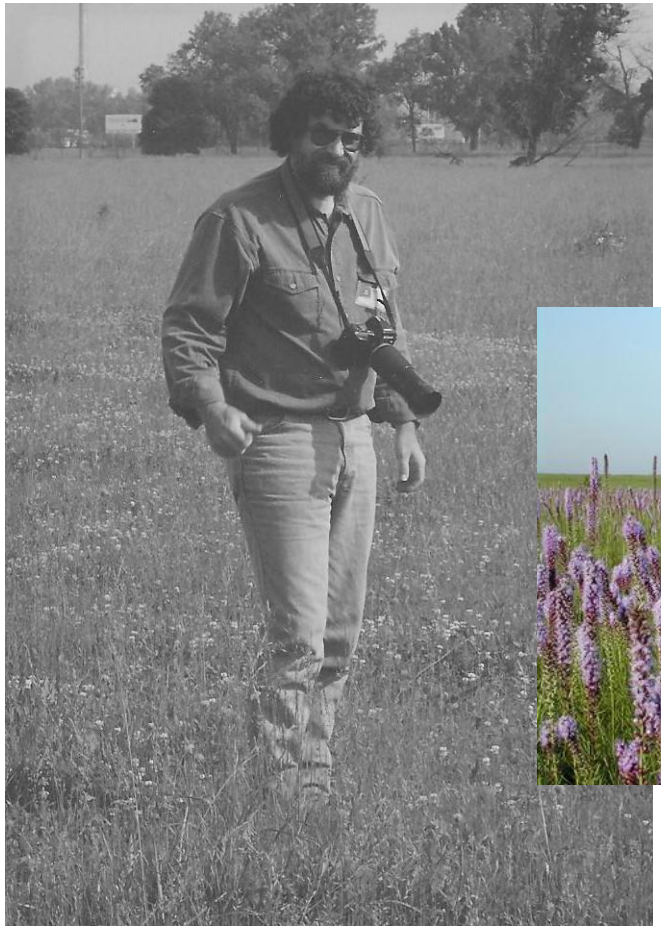
Long-term Studies of Bird-Fire Interactions in Illinois Grasslands

Jim Herkert, IDNR
Springfield IL

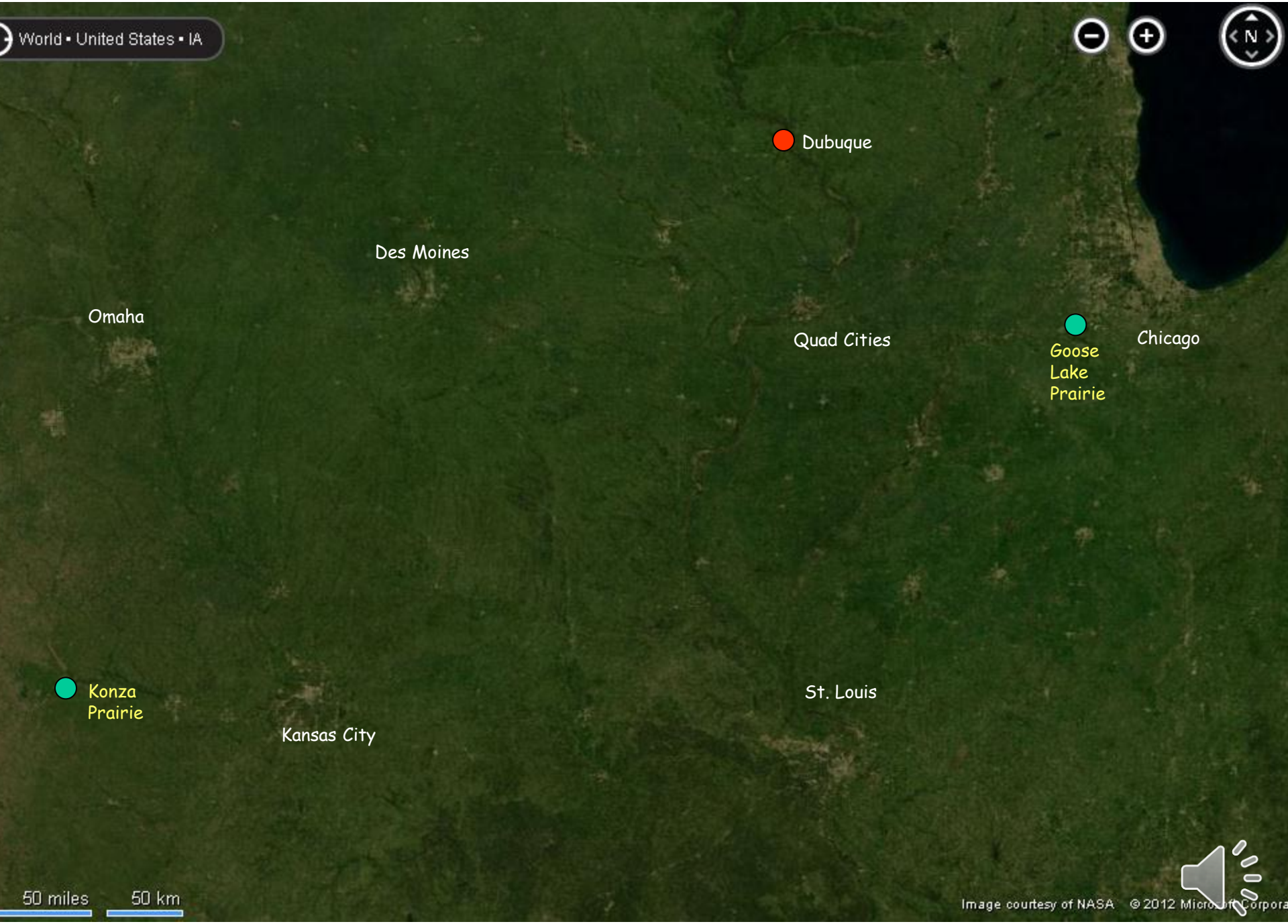
- 2 studies; 1991-2006, 1995-2012+
- 5 bird species

Burn Effects on Bird Abundance at Goose Lake Prairie, 1991-2006



KONZA Prairie Research Natural Area

	Goose Lake Prairie	KONZA
Years	1991-2006	1981-1990
Treatments	Burned/Unburned (13+ yrs post-fire): rotational burning, mean Fire Return Interval 6.5 years	Burned: burned every year since 1972/1978 Unburned: not burned since at least 1971 Soruce: Zimmerman 1992


World • United States • IA
N
Dubuque
Des Moines
Omaha
Quad Cities
Chicago
Goose
Lake
Prairie
Konza
Prairie
St. Louis
Kansas City
50 miles
50 km
Image courtesy of NASA
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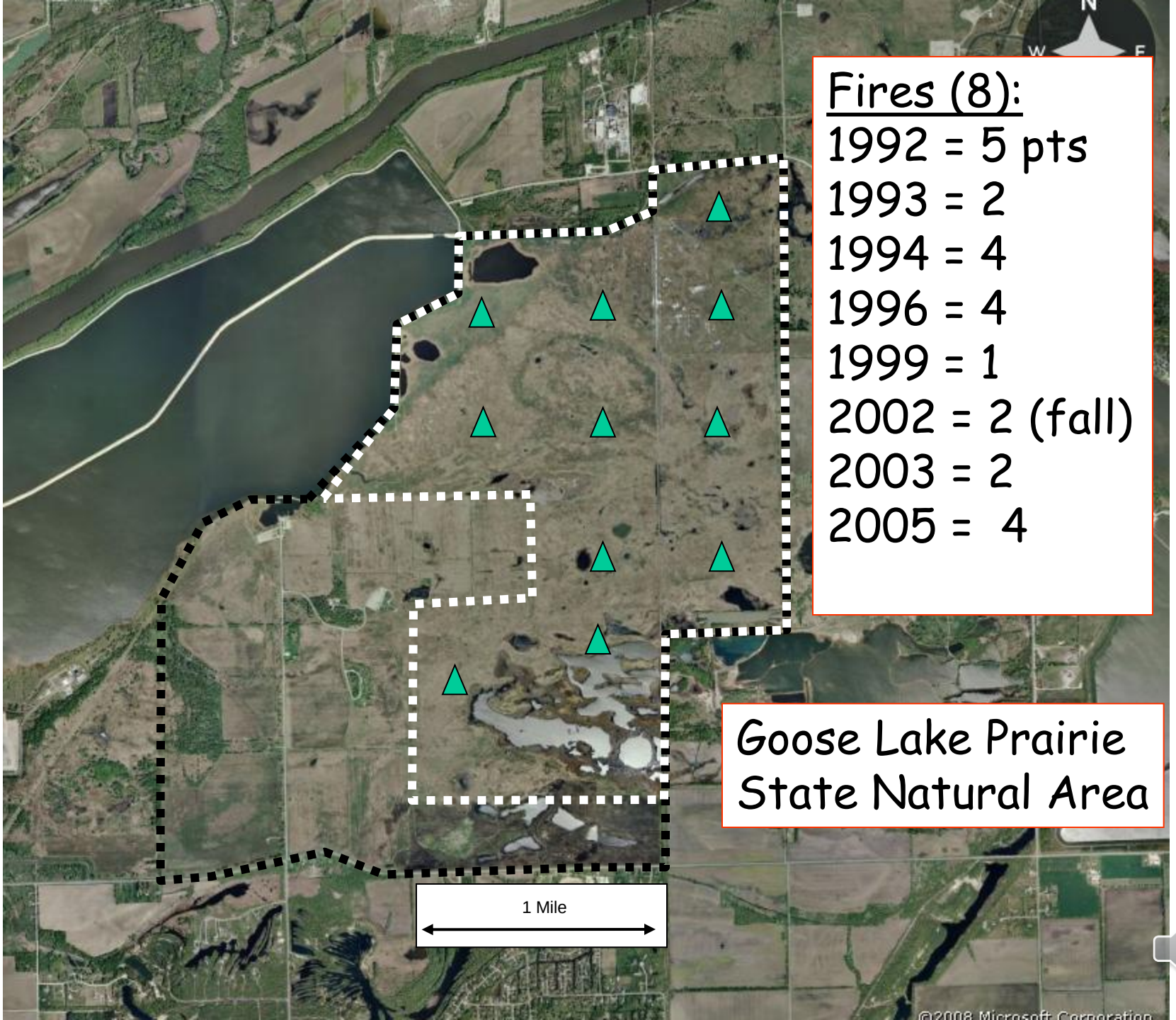
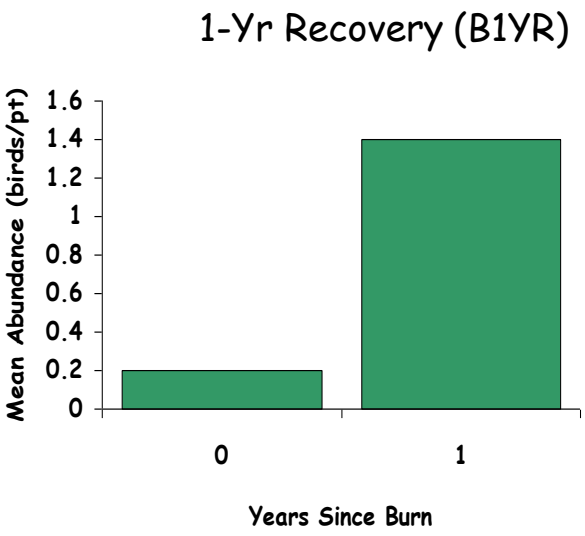
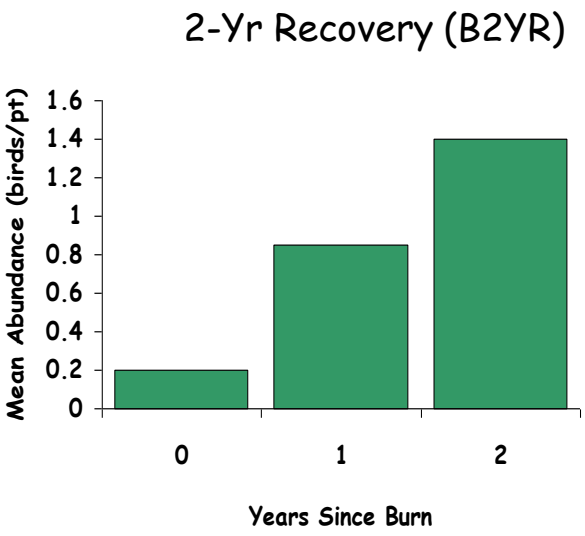


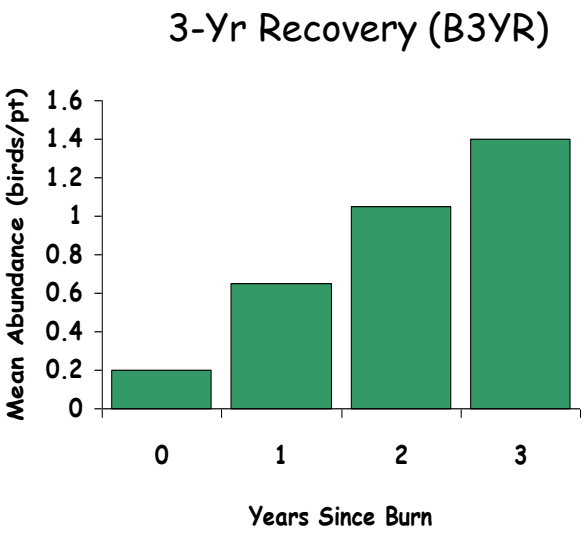
Fires (8):
1992 = 5 pts
1993 = 2
1994 = 4
1996 = 4
1999 = 1
2002 = 2 (fall)
2003 = 2
2005 = 4

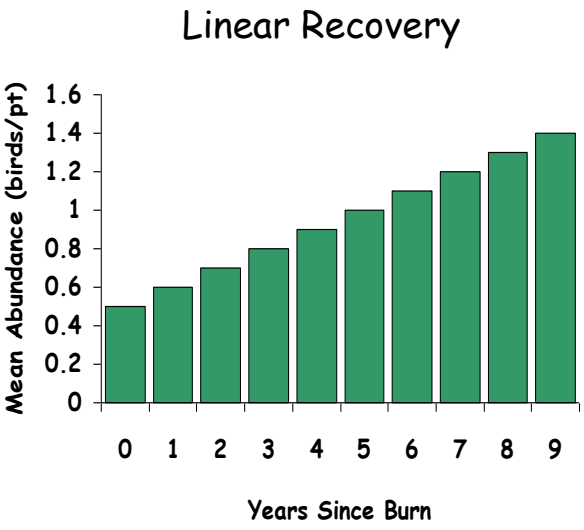
Goose Lake Prairie State Natural Area

POTENTIAL BURN RESPONSES



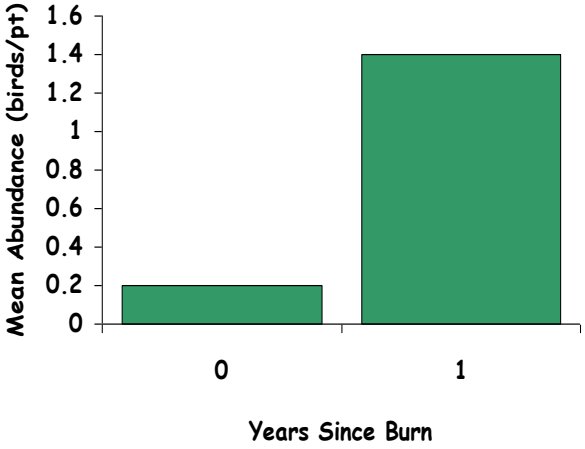




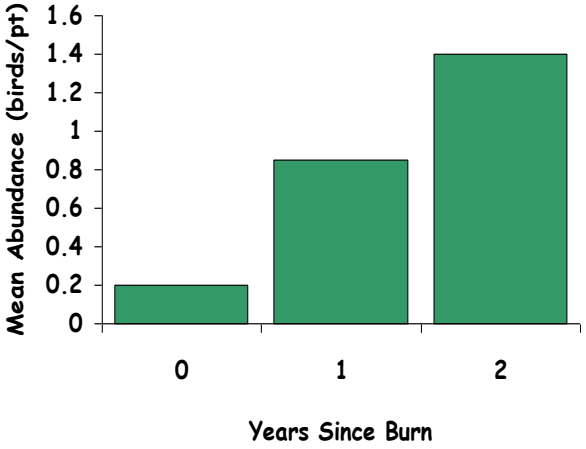


POTENTIAL BURN MODELS CONSIDERED

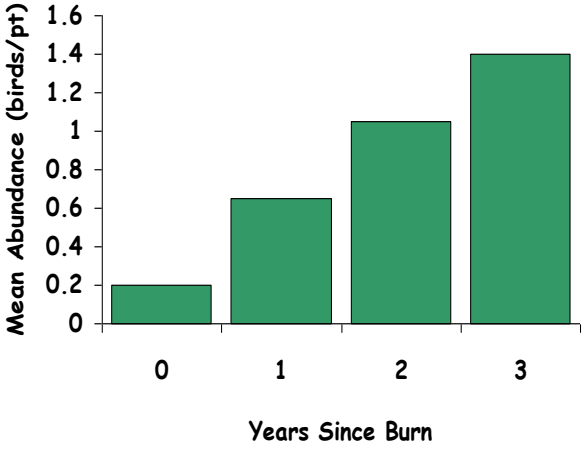
1-Yr Recovery (B1YR)



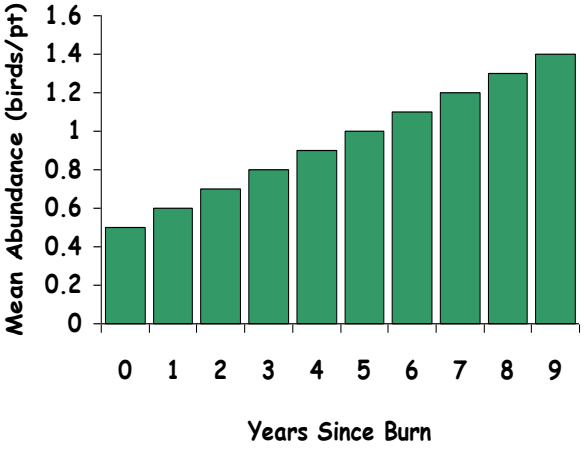
2-Yr Recovery (B2YR)



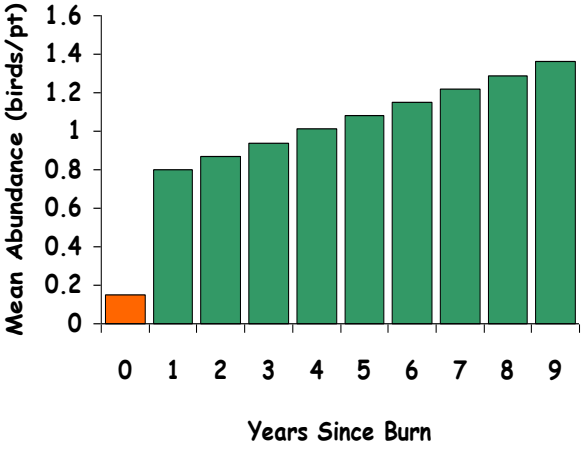
3-Yr Recovery (B3YR)

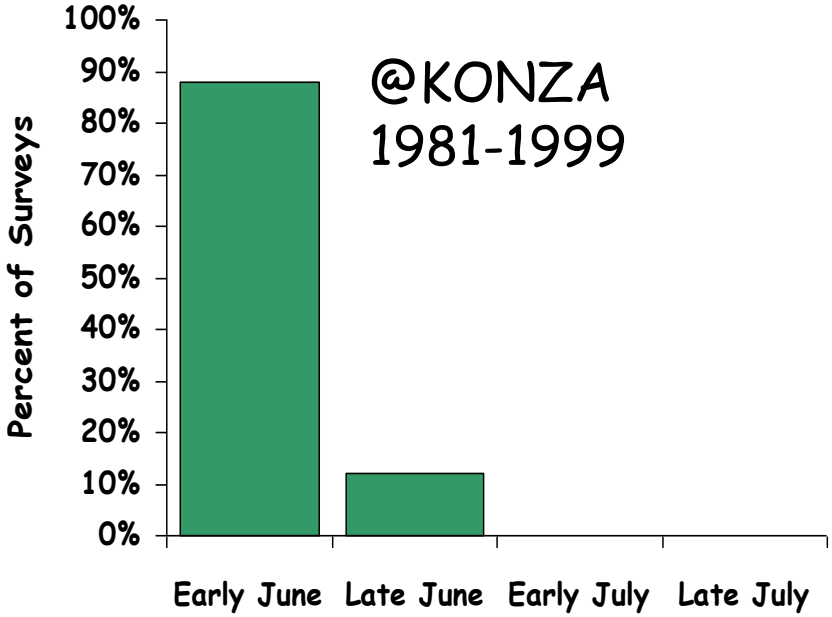


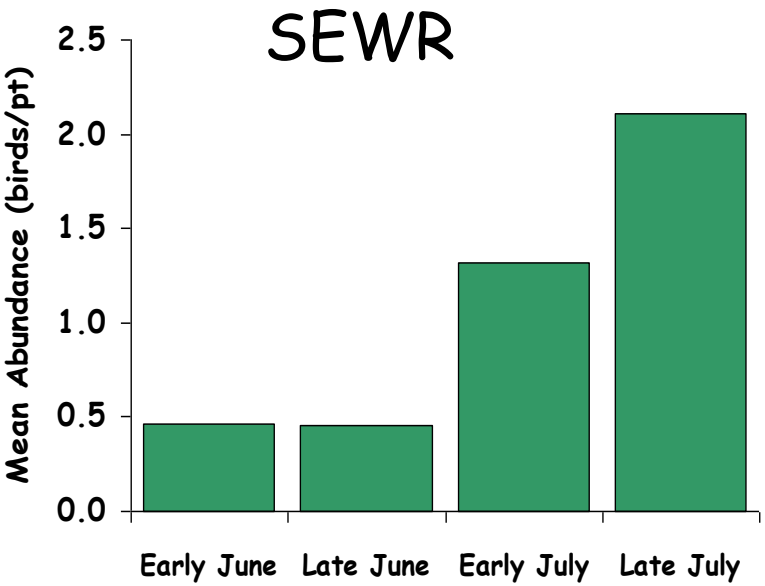
Linear Recovery



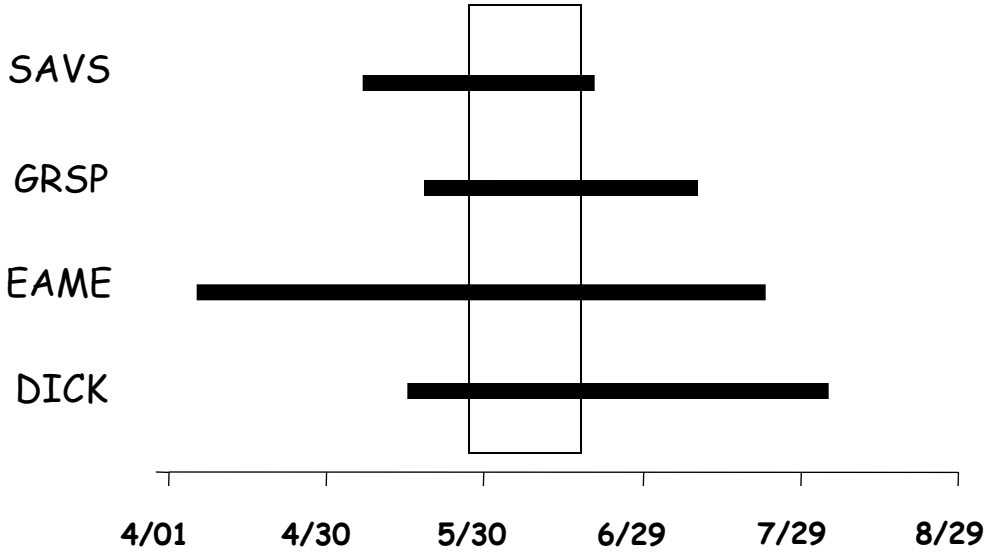
Mixed (short- & long-term)

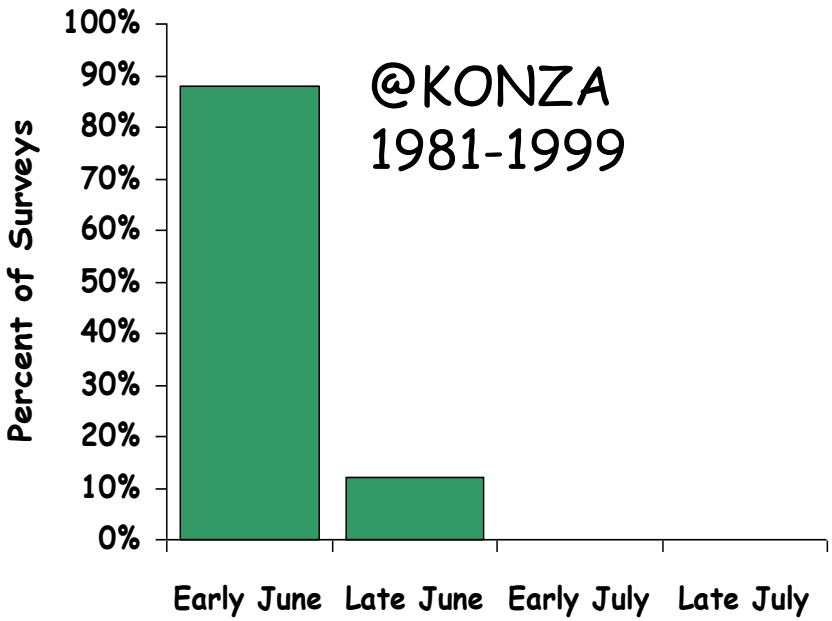


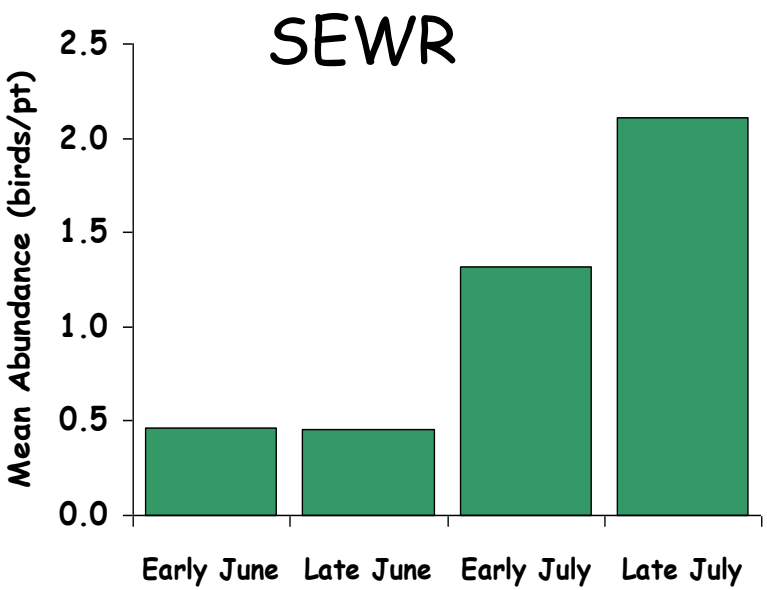




IL Egg Dates
(Bohlen 1989)





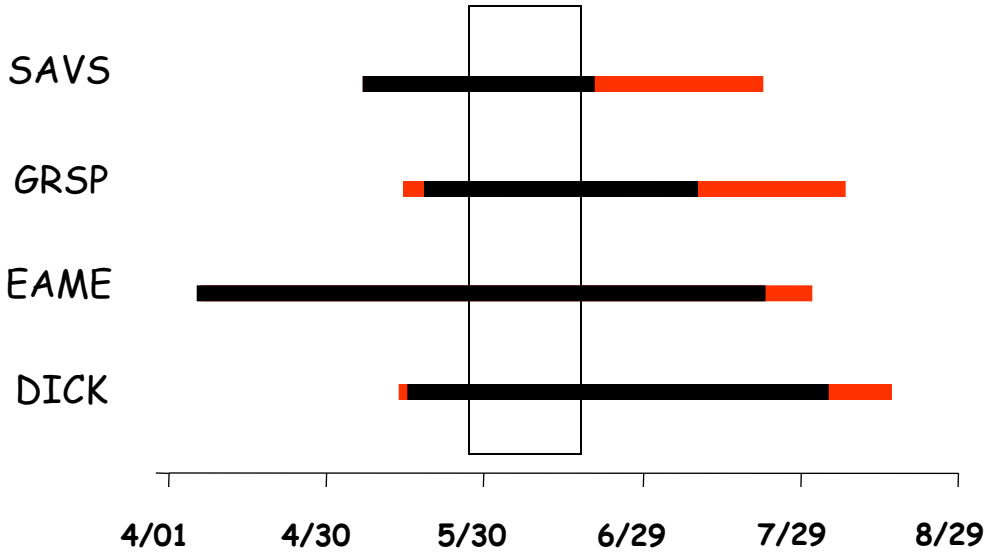


IL Egg Dates

(Bohlen 1989)

Walk et al. (1999)

Herkert, unpublished



Information Theoretic Framework (AIC)

- **Burn**
  - –Short-term (one year recovery)
  - –Short-term (two year recovery)
  - –Short-term (three year recovery)
  - –Short-term (four year recovery)
  - –Long-term (linear trend; 1-13 yrs post-fire)
  - –Mixed (Short- & Long-term)
- **Date (within season)**
  - –Julian Date (squared)
- **Year**
  - –Trend (continuous variable)
- **Date x Burn Interaction**

FACTORS INFLUENCING BIRD ABUDANCE AT GOOSE LAKE PRAIRIE 1991-2006

SPECIES X	ΔAIC_c	AIC-Weight
Date	0.00	0.34
Date, Year	1.18	0.18
Date, Burn01	1.74	0.14
Date, Burn-linear	2.19	0.11
Date, Burn01, Year	3.02	0.07
Date, Burn-linear, Year	3.42	0.06
Date, Burn01, Burn01 x Date	4.51	0.03

Levels of Empirical Support
0-2 "substantial"
4-7 "considerably less"
>10 "essentially none
(Burnham & Anderson 2002)

FACTORS INFLUENCING BIRD ABUDANCE AT GOOSE LAKE PRAIRIE 1991-2006

	AIC_c	AIC-Weight
Date	0.00	0.34
Date, Year	1.18	0.18
Date, Burn01	1.74	0.14
Date, Burnstat	2.19	0.11
Date, Burn01, Year	3.02	0.07
Date, Burnstat, Year	3.42	0.06
Date, Burn01, Burn01 x Date	4.51	0.03

Date (0.93) > **Burn** (0.41) > **Year** (0.31)

FACTORS INFLUENCING BIRD ABUDANCE AT GOOSE LAKE PRAIRIE 1991-2006

	AIC_c	AIC-Weight
Date	0.00	0.34
Date, Year	1.18	0.18
Date, Burn01	1.74	0.14
Date, Burnstat	2.19	0.11
Date, Burn01, Year	3.02	0.07
Date, Burnstat, Year	3.42	0.06
Date, Burn01, Burn01 x Date	4.51	0.03

Date (0.93) > **Burn** (0.41) > **Year** (0.31)

FACTORS INFLUENCING BIRD ABUDANCE AT GOOSE LAKE PRAIRIE 1991-2006

	AIC_c	AIC-Weight
Date	0.00	0.34
Date, Year (trend)	1.18	0.18
Date, Burn01	1.74	0.14
Date, Burn1-7	2.19	0.11
Date, Burn01, Year (trend)	3.02	0.07
Date, Burn1-7, Year (trend)	3.42	0.06
Date, Burn01, Burn01 x Date	4.51	0.03

Date (0.93) > **Burn** (0.41) > **Year** (0.31)

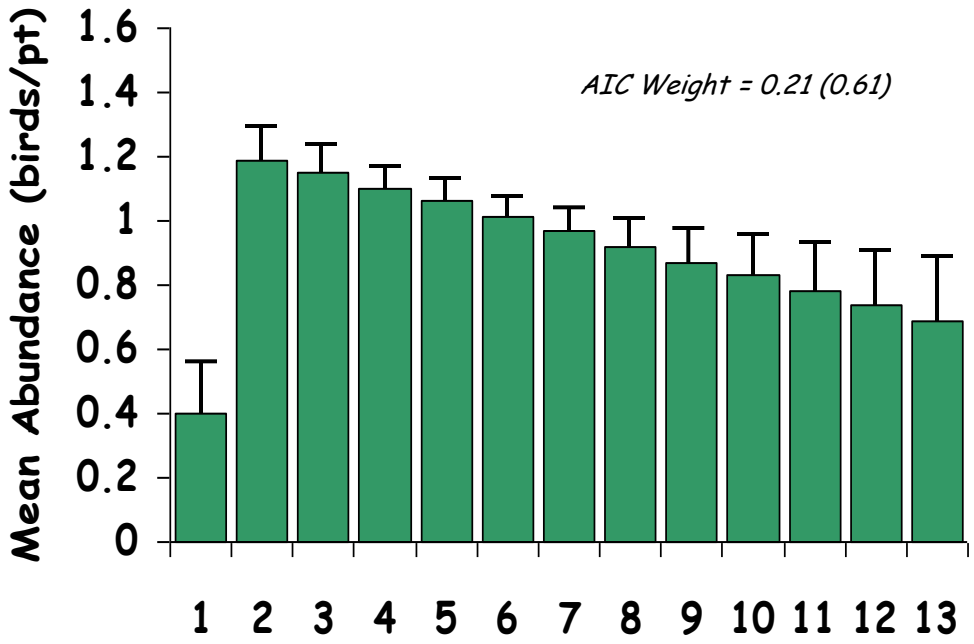
Henslow's Sparrow

SPECIES	AIC	DATE	YEAR	BURN	BURN x DATE	PRECIP	AIC-Wi
HESP	0.00	X	X	X			0.211
HESP	1.15	X	X	X			0.119
HESP	1.72	X	X	X	X		0.089
HESP	2.08	X	X	X		X	0.075
HESP	2.15	X	X	X		X	0.072
HESP	2.16	X	X	X		X	0.072
HESP	2.71	X	X	X	X		0.055
HESP	3.03	X	X	X			0.047
HESP	3.08	X	X	X			0.045
HESP	3.24	X	X	X		X	0.042
HESP	3.26	X	X	X		X	0.042
HESP	3.30	X	X	X		X	0.041
HESP	3.87	X	X	X	X	X	0.031
HESP	3.90	X	X	X	X	X	0.030
HESP	3.92	X	X	X	X	X	0.030
		1.00	1.00	1.00	0.23	0.67	

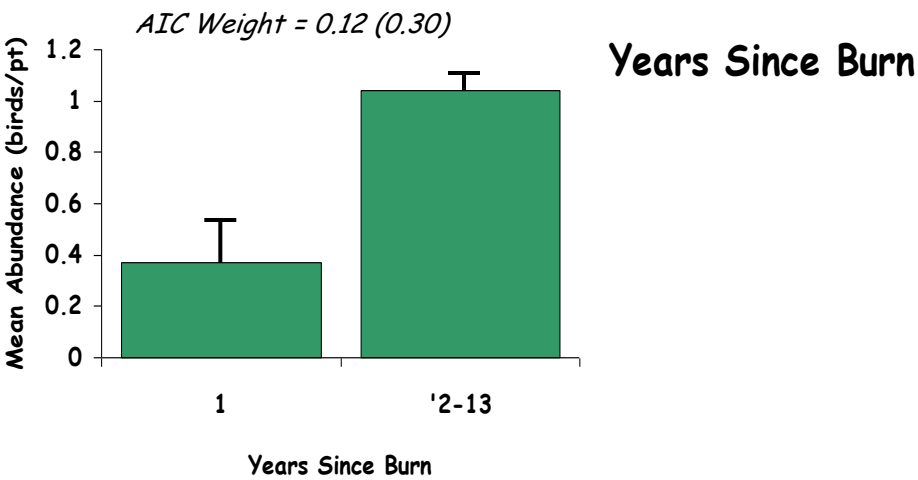
SPECIES	AIC	Burn1	Burn2	Burn3	Burn4	Burnstat	Burn X DATE	Burnstat X DATE	AIC-Wi
HESP	0.00	x				x			0.211
HESP	1.15	x							0.119
HESP	1.72	x				x	x		0.089
HESP	2.08	x				x			0.075
HESP	2.15	x				x			0.072
HESP	2.16	x				x			0.072
HESP	2.71	x					x		0.055
HESP	3.03		x						0.047
HESP	3.08			x					0.045
HESP	3.24	x							0.042
HESP	3.26	x							0.042
HESP	3.30	x							0.041
HESP	3.87	x				x	x		0.031
HESP	3.90	x				x	x		0.030
HESP	3.92	x				x	x		0.030
Wt-sum		0.91	0.05	0.05	0.00	0.61	0.23	0.00	

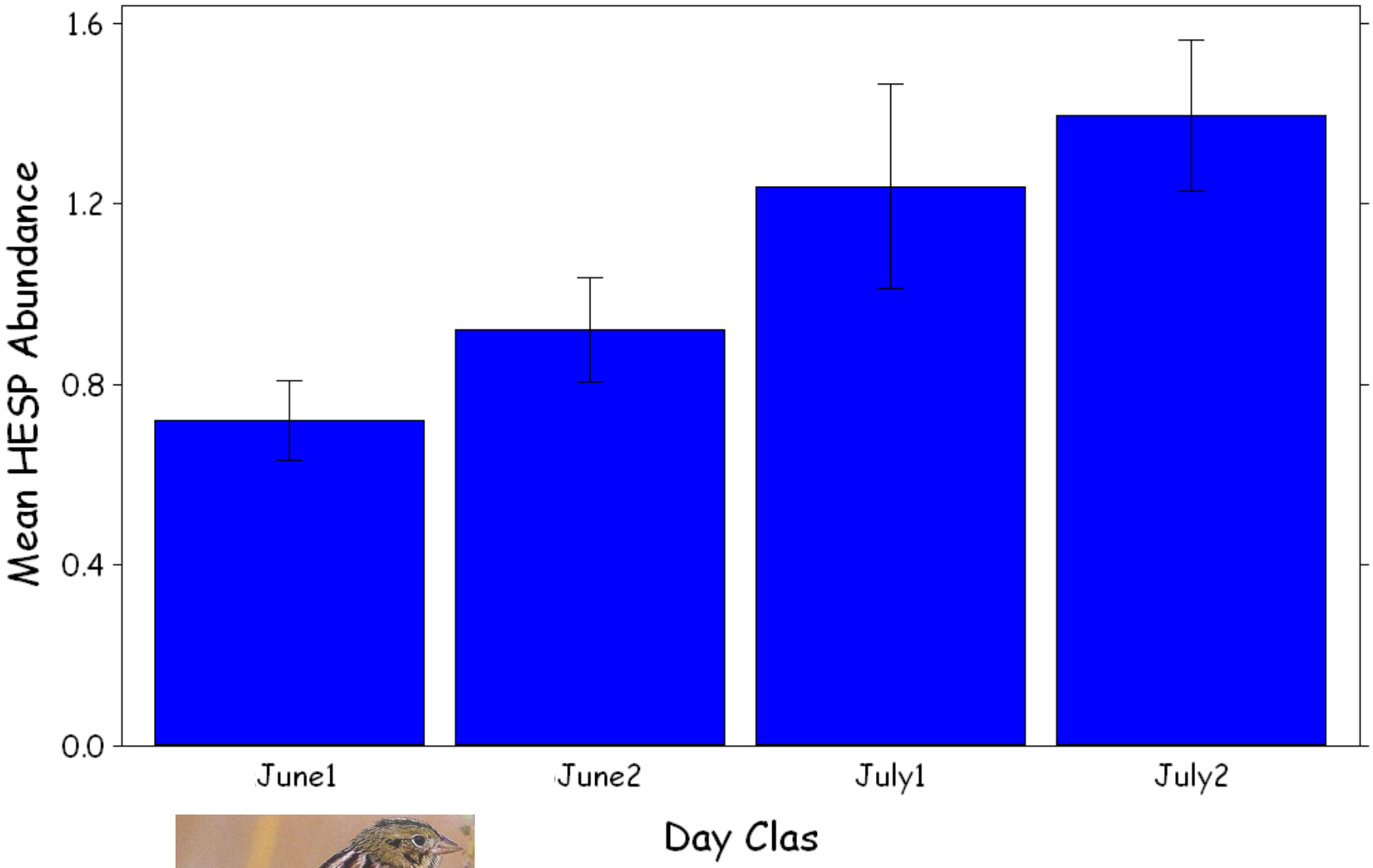
Burn1+Burnstat (.61) > Burn1 (.30) > Burn2 (.04) > Burn3 (.04)

BURN EFFECTS -- BEST FITTING MODELS

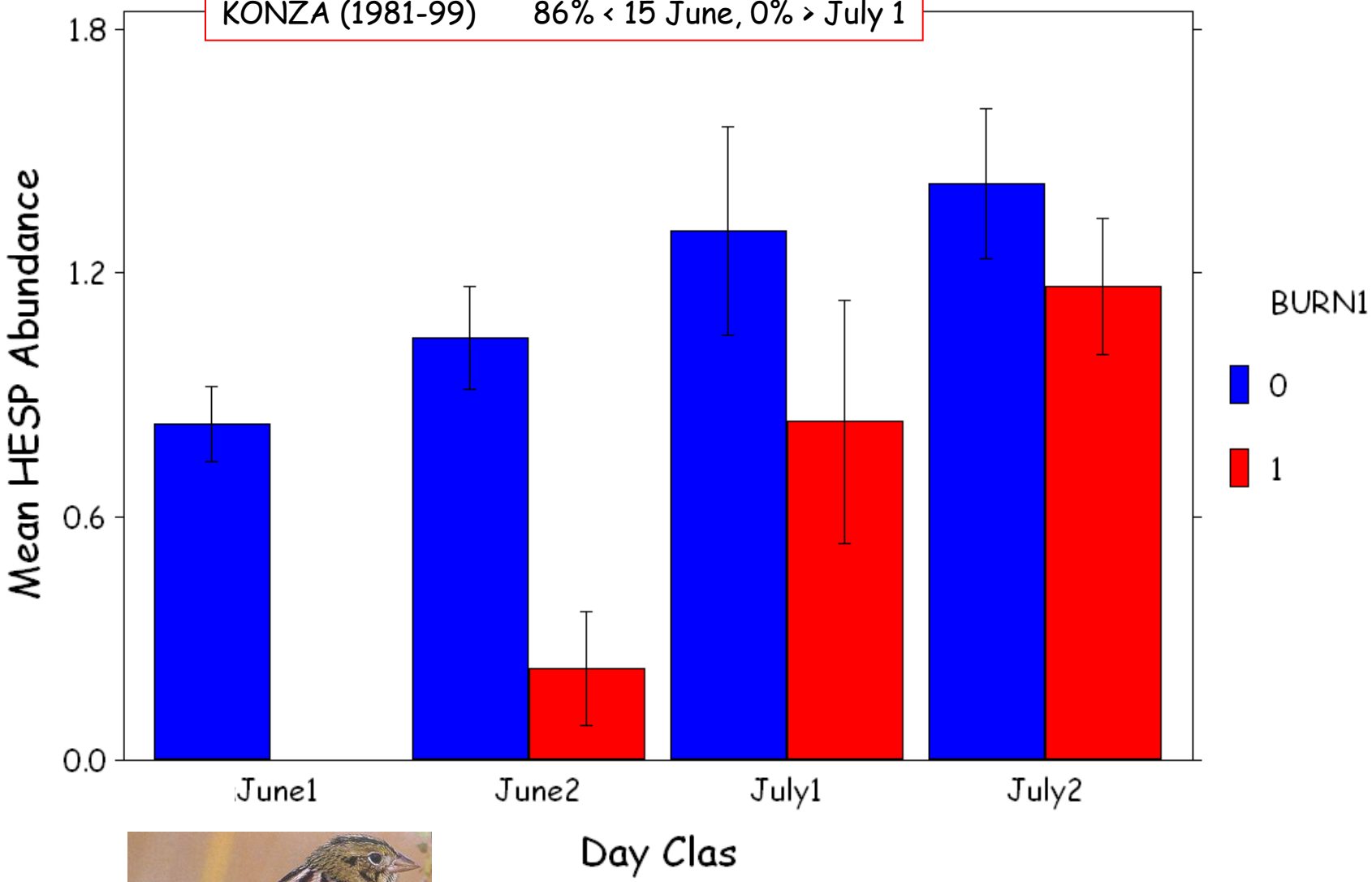


LSMEANS
Date = 6/20
Year = 2000

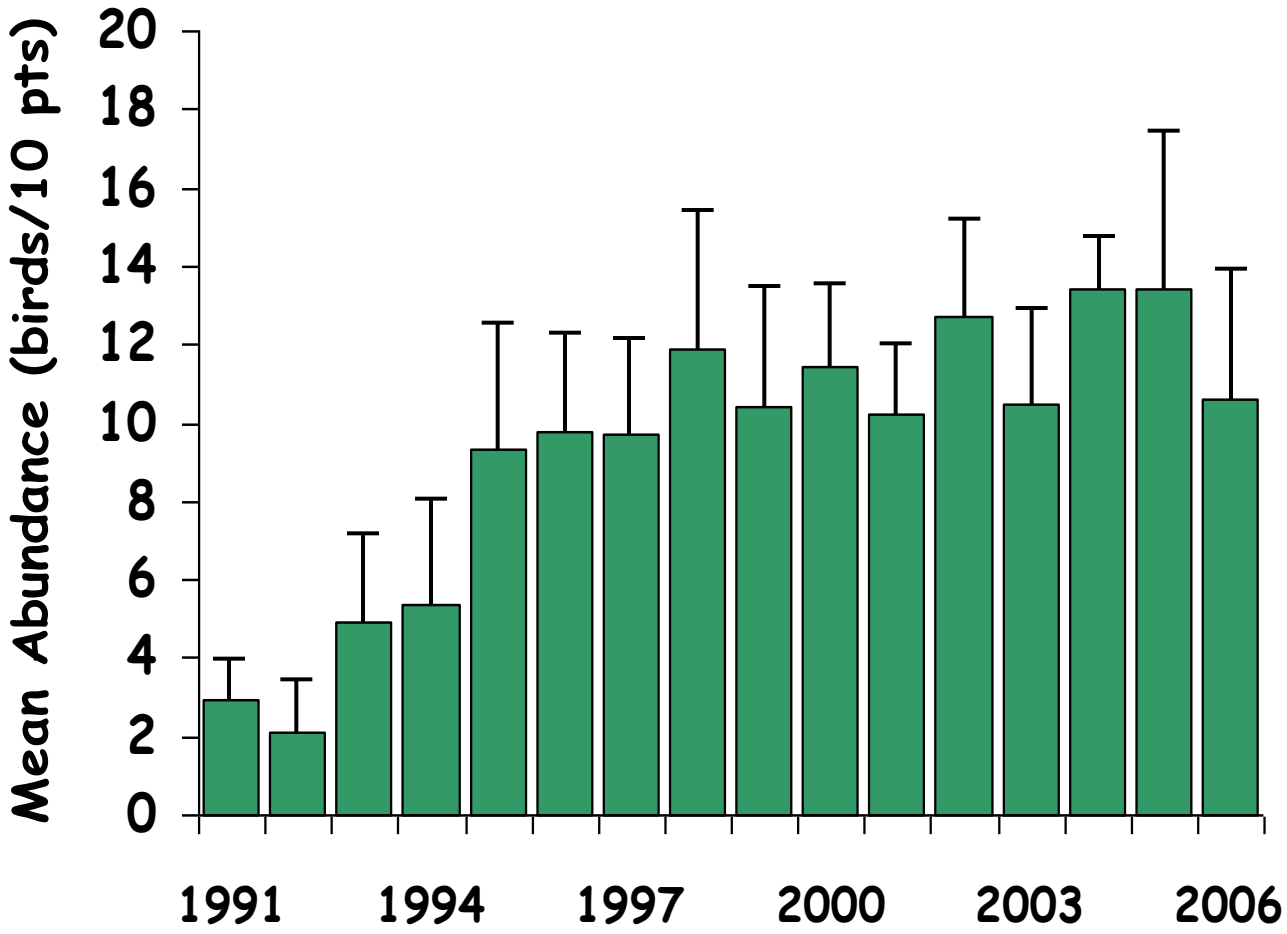



Mean HESP Abundance
1.6
1.2
0.8
0.4
0.0
June1
June2
July1
July2
Day Clas

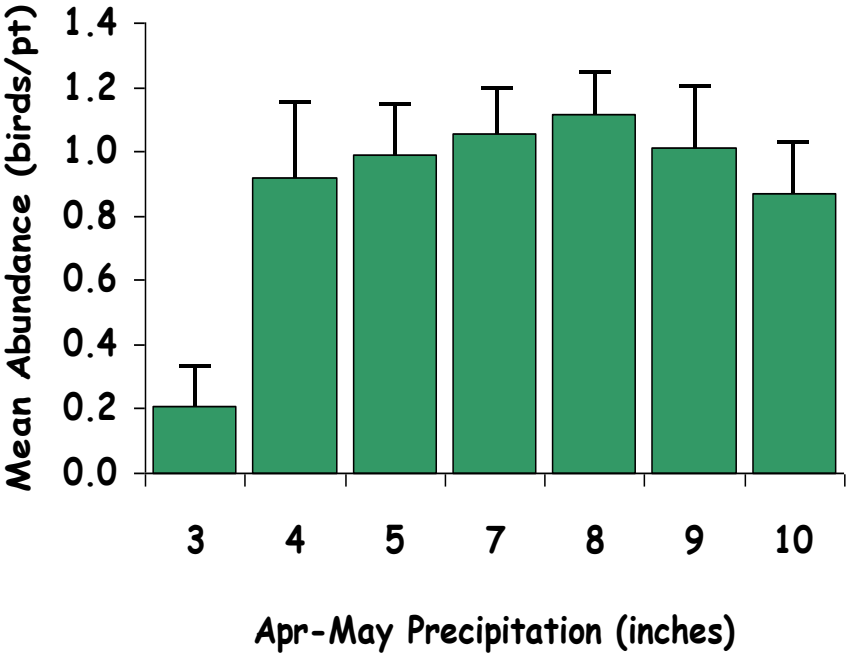
Herkert (1994) 76% < 15 June, 0% > July 1
KONZA (1981-99) 86% < 15 June, 0% > July 1



Henslow's Sparrow Abundance at Goose Lake Prairie, IL 1991-2006



Influence of Precipitation on Henslow's Sparrow Abundance At Goose Lake Prairie, 1991-2006



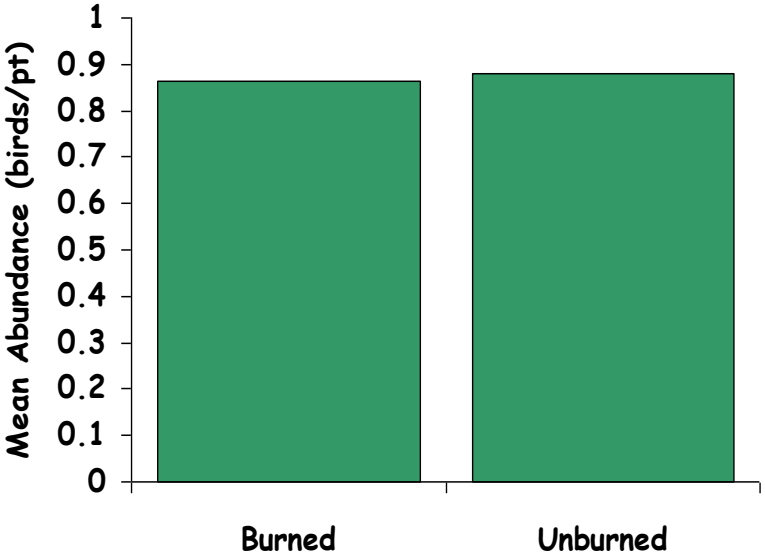
Sedge Wren

SPECIES	AIC	DATE	YEAR	BURN	BURN x DATE	PRECIP	AIC-Wi
SEWR	0.00	x		x	x		0.149
SEWR	0.53	x		x	x		0.114
SEWR	1.22	x	x	x	x		0.081
SEWR	1.38	x		x	x	x	0.075
SEWR	1.43	x		x	x	x	0.073
SEWR	1.88	x		x	x		0.058
SEWR	1.93	x		x	x	x	0.057
SEWR	2.46	x		x	x	x	0.044
SEWR	2.50	x		x	x	x	0.043
SEWR	2.63	x		x	x	x	0.040
SEWR	2.67	x	x	x	x	x	0.039
SEWR	2.71	x	x	x	x		0.039
SEWR	2.76	x	x	x	x	x	0.038
SEWR	2.89	x		x	x	x	0.035
SEWR	3.07	x		x	x	x	0.032
SEWR	3.26	x	x	x	x	x	0.029
SEWR	3.45	x		x	x		0.027
SEWR	3.62	x	x	x	x		0.025
		1.00	0.25	1.00	1.00	0.51	

SPECIES	AIC	Burn1	Burn2	Burn3	Burn4	Burnstat	Burn X DATE	Burnstat X DATE	AIC-Wi
SEWR	0.00		x				x		0.149
SEWR	0.53	x				x	x	x	0.114
SEWR	1.22		x				x		0.081
SEWR	1.38		x				x		0.075
SEWR	1.43		x				x		0.073
SEWR	1.88			x			x		0.058
SEWR	1.93		x				x		0.057
SEWR	2.46	x				x	x	x	0.044
SEWR	2.50	x				x	x	x	0.043
SEWR	2.63	x				x	x	x	0.040
SEWR	2.67		x				x		0.039
SEWR	2.71	x				x	x	x	0.039
SEWR	2.76		x				x		0.038
SEWR	2.89			x			x		0.035
SEWR	3.07			x			x		0.032
SEWR	3.26		x				x		0.029
SEWR	3.45				x		x		0.027
SEWR	3.62			x			x		0.025
Wt-sum		0.28	0.54	0.15	0.03	0.28	1.00	0.28	

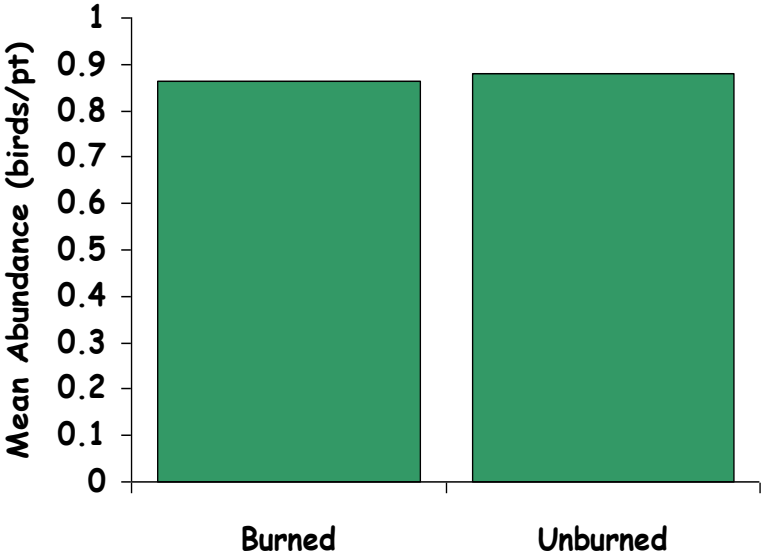
Sedge Wren Abundance at Goose Lake Prairie

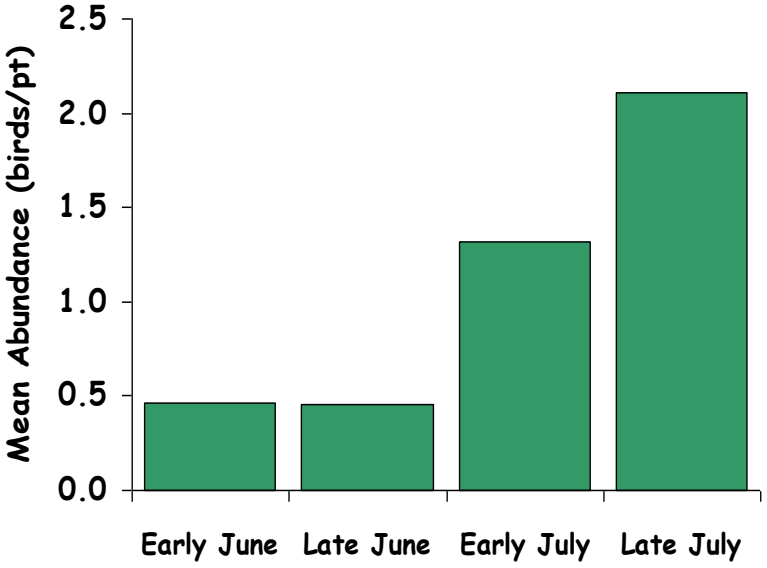
1991-2006



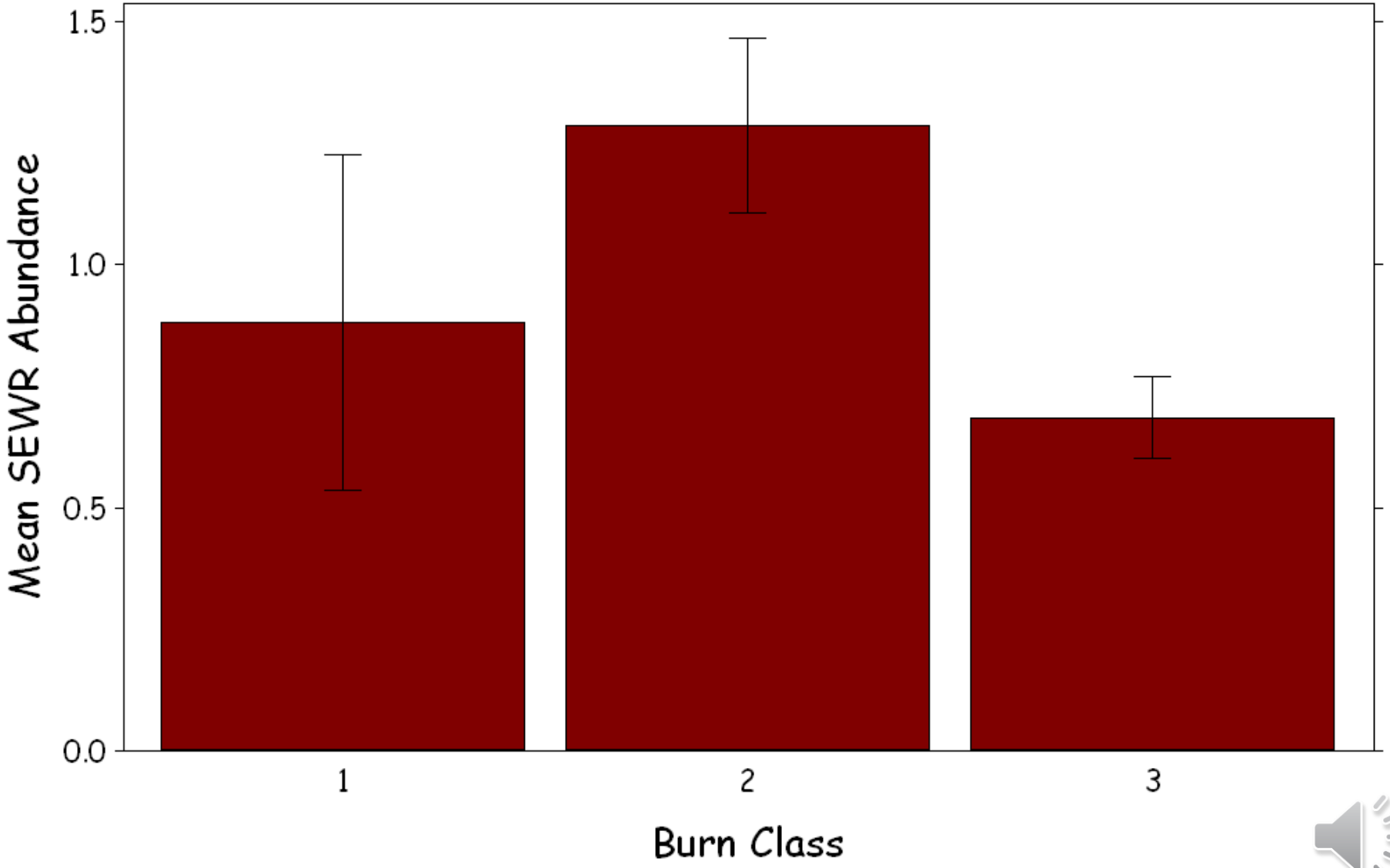
Sedge Wren Abundance at Goose Lake Prairie

1991-2006

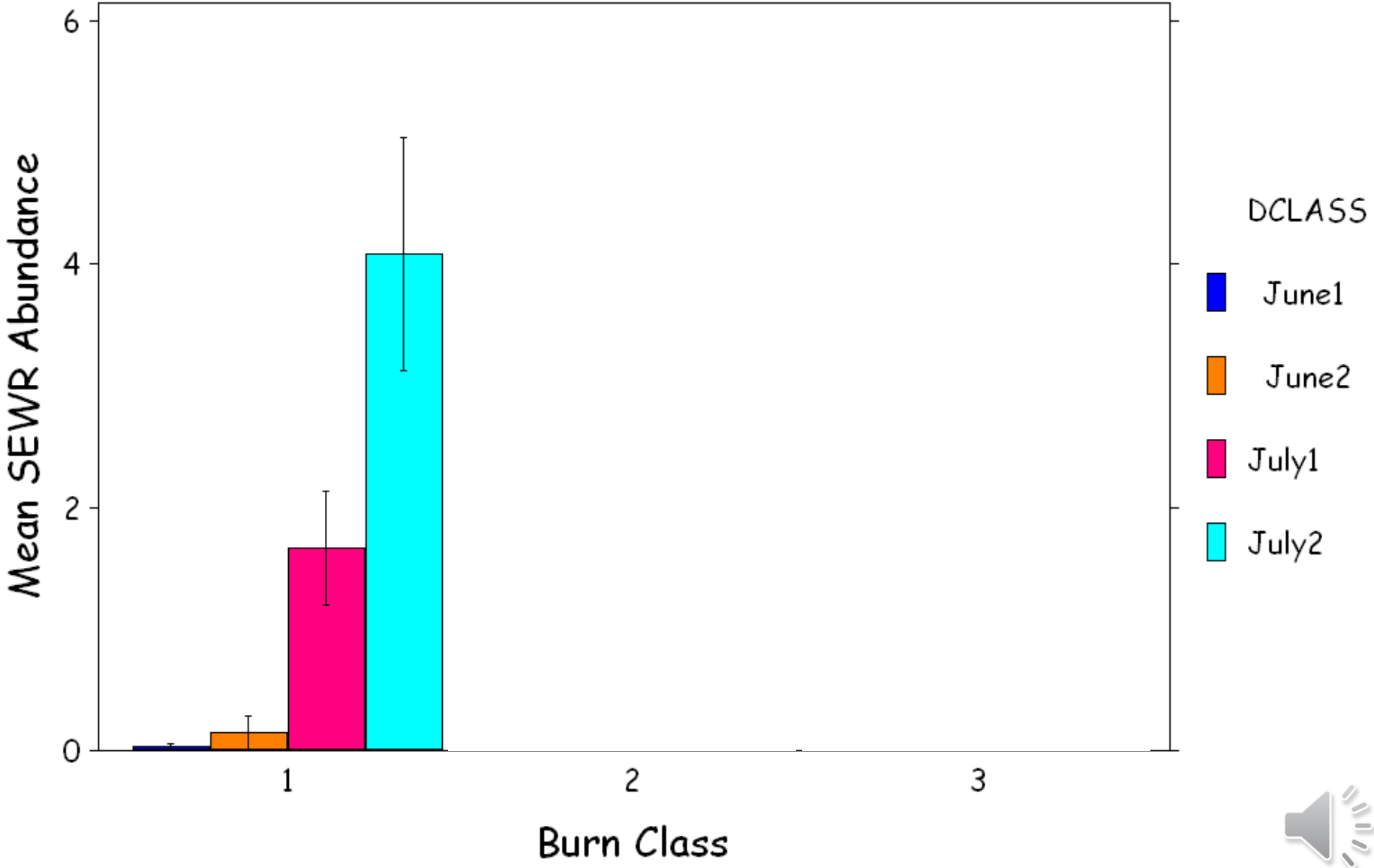




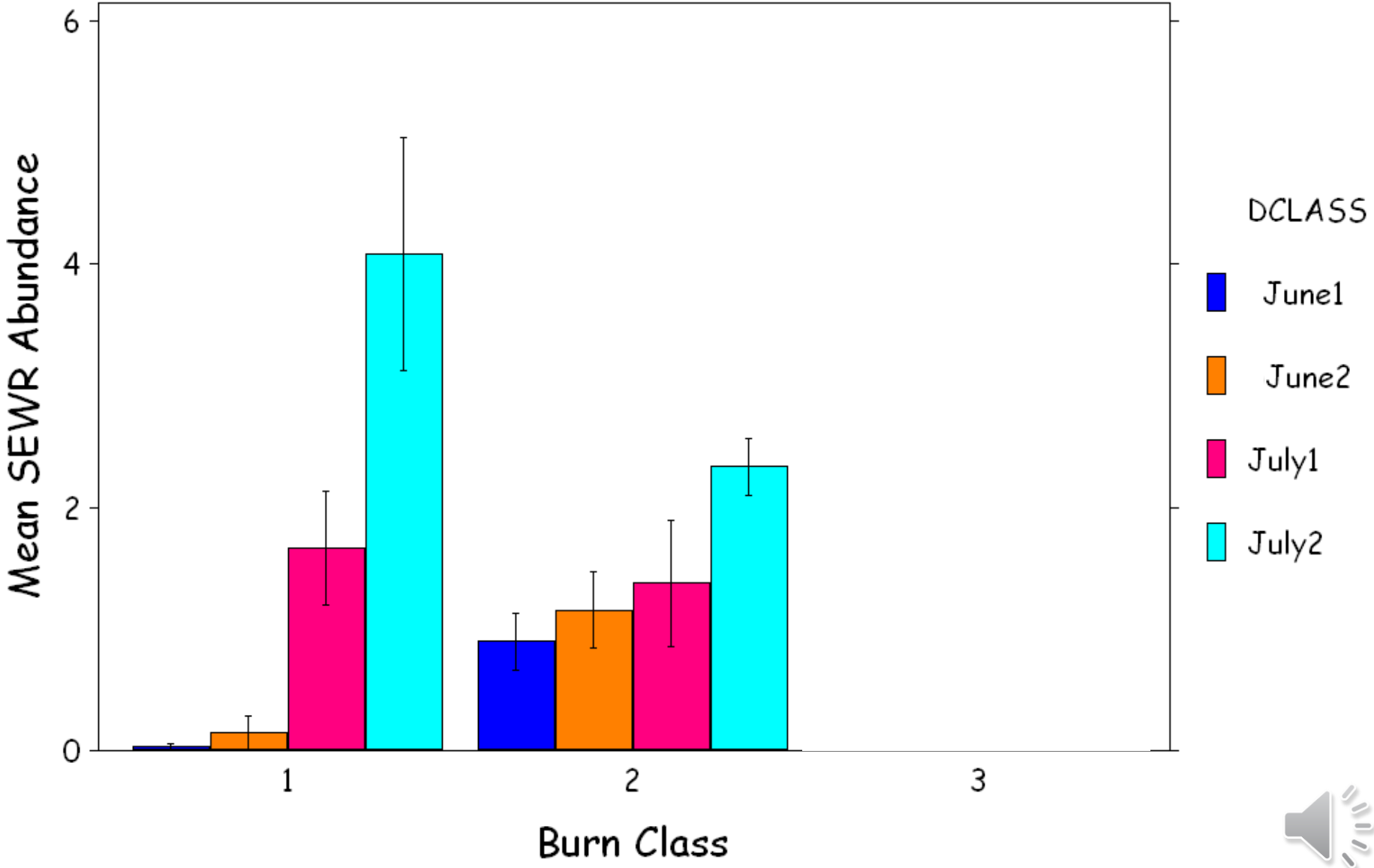
Sedge Wren Abundance in Burn Categories 1-3 at Goose Lake Prairie, 1991-2006



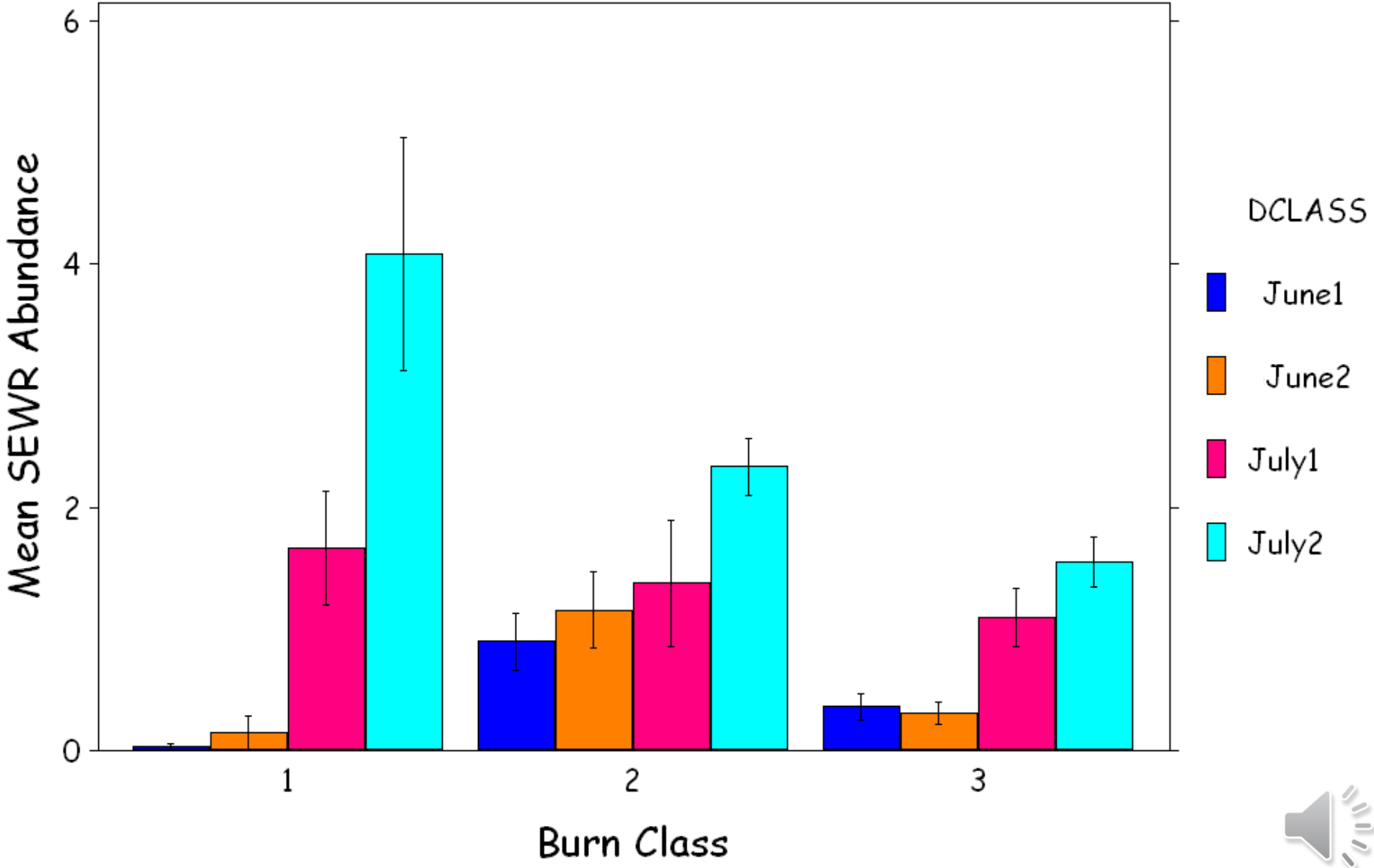
Sedge Wren Abundance in Date & Burn Categories at Goose Lake Prairie, 1991-2006



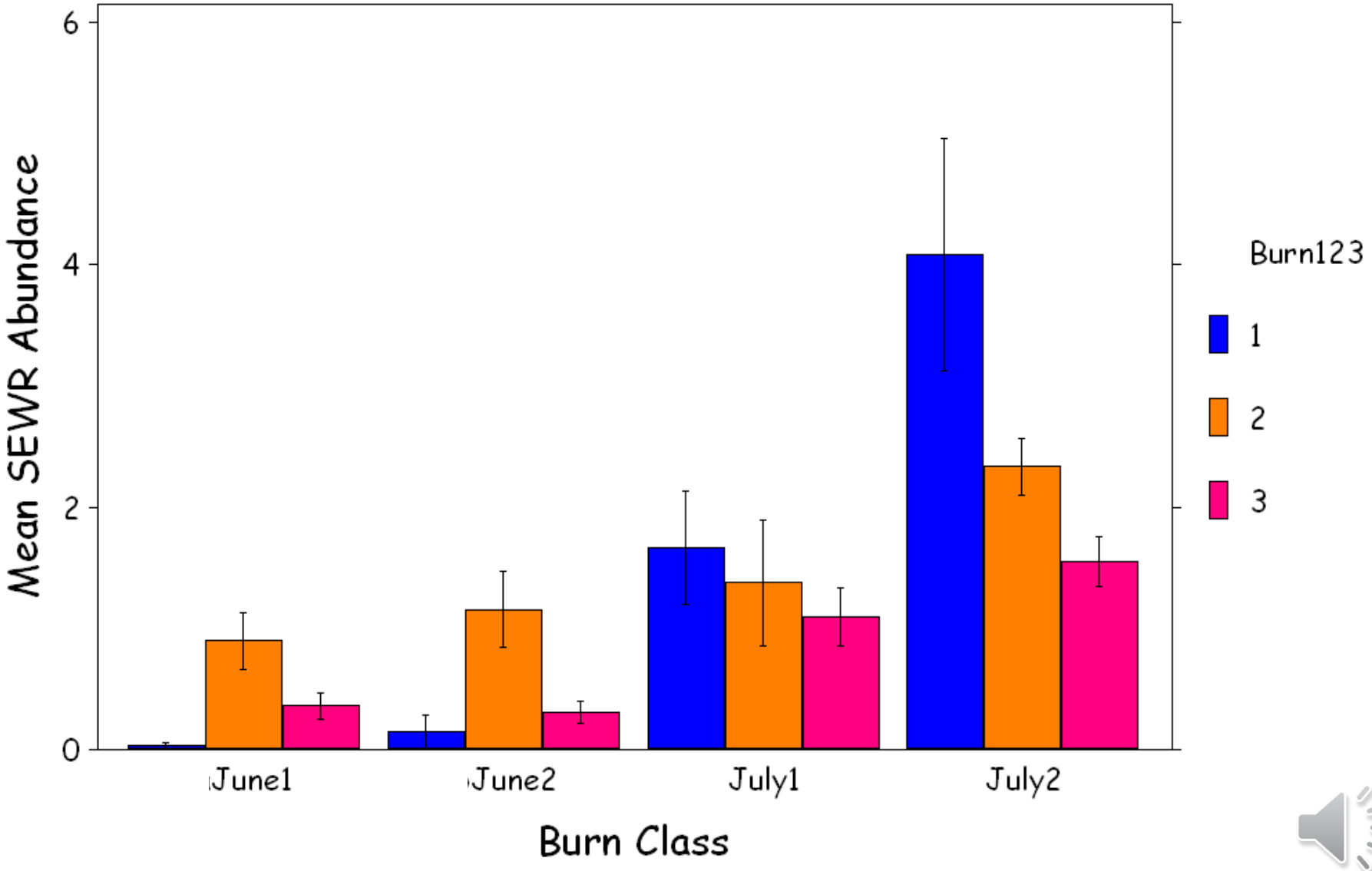
Sedge Wren Abundance in Date & Burn Categories at Goose Lake Prairie, 1991-2006



Sedge Wren Abundance in Date & Burn Categories at Goose Lake Prairie, 1991-2006



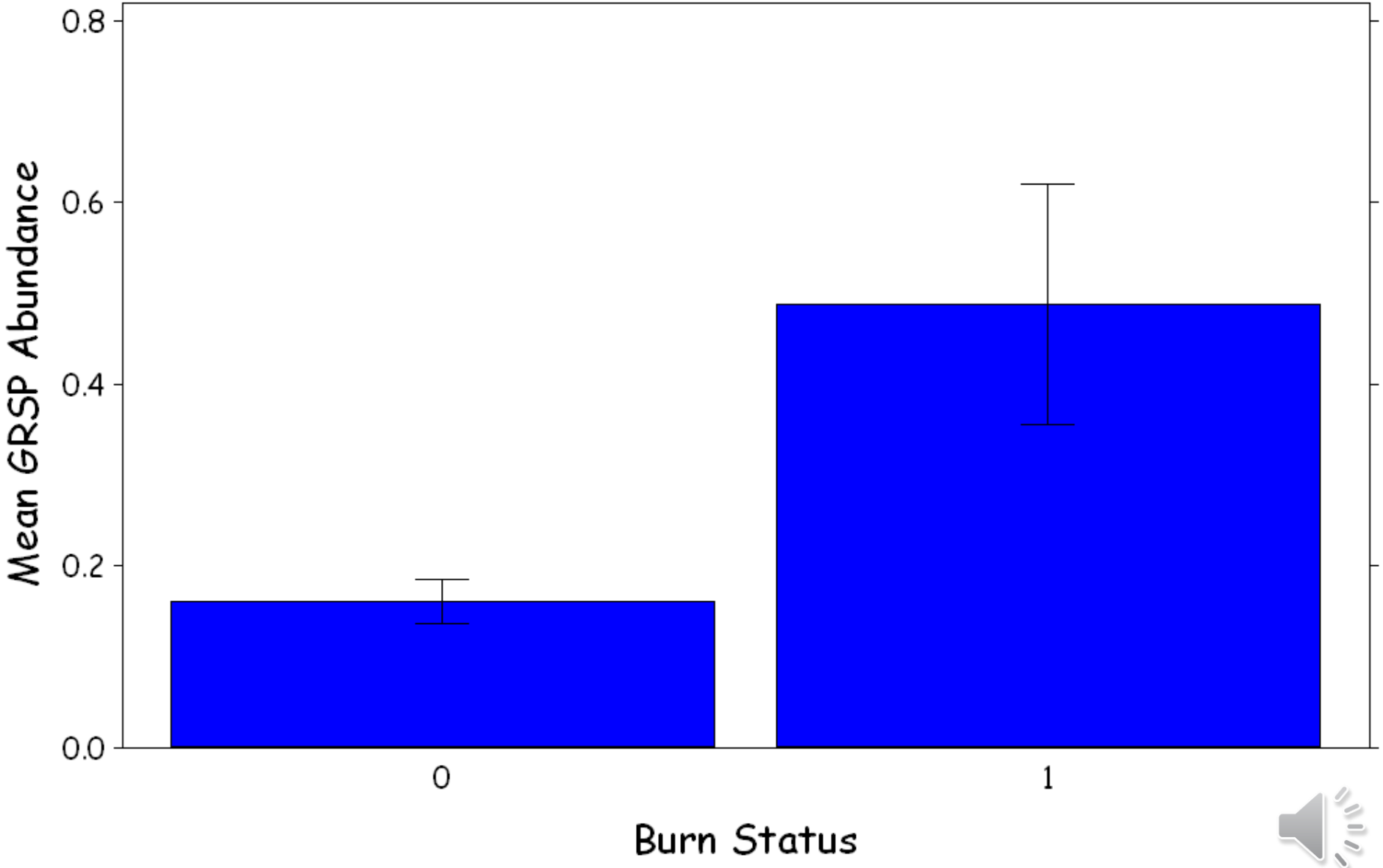
Sedge Wren Abundance in Date & Burn Categories at Goose Lake Prairie, 1991-2006



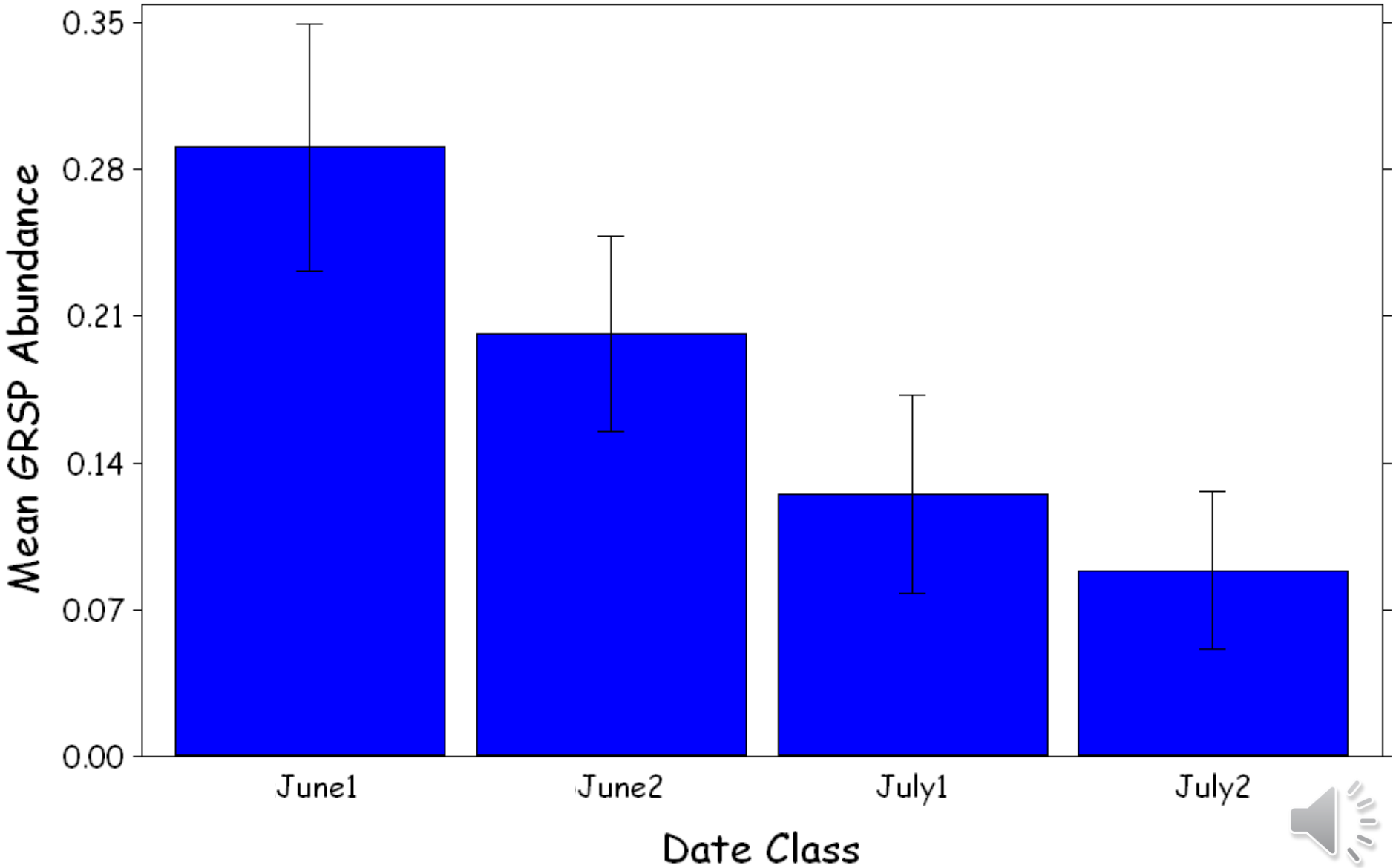
Grasshopper Sparrow

SPECIES	AIC	DATE	YEAR	BURN	BURN x DATE	PRECIP	AIC-Wi
GRSP	0.00	x	x	x		x	0.119
GRSP	0.59	x	x	x	x	x	0.089
GRSP	1.32	x	x	x		x	0.062
GRSP	1.39	x	x	x	x	x	0.060
GRSP	1.57	x	x	x		x	0.054
GRSP	1.65	x	x	x		x	0.052
GRSP	1.77	x	x	x	x	x	0.049
GRSP	2.01	x	x	x	x	x	0.044
GRSP	2.03	x	x	x		x	0.043
GRSP	2.41	x	x	x		x	0.036
GRSP	2.60	x	x	x	x	x	0.033
GRSP	2.74		x	x		x	0.030
GRSP	2.82	x	x	x	x		0.029
GRSP	2.83	x	x	x			0.029
GRSP	2.87	x	x	x	x	x	0.028
GRSP	3.00	x	x	x		x	0.027
GRSP	3.22		x	x	x	x	0.024
GRSP	3.24	x	x	x	x	x	0.024
GRSP	3.27	x	x	x		x	0.023
GRSP	3.39		x	x	x	x	0.022
GRSP	3.63	x	x	x		x	0.019
GRSP	3.70	x	x	x	x		0.019
GRSP	3.79	x	x	x	x	x	0.018
GRSP	3.89	x	x	x			0.017
GRSP	3.92	x	x	x	x	x	0.017
GRSP	3.98	x	x	x	x	x	0.016
GRSP	4.00	x	x	x	x	x	0.016
		0.92	1.00	1.00	0.49	0.91	

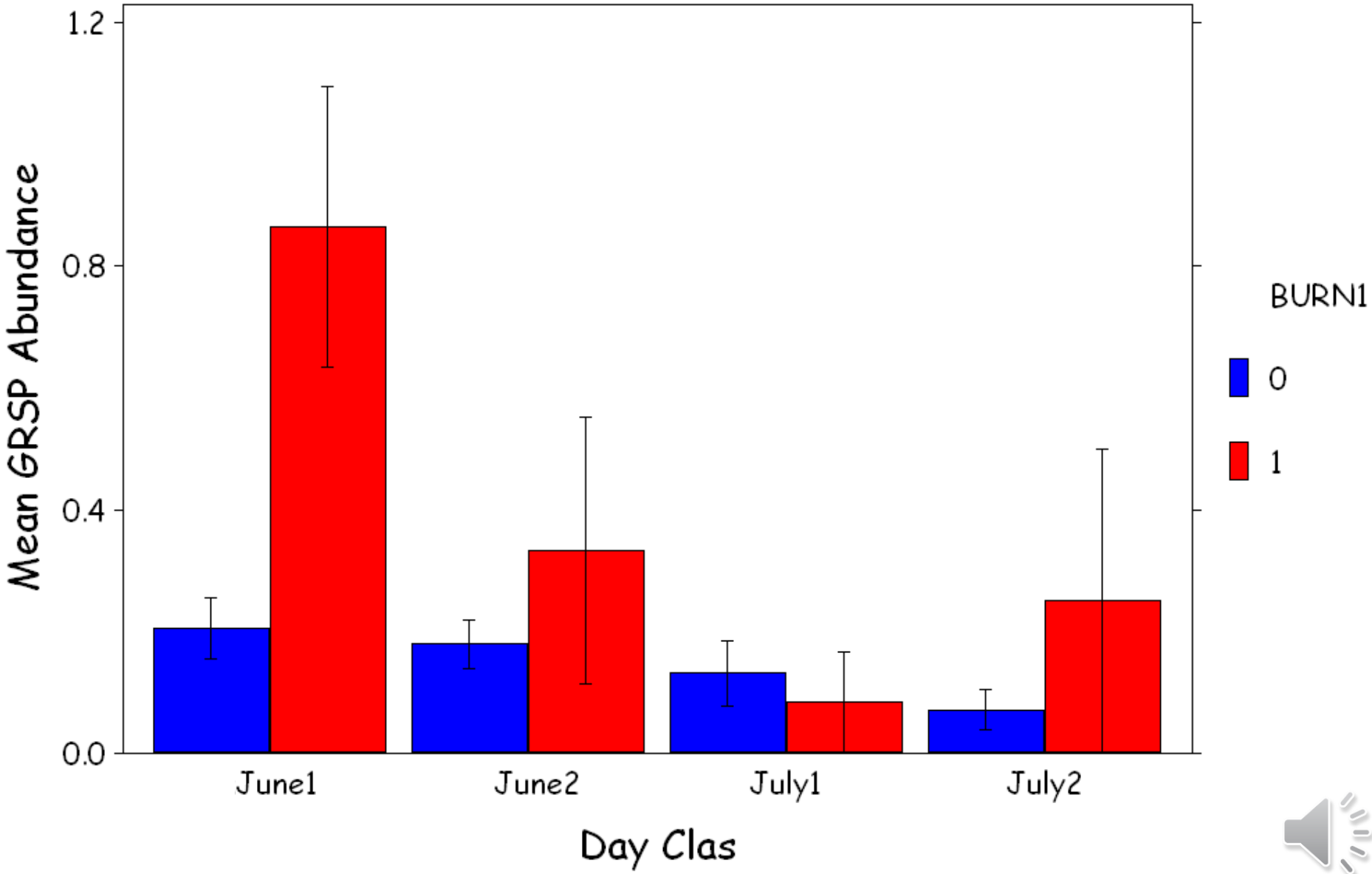
Factors Influencing Grasshopper Sparrow Abundance at Goose Lake Prairie, 1991-2006



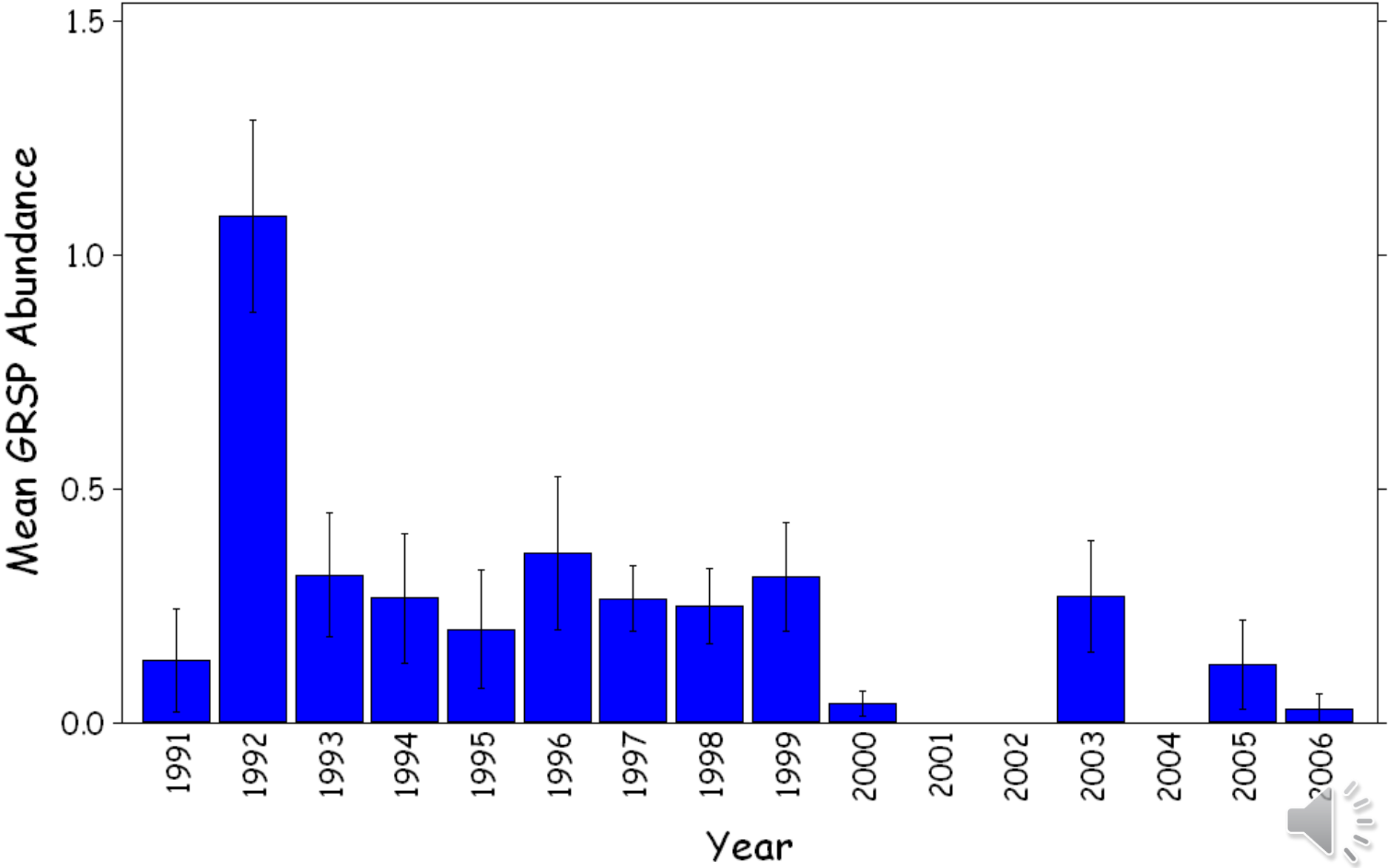
Factors Influencing Grasshopper Sparrow Abundance at Goose Lake Prairie, 1991-2006



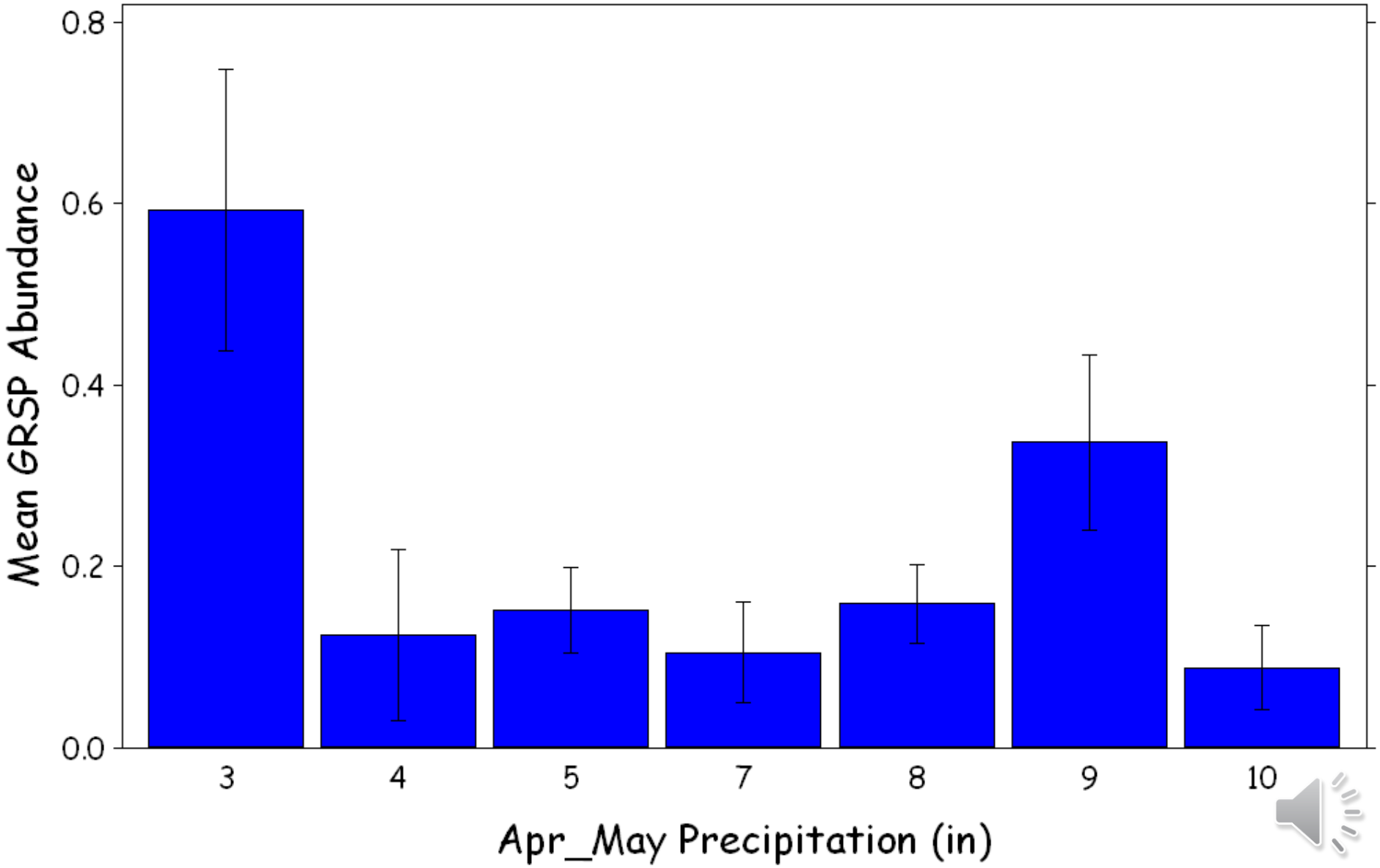
Factors Influencing Grasshopper Sparrow Abundance at Goose Lake Prairie, 1991-2006



Factors Influencing Grasshopper Sparrow Abundance at Goose Lake Prairie, 1991-2006



Factors Influencing Grasshopper Sparrow Abundance at Goose Lake Prairie, 1991-2006



Part I - Summary

- Complex Burn Responses (e.g., HESP, SEWR)
- May Be Missed by Simple Approaches (ie., burn vs unburn)
- Within Season Effects Important (and little studied)
- Early Season Bias → Overestimate of Burn Effects?
- Differences Between Burn Response Models Often Subtle

Hyde (1939) stated: "It has been my experience as well as that of other observers that in certain localities Henslow's sparrow is well established as a breeder, whereas in other ones it is irregular, and its presence in a given season cannot be certainly predicted."

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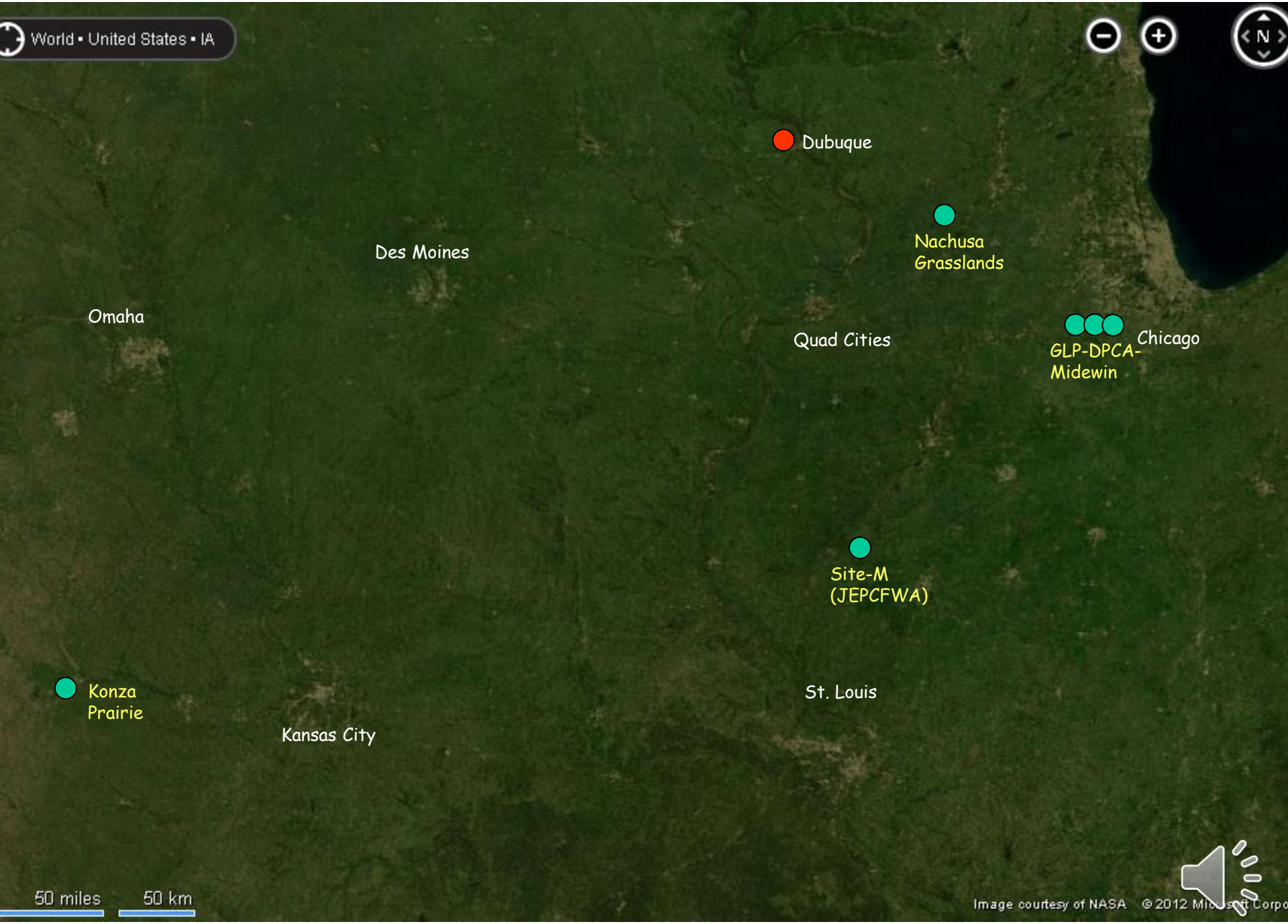
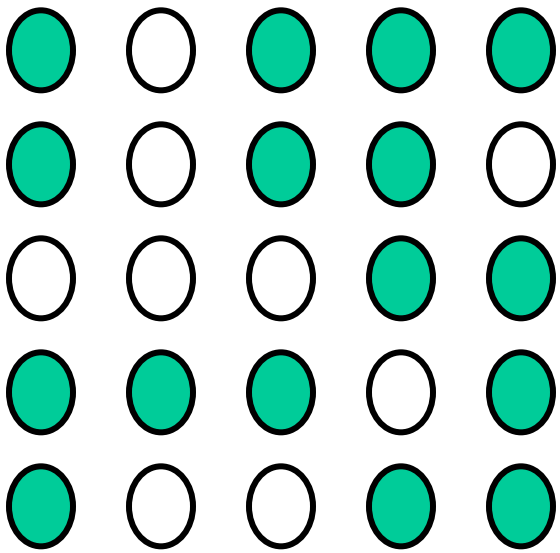
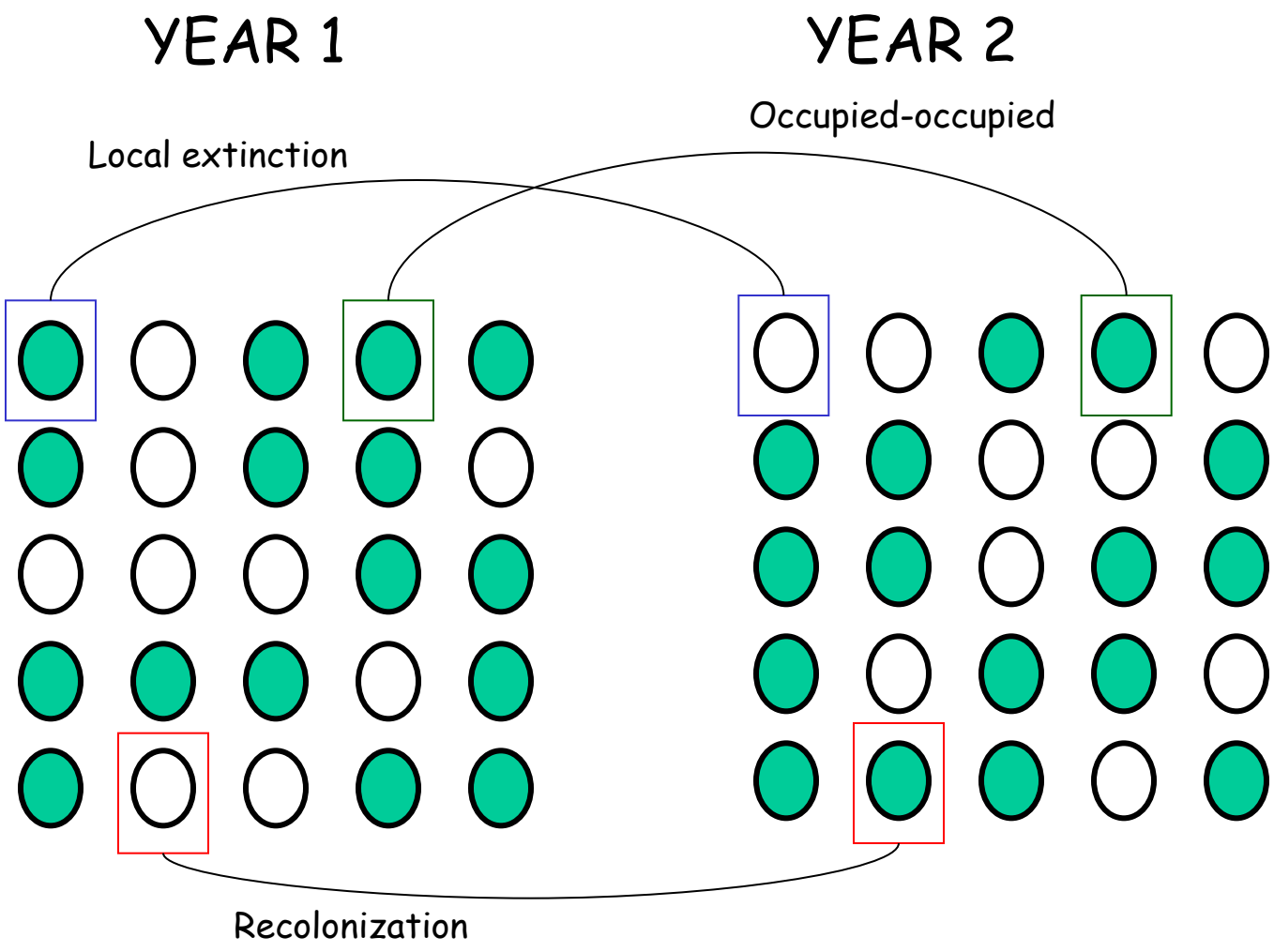
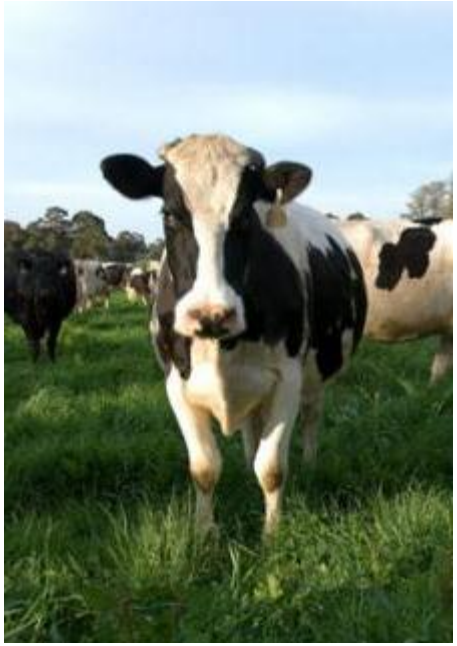
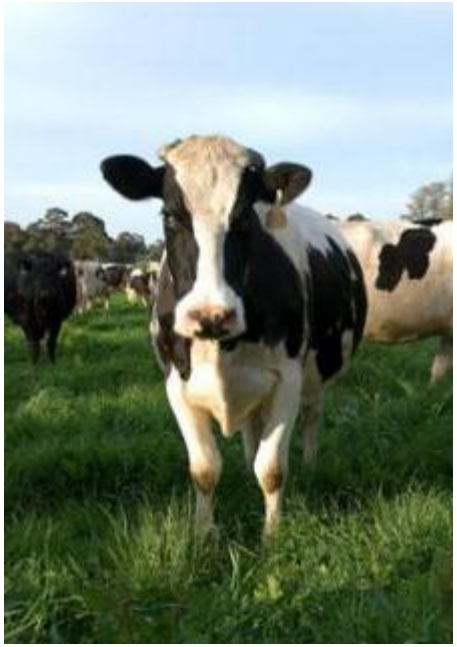

World • United States • IA
N
Dubuque
Nachusa Grasslands
Des Moines
Omaha
Quad Cities
Chicago
GLP-DPCA-Midewin
Site-M (JEPCFWA)
Konza Prairie
St. Louis
Kansas City
50 miles
50 km
Image courtesy of NASA
© 2012 Microsoft Corpo

YEAR 1




YEAR 1
YEAR 2
Occupied-occupied
Local extinction
Recolonization





Year-1 Management	Year-2 Management	# Points
b1	idle	153
b1	b1	79
b1	mow	4
grazed	grazed	189
grazed	idle	20
grazed	mow	14
idle	idle	830
idle	b1	151
idle	mow	32
idle	grazed	3
mow	mow	101
mow	grazed	29
mow	idle	26
mow	b1	1

Year-1 Management	Year-2 Management	# Points
b1	idle	153
b1	b1	79
b1	mow	4
grazed	grazed	189
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idle	mow	32
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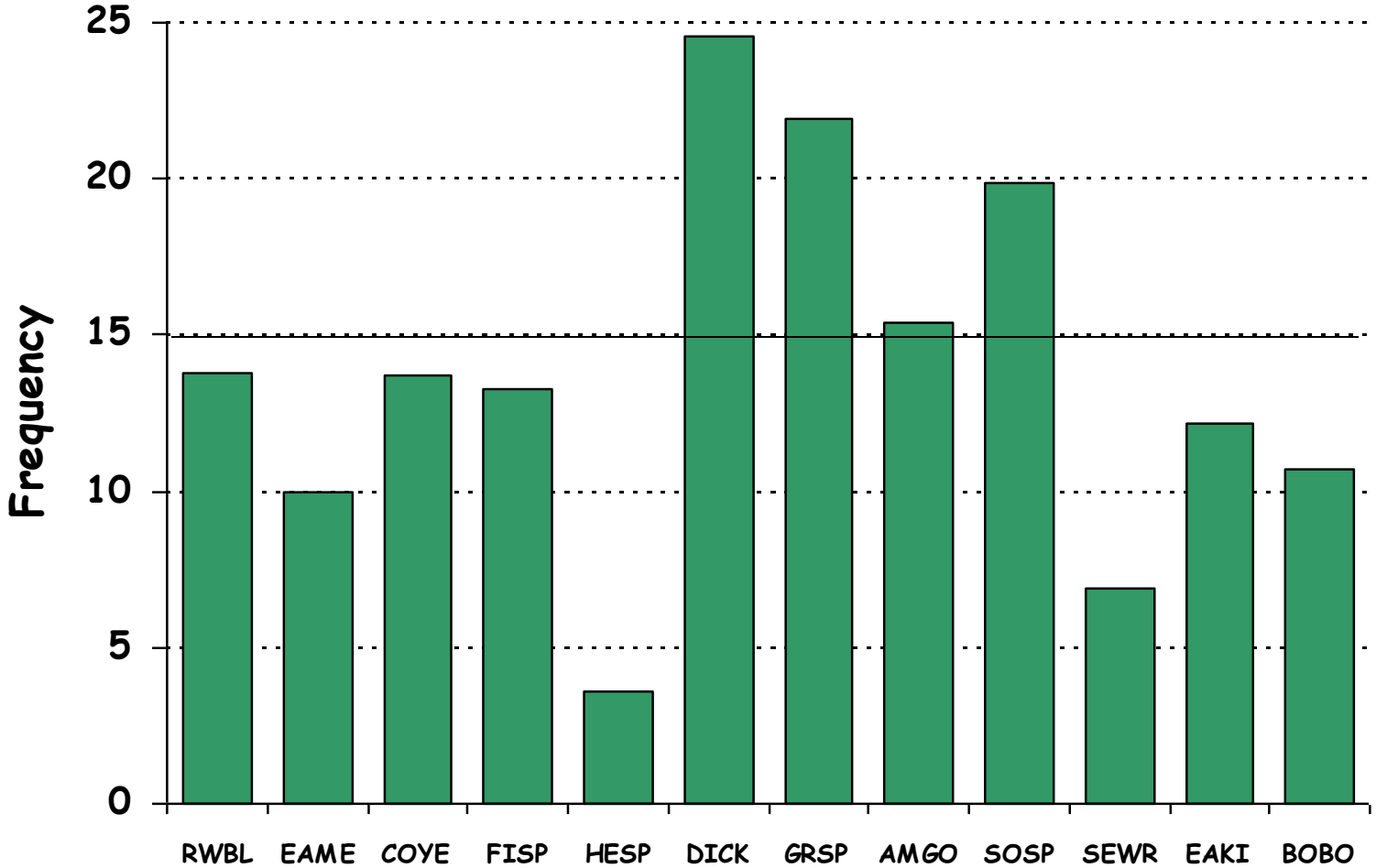
mow	mow	101
mow	grazed	29
mow	idle	26
mow	b1	1


Frequency
25
20
15
10
5
0
RWBL
EAME
COYE
FISP
HESP
DICK
GRSP
AMGO
SOSP
SEWR
EAKI
BOBO

Burned

OCCUPANCY (present-present)

HESP	b1-b1	idle-b1	b1-idle	idle-idle
Occ-Occ				
RECOL				
EXTIRP				
N	79	151	153	830

OCCUPANCY (present-present)

HESP	b1-b1	idle-b1	b1-idle	idle-idle
Occ-Occ				0.69
RECOL				
EXTIRP				0.31
N	79	151	153	830

OCCUPANCY (present-present)

HESP	b1-b1	idle-b1	b1-idle	idle-idle
Occ-Occ				0.69
RECOL				0.34
EXTIRP				0.31
N	79	151	153	830

OCCUPANCY (present-present)

HESP	b1-b1	idle-b1	b1-idle	idle-idle
Occ-Occ		↓		0.69
RECOL			↑	0.34
EXTIRP		↑		0.31
N	79	151	153	830

<u>Predictions</u>

1. Burning should lower occupancy
2. Birds should recolonize burned areas after burning

OCCUPANCY (present-present)

HESP	b1-b1	idle-b1	b1-idle	idle-idle
Occ-Occ		↓ 0.20		0.69
RECOL			↑	0.34
EXTIRP		↑ 0.80		0.31
N	79	151	153	830

<u>Predictions</u>

1. Burning should lower occupancy
2. Birds should recolonize burned areas after burning

OCCUPANCY (present-present)

HESP	b1-b1	idle-b1	b1-idle	idle-idle
Occ-Occ		↓ 0.20		0.69
RECOL			↑ 0.32	0.34
EXTIRP		↑ 0.80		0.31
N	79	151	153	830

<u>Predictions</u>

1. Burning should lower occupancy
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OCCUPANCY (present-present)

HESP	b1-b1	idle-b1	b1-idle	idle-idle
Occ-Occ		↓ 0.20		0.69
RECOL		0.07	↑ 0.32	0.34
EXTIRP		↑ 0.80		0.31
N	79	151	153	830

<u>Predictions</u>

1. Burning should lower occupancy
2. Birds should recolonize burned areas after burning

OCCUPANCY (present-present)

HESP	b1-b1	idle-b1	b1-idle	idle-idle
Occ-Occ		↓ 0.20	0.68	0.69
RECOL		0.07	↑ 0.32	0.34
EXTIRP		↑ 0.80	0.32	0.31
N	79	151	153	830

<u>Predictions</u>

1. Burning should lower occupancy
2. Birds should recolonize burned areas after burning

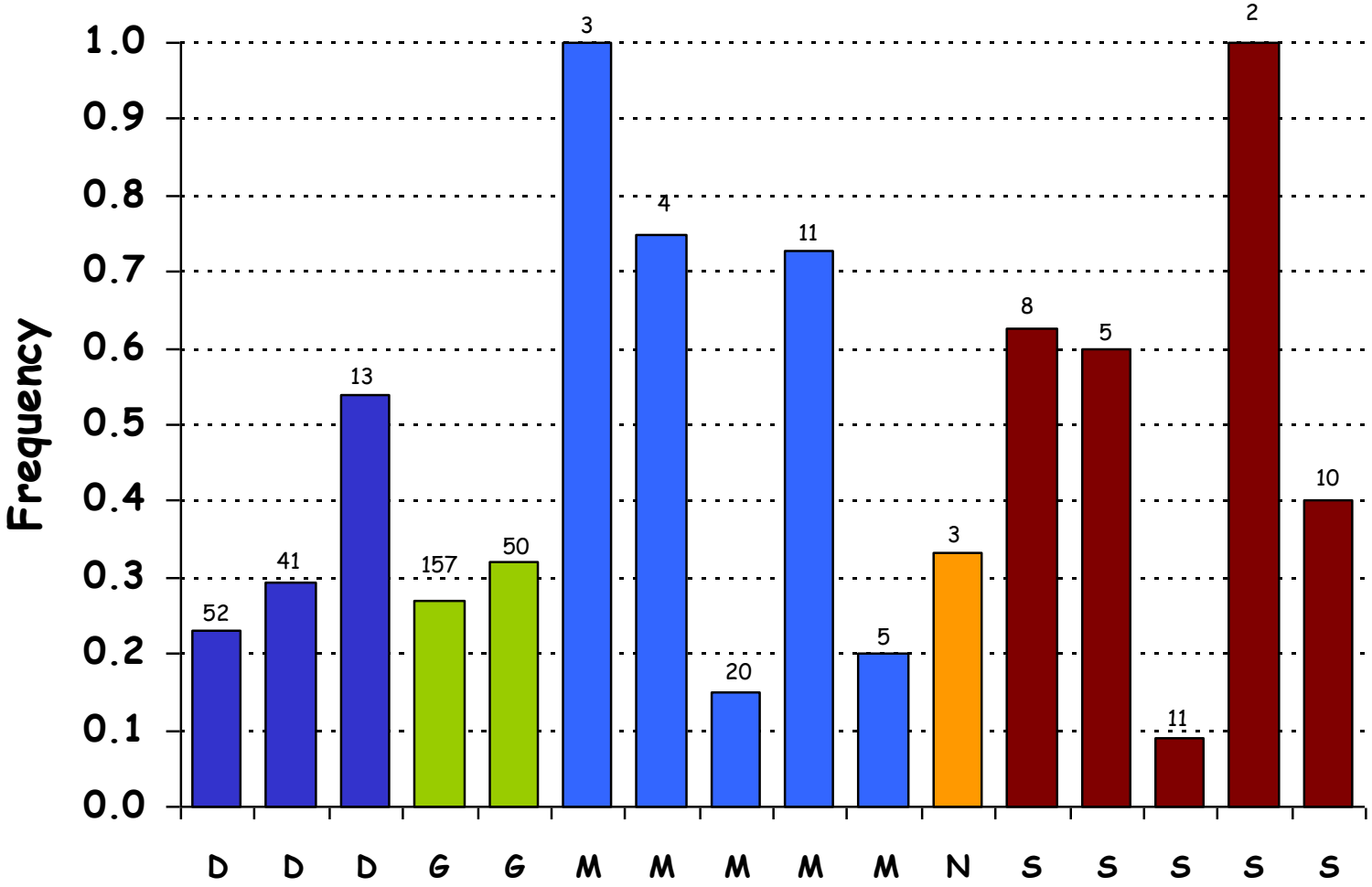
OCCUPANCY (present-present)

HESP	b1-b1	idle-b1	b1-idle	idle-idle
Occ-Occ	0.25	↓ 0.20	0.68	0.69
RECOL	0.04	0.07	↑ 0.32	0.34
EXTIRP	0.75	↑ 0.80	0.32	0.31
N	79	151	153	830

<u>Predictions</u>

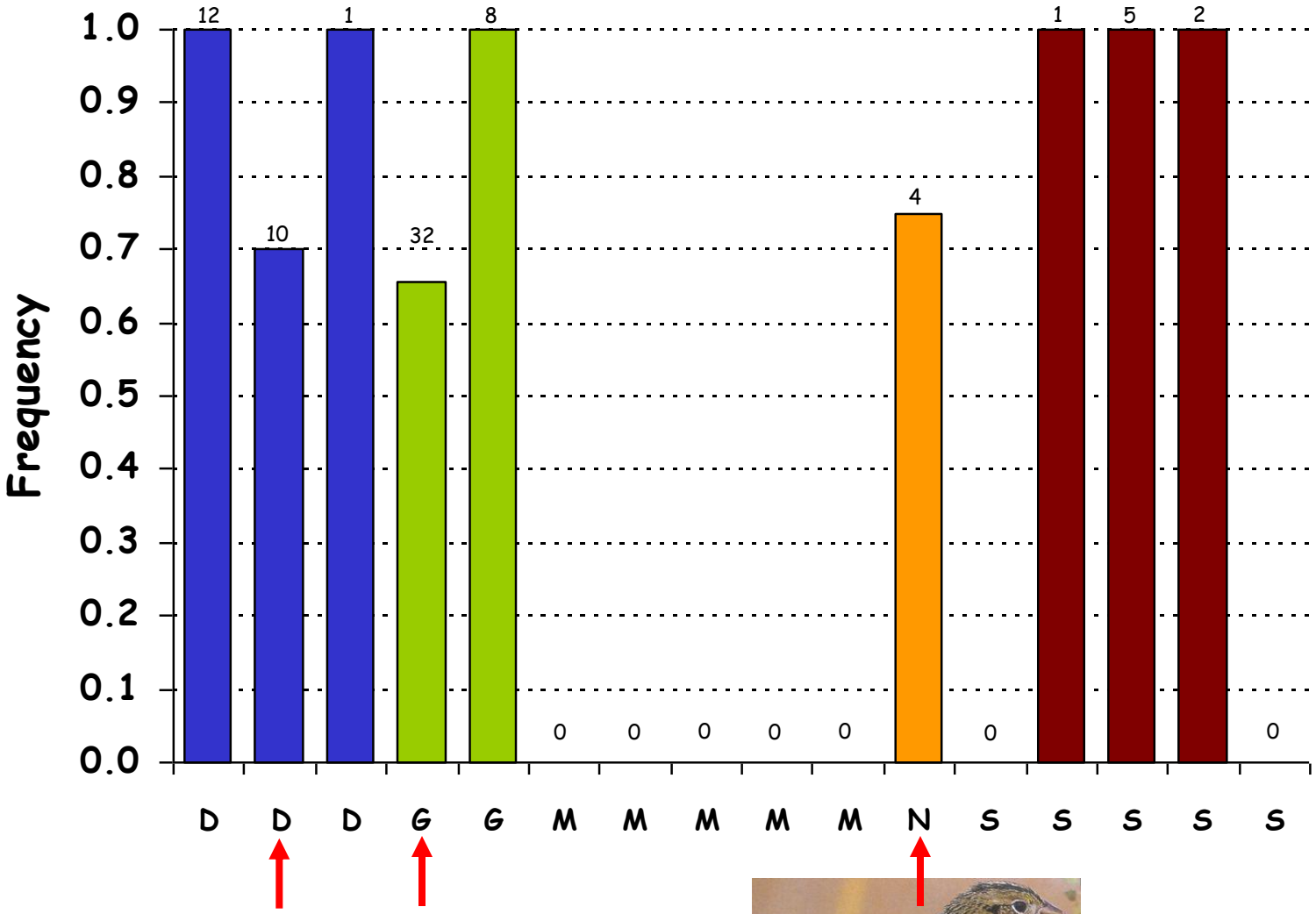
1. Burning should lower occupancy
2. Birds should recolonize burned areas after burning

LOCAL EXTIRPATION BY FIELDS (idle-idle)

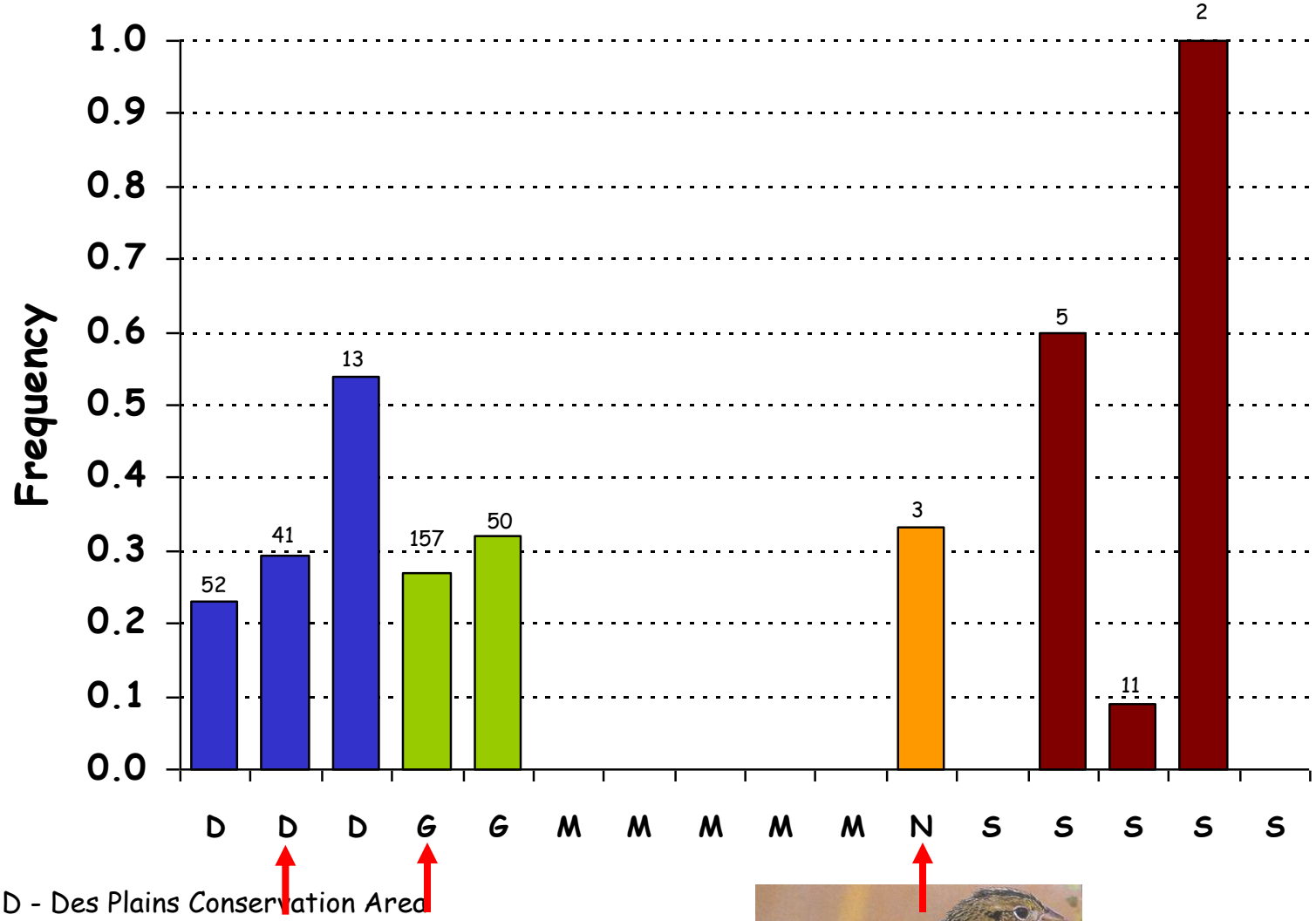


D - Des Plains Conservation Area
G - Goose Lake Prairie
M - Midewin N.T.P.
N - Nachusa Grasslands
S - Site-M (JEPCFWA)

LOCAL EXTIRPATION (idle-b1)

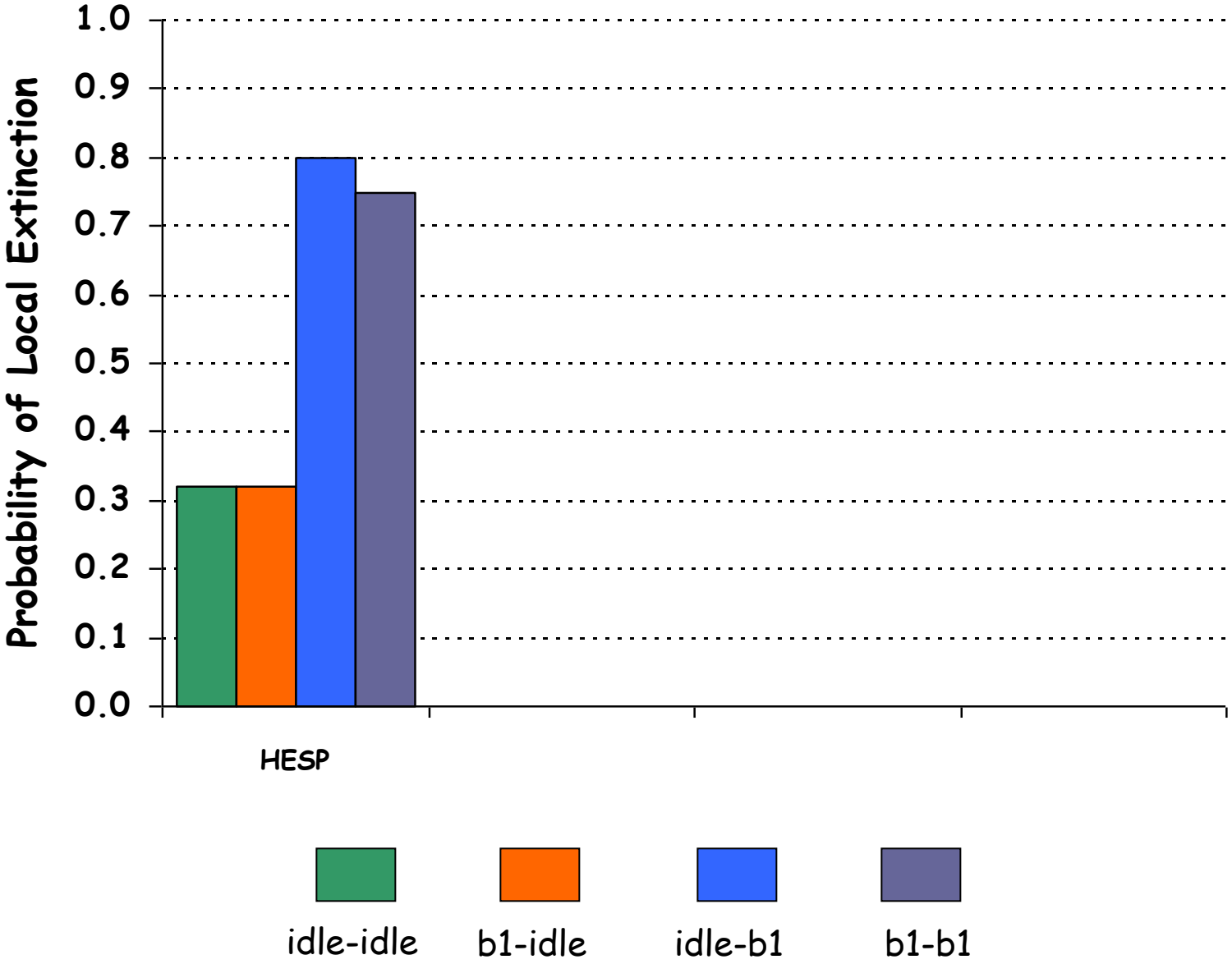


LOCAL EXTIRPATION BY FIELDS (idle-idle)

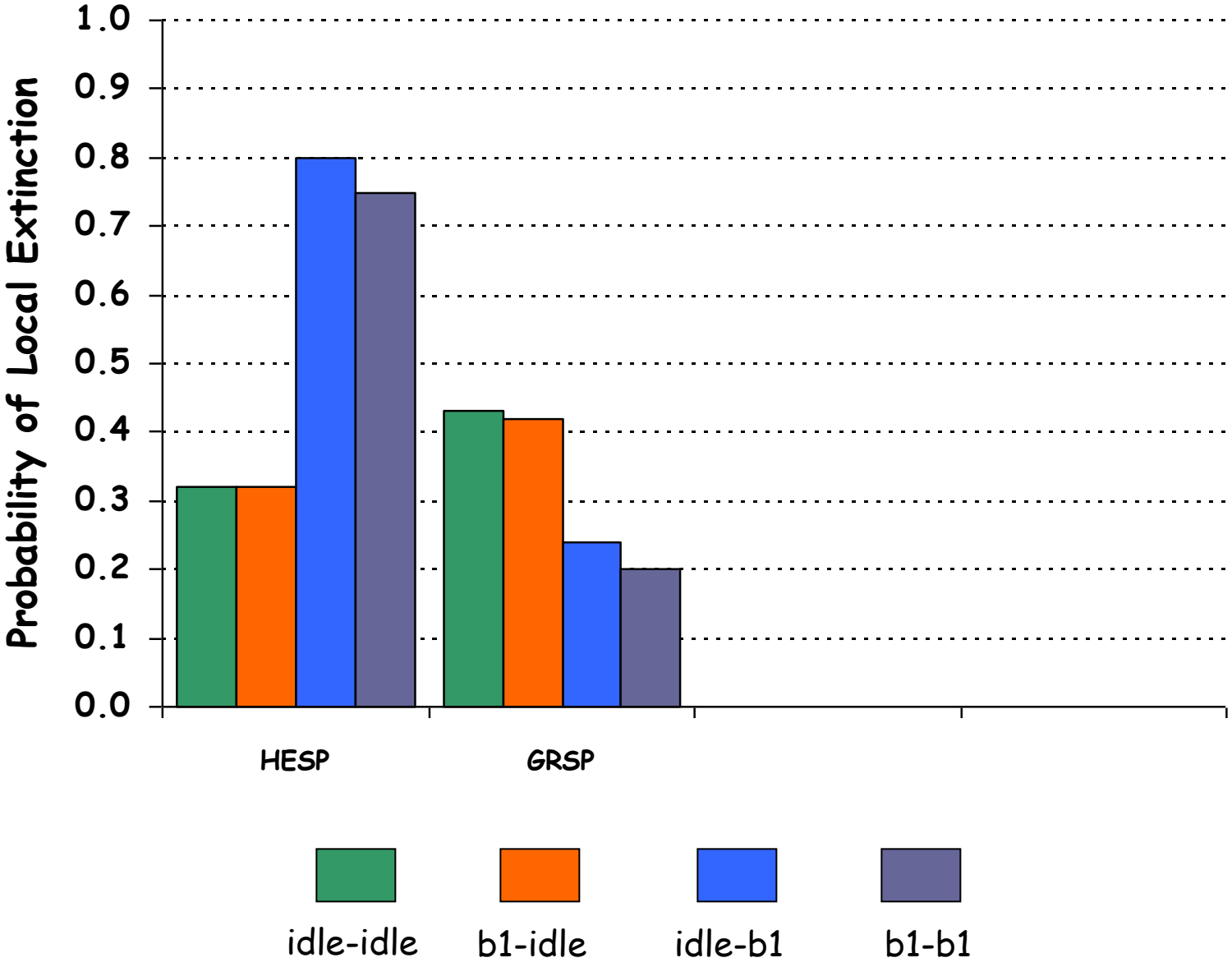


D - Des Plains Conservation Area
G - Goose Lake Prairie
M - Midewin N.T.P.
N - Nachusa Grasslands
S - Site-M (JEPCFWA)

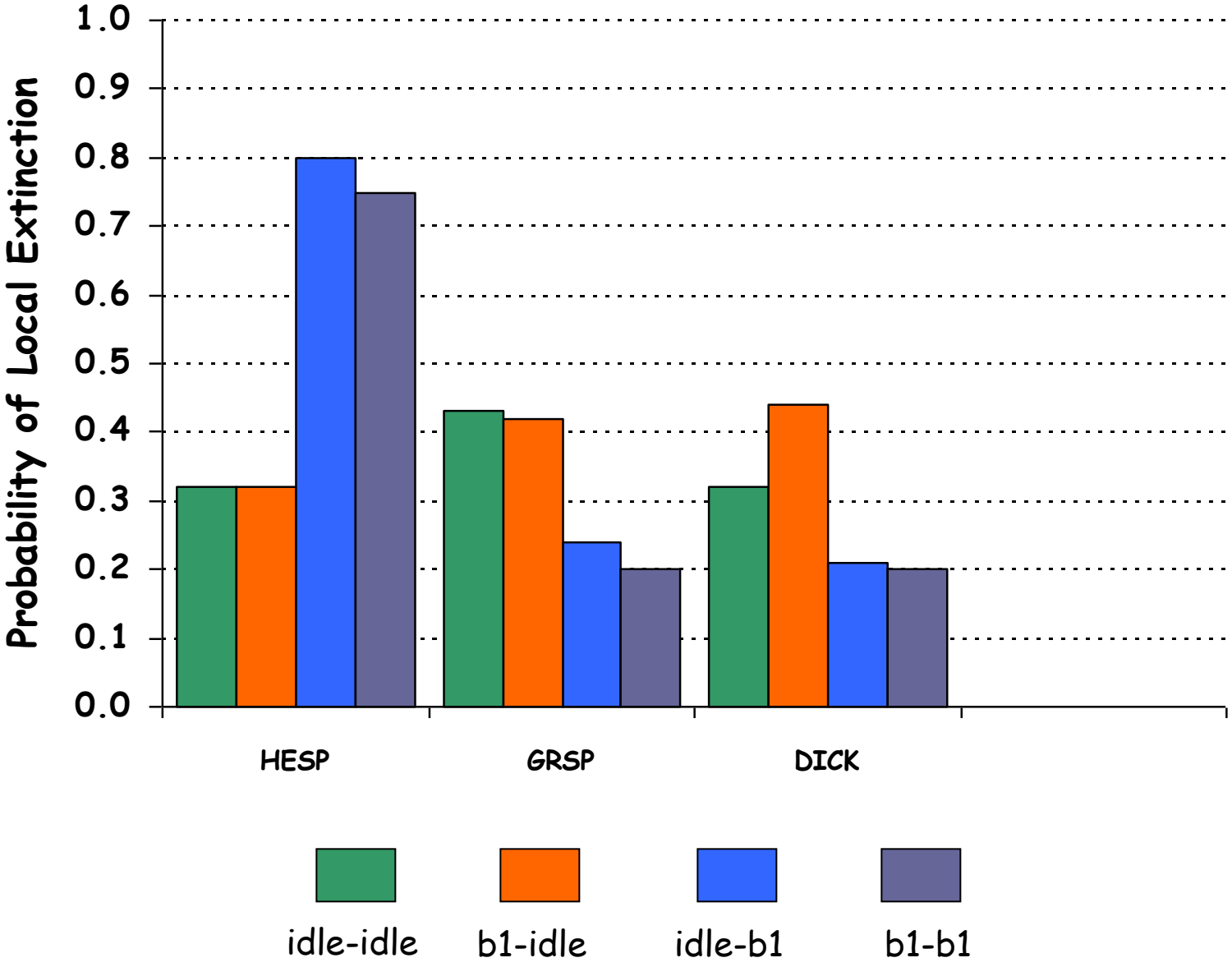
OVERALL COMPARISON



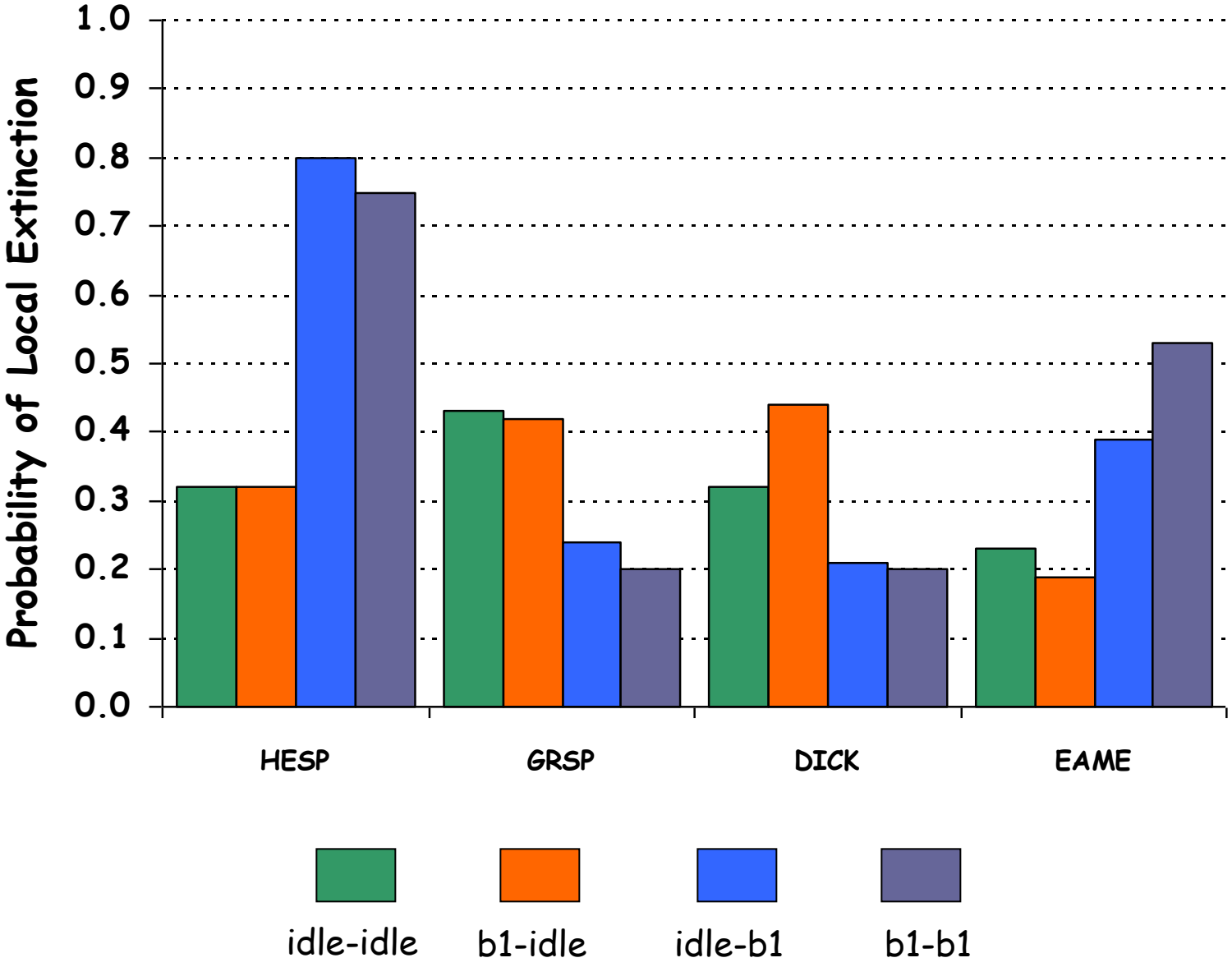
OVERALL COMPARISON



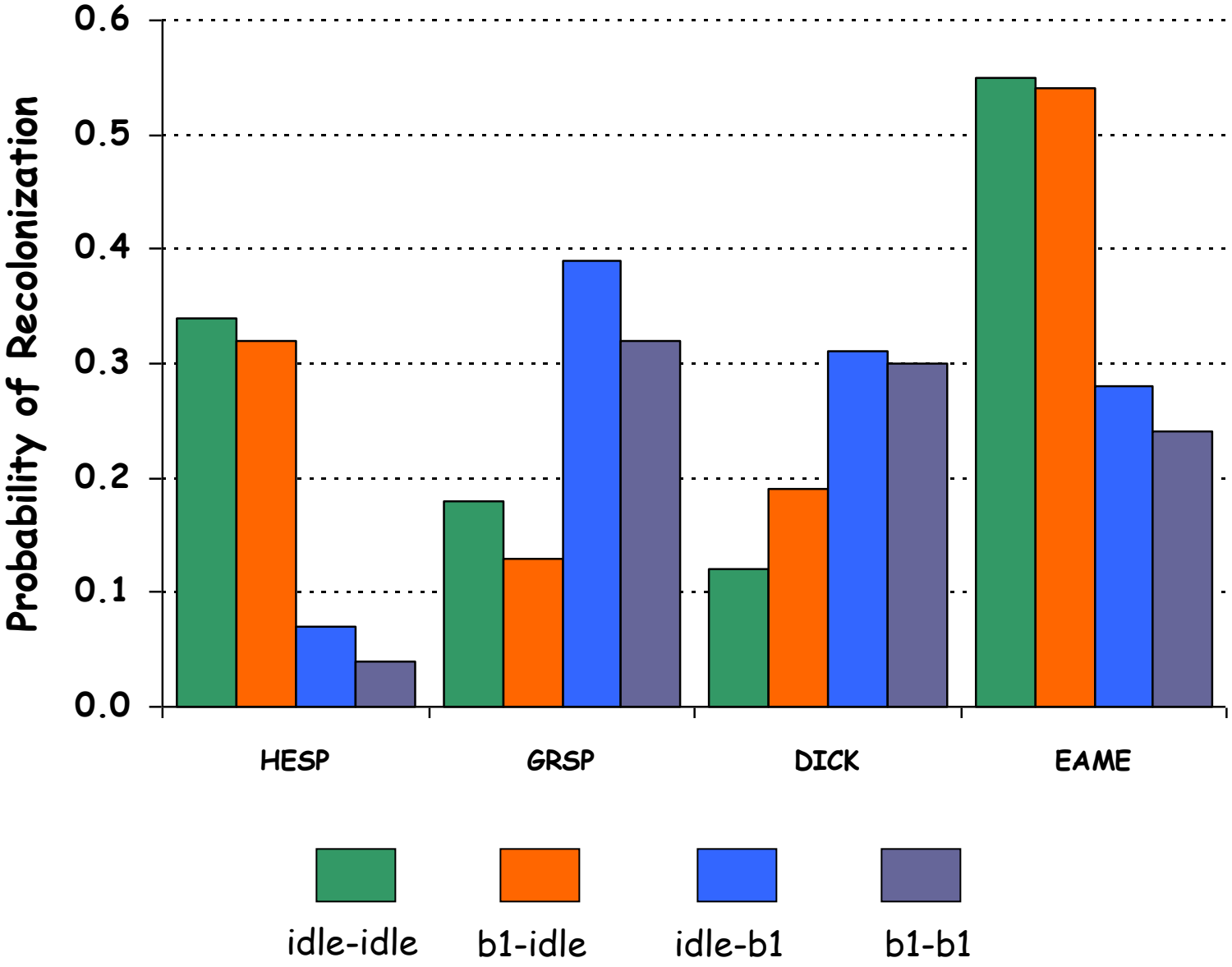
OVERALL COMPARISON



OVERALL COMPARISON



OVERALL COMPARISON



Part II - Summary

- Preliminary Results

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- Occupancy Provides Different Perspective on Burn Reponses and Potential New Insights on Species Reponses (e.g., HESP re-colonization rates)

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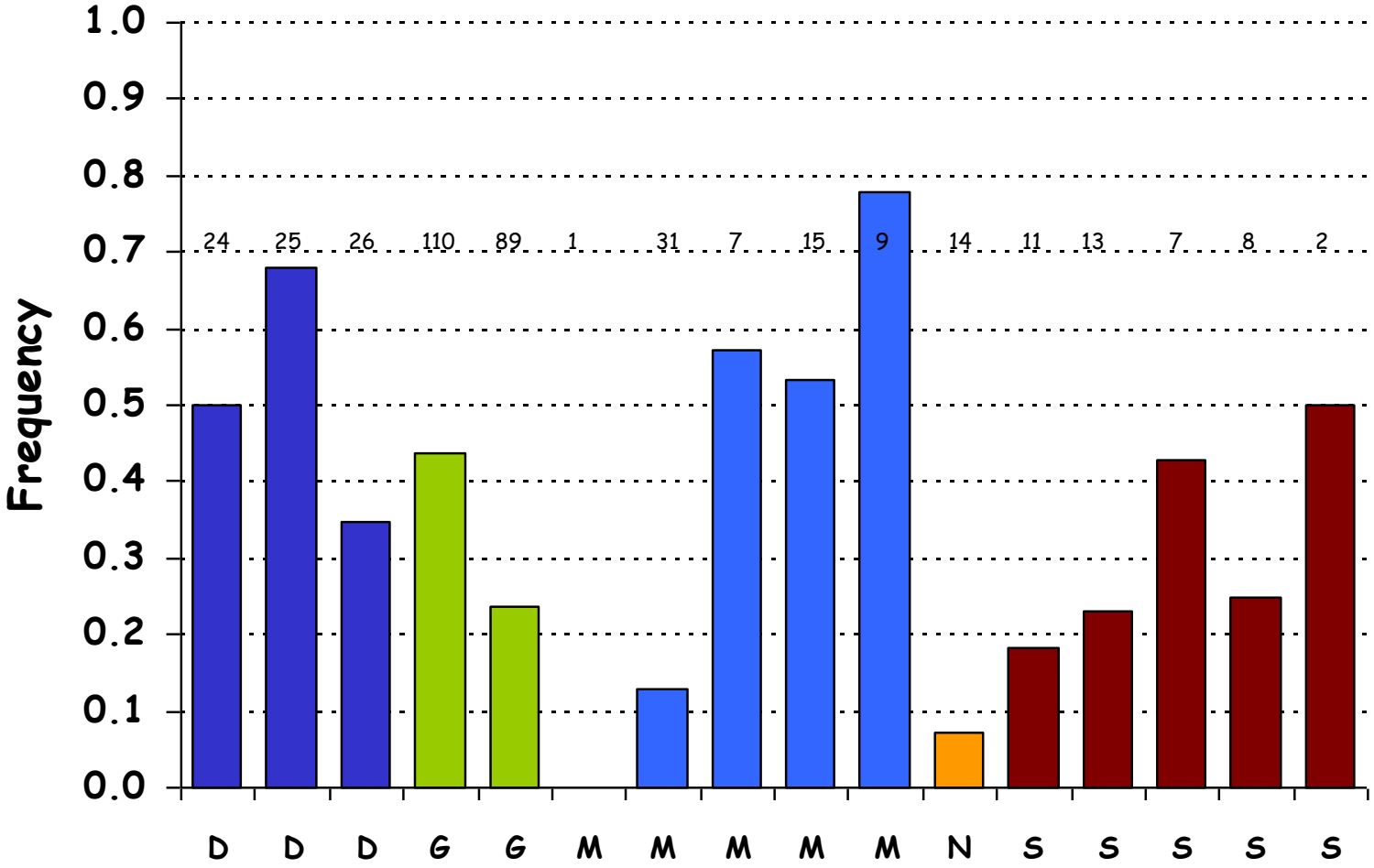
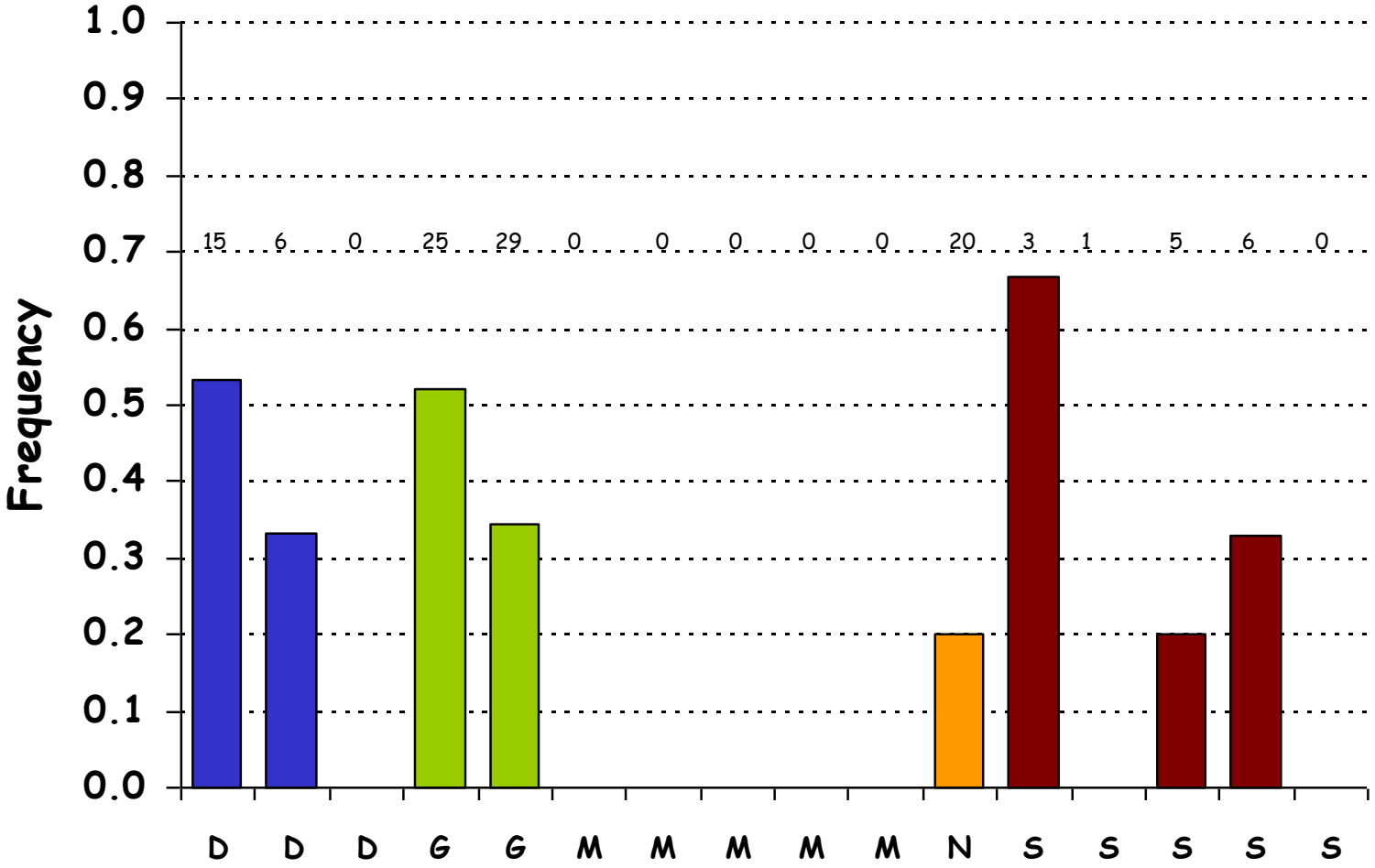
Part II - Summary

- Preliminary Results
- Occupancy Provides Different Perspective on Burn Reponses and Potential New Insights on Species Reponses (e.g., HESP re-colonization rates)
- Appears to be Considerable Variation in Rates Between Fields
- Current 'State' Appears to be More Influential on Rates Than Previous Year

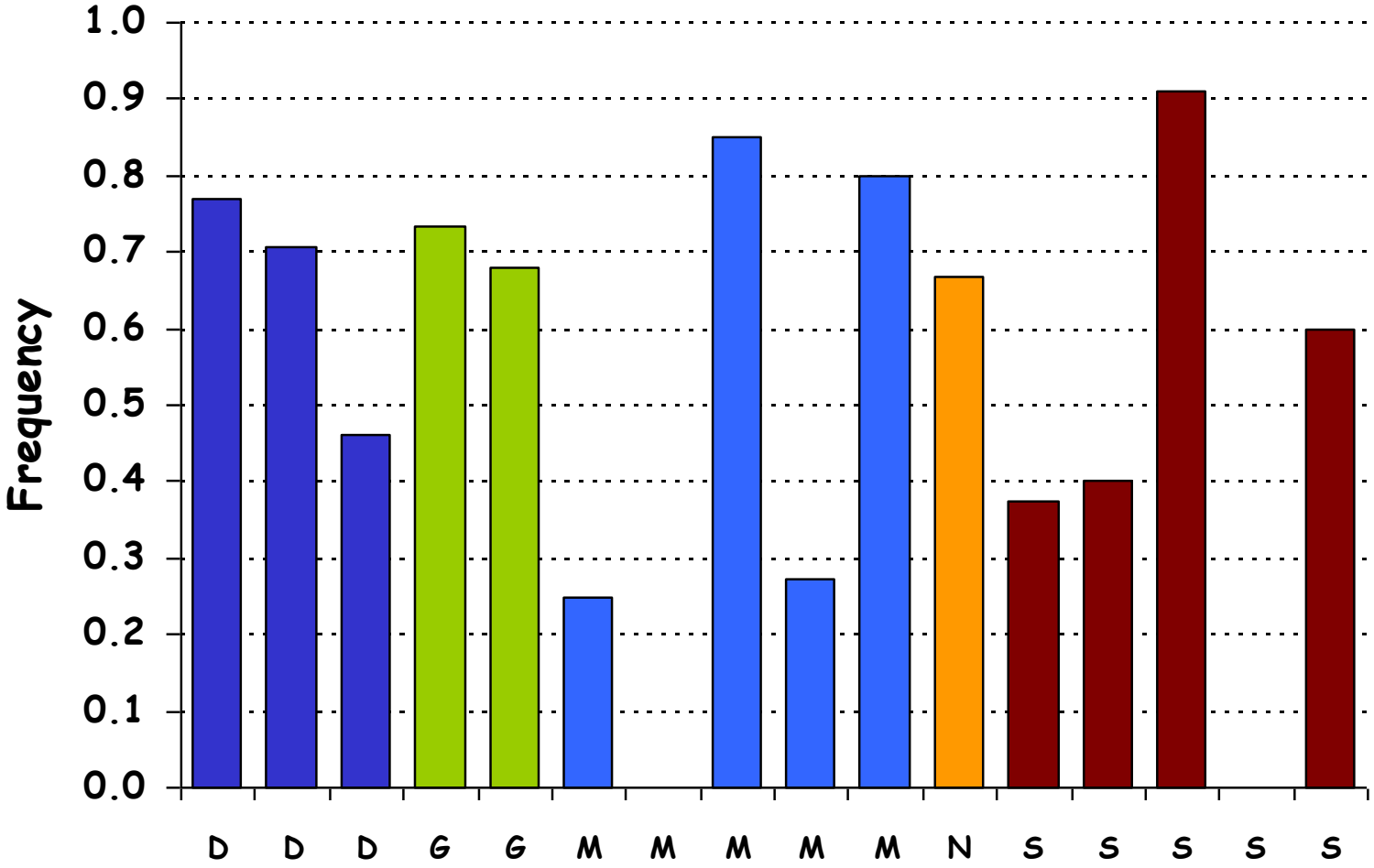
RECOLONIZATION (idle-idle)



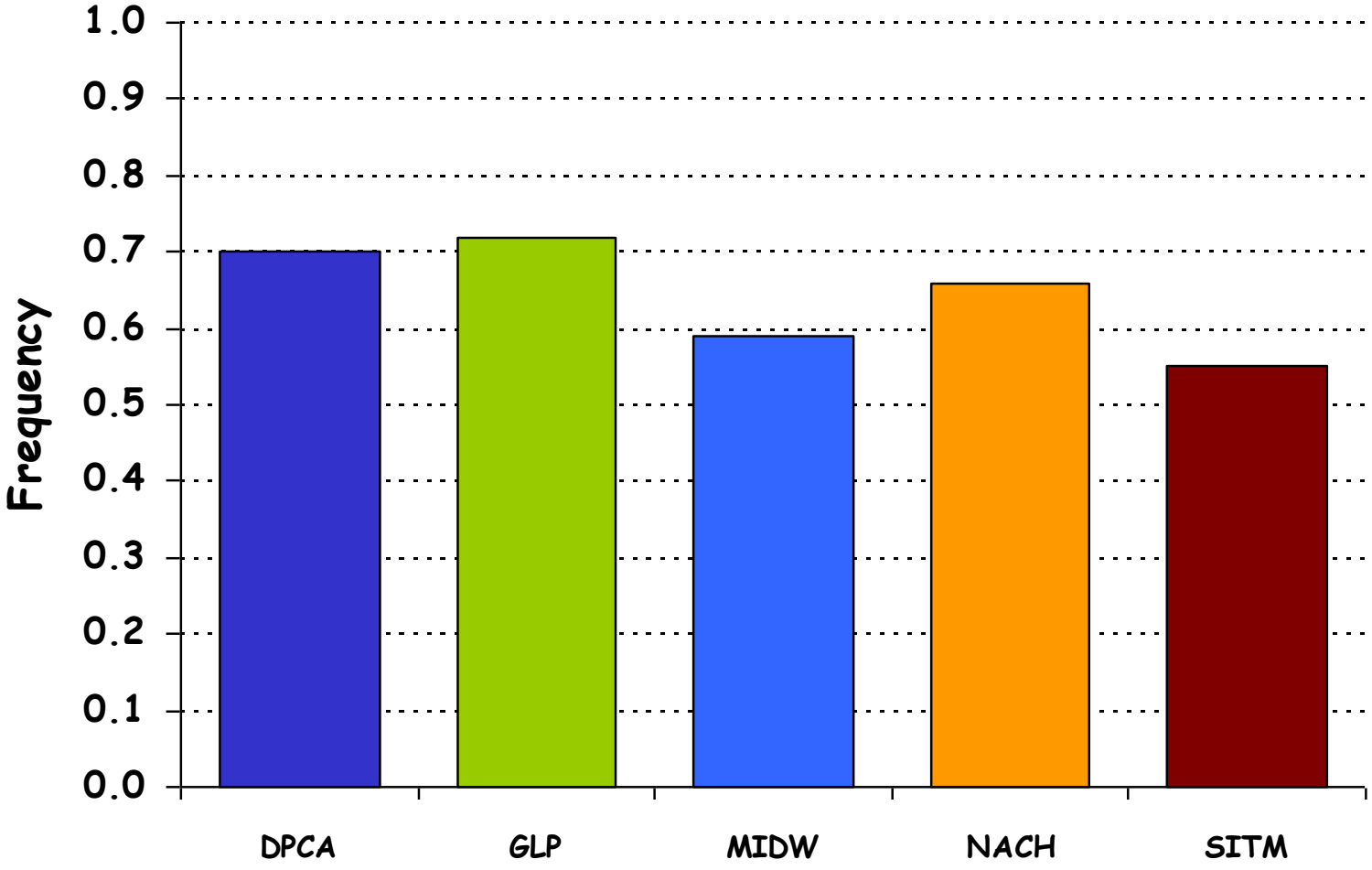
RECOLONIZATION (b1-idle)



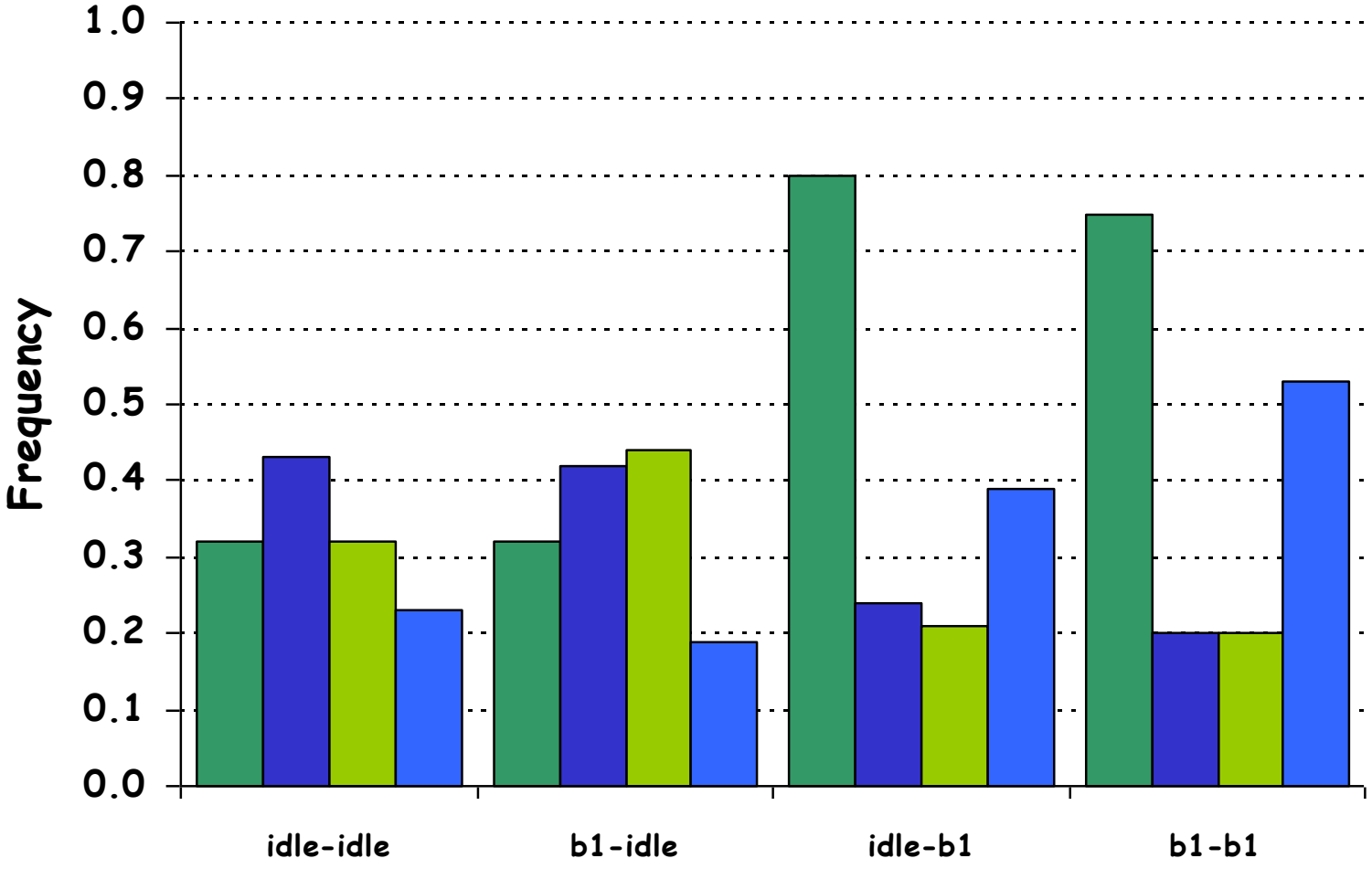
OCCUPANCY (idle-idle)



OCCUPANCY (idle-idle)



OVERALL COMPARISON

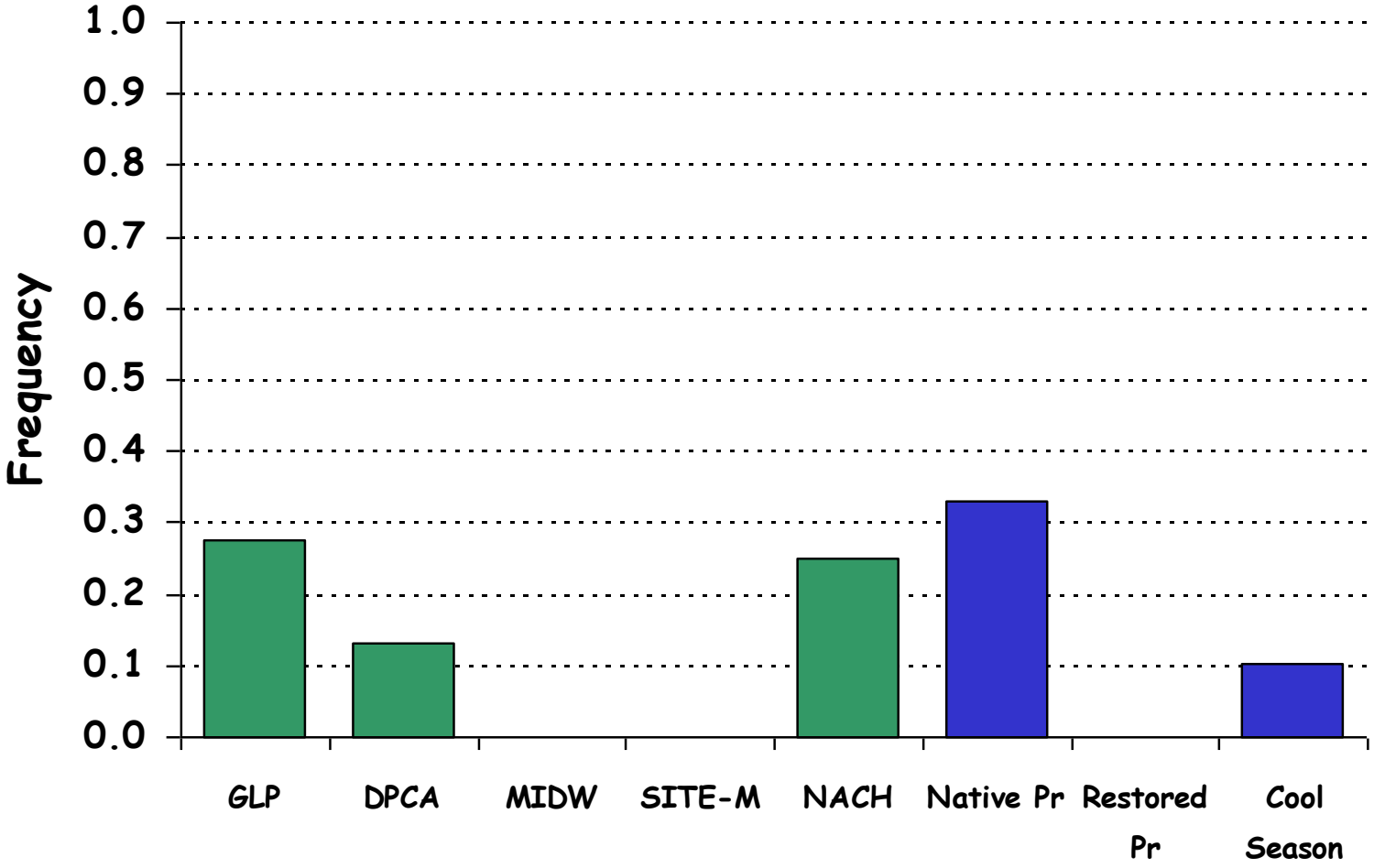


GRSP	b1-b1	idle-b1	b1-idle	idle-idle
Occ-Occ	[illegible]	[illegible]	[illegible]	0.57
RECOL	[illegible]	[illegible]	[illegible]	0.18
EXTIRP	[illegible]	[illegible]	[illegible]	0.43
N	79	151	153	830

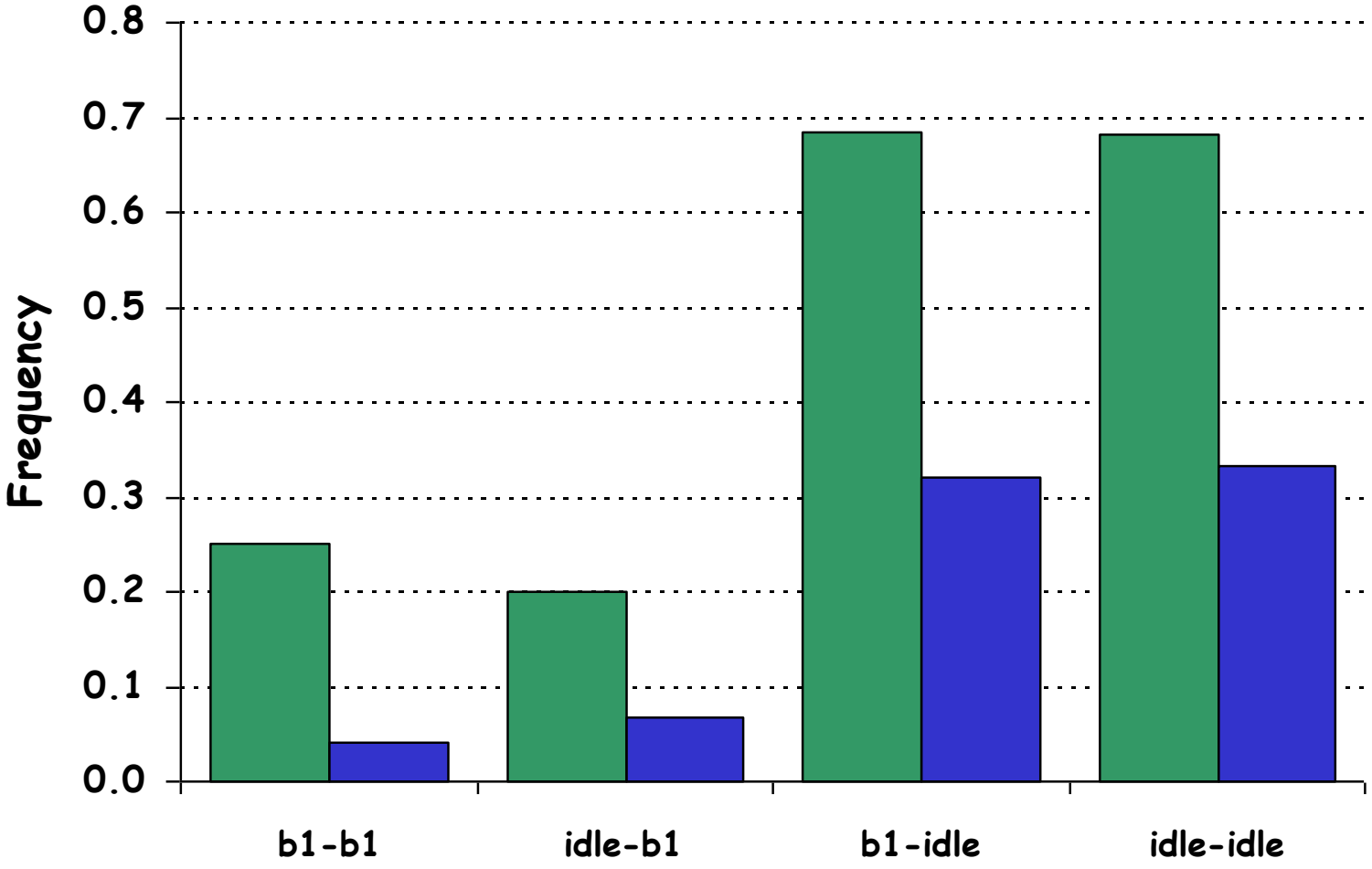
DICK	b1-b1	idle-b1	b1-idle	idle-idle
Occ-Occ				0.68
RECOL				0.12
EXTIRP				0.32
N	79	151	153	830

EAME	b1-b1	idle-b1	b1-idle	idle-idle
Occ-Occ				0.77
RECOL				0.55
EXTIRP				0.23
N	79	151	153	830

OCCUPANCY (idle-b1)



Needs updating - possibly bad management data

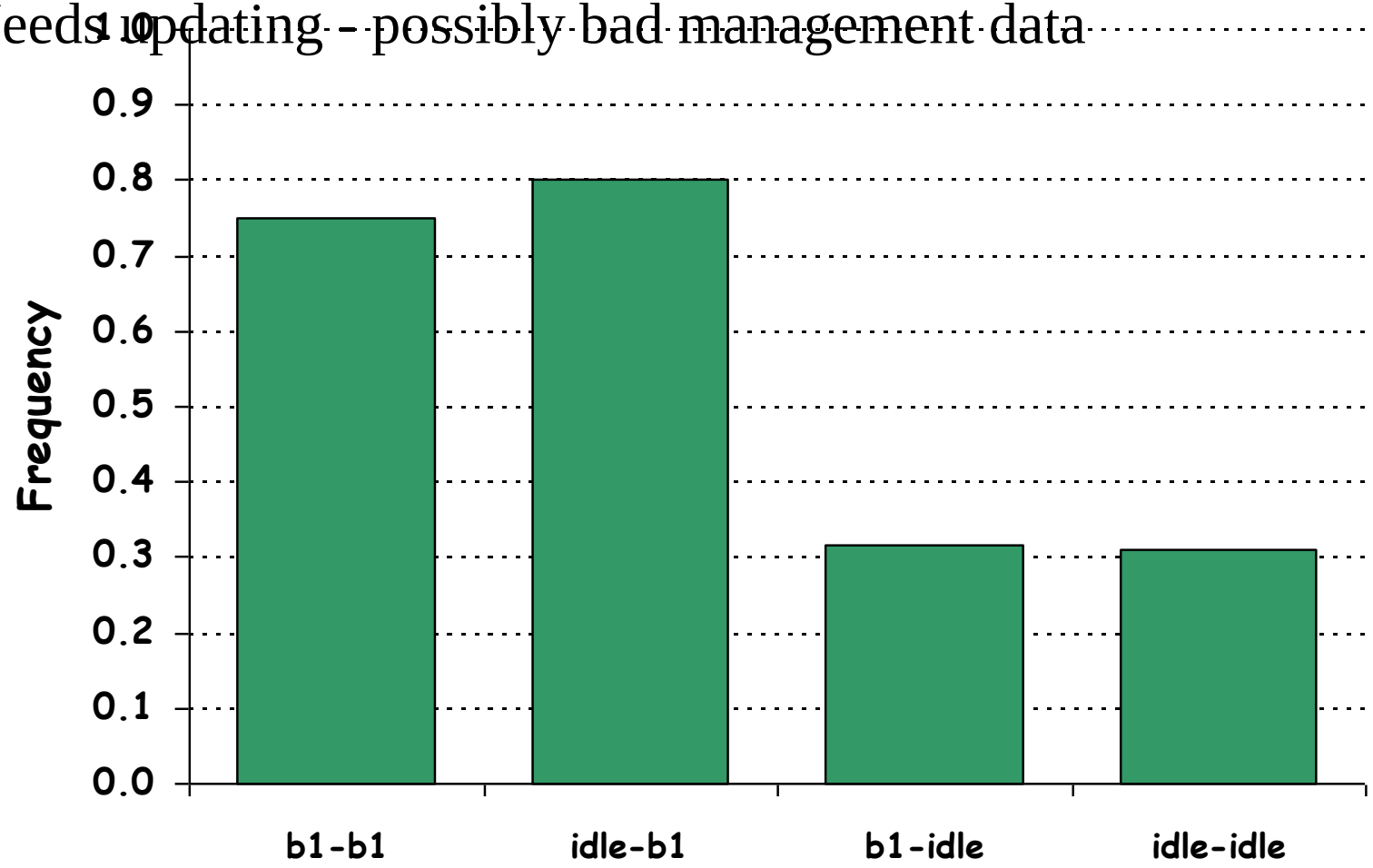


Occupancy (pres-pres)

Recolonization (abs-pres)

EXTIRPATION (present-absent)

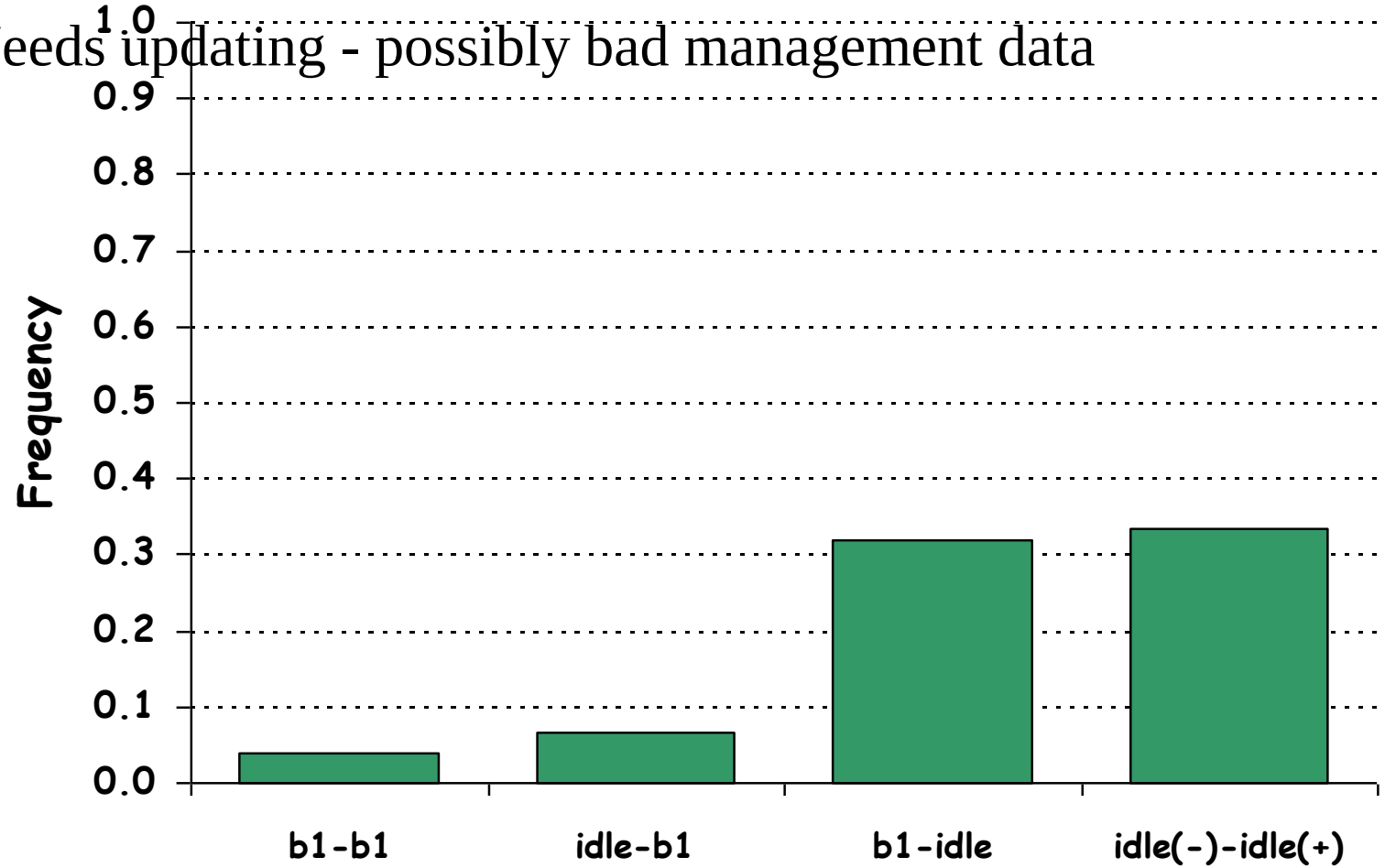
Needs updating - possibly bad management data



Burned

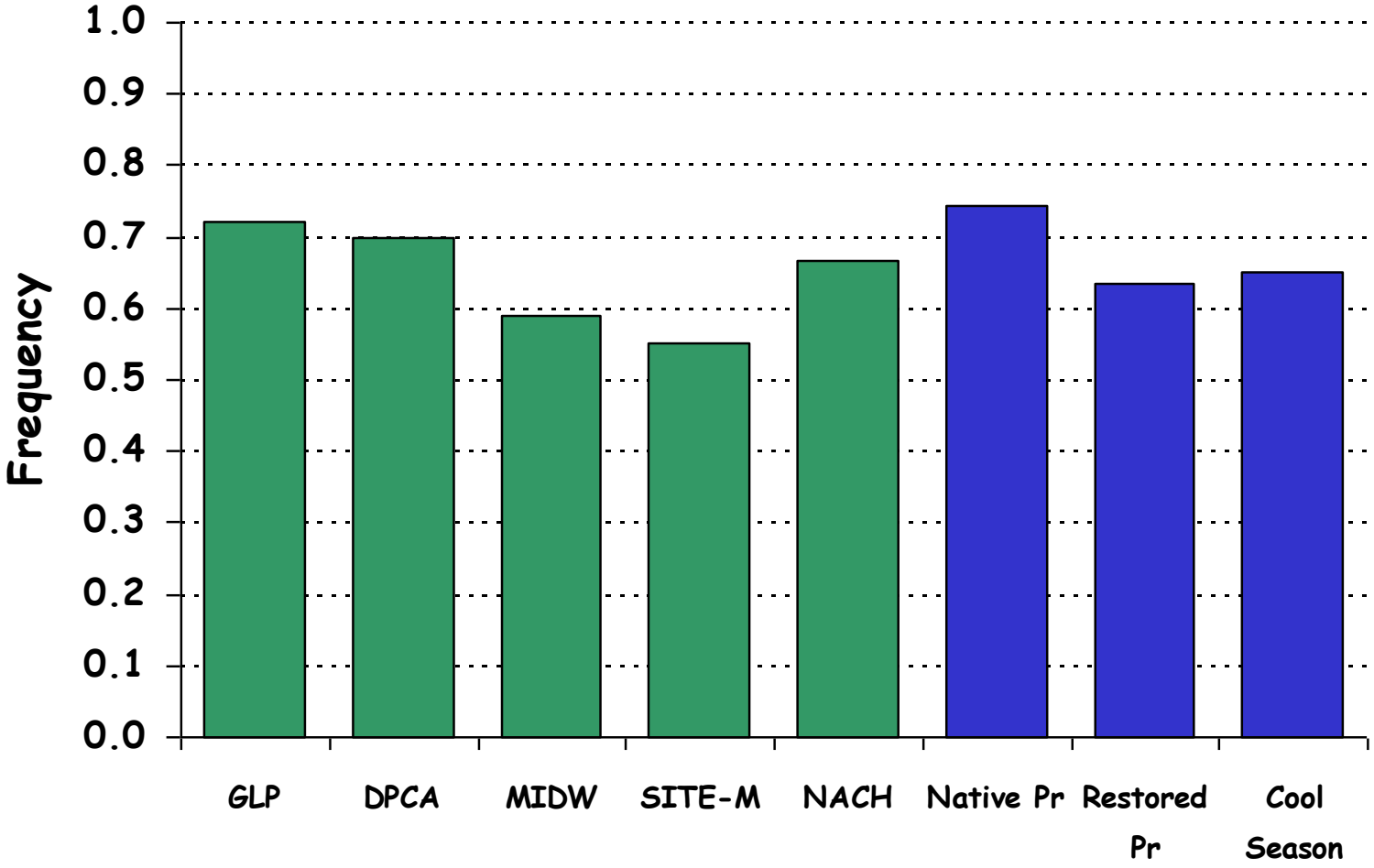
RECOLONIZATION (absent-present)

Needs updating - possibly bad management data



Burned

OCCUPANCY (idle-idle)



OCCUPANCY (idle-idle)

Several authors have noted the tendency for local populations of Henslow's sparrow to be unstable from year to year. Pruitt 1996

Hyde (1939) stated: "It has been my experience as well as that of other observers that in certain localities Henslow's sparrow is well established as a breeder, whereas in other ones it is irregular, and its presence in a given season cannot be certainly predicted."