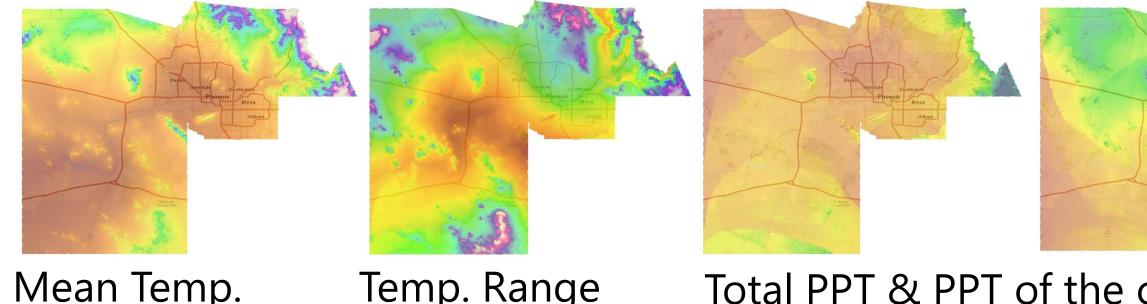


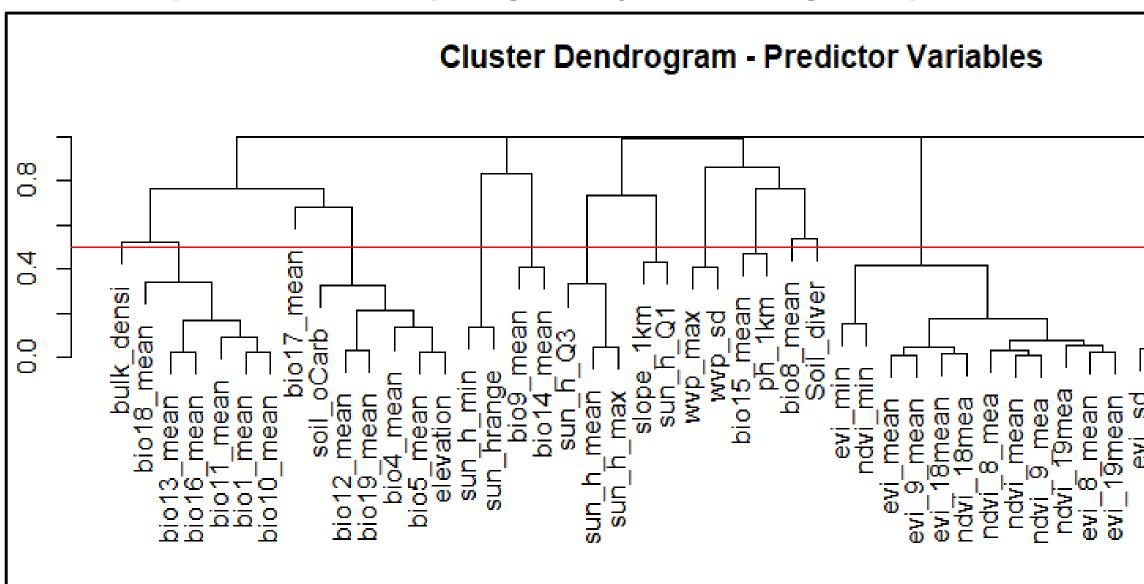
Environmental Predictors of Bird Richness Cameron Boehme and Fabio Suzart de Albuquerque College of Integrative Sciences and Arts, Arizona State University, Polytechnic

Background

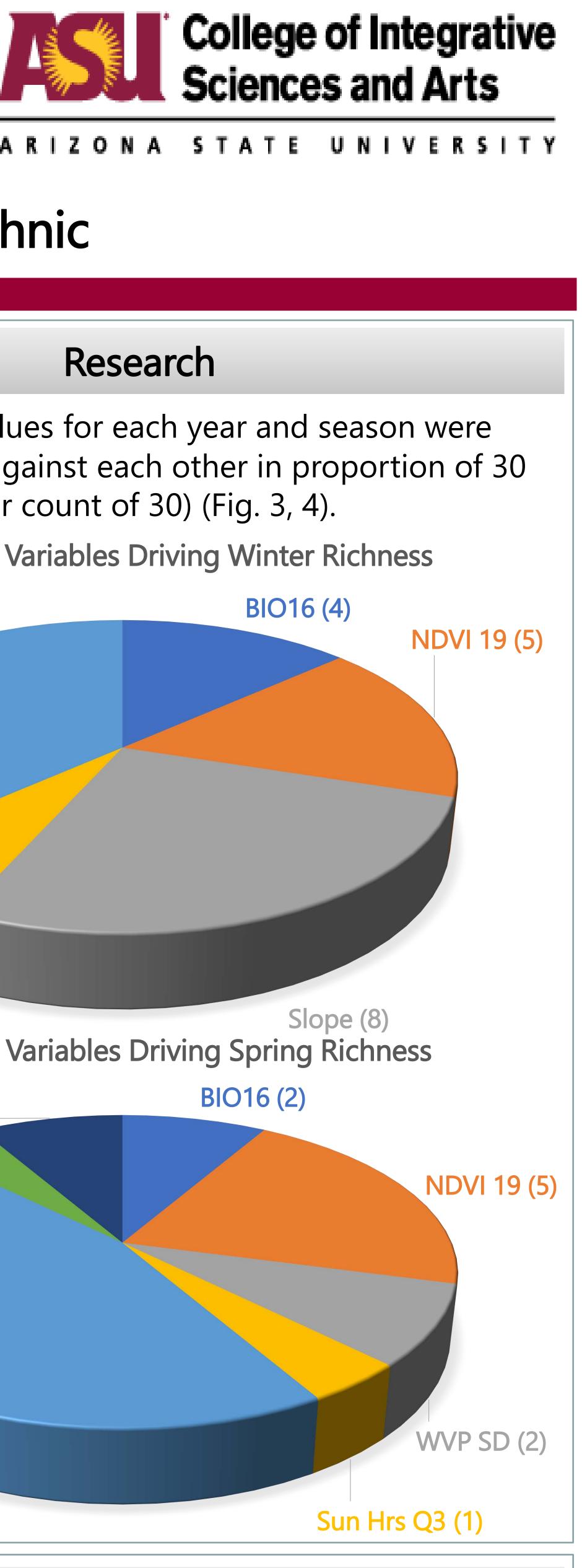
- We used generalized linear models with Poisson regression to build our models in R keeping data abundance from point count surveys in riparian sites. separated by season and year. The R² value for each model was used to assess the We used data from winter (Dec. – Mar. 15th) and spring (Mar. 16th – May) counts from 51 sites in the ESCA and overall contribution of environmental factors on species Riparian surveys from 2001-2002 and 2004-2016. richness (Fig. 2). **Bulk Density** (11) Goodness of Fit (R2) Over Time variables including: **Bioclimatic Variables** (Seasonality etc.), Vegetation Indices (NDVI and EVI), soil variables, 0.8 and geomorphological variables for use in our models. 0.6 0.4 Ass Winter Spring Temp. Range Total PPT & PPT of the coldest qtr. Sun Hrs Q3 (2) Research Question 2 **Research Questions** • In order to access each independent variable against Soil Diversity (2) each other, we used the standardized beta coefficients (β) from each model. Soil pH (1) richness in Phoenix? If they are, how much do they The two highest coefficients for each model were contribute to annual species richness? highlighted to determine patterns over time (Table 1,2). 2001 2002 2004 2005 2006 2007 2008 2009 20 species richness in Phoenix? Research Slope -0.4 -0.5 -0.3 0.0 0.3 -0.1 0.6 0.0 Cluster analysis conducted between correlation of all Sun Hrs Min 0.0 0.0 0.0 0.0 0.0 0.0 0.0 Sun Hrs Q3 0.0 0.0 0.0 0.0 0.0 0.0 0.0 environmental variables for all years at each site. Groups Bulk Density -1.0 -0.5 -0.3 -0.4 -0.2 -0.4 -0.5 -0.7 -0 Bulk Density (11) were split at the cluster difference height of 0.5 (Fig. 1). Soil pH 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 Soil Diversity 0.1 0.0 0.1 0.0 0.2 0.0 -0.1 0.0 Organic Matter 0.0 0.1 -0.1 0.0 0.0 -0.1 0.1 0.0 component keeping only those groups with values < 5. Table 1(above): Winter yearly comparison of (β). First Table 2(below): and Second highest β marked for each year. Second highest 2001 2002 2004 2005 2006 2007 2008 2009 201 **Cluster Dendrogram - Predictor Variables** 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.1 -0.1 -0.1 0.0 -0.1 0.1 0.1 -0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 BIO17 0.0 2010, and 2015. NDVI Max 0.0 0.0 0.0 0.0 0.1 0.0 0.0 0.0 NDVI 19 0.7 0.4 -0.1 0.1 0.4 -0.3 0.0 0.0 WVP SD 0.0 0.1 0.1 0.1 0.1 0.0 -0.1 0.0 Slope -0.5 -0.4 0.0 -0.2 -0.5 -0.4 0.0 0.0 Sun Hrs Min 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 wettest qtr.) (-) were most influencing richness. Sun Hrs Q3 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 Bulk Density -0.6 -0.5 -0.4 -0.6 -0.2 -0.1 -0.4 -0.3 -0



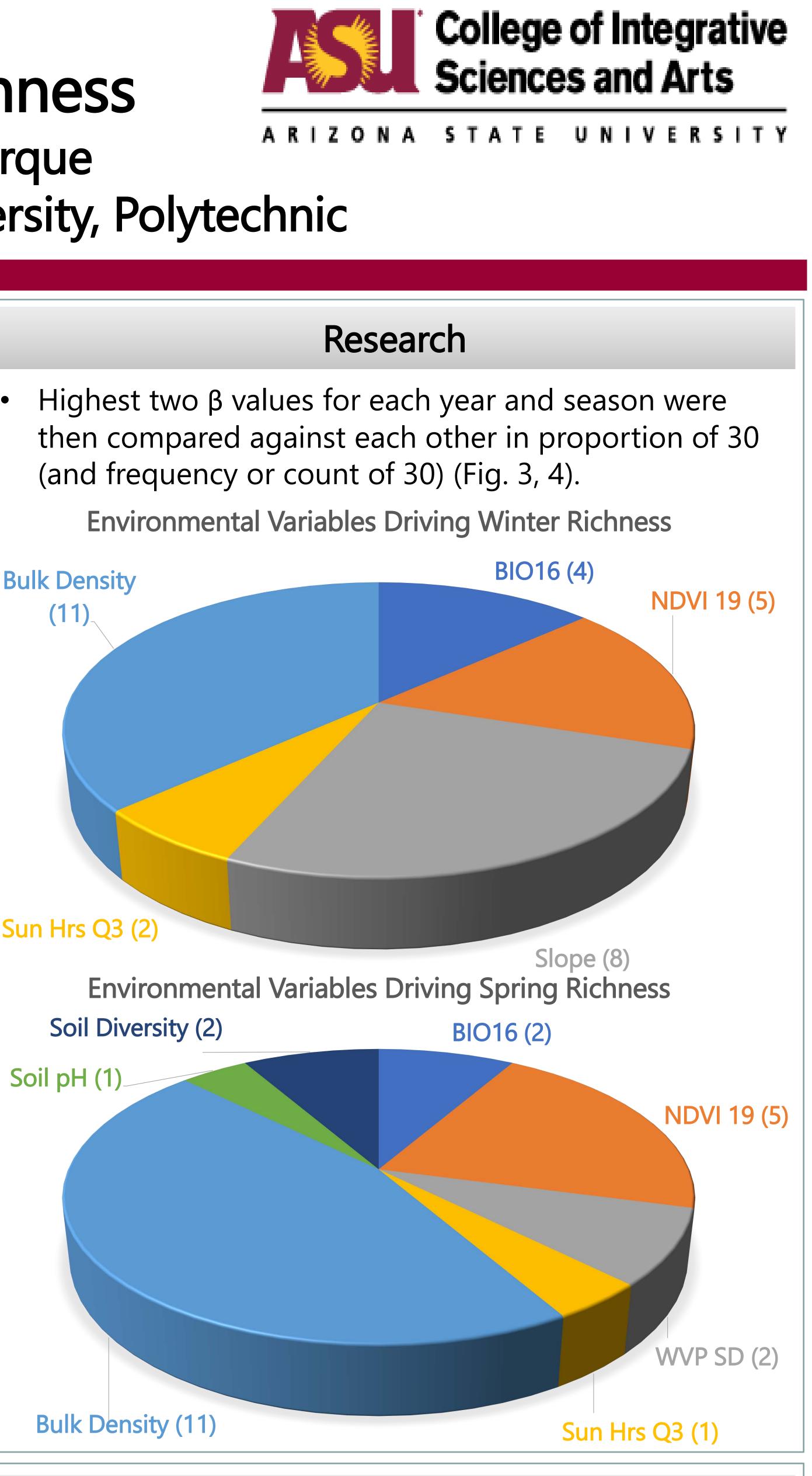
- Previous studies have seen declines in richness and • CAP LTER has 17 years of bird point count survey data. • We generated a **geodatabase** of over 50 environmental Mean Temp. 1. Are environmental variables driving bird species 2. Which environmental variables have the largest effect on **Research Question 1** • Variance inflation factor (VIF) was accessed for each



Research



mgmig														• / —	•/•
	2001	2002	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
BIO6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BIO8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BIO16	-0.1	0.1	-0.1	0.1	-0.1	-0.2	0.1	0.1	-0.6	0.0	0.3	-0.2	-1.2	0.0	0.0
BIO17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NDVI Max	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0
NDVI 19	-0.1	0.3	-0.2	-0.5	0.9	0.1	0.1	0.5	0.0	0.0	0.1	0.1	-0.3	0.0	0.0
WVP SD	0.0	0.1	0.1	0.1	0.1	0.1	0.4	-0.1	0.3	0.0	0.0	0.1	0.2	0.0	0.3
Slope	-0.4	-0.5	-0.3	0.0	0.3	-0.1	0.6	0.0	0.8	0.0	-0.3	0.1	0.4	0.0	0.6
Sun Hrs Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sun Hrs Q3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bulk Density	-1.0	-0.5	-0.3	-0.4	-0.2	-0.4	-0.5	-0.7	-0.5	0.0	-0.3	-0.6	-0.9	0.0	-0.6
Soil pH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Soil Diversity	0.1	0.0	0.1	0.0	0.2	0.0	-0.1	0.0	0.0	0.0	0.1	0.0	-0.1	0.0	0.0
Organic Matter	0.0	0.1	-0.1	0.0	0.0	-0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1
Table 1(above): Winter yearly comparison of (β). First and Second highest β marked for each year.							Table 2(below): Fall yearly comparison of β . First and Second highest β marked for each year.								
and Second highes	stβma	arked f	or eacl		N <i>i</i>			•	-	<i>y</i>			•		
	-			n year.			Seco	•	iest β n	narked	for ea	ch yea	r.		
	-		2004	n year.	2006	2007	Seco 2008	nd high	iest β n	narked	for ea	ch yea	r.		
	2001	2002	2004 0.0	n year. 2005	2006 0.0	2007 0.0	Seco 2008 0.0	nd high 2009	nest β n 2010	narked 2011	for ea 2012	ch yea 2013	r. 2014	2015	2016
BIO6	2001 0.0	2002 0.0	2004 0.0 0.0	n year. 2005 0.0	2006 0.0	2007 0.0 0.0	Seco 2008 0.0	nd high 2009 0.0	nest β n 2010 0.0	narked 2011 0.0	for ea 2012 0.0	ch yea 2013 0.0	r. 2014 0.0	2015 0.0	2016 0.0
BIO6 BIO8	2001 0.0 0.0	2002 0.0 0.0	2004 0.0 0.0 -0.1	n year. 2005 0.0 0.0	2006 0.0 0.0 0.0	2007 0.0 0.0 -0.1	Seco 2008 0.0 0.0 0.1	nd high 2009 0.0 0.0	nest β n 2010 0.0 0.0	narked 2011 0.0 0.0	for ea 2012 0.0 0.0	ch yea 2013 0.0 0.0	r. 2014 0.0 0.0	2015 0.0 0.0	2016 0.0 0.0
BIO6 BIO8 BIO16	2001 0.0 0.0 -0.1	2002 0.0 0.0 0.1	2004 0.0 0.0 -0.1 0.0	n year. 2005 0.0 0.0 -0.1	2006 0.0 0.0 0.0 0.0	2007 0.0 0.0 -0.1 0.0	Seco 2008 0.0 0.0 0.1	nd high 2009 0.0 0.0 0.1	nest β n 2010 0.0 0.0 -0.1	narked 2011 0.0 0.0 <mark>0.0</mark>	for ea 2012 0.0 0.0 0.2	ch yea 2013 0.0 0.0 -0.2	r. 2014 0.0 0.0 -0.9	2015 0.0 0.0 0.0	2016 0.0 0.0 0.0
BIO6 BIO8 BIO16 BIO17	2001 0.0 0.0 -0.1 0.0	2002 0.0 0.0 0.1 0.0 0.0	2004 0.0 0.0 -0.1 0.0 0.0	n year. 2005 0.0 0.0 -0.1 0.0	2006 0.0 0.0 0.0 0.0	2007 0.0 0.0 -0.1 0.0 0.1	Seco 2008 0.0 0.0 0.1 0.0	nd high 2009 0.0 0.0 0.1 0.0	est β n 2010 0.0 0.0 -0.1 0.0	narked 2011 0.0 0.0 <mark>0.0</mark> 0.0	for ea 2012 0.0 0.0 0.2 0.0	ch yea 2013 0.0 0.0 -0.2 0.0	r. 2014 0.0 0.0 -0.9 0.0	2015 0.0 0.0 0.0 0.0	2016 0.0 0.0 0.0 0.0
BIO6 BIO8 BIO16 BIO17 NDVI Max	2001 0.0 0.0 -0.1 0.0 0.0	2002 0.0 0.0 0.1 0.0 0.0	2004 0.0 0.0 -0.1 0.0 0.0	n year. 2005 0.0 0.0 -0.1 0.0 0.0	2006 0.0 0.0 0.0 0.0 0.0	2007 0.0 0.0 -0.1 0.0 0.1	Seco 2008 0.0 0.0 0.1 0.0 0.0 0.0	nd high 2009 0.0 0.0 0.1 0.0 0.0	est β n 2010 0.0 0.0 -0.1 0.0 0.0	narked 2011 0.0 0.0 0.0 0.0 0.0	for ea 2012 0.0 0.0 0.2 0.0 0.0	ch yea 2013 0.0 0.0 -0.2 0.0 0.1	r. 2014 0.0 0.0 -0.9 0.0 0.1	2015 0.0 0.0 0.0 0.0	2016 0.0 0.0 0.0 0.0 0.0
BIO6 BIO8 BIO16 BIO17 NDVI Max NDVI 19	2001 0.0 0.0 -0.1 0.0 0.0 0.7	2002 0.0 0.0 0.1 0.0 0.0 0.4 0.1	2004 0.0 0.0 -0.1 0.0 0.0 -0.1 0.1	n year. 2005 0.0 0.0 -0.1 0.0 0.0 0.1 0.1	2006 0.0 0.0 0.0 0.0 0.0 0.0 0.1	2007 0.0 0.0 -0.1 0.0 0.1 -0.3 0.0	Seco 2008 0.0 0.0 0.1 0.0 0.0 0.0 -0.1	nd high 2009 0.0 0.0 0.1 0.0 0.0 0.0	est β n 2010 0.0 0.0 -0.1 0.0 0.0 0.0	narked 2011 0.0 0.0 0.0 0.0 0.0 0.0	for ea 2012 0.0 0.0 0.2 0.0 0.0 0.0	ch yea 2013 0.0 0.0 -0.2 0.0 0.1 0.1	r. 2014 0.0 0.0 - 0.9 0.0 0.1 -0.2	2015 0.0 0.0 0.0 0.0 0.0	2016 0.0 0.0 0.0 0.0 0.0 0.0
BIO6 BIO8 BIO16 BIO17 NDVI Max NDVI 19 WVP SD	2001 0.0 0.0 -0.1 0.0 0.0 0.7 0.0	2002 0.0 0.0 0.1 0.0 0.0 0.4 0.1	2004 0.0 0.0 -0.1 0.0 -0.1 0.1 0.0	n year. 2005 0.0 0.0 -0.1 0.0 0.0 0.1 0.1	2006 0.0 0.0 0.0 0.0 0.0 0.0 0.1 0.1 -0.5	2007 0.0 0.0 -0.1 0.0 0.1 -0.3 0.0 -0.4	Seco 2008 0.0 0.0 0.1 0.0 0.0 0.0 -0.1 0.0	nd high 2009 0.0 0.0 0.1 0.0 0.0 0.0 0.0	est β n 2010 0.0 0.0 -0.1 0.0 0.0 0.0 0.0	narked 2011 0.0 0.0 0.0 0.0 0.0 0.0 0.0	for ea 2012 0.0 0.0 0.2 0.0 0.0 0.0 0.0	ch yea 2013 0.0 0.0 -0.2 0.0 0.1 0.1 0.1	r. 2014 0.0 0.0 - 0.9 0.0 0.1 -0.2 0.0	2015 0.0 0.0 0.0 0.0 0.0 0.0	2016 0.0 0.0 0.0 0.0 0.0 0.0 0.1
BIO6 BIO8 BIO16 BIO17 NDVI Max NDVI Max NDVI 19 WVP SD Slope	2001 0.0 0.0 -0.1 0.0 0.0 0.7 0.0 -0.5	2002 0.0 0.0 0.1 0.0 0.0 0.4 0.1 - 0.4	2004 0.0 0.0 -0.1 0.0 0.0 -0.1 0.1 0.0 0.0	n year. 2005 0.0 0.0 -0.1 0.0 0.0 0.1 0.1 0.1 -0.2	2006 0.0 0.0 0.0 0.0 0.0 0.0 0.1 -0.5 0.0	2007 0.0 0.0 -0.1 0.0 0.1 -0.3 0.0 -0.4 0.0	Seco 2008 0.0 0.0 0.1 0.0 0.0 0.0 -0.1 0.0 0.0	nd high 2009 0.0 0.0 0.1 0.0 0.0 0.0 0.0 0.0	est β n 2010 0.0 0.0 -0.1 0.0 0.0 0.0 0.0 0.2	narked 2011 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	for ea 2012 0.0 0.0 0.2 0.0 0.0 0.0 0.0 0.2 0.2 -0.2	ch yea 2013 0.0 0.0 -0.2 0.0 0.1 0.1 0.1 0.2 -0.1	r. 2014 0.0 0.0 - 0.9 0.0 0.1 -0.2 0.0 0.1	2015 0.0 0.0 0.0 0.0 0.0 0.0 0.0	2016 0.0 0.0 0.0 0.0 0.0 0.0 0.1 0.1 0.3
BIO6 BIO8 BIO16 BIO17 BIO17 NDVI Max NDVI Max NDVI 19 WVP SD Slope Sun Hrs Min	2001 0.0 0.0 -0.1 0.0 0.0 0.0 -0.5 0.0 0.0	2002 0.0 0.0 0.1 0.0 0.0 0.4 0.1 -0.4 0.0 0.0	2004 0.0 0.0 -0.1 0.0 0.0 -0.1 0.1 0.1 0.0 0.0	n year. 2005 0.0 0.0 -0.1 0.0 0.0 0.1 0.1 -0.2 0.0 0.0	2006 0.0 0.0 0.0 0.0 0.0 0.0 0.1 -0.5 0.0 0.0	2007 0.0 0.0 -0.1 0.0 0.1 -0.3 0.0 -0.4 0.0	Seco 2008 0.0 0.0 0.1 0.0 0.0 0.0 -0.1 0.0 0.0	nd high 2009 0.0 0.0 0.1 0.0 0.0 0.0 0.0 0.0 0.0	est β n 2010 0.0 0.0 -0.1 0.0 0.0 0.0 0.0 0.2 0.2 0.2	narked 2011 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	for ea 2012 0.0 0.0 0.2 0.0 0.0 0.0 0.0 0.2 0.2 0.	ch yea 2013 0.0 0.0 -0.2 0.0 0.1 0.1 0.1 0.1 0.1 0.2	r. 2014 0.0 0.0 - 0.9 0.0 0.1 -0.2 0.0 0.1 0.1	2015 0.0 0.0 0.0 0.0 0.0 0.0 0.0	2016 0.0 0.0 0.0 0.0 0.0 0.0 0.1 0.3 0.0
BIO6 BIO8 BIO16 BIO17 BIO17 NDVI Max NDVI Max NDVI 19 WVP SD Slope Sun Hrs Min Sun Hrs Q3	2001 0.0 0.0 -0.1 0.0 0.0 0.0 -0.5 0.0 0.0	2002 0.0 0.0 0.1 0.0 0.0 0.4 0.1 -0.4 0.0 0.0	2004 0.0 0.0 -0.1 0.0 0.0 -0.1 0.1 0.1 0.0 0.0 0.0 0.0	n year. 2005 0.0 0.0 -0.1 0.0 0.0 0.1 0.1 -0.2 0.0 0.0	2006 0.0 0.0 0.0 0.0 0.0 0.0 0.1 -0.5 0.0 0.0 0.0	2007 0.0 0.0 -0.1 0.0 0.1 -0.3 0.0 -0.4 0.0 0.0 0.0	Seco 2008 0.0 0.0 0.1 0.0 0.0 0.0 -0.1 0.0 0.0 0.0 0.0 0.0	nd high 2009 0.0 0.0 0.1 0.0 0.0 0.0 0.0 0.0 0.0 0.0	est β n 2010 0.0 0.0 -0.1 0.0 0.0 0.0 0.0 0.2 0.2 0.2 0.2	narked 2011 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	for ea 2012 0.0 0.0 0.2 0.0 0.0 0.0 0.2 0.0 0.2 0.0 0.2	ch yea 2013 0.0 0.0 -0.2 0.0 0.1 0.1 0.1 0.1 0.1 0.1 0.1	r. 2014 0.0 0.0 - 0.9 0.0 0.1 -0.2 0.0 0.1 0.1 0.0	2015 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	2016 0.0 0.0 0.0 0.0 0.0 0.0 0.1 0.3 0.0 0.0
BIO6 BIO8 BIO16 BIO17 BIO17 NDVI Max NDVI Max NDVI 19 WVP SD Slope Sun Hrs Min Sun Hrs Q3 Bulk Density	2001 0.0 0.0 -0.1 0.0 0.0 0.0 -0.5 0.0 0.0 0.0 0.0	2002 0.0 0.0 0.1 0.0 0.0 0.4 0.1 0.1 0.1 0.0 0.0 0.0	2004 0.0 -0.1 0.0 0.0 -0.1 0.0 -0.1 0.0 0.0 0.0 0.0 0.0	n year. 2005 0.0 0.0 -0.1 0.0 0.0 0.1 0.1 0.1 0.1 0.1 0.1 0.1	2006 0.0 0.0 0.0 0.0 0.0 0.0 0.1 -0.5 0.0 0.0 0.0 0.0	2007 0.0 0.0 -0.1 0.0 0.1 -0.3 0.0 -0.4 0.0 0.0 0.0	Seco 2008 0.0 0.0 0.1 0.0 0.0 0.0 -0.1 0.0 0.0 0.0 0.0 0.0	nd high 2009 0.0 0.0 0.1 0.0 0.0 0.0 0.0 0.0 0.0 0.0	est β n 2010 0.0 0.0 -0.1 0.0 0.0 0.0 0.0 0.2 0.2 0.2 0.2 0.2 0.0 0.0	narked 2011 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	for ea 2012 0.0 0.0 0.2 0.0 0.0 0.0 0.0 0.2 0.0 0.0	ch yea 2013 0.0 0.0 -0.2 0.0 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1	r. 2014 0.0 0.0 -0.9 0.0 0.1 -0.2 0.0 0.1 0.0 0.1 0.0 0.1	2015 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	2016 0.0 0.0 0.0 0.0 0.0 0.0 0.1 0.1 0.3 0.0 0.0 0.0 0.0



Discussion

Our acknowledgement and thanks go to CAP LTER and all the CAP technicians that continue to gather bird point count data.

• Environmental variables affect bird species richness. The R² value for spring was 54% and winter was 55%. We need to further investigate the large declines in 2005,

• Soil bulk density (-), slope (- in winter + in spring), NDVI 19 (NDVI of the wettest qtr.)(+), and BIO16 (PPT of the