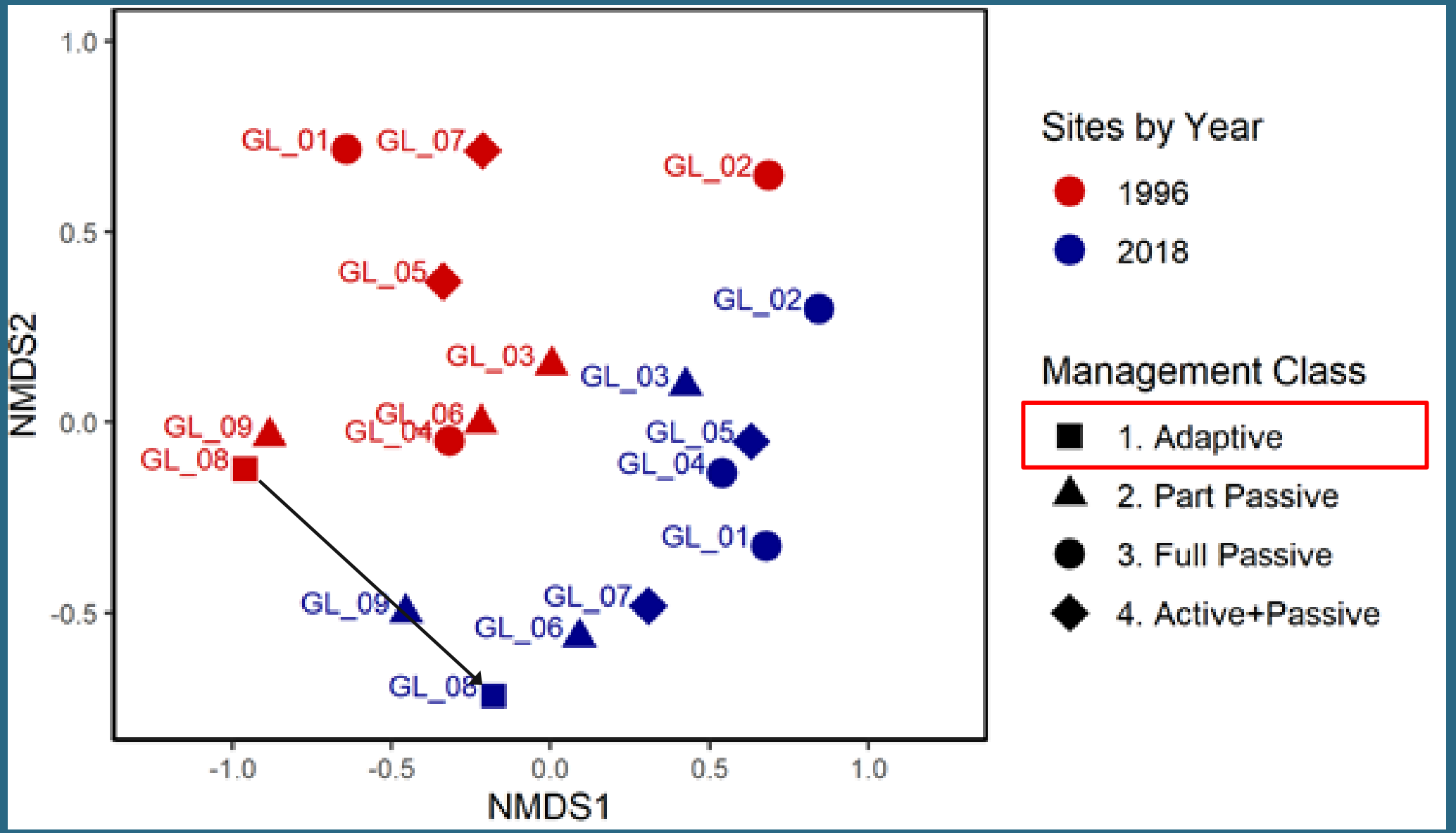
Data Analysis

- NMDS (Non-metric multi-dimensional scaling)
  - Differentiation of species assemblages
- Class based comparisons of specific metrics

Greenline vegetation – NMDS Ordination of **Sites**



Greenline vegetation – NMDS Ordination of **Sites**



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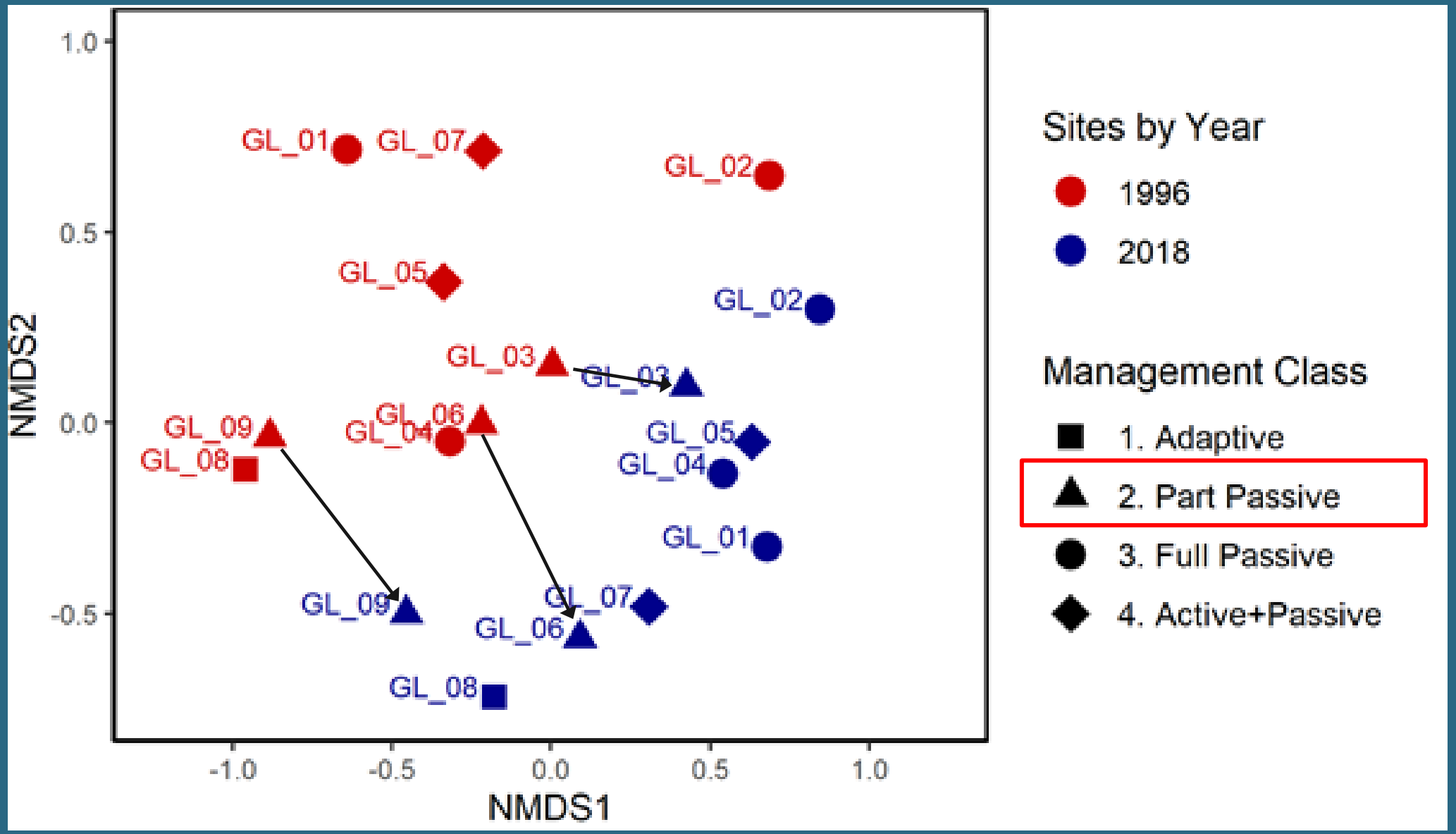
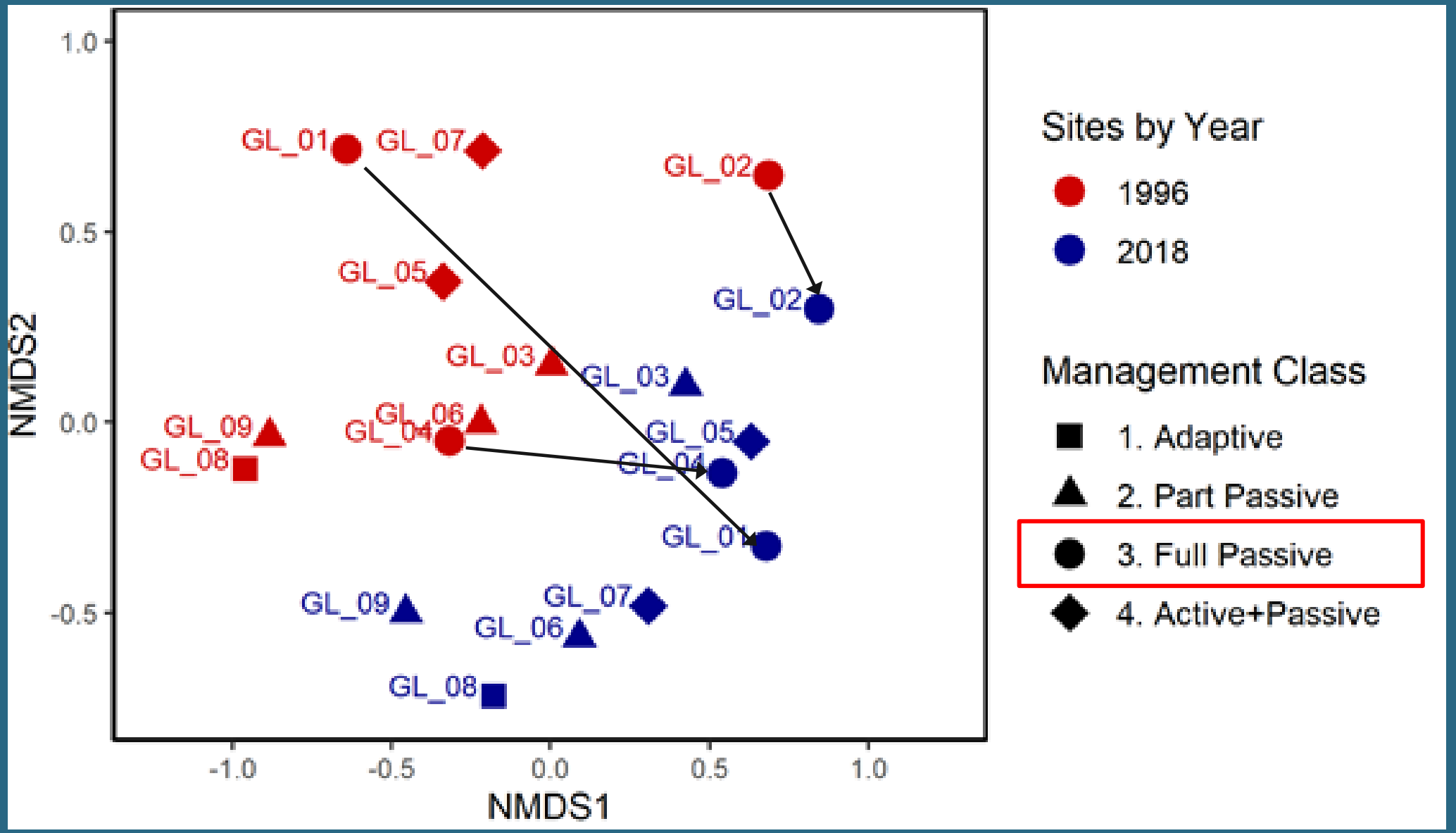
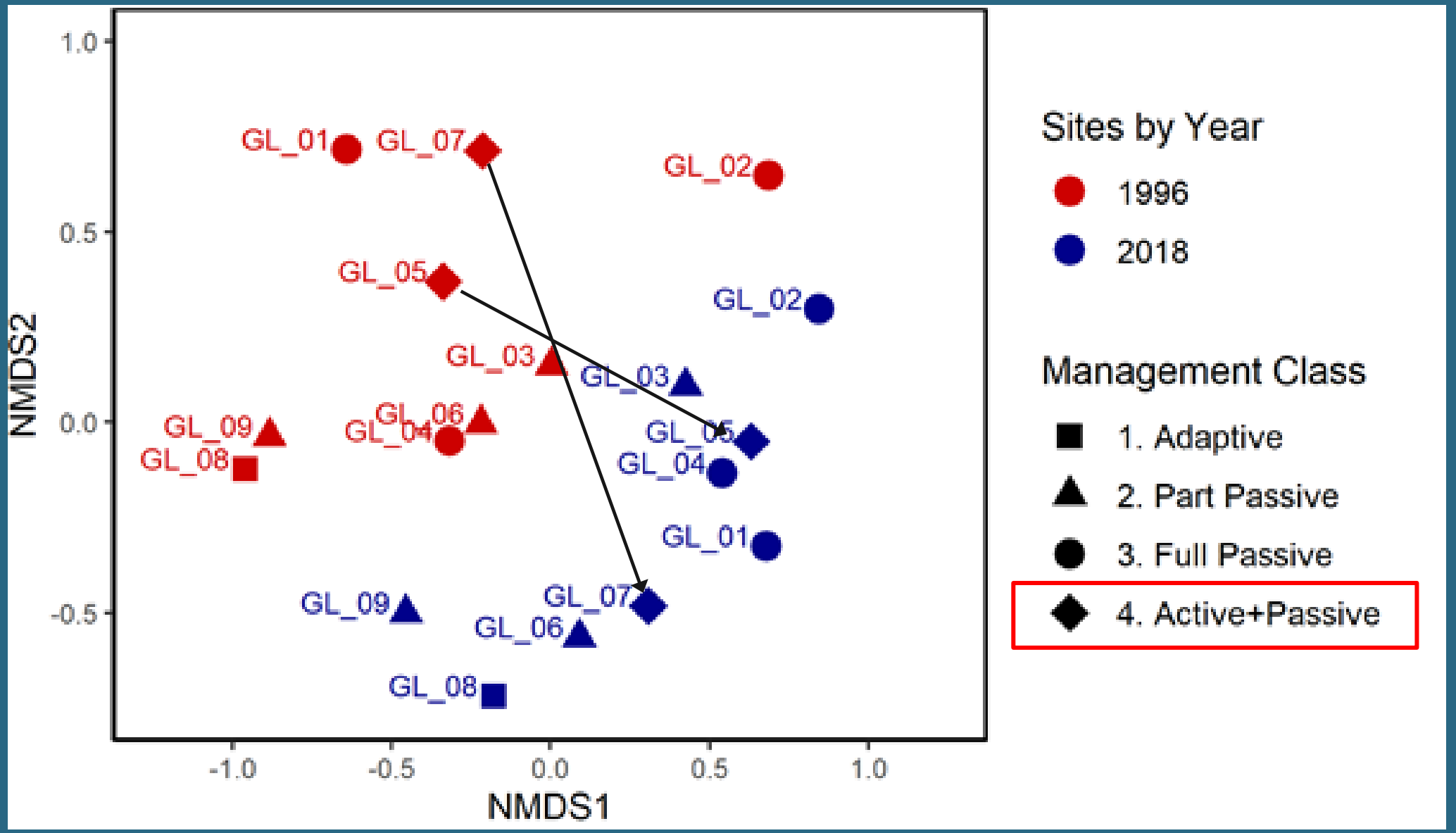


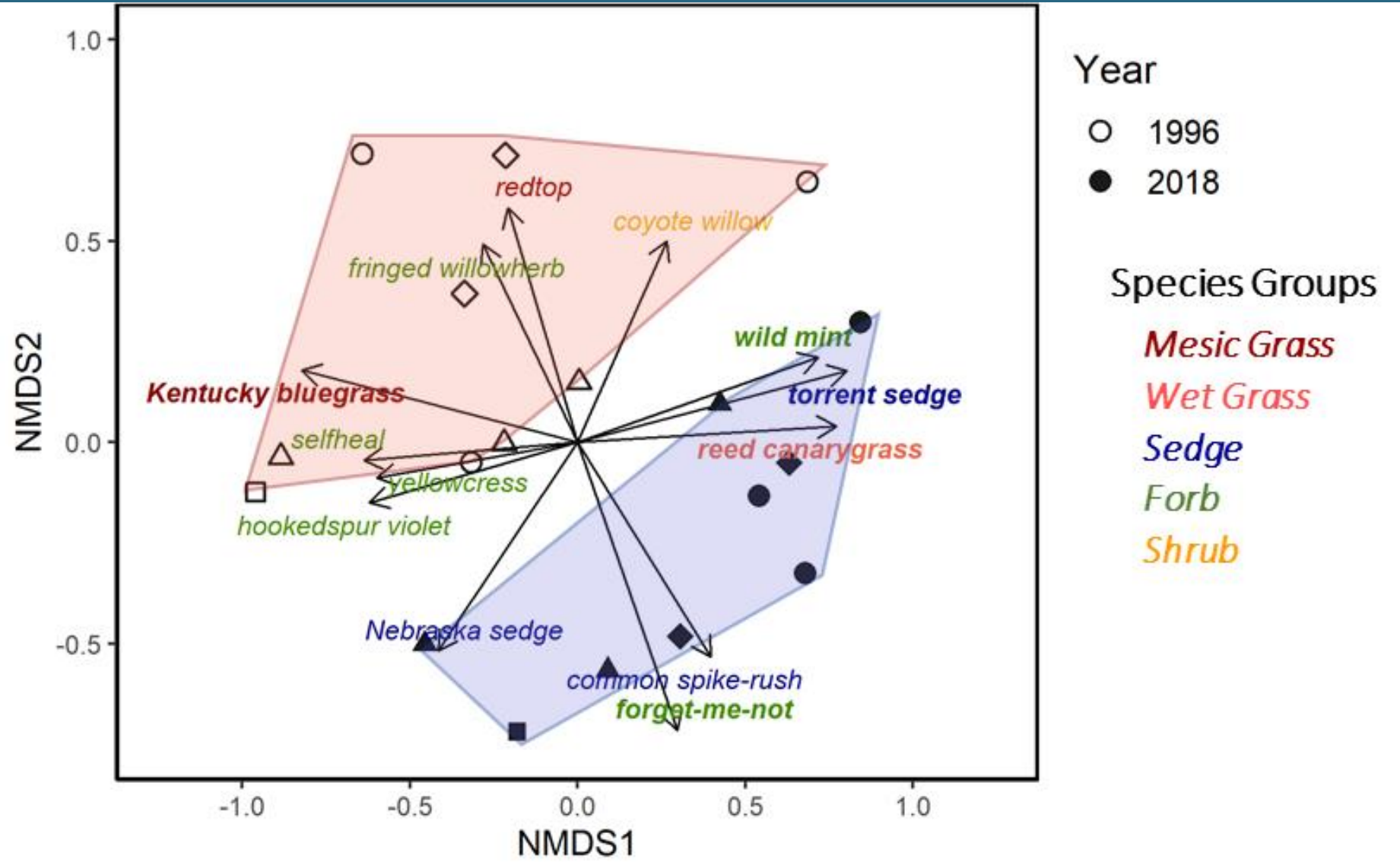
Greenline vegetation – NMDS Ordination of **Sites**



Greenline vegetation – NMDS Ordination of **Sites**



Greenline vegetation – NMDS Ordination – **Species Vectors**

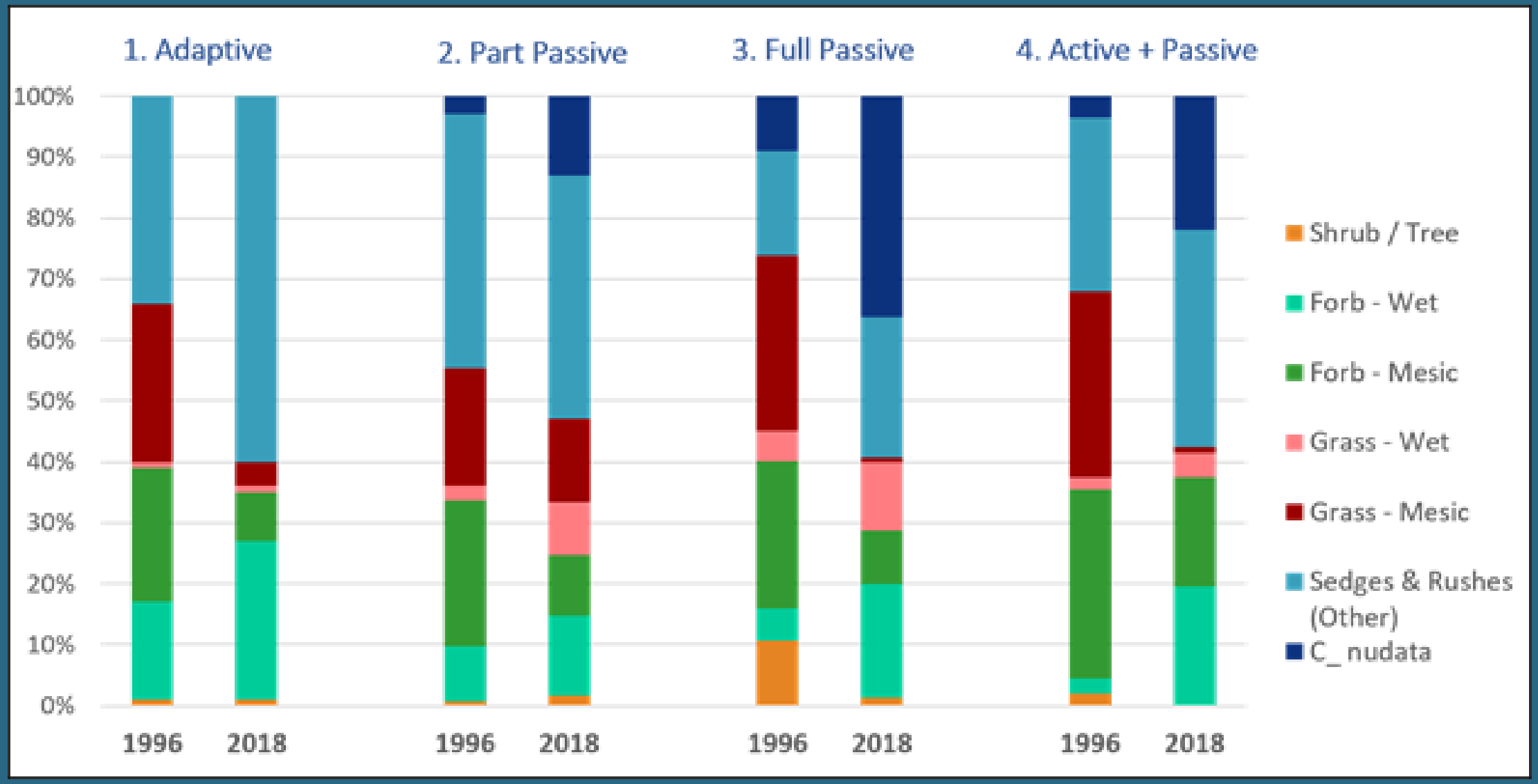


What species are driving the ordination?

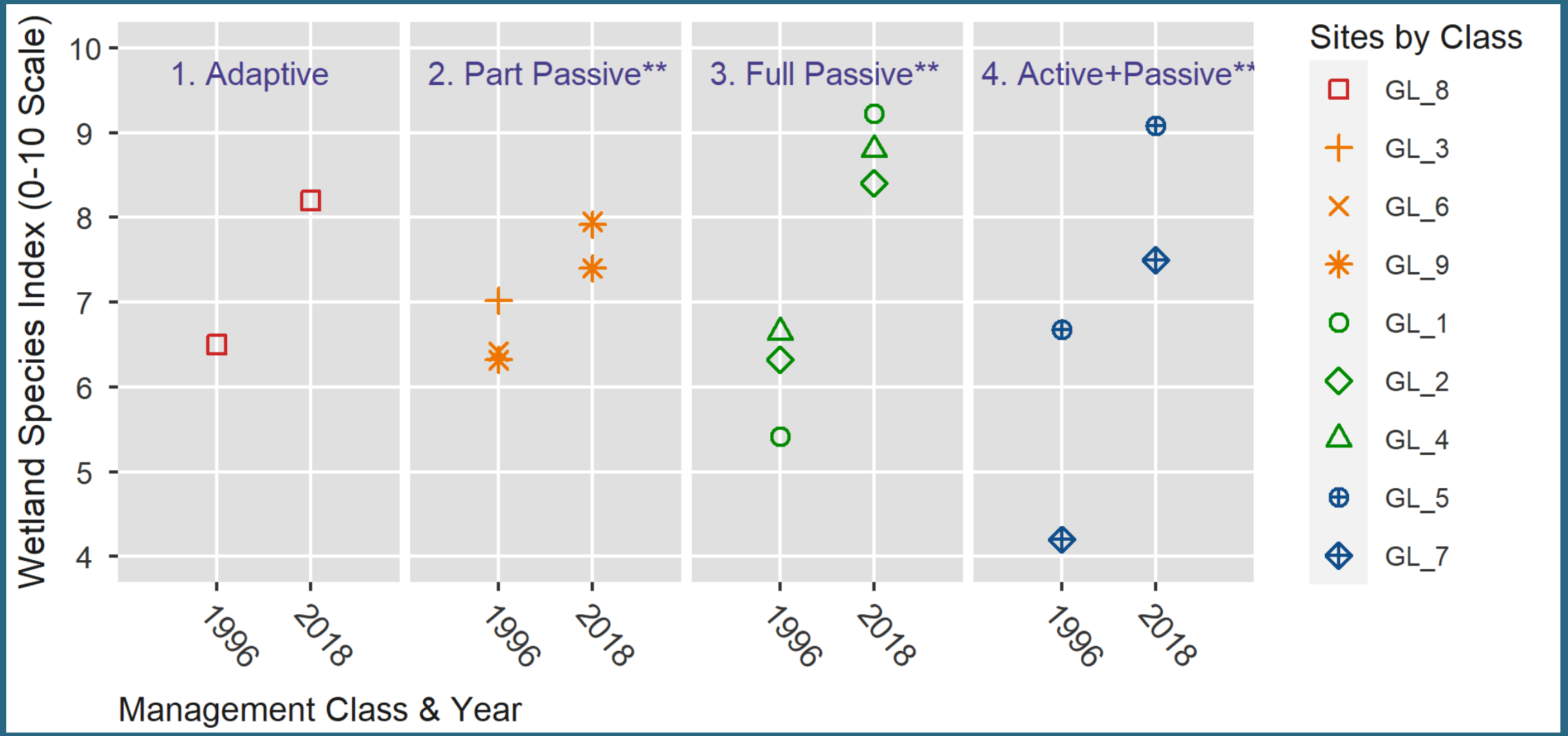
What species are driving change in site species composition?

species shown: $p < .025$
bold species: $p < .001$

Greenline vegetation – **Species Group Proportions**
by Management Class & Year

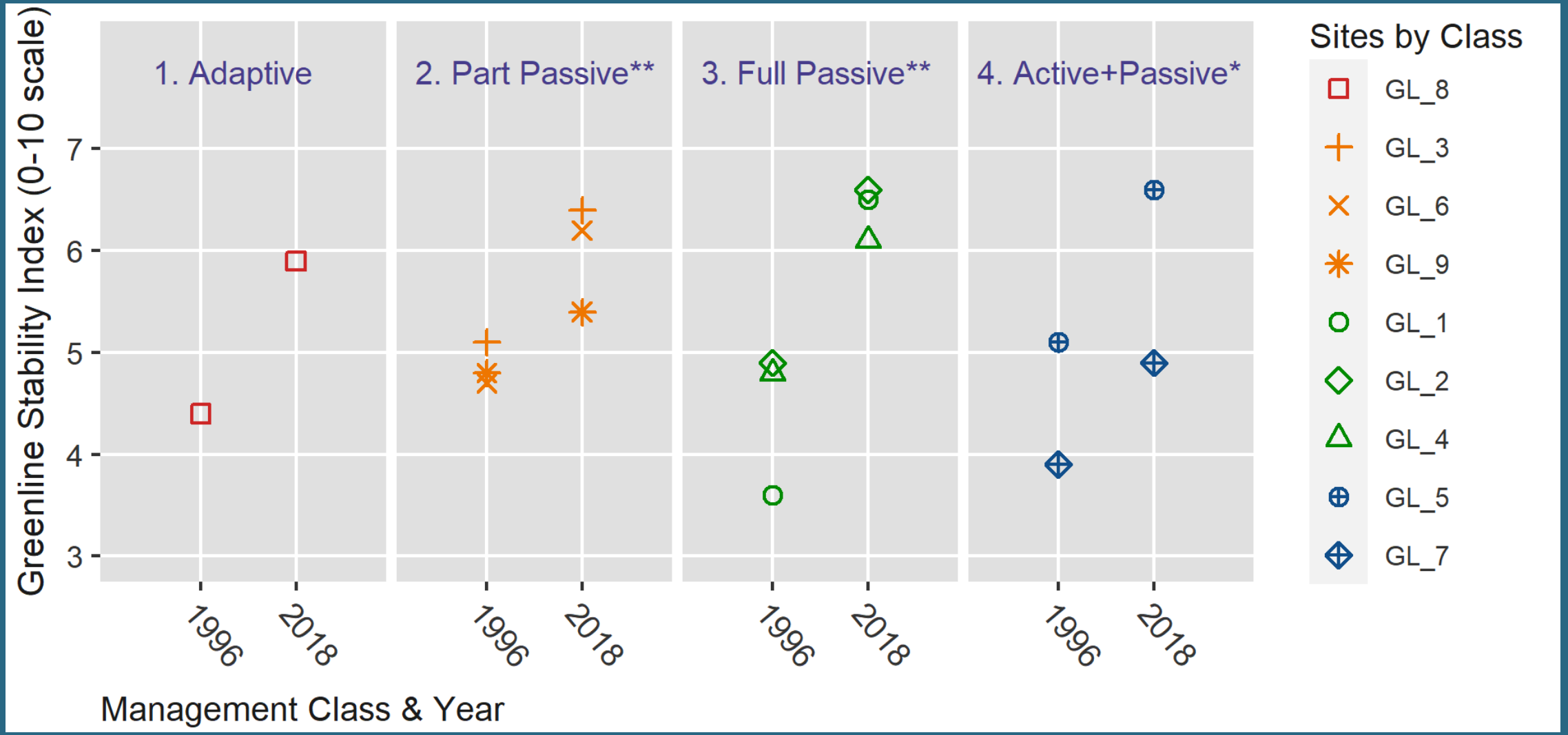


Greenline vegetation – **Wetland Species Index**



** $p < .05$, * $p < .1$ for within-class change (between years). No sig diffs in change among classes

Greenline vegetation – **Stability Index**



** $p < .05$, * $p < .1$ for within-class change (between years). No sig diffs in change among classes

Plants assigned stability rating based on root depth, strength, extent

This presentation →

Vegetation change effects on planform & morphology?

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Aerial imagery chronosequence: **Greenline-to-greenline widths**

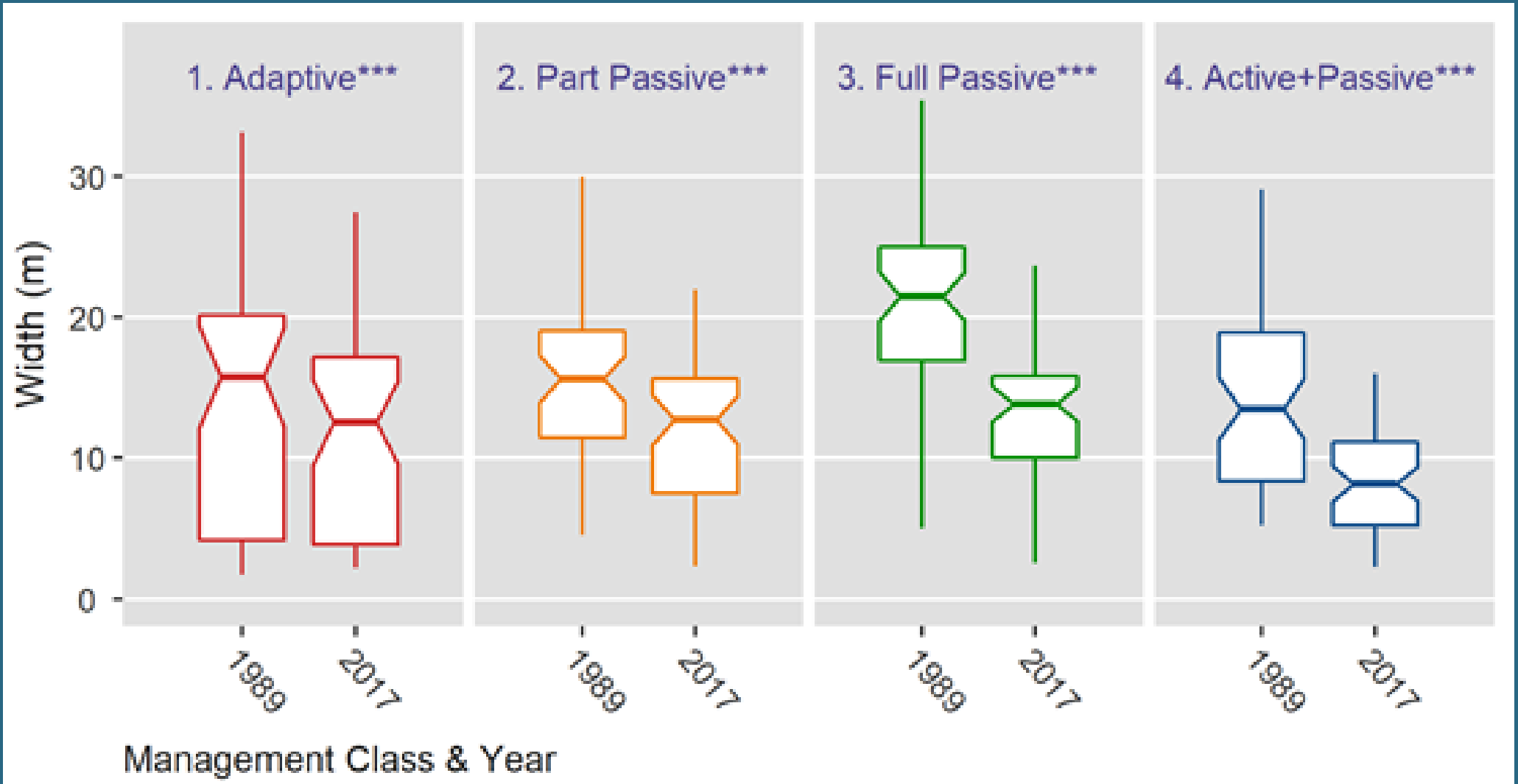
1989 – False color image: red indicates vegetation

Star = Greenline site

Aerial imagery chronosequence: **Greenline-to-greenline widths**

N = 50-60 widths sampled within each class
Uniformly spaced intervals
Unconstrained reaches only

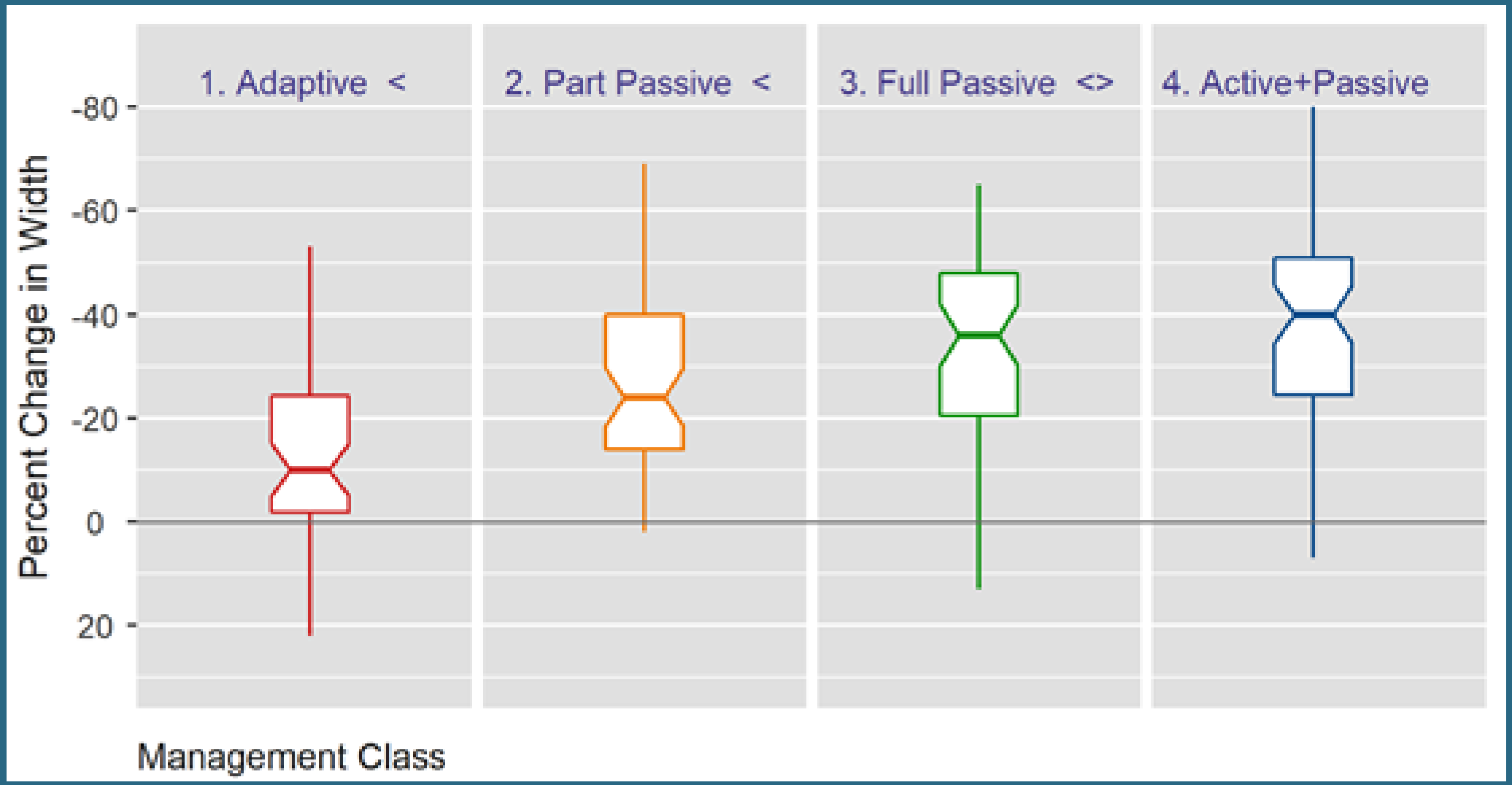
Greenline-to-Greenline channel widths: 1989-2017



Absolute widths; Comparing differences between years within classes

*** $p < .001$

Greenline-to-Greenline channel widths: Percent Change 1989-2017



Normalized widths (percent change); Comparing change in time between classes

"<" = directional difference ($p < .001$) between classes; "<>" = no difference

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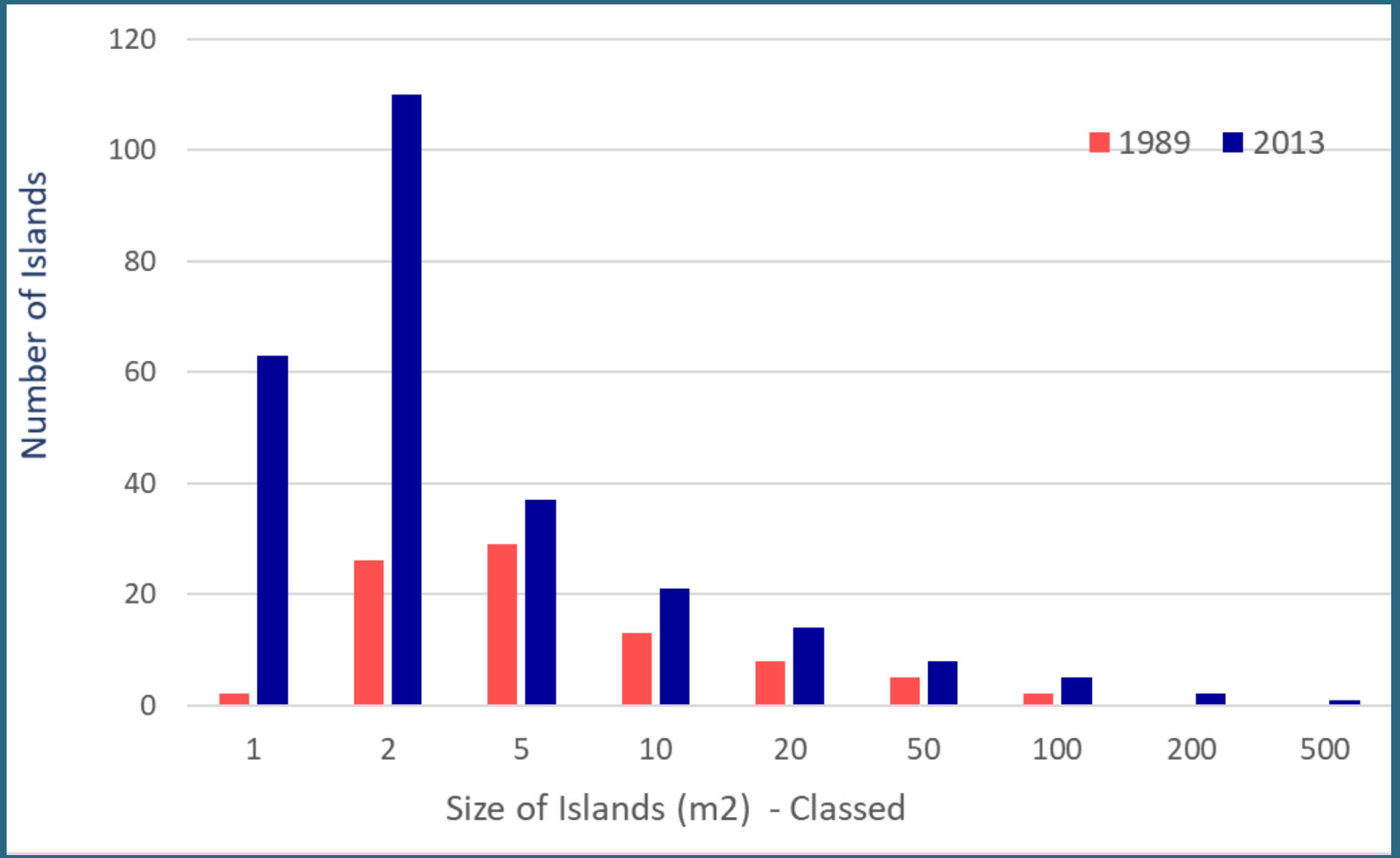
Carex nudata in the river landscape

Gravel bars

Fringe below Eroding Banks

Islands

C. nudata Island Frequency: 1989-2013 - Full Restoration



Complexity metric: Increase in multi-threading

Size distribution

13 km study segment

This presentation

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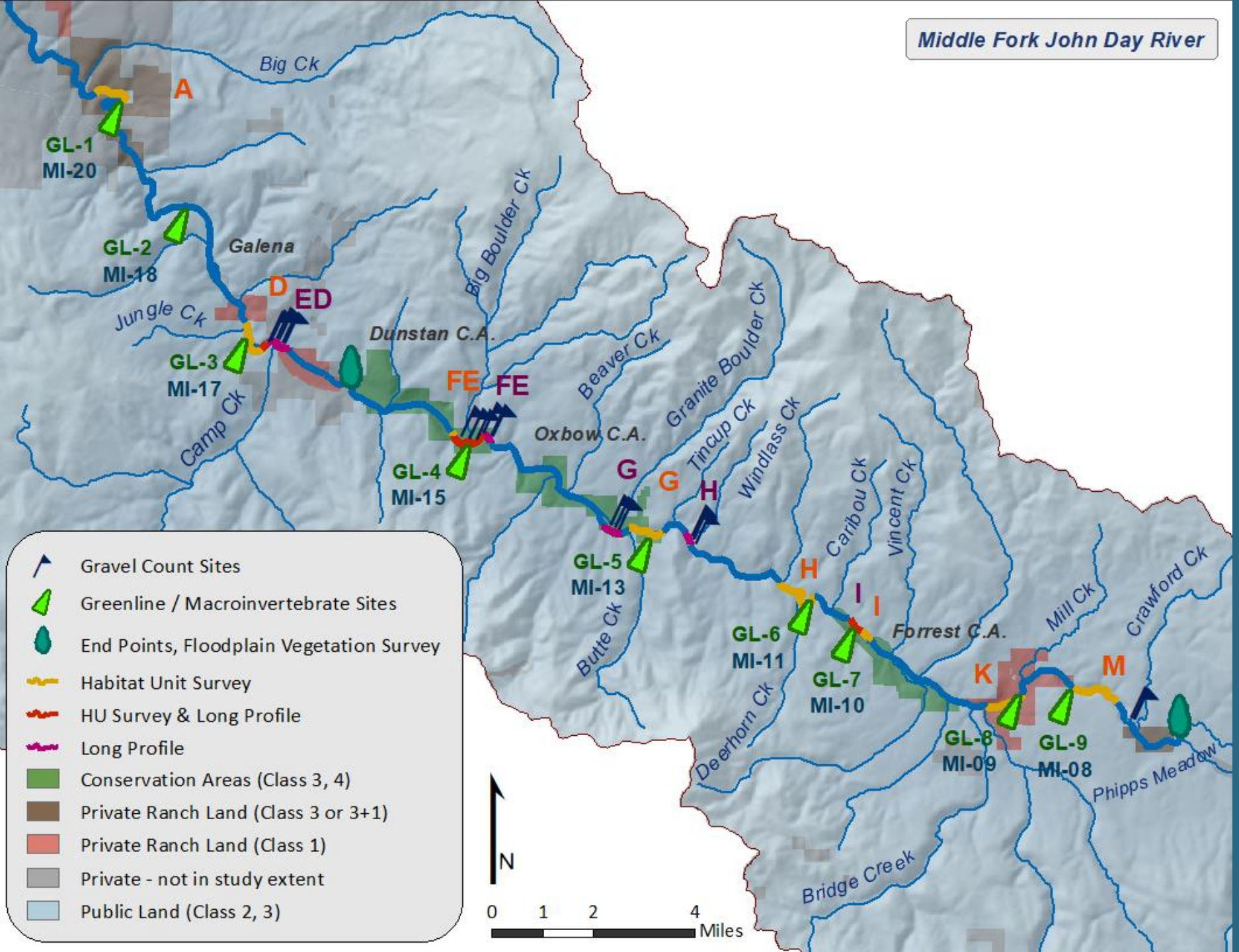

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Habitat Unit Surveys

Habitat Unit Surveys

Habitat Units/ km (Complexity metric)

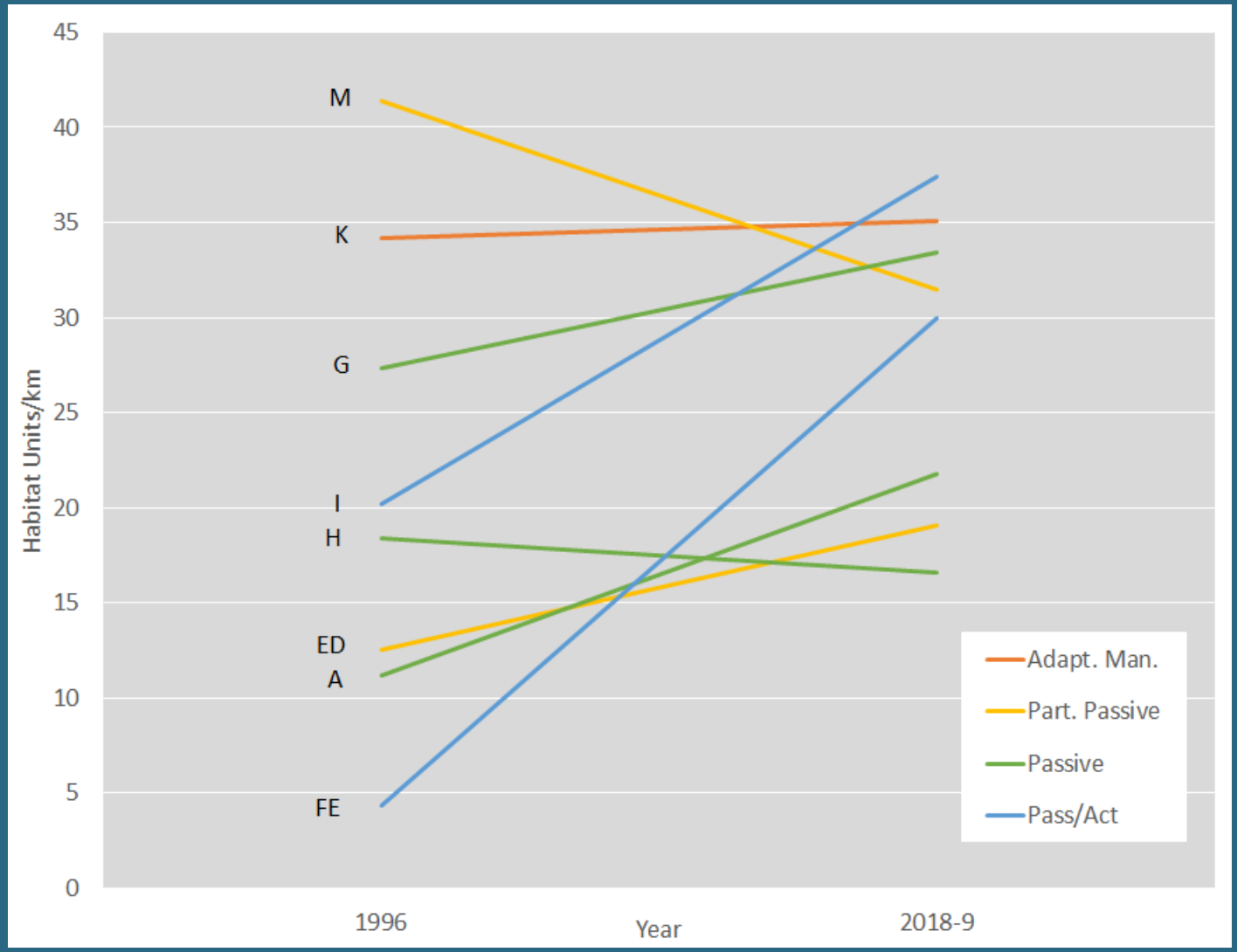
- Generally increasing, most dramatically in Passive + Active

% Length in Pools

- Mixed results, unclear pattern among management types

Residual Pool Depth

- Mixed results, unclear pattern among management types

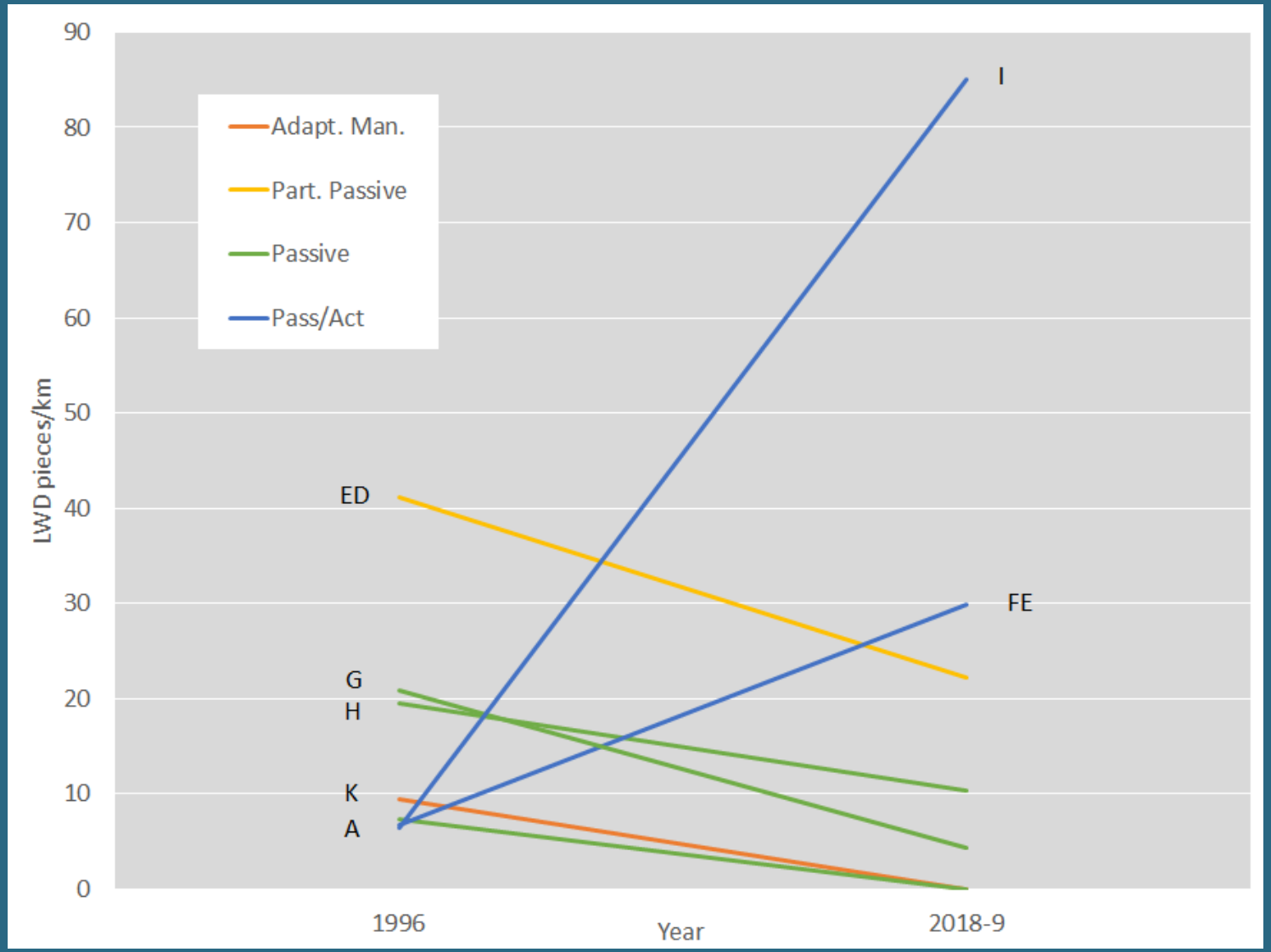


Pat McDowell

Habitat Unit Surveys

Large Woody Debris

- Generally decreasing, except dramatic increase in Passive + Active



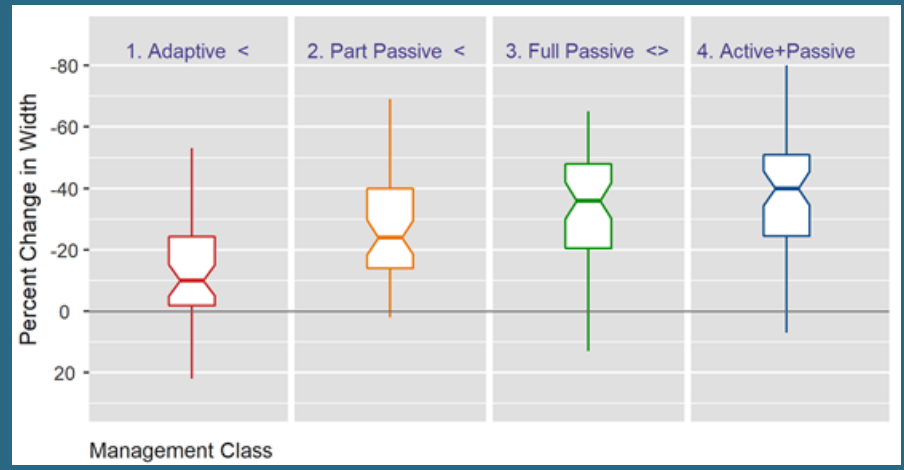
Pat McDowell

Conclusions: Change 1990s-present

- Greenline vegetation shift away from mesic grasses to wet-adapted, sedge-dominated communities w high stability
  - Less *Poa pratensis* (Kentucky bluegrass), in particular
  - More *Carex nudata* (torrent sedge), in particular
- Narrowing of greenline-to-greenline channel widths
- Increasing complexity (*C. nudata* islands, habitat units/km)

Conclusions: Differences among management classes

- Greenline Veg
  - No clear differences (but small sample size)
- Narrowing in GL-GL channel widths
  - Full Passive = Full Passive + Active > Part Passive > Adaptive
- Complexity
  - Inconclusive: Full Passive + Active appears to have greatest increase in Habitat Units/km
- Large Woody Debris
  - Clear increase in Active + Passive
  - Decrease in all other classes



Lessons Learned

- Changes in system components occur at different rates / lag times
- Passive restoration can facilitate systemic, system-wide changes
- Active restoration can “jump-start” certain processes (e.g. large woody debris) & localized changes (pool depth)
- Passive restoration needs to be explicitly recognized (& monitored) in developing restoration strategies

Lessons Learned continued

- Whole watershed strategies should not discount the potential contributions of private landowners
  - Adaptive management (private lands) also showed changes consistent with restoration goals (even if smaller in magnitude)
  - Practices may be evolving over time as landowners participate in the larger conversations within the watershed

- Keep the potential for long-term monitoring in mind when designing short-term monitoring projects now
  - Document! document! document! methods to ensure repeatability when you're no longer around to assist

Acknowledgements:

- Confederated Tribes of the Warm Springs
- Funding: Oregon Watershed Enhancement Board
- Collaborators: Pat McDowell (UO), Lisa Ellsworth (OSU), Seth White (CRITFC)
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- Daniel Baldwin (UO/Freshwater Trust), Kimberly Higgs (USFS) – Botany Wizards
- the original 1990s “Blue & Green Crews”– Boone Kaufmann (OSU), Bob Beschta (OSU), Kris Wright (OSU/U.Wisc-Platteville), Hiram Li (OSU), Judy Li (OSU)