Do microhabitat characteristics affect seedling survival?

Emma Greenlee • The Echinacea Project

Background: seedling establishment

- The seedling establishment project (Sling) tracks seedlings that originated between 2007-2013 in prairie remnants in Douglas County, MN

- Overall goal: better understand the factors contributing to seedling establishment and fitness

Image: http://echinaceaproject.org/2017-update-seedling-establishment/

Seedling establishment and microhabitat

- Are there differences in microhabitat between living and dead seedlings?
- Data collected: litter depth, vegetation cover, slope, aspect, distance to roads and fields, community composition, and floral neighborhood[1]
- Sites: EELR, ERI, ETH, KJ, LF, LC, NESS, NNWLF, NWLF, RNDT, RI, SGC, SAP, SPP

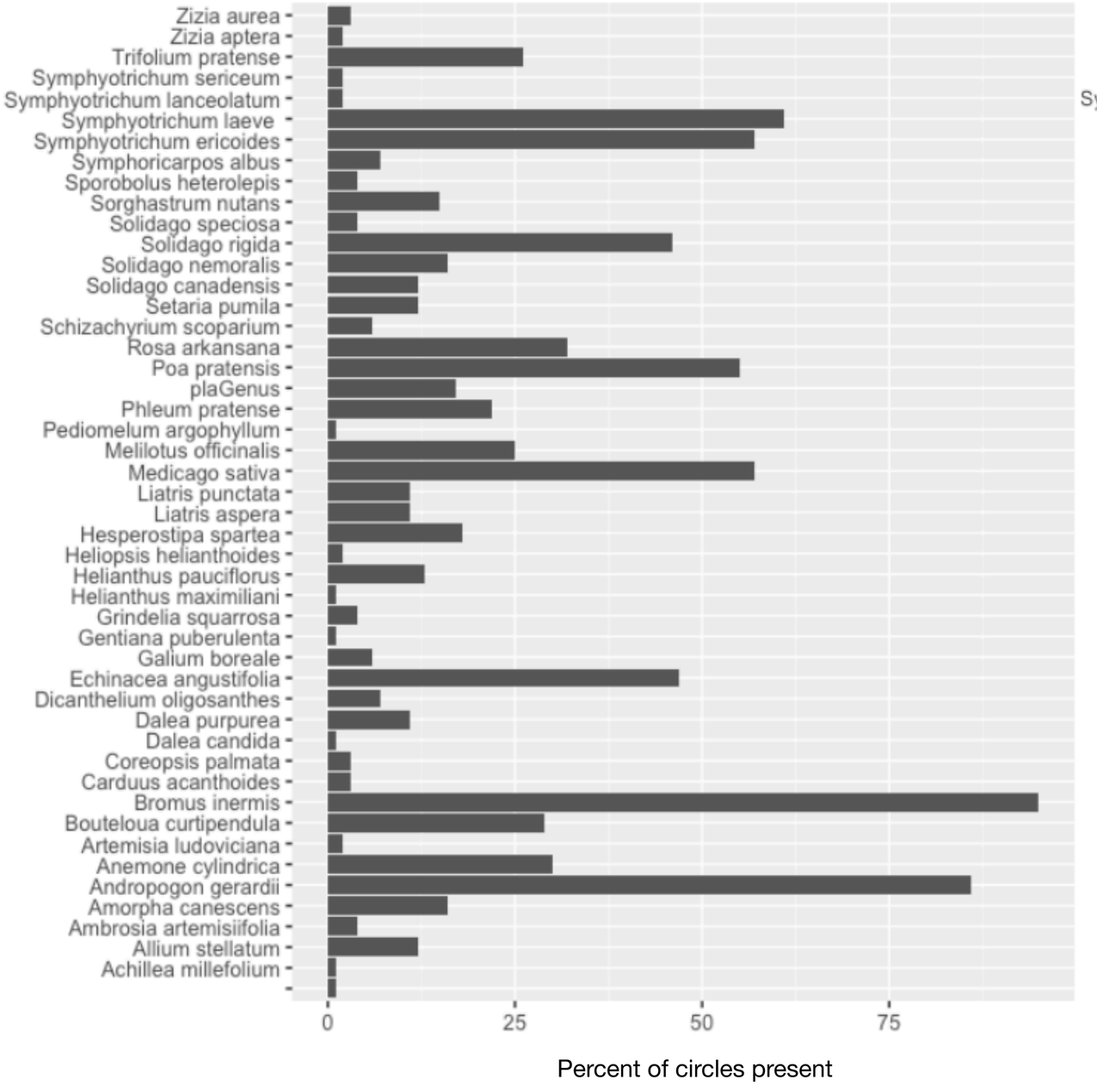
1. Richardson, L. K., M. K. Gallagher, T. E. Hayes, et al. Competition for pollination and isolation from mates differentially impact four stages of pollination in a model grassland perennial. Journal of Ecology 2020:1–14. https://doi.org/10.1111/1365-2745.13562

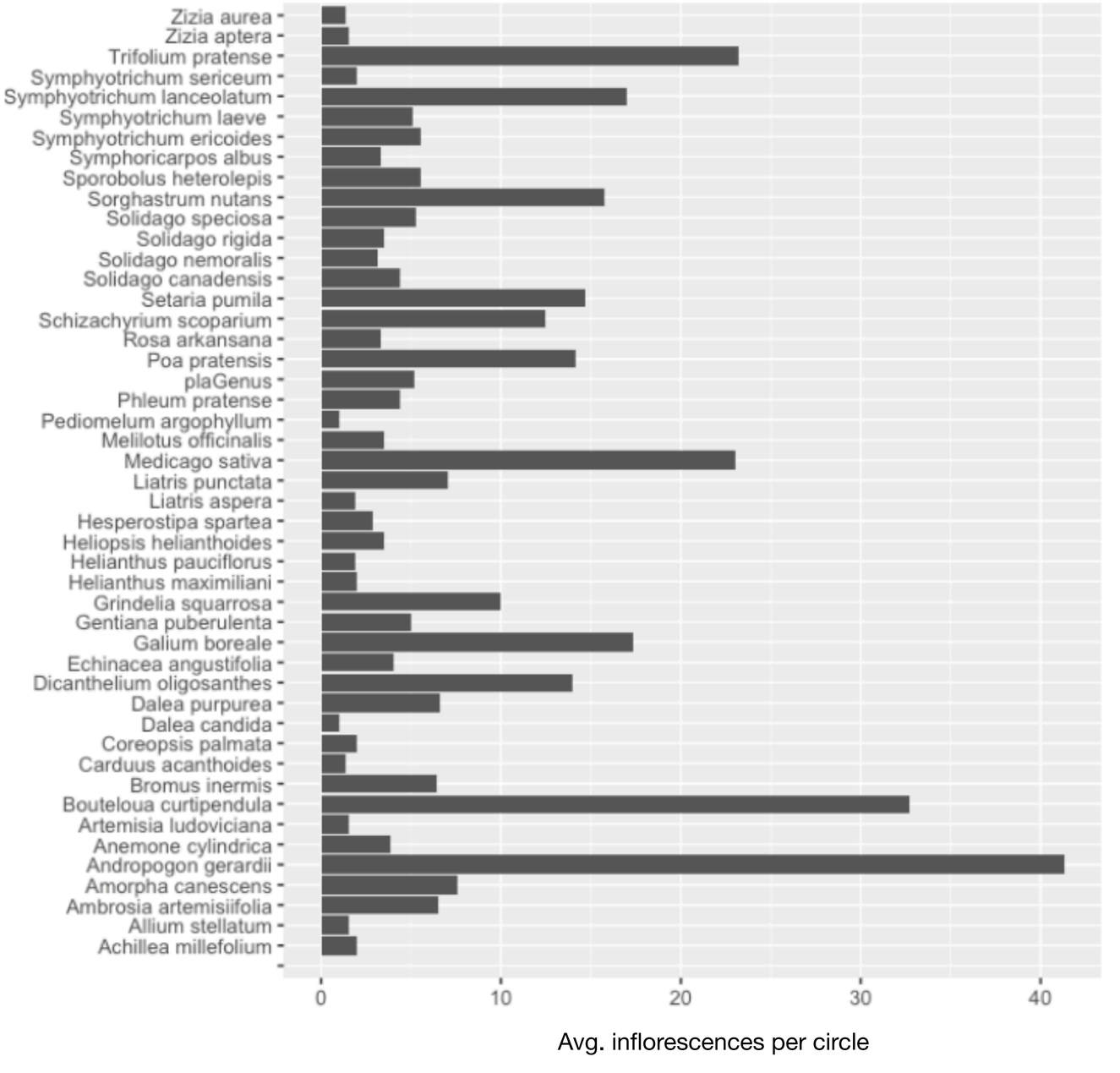
Descriptive statistics

- 899 observations of 48 total identified species plus a few miscellaneous grasses and weeds I was not sure about

- Most abundant flowering species was *Andropogon gerardii* with an average of 41 inflorescences per circle, while the rarest were *Dalea candida* and *Pediomelum argophyllum* which each had 1 flower at 1 circle

- Floral diversity ranged from 2 species at a living EELR circle to 18 species at a dead SPP circle


Zizia aurea
Zizia aptera
Trifolium pratense
Symphyotrichum sericeum
Symphyotrichum lanceolatum
Symphyotrichum laeve
Symphyotrichum ericoides
Symphoricarpos albus
Sporobolus heterolepis
Sorghastrum nutans
Solidago speciosa
Solidago rigida
Solidago nemoralis
Solidago canadensis
Setaria pumila
Schizachyrium scoparium
Rosa arkansana
Poa pratensis
plaGenus
Phleum pratense
Pediomelum argophyllum
Melilotus officinalis
Medicago sativa
Liatris punctata
Liatris aspera
Hesperostipa spartea
Heliopsis helianthoides
Helianthus pauciflorus
Helianthus maximiliani
Grindelia squarrosa
Gentiana puberulenta
Galium boreale
Echinacea angustifolia
Dicanthelium oligosanthes
Dalea purpurea
Dalea candida
Coreopsis palmata
Carduus acanthoides
Bromus inermis
Bouteloua curtipendula
Artemisia ludoviciana
Anemone cylindrica
Andropogon gerardii
Amorpha canescens
Ambrosia artemisiifolia
Allium stellatum
Achillea millefolium
0
25
50
75
Percent of circles present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Bromus inermis
Bouteloua curtipendula
Artemisia ludoviciana
Anemone cylindrica
Andropogon gerardii
Amorpha canescens
Ambrosia artemisiifolia
Allium stellatum
Achillea millefolium
0
10
20
30
40
Avg. inflorescences per circle


Solidago speciosa


Gentiana puberulenta


Symphyotrichum laeve

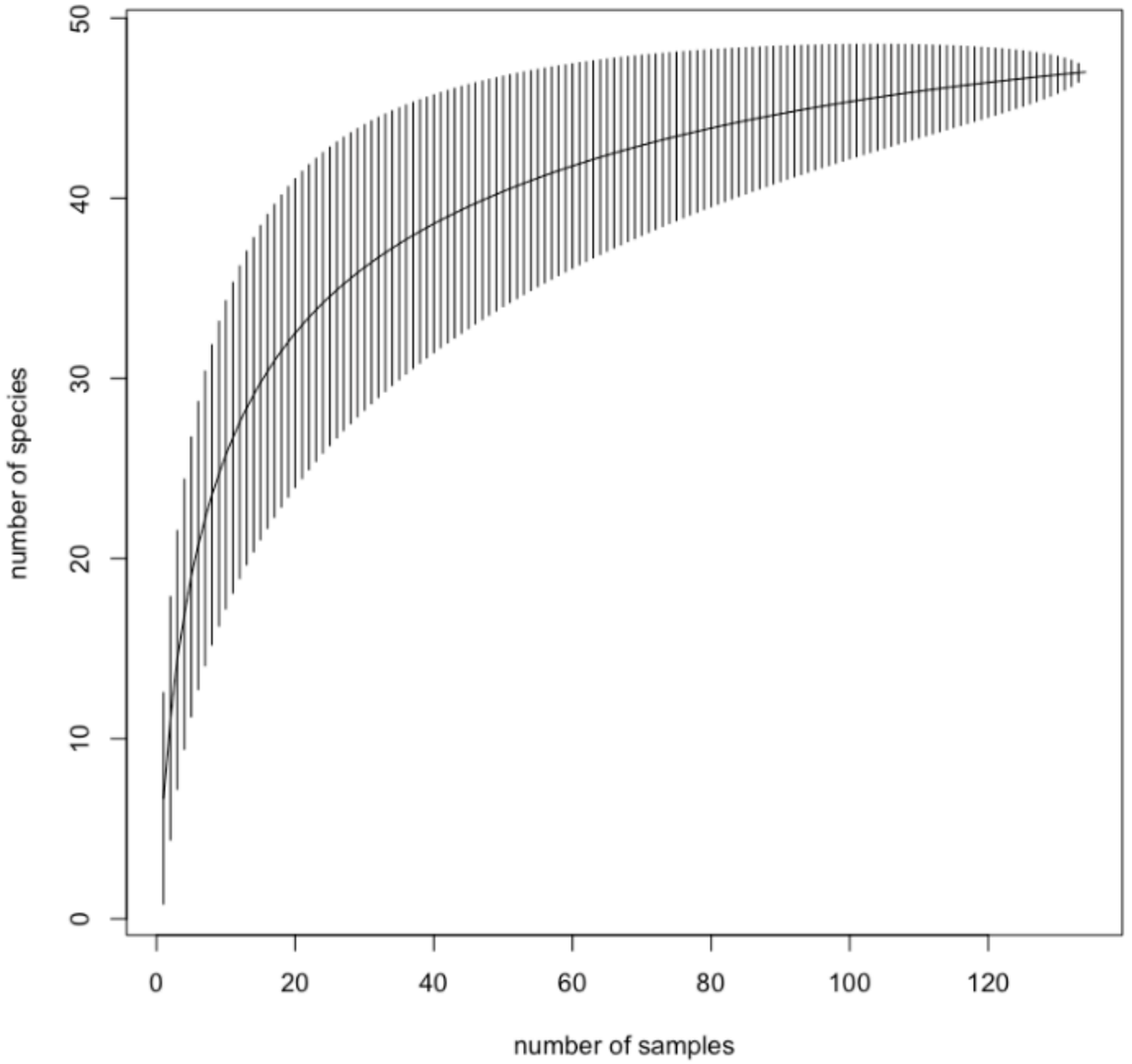

Symphyotrichum ericoides


Symphyotrichum sericeum

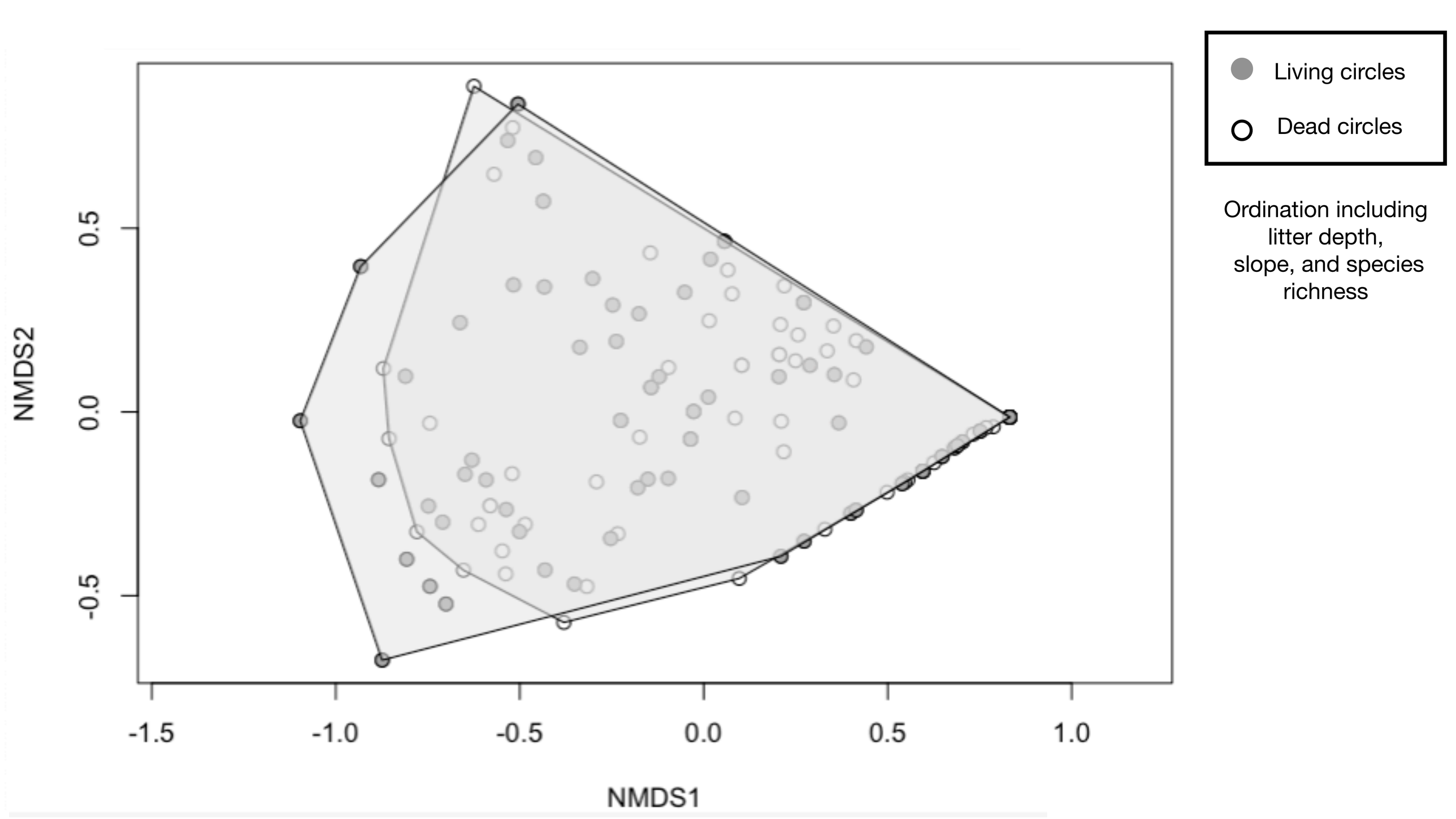
Surviving vs. dead circles

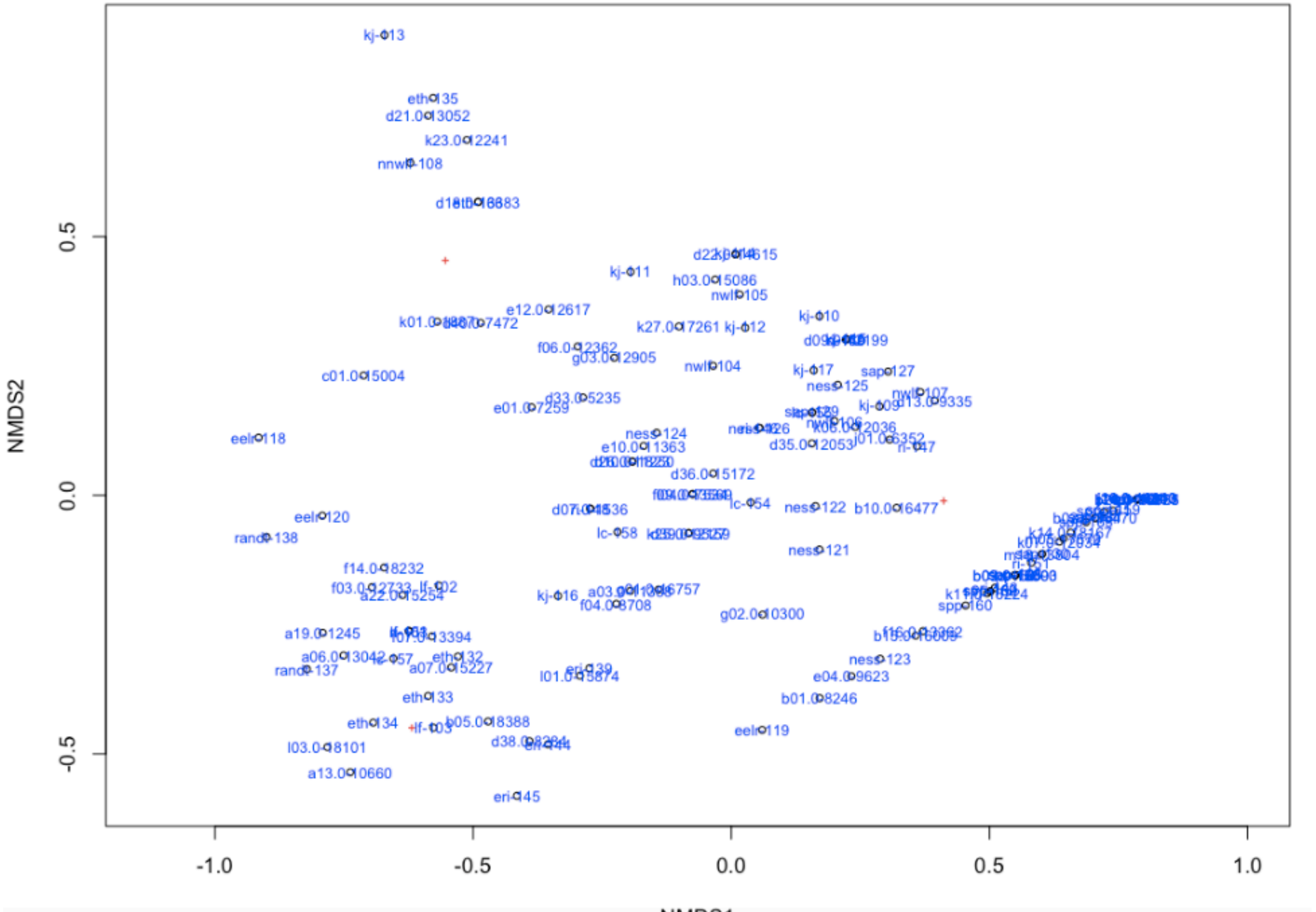
Variable	Surviving circles mean	Dead circles mean
Litter depth	1.109 cm	.985 cm
Vegetation cover	8.547 cm	11.410 cm
Slope	8.377°	7.152°
Distance to roads	10.633 m	9.891 m
Distance to fields	11.650 m	8.737 m
Number of species	6.203 per circle	7.091 per circle
Inflorescence count	11.73 per circle	12.02 per circle

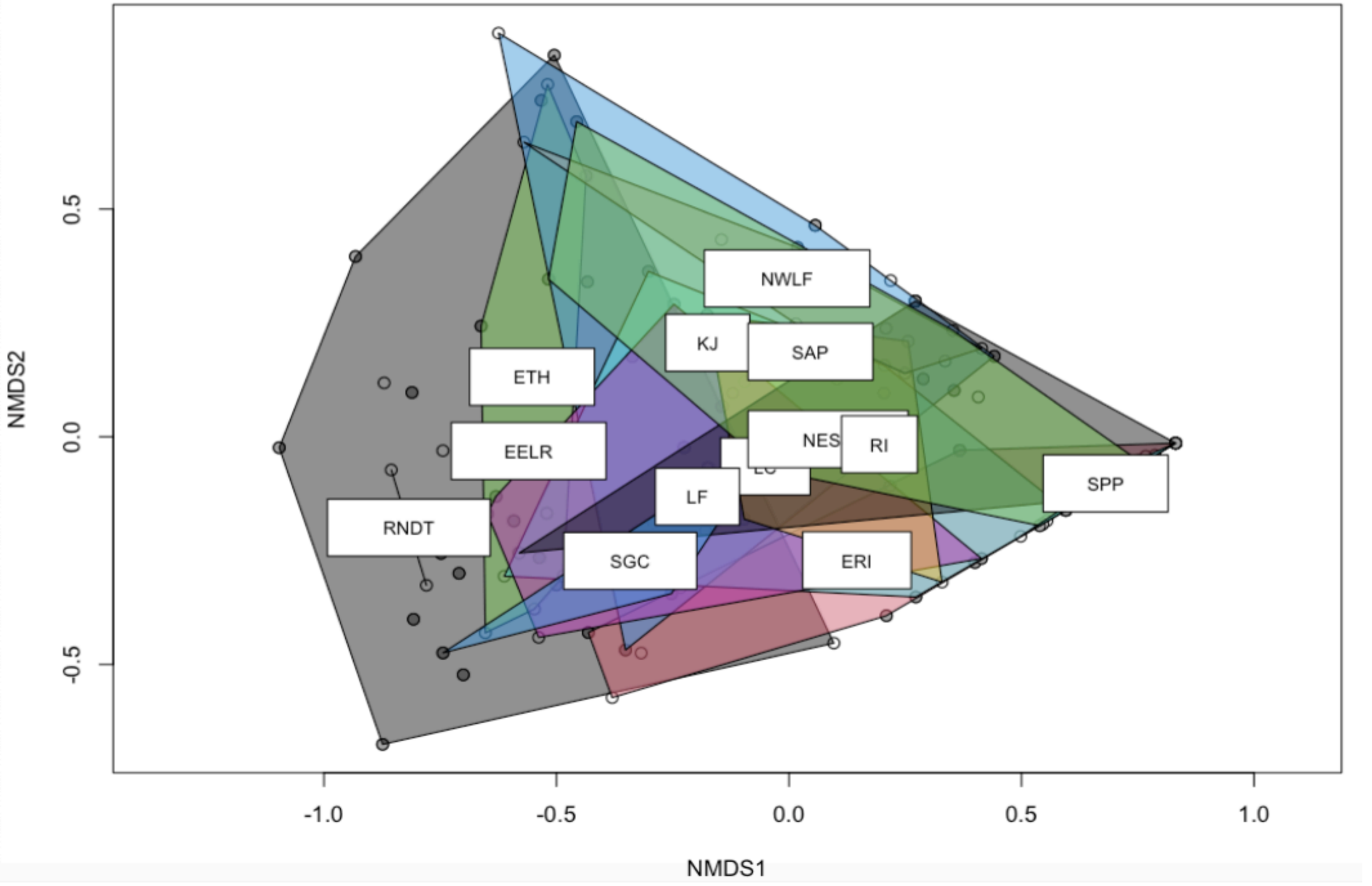
Formal analyses

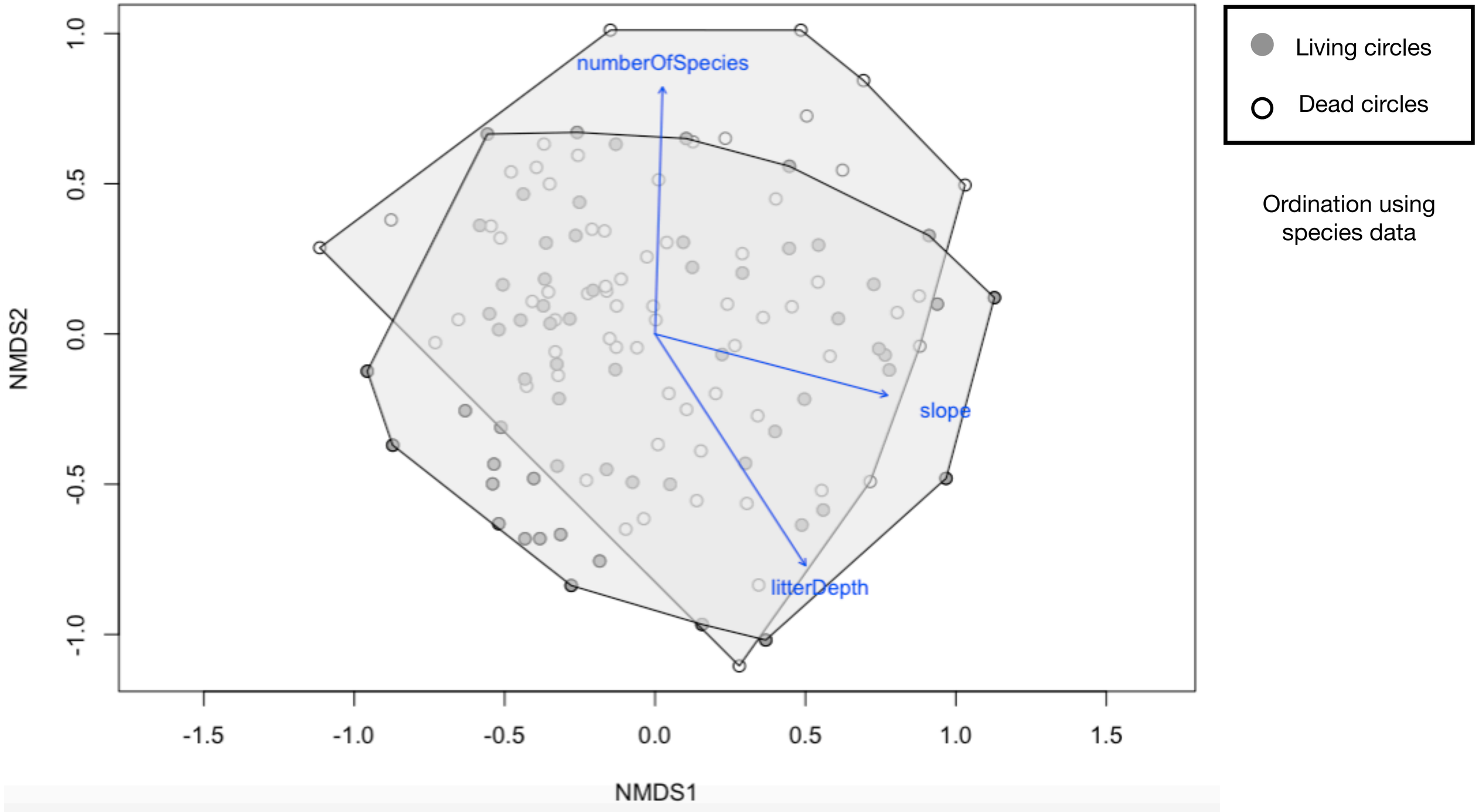


Diversity index	Surviving circles mean	Dead circles mean
Shannon's	1.178	1.371
Simpson's	0.560	0.641

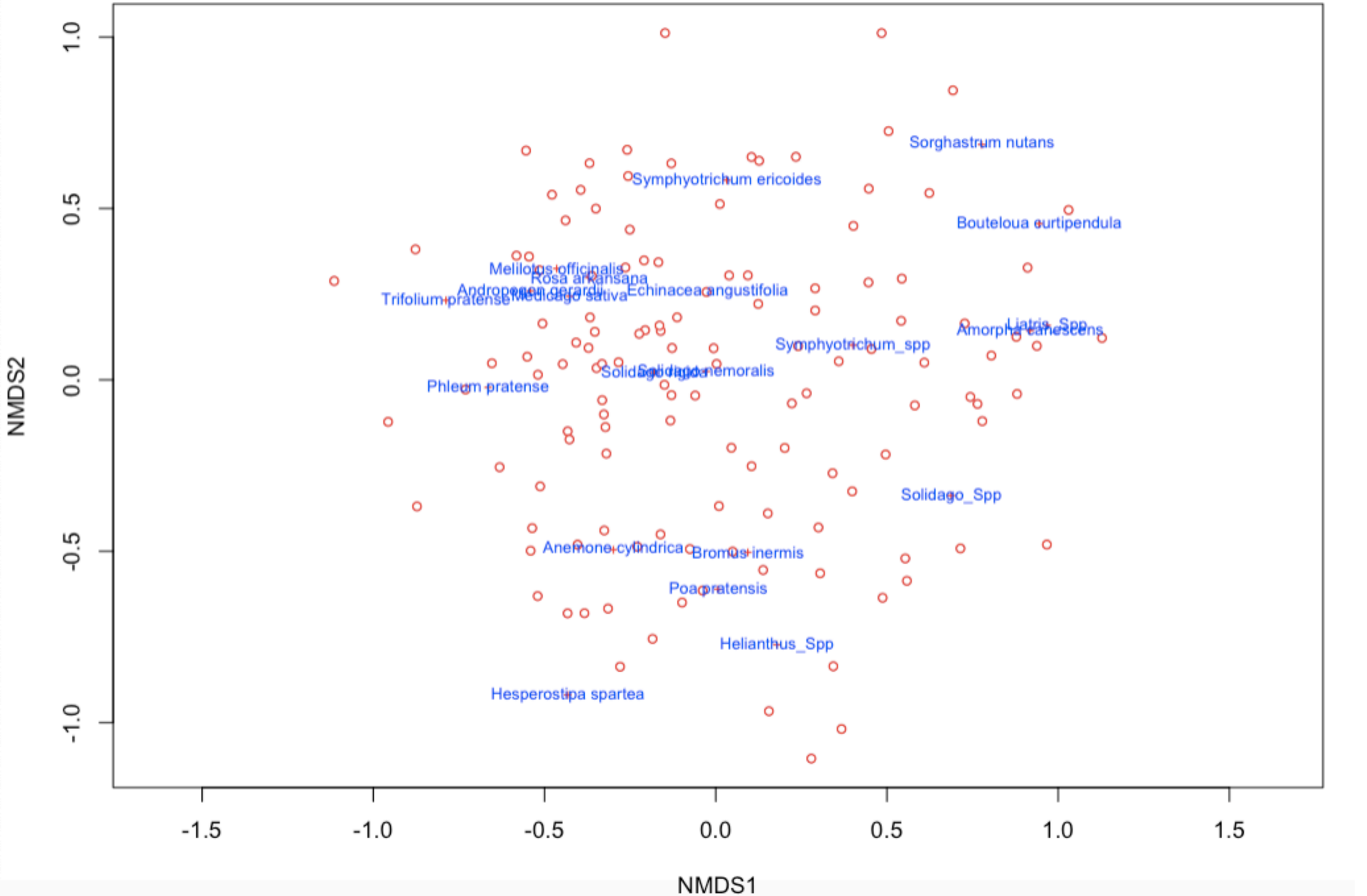

Living circles
Dead circles
Ordination including litter depth, slope, and species richness
NMDS2
0.5
0.0
-0.5
-1.5
-1.0
-0.5
0.0
0.5
1.0
NMDS1


NMDS2
NMDS1
0.5
0.0
-0.5
-1.0
-0.5
0.0
0.5
1.0
kj-013
eth135
d21.013052
k23.012241
nnwl108
kj-011
h03.015086
nwl105
e12.012617
kj-010
k27.017261
kj-012
f06.012362
g03.012905
nwl104
kj-017
sap127
c01.015004
ness125
nwl107
d33.015235
e01.017259
kj-009
d13.009335
eelr118
ness124
e10.011363
d35.012053
k06.002036
l01.006352
n-047
d36.015172
eelr120
d07.015536
lc-054
ness122
b10.016477
rand138
lc-058
ness121
f14.018232
f03.012733
lf-002
a22.015254
kj-016
a03.001
f04.008708
g02.010300
spp160
a19.001245
lf-003
l07.013394
a06.013042
lc-057
eth132
rand137
a07.015227
eri139
l01.015874
ness123
e04.009623
eth133
b01.008246
eth134
lf-005
b05.018388
eelr119
l03.018101
d38.008264
a13.010660
eri145


NWLF
KJ
SAP
ETH
EELR
NES
RI
SPP
LF
RNDT
SGC
ERI
0.5
0.0
-0.5
NMDS2
-1.0
-0.5
0.0
0.5
1.0
NMDS1



Ordination using species data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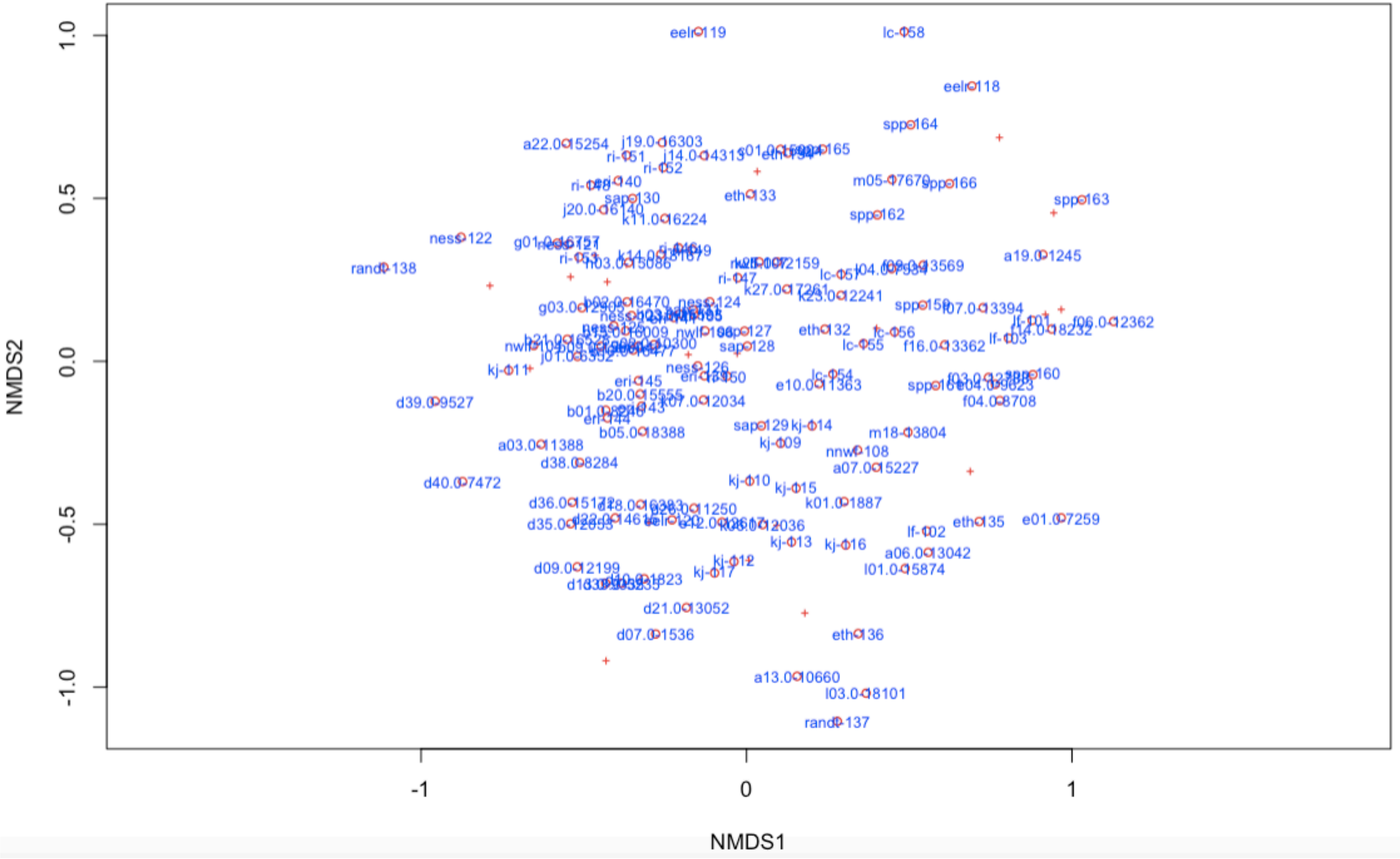
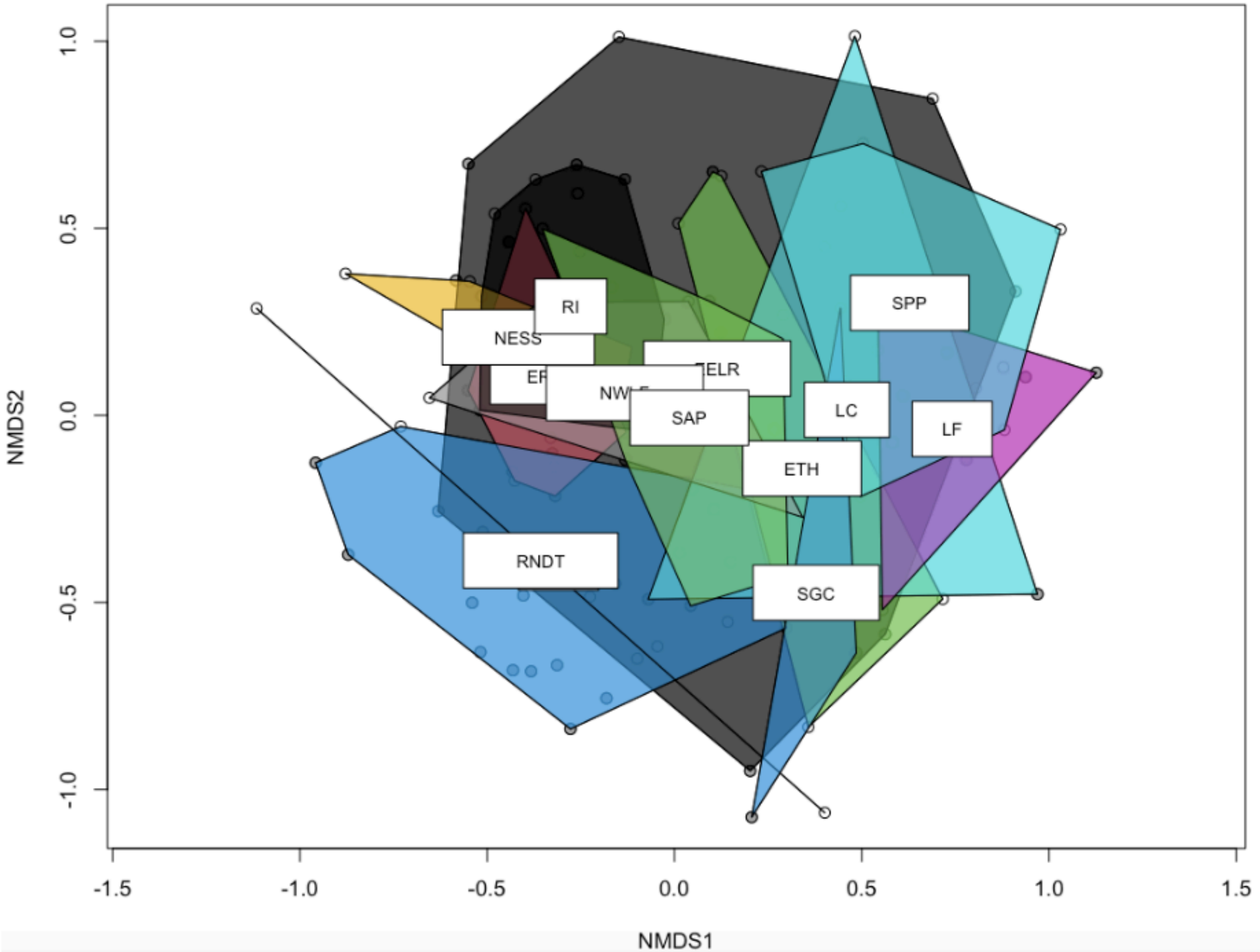
Melilotus officinalis
Rosa arkansana
Andropogon gerardii
Echinacea angustifolia
Trifolium pratense
Medicago sativa
Liatris_Spp
Amorpha canescens
Symphyotrichum_spp
Solidago nemoralis
Phleum pratense
Solidago_Spp
Anemone cylindrica
Bromus inermis
Poa pratensis
Helianthus_Spp
Hesperostipa spartea
NMDS1
NMDS2
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
-1.0
-0.5
0.0
0.5
1.0


NMDS2
NMDS1
1.0
0.5
0.0
-0.5
-1.0
-1
0
1
eelr119
lc-058
eelr118
spp164
a22.0-15254
j19.0-16303
ri-051
j14.0-14315
ri-052
spp165
m05-17679
spp166
ri-048
sap130
eth133
spp163
j20.0-16140
k11.0-16224
spp162
ness122
g01.0-16757
ness121
ri-053
k14.0-15187
rand138
h03.0-15086
ri-047
k27.0-17261
k23.0-12241
a19.0-1245
lc-057
f09.0-13569
spp159
f07.0-13394
lf-001
f06.0-12362
g03.0-12905
ness124
eth132
lc-056
f14.0-18232
lf-003
nwlf127
sap127
sap128
lc-055
f16.0-13362
kj-011
ness126
lc-054
e10.0-11363
spp160
eri-145
d39.0-9527
b20.0-15555
k07.0-12034
f04.0-8708
eri-144
sap129
kj-014
b05.0-18388
m18-13804
a03.0-11388
kj-009
nnwf108
d38.0-8284
a07.0-15227
d40.0-7472
kj-010
kj-015
k01.0-1887
d36.0-15172
d35.0-12853
eth135
e01.0-7259
lf-002
kj-013
kj-016
a06.0-13042
kj-012
d09.0-12199
kj-017
l01.0-15874
d21.0-13052
d07.0-1536
eth136
a13.0-10660
l03.0-18101
rand137


RI
NESS
SPP
ELR
SAP
LC
LF
ETH
RNDT
SGC
NMDS1
NMDS2
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
-1.0
-0.5
0.0
0.5
1.0

Discussion

- No evidence of microhabitat differences between living and dead sling circles
- No evidence of differences in seedling survival by site
- Other characteristics that may affect seedling survival—climate, soil moisture & nutrients, pesticide drift, light limitation, herbivory, genetic factors

A huge thank-you to Stuart, Mia, and Lea for helping me with this project!